APPENDIX G: CZMA Consistency Letters

NATIONAL SCIENCE FOUNDATION
4201 WILSON BOULEVARD
ARLINGTON, VIRGINIA 22230

September 11, 2014

Braxton Davis
Director, NC Division of Coastal Management
Department of Environment and Natural Resources
400 Commerce Avenue
Morehead City, NC 28557-3421

RE: CD14-037 – Consistency Concurrence Concerning the Marine Geophysical Survey by the R/V *Marcus G. Langseth* in the Atlantic Ocean off Cape Hatteras, September-October 2014 (DCM#20140033)

Dear Mr. Davis:

The National Science Foundation (NSF) was pleased to receive the North Carolina Division of Coastal Management's (DCM) letter of concurrence that the NSF proposed marine geophysical survey by the R/V *Marcus G. Langseth* in the Atlantic Ocean off Cape Hatteras is consistent to the maximum extent practicable with the enforceable policies of North Carolina's approved Coastal Management Program (CMP). We appreciate the interest identified by the DCM to request implementation of the monitoring and mitigation measures identified in the Final Programmatic Environmental Impact Statement (PEIS) issued in February 2014 by the Bureau of Ocean Energy Management (BOEM). Although not linked to the enforceable policies of the NC CMP, NSF has reviewed the monitoring and mitigation measures in the BOEM PEIS, and the subsequent Record of Decision issued in July 2014, relative to seismic surveys and will implement those to the maximum extent practical. As the National Oceanic and Atmospheric Administration's National Marine Fisheries Service (NMFS) has regulatory jurisdiction in federal waters over marine mammals pursuant to the Marine Mammal Protection Act of 1972, as amended (16 U.S.C. 1361 *et seq.*) and the Endangered Species Act of 1973 (16 U.S.C. 1531 *et seq.*), however, NSF will be required to adhere to any specific monitoring and mitigation requirements identified in the Incidental Harassment Authorization and Incidental Take Statement. Additionally, as NMFS has regulatory jurisdiction for essential fish habitat in federal waters pursuant to the Magnuson-Stevens Fishery Conservation and Management Act (16 U.S.C. 1801 *et seq.*), NSF will be required to comply with the specific conservation recommendations established by NMFS for the proposed research activities. As encouraged by DCM, NSF will also attempt to minimize impacts to offshore industries; as noted in the Draft EA, significant impacts to fisheries (recreational and commercial) and scuba diving would not be anticipated.

NSF is especially appreciative of the assistance and cooperation demonstrated by the DCM staff with the federal consistency process. We recognize that the CZMA process associated with the proposed activities was complicated and time consuming; the DCM staff were critical in the successful and timely completion of the CZMA process for the proposed activities.

Sincerely,

Holly Smith
Environmental Compliance Officer

cc:
Doug Huggett, NC Division of Coastal Management
Kerry Kehoe, NOAA Office of Ocean and Coastal Resource Management

NCDENR
North Carolina Department of Environment and Natural Resources
Division of Coastal Management

Pat McCrory
Governor

John E. Skvarla, III
Secretary

September 8, 2014

Holly Smith
Environmental Compliance Officer
National Science Foundation
4201 Wilson Boulevard
Arlington, VA 22230

SUBJECT: **CD14-037**– Consistency Concurrence Concerning the Marine Geophysical Survey by the R/V Marcus G. Langseth in the Atlantic Ocean off the North Carolina coast (DCM#20140033)

Dear Ms. Smith:

We received your consistency submission on June 20, 2014 concerning the Marine Geophysical Survey by the R/V Marcus G. Langseth in the Atlantic Ocean off the North Carolina coast. We have evaluated the proposed project for consistency with our State's coastal management program.

North Carolina's coastal zone management program consists of, but is not limited to, the Coastal Area Management Act, the State's Dredge and Fill Law, Chapter 7 of Title 15A of North Carolina's Administrative Code, and the land use plans of the coastal counties and municipalities that the proposed project may affect. It is the objective of the North Carolina Division of Coastal Management (DCM) to manage the State's coastal resources to ensure that proposed federal activities are compatible with safeguarding and perpetuating the biological, social, economic and aesthetic values of the State's coastal waters.

To better understand the possible concerns with your proposed activity, we placed a public notice in several newspapers throughout the North Carolina coastal region and solicited input from State agencies that have a regulatory interest. Three North Carolina agencies, including the Department of Administration, the Division of Water Resources, and the Division of Marine Fisheries, as well as several private organizations and individuals provided comments. The Division of Marine Fisheries and the public expressed concerns about the project's potential impact to marine life and the offshore fishing and diving industries. The Department of Administration noted that rights of entry or licenses may be required or activities performed on state owned land and the Division of Water Resources recommended that you coordinate with the United States Army Corps of Engineers concerning identification of any jurisdictional features and required permitting. We trust that you will take these into consideration. Copies of all referenced responses, comments, and concerns have been attached for your information.

400 Commerce Ave., Morehead City, NC 28557-3421
Phone: 252-808-2808 \ FAX: 252-247-3330Internet: www.nccoastalmanagement.net

DCM reviewed the information you provided and find that the proposed project is consistent, to the maximum extent practicable, with the relevant enforceable polices of North Carolina's approved coastal management program when performed in accordance with the final Atlantic Geological and Geophysical (G&G) Activities Programmatic Environmental Impact Statement (PEIS) that the Bureau of Ocean Energy Management (BOEM) established for oil and gas exploration. Therefore, we require that you follow all mitigation measures in the Atlantic G&G Activities PEIS, which are more stringent than those included in the Draft EA for the proposed project and in the NSF PEIS/Overseas EIS for Marine Seismic Research, when conducting marine geophysical surveys off North Carolina's coast.

For example, when using airgun arrays, you must, along with other mitigation measures, conduct at least 60 minutes of visible monitoring for marine mammals before start-up, use a passive acoustic monitor (with no exceptions), have at least two protected species visual observers during daylight hours, and avoid the area within 20 nautical miles of our coastline between November 1 and April 30. Likewise, setbacks of 152 m (500 ft) are required when conducting seafloor-disturbing activities, such as using ocean bottom seismometers, anchors or other bottom-disturbing devices, in areas with *Lophelia* coral reefs, unless modified by consultations with the National Oceanic and Atmospheric Administration (NOAA) under the National Marine Sanctuaries Act. Plans proposing activities near low-relief hard/live bottom features must include survey coverage extending to 1,000 m (3,280 ft) from the location of proposed bottom-disturbing activity.

This letter of concurrence is contingent upon the National Science Foundation agreeing with all of the requirements stated above. Should you decide not to accept these conditions, this letter effectively becomes a letter of objection, and a letter of non-agreement should be submitted to DCM. A revised consistency determination may be necessary if the proposed project is modified. This may take the form of either a supplemental consistency determination pursuant to 15 CFR 930.46 or a new consistency determination pursuant to 15 CFR 930.36. Likewise, if further project assessments reveal environmental effects not previously considered, a supplemental consistency certification may be required.

We would also greatly appreciate any effort on your part to minimize the project's impact to the offshore industries as they contribute significantly to the coastal economy. We recommend, where practical, that you relocate proposed survey transects to avoid South Atlantic Fishery Management Council-designated Habitat Areas of Particular Concern (HAPC) and coordinate the survey to avoid interfering with saltwater fishing tournaments. A list of the saltwater fishing tournaments planned off North Carolina's coast this fall is attached. Please contact Carole Willis, carole.y.willis@ncdenr.gov, or Randy Gregory, randy.gregory@ncdenr.gov, with the Division of Marine Fisheries at 252-726-7021 if you have any questions related to these tournaments.

Thank you for your consideration of the North Carolina Coastal Management Program. If you have any questions, please contact Daniel Govoni at 252-808-2808 x215.

Sincerely,

Braxton Davis
Director, NC Division of Coastal Management

NCDENR
North Carolina Department of Environment and Natural Resources
Division of Coastal Management

Pat McCrory
Governor

John E. Skvarla, III
Secretary

August 19, 2014

TO: Daniel Govoni, NCDCM Assistant Major Permits Coordinator

FROM: Jessi Baker, NCDCM Fisheries Resource Specialist JoB

THROUGH: Dr. Louis Daniel, NC Division of Marine Fisheries Director

SUBJECT: National Science Foundation Consistency Determination and Draft Environmental Assessment for Marine Geophysical Surveys off Cape Hatteras, NC

The Division of Coastal Management, Fisheries Resource Specialist has reviewed the National Science Foundation (NSF) Consistency Determination and Draft Environmental Assessment for Marine Geophysical Surveys off Cape Hatteras, NC. The NSF plans to conduct marine seismic surveys off the NC coast as a part of research investigating how the continental crust stretched and separated during the opening of the Atlantic Ocean.

Project description

Seismic surveys would be conducted from September 15 to October 22, 2014 aboard the R/V *Langseth* approximately 6 to 430 km off the North Carolina coast in depths ranging from 20 to 4300m. The surveys will cover 6,350 km of transect lines while towing various airgun arrays and hydrophones and deploying seismometers on the seafloor. Airguns are an energy source for seismic surveys that produce sound at a maximum of approximately 250 decibels. The vessel will be travelling at approximately 8.5 km/hour (4-5 kt) and airguns will fire either every 22 or 65 s, depending on the transect line. Each shot lasts for less than 1 s.

The Consistency Determination and EA make several references to the National Science Foundation/US Geological Survey Programmatic Environmental Impact Statement/Overseas Environmental Impact Statement for Marine Seismic Research (PEIS) for additional information, so many of the comments below are with reference to the PEIS.

According to the PEIS, the known effects of seismic survey sounds on fish and fisheries include masking of other sounds, disturbance, stress, hearing or detection impairment, auditory tissue damage, non auditory injury, mortality, and impediments to fishing activity (Table 3.3-6). Concerns regarding the impacts of the noise associated with the use of airgun arrays can be separated into physical impacts to fish and impacts to the offshore fishing industry in coastal NC.

Fish Impacts

The PEIS reports impacts to fish ranging from mortality to injury to behavioral responses. Section 3.3.4 and Appendix D of the PEIS describe the relevant research on effects of airguns on fish and note that there has been

400 Commerce Ave., Morehead City, NC 28557
Phone: 252-808-2808 \ FAX: 252-247-3330 Internet: www.nccoastalmanagement.net

a minimal amount of research on these topics that makes drawing conclusions of any type of effect to fish populations problematic. Of the few studies available, reported physiological effects ranged from increased levels of stress-related chemicals in blood, long-term damage to hearing structures, mortality to fish, eggs, and larvae, to no damage. The PEIS concludes that mortality or serious injury is possible within a few meters of airgun blasts and no population scale effect is anticipated.

Several of the studies summarized in Appendix D of the PEIS report a change in fish behavior between received sound levels of approximately 160 and 200 dB. The EA provides graphical depictions of the distance from the airgun blast where exposure to sounds of 180 and 160 dB is anticipated in Figures 2-5. Based on Table 1 in the EA, the area with exposure to 180 dB is estimated to have a radius of 2,060 m (over 2.5 mile wide area) in depths less than 100 feet. The area with exposure to 160 dB could have a radius of 22,600 m (over 28 mile wide area) in depths less than 100 feet. The radii decrease with increasing depth ranges.

Extensive hard bottom habitat exists on the continental shelf off of North Carolina in both state and federal waters. Hard bottom habitat is a critical habitat for many commercially and recreationally important fisheries, particularly the snapper-grouper complex. The South Atlantic Fishery Management Council has designated a subset of Essential Fish Habitat as Habitat Areas of Particular Concern (EFH-HAPC). Specific areas are designated EFH-HAPC if considered particularly important for managed species or species complexes due to importance of ecological functions provided, and are at risk due to their rarity or sensitivity to human degradation. Several of these hard bottom areas are directly traversed by the proposed transects as shown in Figure 1, including HAPCs namely Big Rock, 10-Fathom Ledge, The Point, Charleston Bump Complex, and Cape Fear *Lophelia* Banks. Others are in very close vicinity to transects including Cape Lookout *Lophelia* Banks. Disturbance in these areas of concentrated fish use that results in displacement of fish could impact local fish abundance by deterring foraging, refuge, and spawning activities in preferred habitat areas.

Lophelia coral banks are located in water depths greater than 300 m and individuals can be up to 1,000 years old. These fragile coral reefs thrive in complete darkness and have an exceptionally slow growth rate. The Lophelia coral banks located off Cape Lookout, NC, may be the northernmost deep-water coral banks along the U.S. East Coast.

In addition, marine mammals and sea turtles are an important component of NC's coastal ecosystem, and state and federal fishery agencies go to great extent to reduce fishery related takes. Of particular concern is the high number of estimated takes due to this project of 18,384 dolphins and whales per year (Table 9, p.65). A take is defined as numbers of individuals that could be exposed to 160 dB or more. The relative percentages of takes in the regional populations reported in Table 9 are as high as 6 and 9% for Bottlenose and Roughtoothed dolphins and 16 and 34 % for Atlantic spotted and Pantropical spotted dolphin in US waters, respectively. Additional mitigation measures to reduce takes should be considered to reduce these numbers.

Fisheries Impacts

Fisheries can be impacted in many ways besides actual physiological damage to the fish, including reduced catch due to fish displacement, direct interaction with fishing activities, and change in fish distributions in the water column. Studies described in PEIS section 3.3.4.4. (p.3-47) found that catch declined in the onset of surveys and remained depressed during and after the surveys ended. Although it is recognized that survey activities may be ongoing in areas with potential user-conflicts for only a few days, if the lasting effects result in fish displacement, changes in fish distribution, or more severe physiological impacts, then the impacts to fishing and diving could last well into the winter.

North Carolina coastal areas support industries critical to our entire state's economy, including our fishing industry. With over 8,200 licensed commercial fishermen and close to 800 seafood dealers throughout our coastal area, the commercial fishing industry generates an estimated 5,180 jobs with an annual income exceeding $105 million and an overall economic impact of $255 million (NCDMF, fisheries landings data2014)(NOAA 2014[a]). Recreational fishing is also very important economically and culturally in coastal North Carolina. Approximately 1.7 million anglers take over 5 million fishing trips annually in North Carolina's coastal waters (NOAA 2014[b]). This recreational fishing activity produces an estimated 18,200 jobs, $692 million in income and $1.87 billion in overall economic impacts for the state economy (NOAA 2014[b]). The economic impacts of the state's fishing industry and the rich cultural heritage of our coastal areas demonstrate the immense importance of protecting and sustaining the natural resources of our coast.

In the Fisheries section of the EA beginning on page 40, it would be more representative of potential impacts to list species by ex-vessel value than by weight since offshore fisheries catch may have a relatively small weight but a high value per pound. Certain species groups, such as tunas and other highly migratory pelagic species and snapper-grouper species that are not presently included will become more significant relative to the other mentioned species if examined by value. In particular, the extremely low allowable regional catch levels (NC through FL) for snapper grouper species constrain harvests to quantities that may appear relatively minor, but provide significant economic benefit to individual fishery participants as well as communities. These updates should also be made to Table 6 (p. 42). Not only are these groups of species important due to their relatively high value, they also are relevant to the discussion of potential impacts, as the fisheries targeting them take place in the area where the seismic surveys will occur.

In North Carolina, September and October are prime offshore fishing months and popular for diving, with much of this activity occurring greater than 3 miles offshore. Popular offshore species during this time of year include white marlin, king mackerel, dolphin, tuna, and wahoo as evidenced by the many recreational and charter boat trips as well as tournaments targeting these species. Table 7 in the EA and the associated text should be updated to include tournaments listed in the attached tables. In addition, interactions with commercial fishing activities that span large areas (eg. long line fishery) could result in displacement of fishing operations or entanglement with gear.

The statement on page 70 that "only a small percentage of the recreational dive sites are within 25 km of the survey track lines" needs to be corrected based on Figure 6, which depicts almost all popular dive sites within the 25 km buffer. This buffer shown in Figure 6 is of concern because if diving is not recommended in these areas, then a significant number of popular dive sites will be unavailable.

Other concerns

The PEIS, dated June 2011, does not include the coast off of North Carolina as a Detailed or Quantitative Analysis Area (DAA or QAA) as described in section 2.3 and is, therefore, not discussed in the Affected Environment sections of each sub-chapter. Although the information in the PEIS is relevant regarding fish hearing and research regarding fish and seismic testing, some important rare habitats are not covered, namely Lophelia coral banks. Some discussion of potential impacts to these rare and fragile habitats should be included in the EA.

On page 4 of the EA, water depths in the survey area are stated to be 30-4300 m but according to the maps in Figures 1 and 6, surveys will extend well into waters with depths less than 20 meters.

Avoidance, minimization, mitigation for impacts to fish and fisheries

We recognize that many marine species may be impacted by these surveys and that efforts have already been taken to reduce impacts to some species through the survey timing, relatively brief time period, limited seafloor coverage, and measures to avoid marine mammals and sea turtles once underway. However, further steps are

necessary to avoid or minimize impacts to fish and fisheries and could include a change in survey timing, avoidance of important habitats, and monitoring.

Moving the surveys to winter would greatly reduce conflicts with fishing and diving operations in these areas. Recognizing that North Atlantic right whale utilizes areas off NC from winter to spring, we recommend conducting surveys in November.

Important known habitats and HAPCs should not be directly traversed by the survey transects. These areas should be avoided with a buffer of at least as wide as the distances with received sound levels of 180 dB for that depth. This results in buffers of approximately 2.6 miles for depths less than 100m, 1.7 miles for depths between 100-1000m and 1.2 miles for depths greater than 1000m based on the information provided in Table 1 of the EA and discussed above. This buffer is necessary to reduce the largest impacts (directly under the airguns) to habitats where commercially and recreationally important fish are known to aggregate.

In known locations of *Lophelia* coral reefs or other hard bottom, deployment of ocean bottom seismometers or any other bottom-disturbing activities should not be allowed.

The PEIS states that the sound associated with seismic survey activities could cause behavioral, physiological, and pathological effects in fish but there is "insufficient knowledge to establish objective criteria for determining potential for adverse impacts". Due to this lack of knowledge, if impacts cannot be avoided or minimized, monitoring should be established in areas known to be highly utilized by certain fish species. Monitoring could include remotely operated underwater vehicle (ROV) observation or in situ video recording and traditional hook-and-line sampling in important areas before, during, and after seismic survey. Monitoring areas should at least include portions of the Big Rock, 10-Fathom Ledge, The Point, and Cape Fear Lophelia Banks HAPCs. Considering this is the first large scale use of airguns in this area, this monitoring would be a relatively simple way to provide preliminary data observing fish and fisheries impacts that would guide the management of future seismic surveys off the coast of North Carolina.

Section 3.3.4.4 of the PEIS describes how effects can be minimized through adjustments to tracklines, timing of surveys, and communication with fishers. The summary of section 3.3 Marine Fishes states that in areas where commercially important fisheries are known to occur, pre-survey planning would be conducted to minimize adverse impacts. NCDCM and NCDMF look forward to working with NSF to make these adjustments to the proposed seismic surveys in order to minimize impacts to the fish and fisheries of North Carolina.

Thank you for the opportunity to provide input on this project. If you have any comments or questions, please call Jessi Baker at 252-808-2808 ext. 213 or via email at jessi.baker@ncdenr.gov.

Literature Cited

NOAA (National Oceanic and Atmospheric Administration). *Understanding the Commercial Fisheries and Recreational Fisheries Economic Impact Estimates*. 2014[a]. National Marine Fisheries Service. U.S. Dept. Commerce. http://www.st.nmfs.noaa.gov/Assets/economics/documents/feus/2012/Understanding_fisheries_economic_impact_estimates.pdf

NOAA (National Oceanic and Atmospheric Administration). *Fisheries Economics of the United States, 2012*. 2014. National Marine Fisheries Service. U.S. Dept. Commerce, NOAA Tech. Memo. NMFS-F/SPO-137. http://www.st.nmfs.noaa.gov/Assets/economics/documents/feus/2012/FEUS2012.pdf

North Carolina Department of Environment and Natural Resources

Pat McCrory
Governor

John E. Skvarla, III
Secretary

MEMO

To: Daniel Govoni, Assistant Major Permits Coordinator

Through: Robert Tankard, Assistant Regional Supervisor - Water Quality Regional Operation Section, Division of Water Resources RT

From: Anthony Scarbraugh, Environmental Senior Specialist AS

Subject: **Comments on Atlantic Ocean off Cape Hatteras Marine Geophysical Survey**

Date: July 21, 2014

Review of the subject project found no mention of possible existence or impacts to jurisdictional wetlands, streams, and/or waters within the footprint of the proposed land based activities. Therefore, this Office recommends coordinating with the United States Army Corps of Engineers (USACOE) concerning identification of any jurisdictional features and the required permitting that may be involved prior to the implementation of this project. If you should have any questions or require additional information you may e-mail me at anthony.scarbraugh@ncdenr.gov or 252-948-3924.

Division of Water Resources – Water Quality Regional Operations Section – Washington Regional Office
943 Washington Square Mall, Washington, NC 27889
Phone: 252-946-6481 \ Fax: 252-975-3716\ Internet: www.ncdenr.gov

North Carolina
Department of Administration

Pat McCrory, Governor
Bill Daughtridge, Jr., Secretary

State Property Office

July 24, 2014

To: Daniel Govoni

From: Joy Wayman
Real Property Agent

Re: Marine Geophysical Survey
Applicant: National Science Foundation

Reply: If the activities are located on State-owned land or if the project requires any structure and/or equipment on State-owned land - easements, rights-of-entry, license or other legal documents will be required from the State Property Office prior commencement of any work.

Mailing Address:
1321 Mail Service Center
Raleigh, N.C. 27699-1321

Telephone (919) 807-4650
Fax (919) 733-1431
State Courier #52-71-78

Location:
116 West Jones Street
Raleigh, North Carolina

Walker, Michele

From: angela huskey <adhuskey@gmail.com>
Sent: Thursday, August 21, 2014 1:09 PM
To: Walker, Michele
Subject: Seismic Testing

Please help stop the seismic Testing that is to take place off the coast of NC!
This is a critical time with sea turtle hatchling trying to make it out to the ocean. Mature turtles still laying.
Our right whales around the east coast.
Our fishing industry will hurt greatly from this testing.
It has been proven the sound waves make all sea life vulnerable. It effects there eating, hunting, breeding. They live from detecting sound waves. That's how they feed, breed.
Please stop the madness! There are plenty other options for oil and gas.
Support wind energy! That would create 1000, s of jobs.
They would have to come into the ports. They would have to be assembled, taken out to the ocean, assembles and maintained.
It's a lot better not only for our environment but for our wonderful sea life that we are fortunate to have on the east coast and especially NC.
We now have beaches that are classified as critical habitats for our awesome sea turtles.
Please help stop this first step into drilling for oil and gas off of our wonderful coast!
Thank you,
Angela Huskey

Walker, Michele

From: Pabst, D. Ann <pabsta@uncw.edu>
Sent: Wednesday, August 20, 2014 11:56 AM
To: Walker, Michele
Cc: Pabst, D. Ann
Subject: RE: Hello Dr. Walker - a quick question regarding NOAA permit authorization for 0648-XD394 Seismic Testing Off NC
Attachments: Pabst letter to NOAA Permits regarding Authorization 0648-XD394.pdf

Hello Michele,

Attached and embedded below please find my comments to NOAA, which I wish to share with you.

Best wishes – Ann

18 September 2014

Dr. Jolie Harrison
Chief, Permits and Conservation Division
Office of Protected Resources, NMFS
1315 East-West Highway
Silver Spring, MD 20910

Dear Dr. Harrison,

I am writing to comment upon NOAA's proposed authorization for "Takes of Marine Mammals Incidental to Specified Activities; Marine Geophysical Survey in the Northwest Atlantic Ocean Offshore North Carolina, September to October 2014". My major concerns center around the potential impacts on beaked whales within the proposed seismic survey area.

Multiple survey efforts off Cape Hatteras, North Carolina have documented year-round presence of beaked whales (*Ziphius cavirostris* and *Mesoplodon* spp., OBIS SEAMAP publically available data) in the proposed survey area. Within that area, beaked whales are non-randomly distributed. They are found exclusively along the deep continental shelf edge and beyond. Their very geographically-specific distribution patterns suggest that animals may not be able to respond to seismic activity by simply moving away from the area, as is suggested in the authorization document.

Beaked whale abundances are very difficult to assess, for the reasons well-articulated in NOAA's Stock Assessment Reports. I am unclear, though, as to how the stock abundances for beaked whales were determined. Table 1 in the authorization document lists the abundance estimate for each beaked whale species as 7,092 individuals. The stated best estimate for Cuvier's beaked whale (*Z. cavirostris*) is 6,532 individuals (minimum 5,021; PBR = 50). The 7,092 (minimum 4,632; PBR 46) estimate in Table 1 is for combined *Mesoplodon* spp. from Florida to the Bay of Fundy. While this is currently the best available estimate, this number simply *does not represent* the true abundance of *any one* species. Thus, the total population of each potentially impacted *Mesoplodon* species is an overestimate, and the potential impact on any single species, an underestimate.

Beaked whales are known prolonged, deep divers (e.g. Tyack *et al.* 2006; Schorr *et al*. 2014). Thus, visual monitoring efforts, even with prolonged 30 minute survey windows, are insufficient to assure no beaked whales are in the exclusion zone. The addition of passive acoustics is important, but it is unclear as to whether the tow depth (approximately 20 m) is sufficient to detect beaked whale vocalizations, which usually occur only beyond 400 m depth. Thus, more detailed information on effective monitoring of these deep diving species would be valuable.

Lastly, beaked whales are also known to experience atypical mass stranding events when exposed to other anthropogenic sound sources, specifically military mid-frequency sonar (reviewed by Cox *et al*. 2006). The sound sources used in seismic surveys are of similar amplitude ("246 to 253 decibels (dB) re: 1 µPa (peak to peak)"; information from authorization document), although the frequency of airgun output is much lower. There are, simply put, insufficient data available on beaked whale responses to these types of anthropogenic sounds.

I am appreciative of the serious consideration the Lamont-Doherty – NSF investigators have given to monitoring and mitigation steps, and the extra requirements that NOAA has demanded for this activity to be authorized. I do believe, though, that the potential impacts on beaked whales are unknown, and that special consideration needs to be given to this group of cetaceans in any authorization. I hope that the regional stranding organizations are also notified if this activity does occur, and that NOAA has a robust response plan, should it be required.

Sincerely,

D. Ann Pabst
Professor, Biology and Marine Biology
University of North Carolina Wilmington

D. Ann Pabst
Biology and Marine Biology
University of North Carolina Wilmington
601 S. College Rd.
Wilmington, NC 28403
Phone: 910-962-7266
Fax: 910-962-4066
pabsta@uncw.edu

From: Walker, Michele [mailto:michele.walker@ncdenr.gov]
Sent: Tuesday, August 19, 2014 12:42 PM
To: Pabst, D. Ann
Subject: RE: Hello Dr. Walker - a quick question regarding NOAA permit authorization for 0648-XD394 Seismic Testing Off NC

I have attached our public notice seeking comment on the NSF consistency review. Yes, comments may be sent via email to me.

We also have information regarding the request on our website, www.nccoastalmanagment.net. The link is under What's New on the right side of the page, and is titled National Science Foundation Consistency Review.

Thank you for taking the time to comment. We appreciate your input.

Michele

From: Pabst, D. Ann [mailto:pabsta@uncw.edu]
Sent: Tuesday, August 19, 2014 12:01 PM
To: Walker, Michele
Cc: Pabst, D. Ann
Subject: Hello Dr. Walker - a quick question regarding NOAA permit authorization for 0648-XD394 Seismic Testing Off NC

Hello Dr. Walker,

I submitted comments on the NOAA permit authorization for 0648-XD394 Seismic Testing Off NC yesterday and received an email from NOAA Permits that the "North Carolina Division of Coastal Management is also soliciting public comments on a federal-consistency determination for the seismic survey under the Coastal Zone Management Act."

May I ask if there is a link on your website announcing this request? If not, may I confirm that you would be an appropriate recipient of such a comment letter?

Thank you for your assistance – Ann Pabst

D. Ann Pabst
Biology and Marine Biology
University of North Carolina Wilmington
601 S. College Rd.
Wilmington, NC 28403
Phone: 910-962-7266
Fax: 910-962-4066
pabsta@uncw.edu

18 September 2014

Dr. Jolie Harrison
Chief, Permits and Conservation Division
Office of Protected Resources, NMFS
1315 East-West Highway
Silver Spring, MD 20910

Dear Dr. Harrison,

I am writing to comment upon NOAA's proposed authorization for "Takes of Marine Mammals Incidental to Specified Activities; Marine Geophysical Survey in the Northwest Atlantic Ocean Offshore North Carolina, September to October 2014". My major concerns center around the potential impacts on beaked whales within the proposed seismic survey area.

Multiple survey efforts off Cape Hatteras, North Carolina have documented year-round presence of beaked whales (*Ziphius cavirostris* and *Mesoplodon* spp., OBIS SEAMAP publically available data) in the proposed survey area. Within that area, beaked whales are non-randomly distributed. They are found exclusively along the deep continental shelf edge and beyond. Their very geographically-specific distribution patterns suggest that animals may not be able to respond to seismic activity by simply moving away from the area, as is suggested in the authorization document.

Beaked whale abundances are very difficult to assess, for the reasons well-articulated in NOAA's Stock Assessment Reports. I am unclear, though, as to how the stock abundances for beaked whales were determined. Table 1 in the authorization document lists the abundance estimate for each beaked whale species as 7,092 individuals. The stated best estimate for Cuvier's beaked whale (*Z. cavirostris*) is 6,532 individuals (minimum 5,021; PBR = 50). The 7,092 (minimum 4,632; PBR 46) estimate in Table 1 is for combined *Mesoplodon* spp. from Florida to the Bay of Fundy. While this is currently the best available estimate, this number simply *does not represent* the true abundance of *any one* species. Thus, the total population of each potentially impacted *Mesoplodon* species is an overestimate, and the potential impact on any single species, an underestimate.

Beaked whales are known prolonged, deep divers (e.g. Tyack *et al.* 2006; Schorr *et al*. 2014). Thus, visual monitoring efforts, even with prolonged 30 minute survey windows, are insufficient to assure no beaked whales are in the exclusion zone. The addition of passive acoustics is important, but it is unclear as to whether the tow depth (approximately 20 m) is sufficient to detect beaked whale vocalizations, which usually occur only beyond 400 m depth. Thus, more detailed information on effective monitoring of these deep diving species would be valuable.

Lastly, beaked whales are also known to experience atypical mass stranding events when exposed to other anthropogenic sound sources, specifically military mid-frequency sonar (reviewed by Cox *et al*. 2006). The sound sources used in seismic surveys are of similar amplitude ("246 to 253 decibels (dB) re: 1 μPa $_{\text{(peak to peak)"}}$; information from authorization document), although the frequency of airgun output is much lower. There are, simply put, insufficient data available on beaked whale responses to these types of anthropogenic sounds.

I am appreciative of the serious consideration the Lamont-Doherty – NSF investigators have given to monitoring and mitigation steps, and the extra requirements that NOAA has demanded for this activity to be authorized. I do believe, though, that the potential impacts on beaked whales are unknown, and that special consideration needs to be given to this group of cetaceans in any authorization. I hope that the regional stranding organizations are also notified if this activity does occur, and that NOAA has a robust response plan, should it be required.

Sincerely,

D. Ann Pabst
Professor, Biology and Marine Biology
University of North Carolina Wilmington

Walker, Michele

From: momratz@gmail.com
Sent: Wednesday, August 20, 2014 10:59 AM
To: Walker, Michele
Subject: Re: today's news

Hi Michele,
I suspect that you are not the right person to respond to on this Seismic Testing but I don't know who to send to.
My concerns are not only about the fish and marine mammals but also you stated that they would be in Oregon Inlet. I hope not! I am fearful that the bridge will be further damaged and perhaps fall in. Just a thought that I hope someone at DCM has asked about the potential dangers to the bridge.
Thanks,
Annette Ratzenberger, Nags Head

From: Michele Walker
Sent: Wednesday, August 20, 2014 8:42 AM

Reminder: The information below is an aggregate of news items/editorials for today. Any opinions are not necessarily endorsed by DCM or DENR.

Flooding is more than a nuisance
http://hamptonroads.com/2014/08/flooding-more-nuisance

State commitment boosts Oak Island dredge project
http://www.starnewsonline.com/article/20140819/ARTICLES/140819635/1017/news0102?Title=State-commitment-boosts-Oak-Island-dredge-project

Council to discuss solutions to Freeman Park dune erosion
http://www.starnewsonline.com/article/20140819/ARTICLES/140819660/1015/news0101?p=all&tc=pgall

Dare County moves ahead with plan to widen Buxton beach
http://outerbanksvoice.com/2014/08/19/dare-county-moves-ahead-with-plan-to-widen-buxton-beach/

NC Reviews Coastal Seismic Testing Proposal
http://wunc.org/post/nc-reviews-coastal-seismic-testing-proposal

---

Michele Walker, Public Information Officer
N.C. Dept. of Environment & Natural Resources
Office of Public Affairs/Division of Coastal Management
1601 Mail Service Center, Raleigh, NC 27699-1601
Phone/Fax #: 919-707-8604
E-mail: Michele.Walker@ncdenr.gov

Walker, Michele

From: Bev Veals <bev5k@mac.com>
Sent: Tuesday, August 19, 2014 12:21 PM
To: Walker, Michele
Subject: Seismic Testing Via National Science Foundation

Dear Ms. Walker, with all due respect — NO! Please do not let the National Science Foundation do this to our coast of NC. If you look into the funding or the National Science Foundation, it is heavily funded by subsidiaries of the koch brothers, and those of us keeping an eye on the oil and gas exploration aspect of the Atlantic know that Koch Industries would like to have first dibs at it.

If you need further proof of the potential conflict of interest, look into funding for NOVA, a popular PBS program. it is funded by the David H. Koch Foundation for Science and the National Science Foundation. They work hand in hand in the name of "science". This is NOT a good idea.

In addition, if you look into studies done by NOAA regarding the impact of noise in the ocean, a study that was assisted by Duke University' Marine Geospatial Ecology Lab, the sounds we have now with normal boat and construction noise is having a drastic impact on fisheries and cetaceans now. http://cetsound.noaa.gov/participants.html

Peasse DO NOT allow this seismic testing to occur. It is 1) a potential conflict of interest and 2) a crucial and devastating blow to our recovering dolphin population which is having issues now due to a virus that ran along the eastern seaboard. This is just the tip of the iceberg with what I feel is wrong with this request.

Thank you.

Bev Veals
730 Settlers Ln
Kure Beach, NC

Walker, Michele

From: Govoni, Daniel
Sent: Friday, September 05, 2014 10:57 AM
To: 'BONNIE MONTELEONE'
Cc: Walker, Michele
Subject: RE: Lamont Doherty proposal to conduct research using airguns off the coast of North Carolina

Dear Ms. Monteleone,

Thank you for your email dated 9/5/14 concerning the Federal Consistency Determination submitted by the National Science Foundation proposing to conduct a Marine Geophysical Survey via seismic testing in the Atlantic Ocean off of the North Carolina coast. As you may be aware, the Division of Coastal Management is coordinating a state review. Your comments will be examined and taken into consideration prior to the Division making a final Consistency Determination, you will be informed of this final decision.

The Division appreciates you taking the time to comment on this proposal, and your email will be added to the official file. Please feel free to contact me at (252) 808-2808 (ext. 215), if you should have any additional questions or concerns relating to this proposal.

Sincerely,
Daniel Govoni

Daniel M. Govoni
Asst. Major Permits Coordinator
NC Division of Coastal Management
400 Commerce Ave.
Morehead City, NC 28557

(252) 808-2808
(252) 247-3330 fax
daniel.govoni@ncdenr.gov

From: BONNIE MONTELEONE [mailto:bonmon11@hotmail.com]
Sent: Friday, September 05, 2014 10:50 AM
To: Govoni, Daniel
Subject: Lamont Doherty proposal to conduct research using airguns off the coast of North Carolina

I petition the Division of Coastal Management to find this proposal inconsistent with coastal zone management for the region to be affected along the east coast especially off of North Carolina for the following reasons:

1. Due to the unique diversity of marine biota, the Outer Banks' economy is heavily impacted by the success of the fish stocks. Airguns have been shown to dramatically depress catch rates of various commercial species. (Engas, A. et al., 1996)

2. The Federal Register's Revised Take Table as of July 25, 2014 is not completely accurate. According to their list, North Atlantic right and fin whales have a 0% take risk (both of which are endangered species). Fin whales are reportedly seen year round off of Hatteras. Right whales migrate in the fall from Bay of Fundy to Florida to calve. Though aerial surveys report rare sightings, they are RARE as a species. We cannot assume because we don't see them, they are not in the Cape Hatteras vicinity. Right whales have been seen off the coast of Fort Fisher, NC in early November making it possible that they could be feeding in the nutrient rich water off of Cape Hatteras in October. Furthermore, right whales do not travel in families and are far less audible than other whales making the potential of them being in the region yet undetected much greater.(http://www.starnewsonline.com/article/20091112/articles/911129985?p=1&tc=pg&tc=ar)But regardless, seismic testing has been reported to travel 100,000 miles which spans the distance from the Bay of Fundy to Florida. (Boom, Baby, Boom: The Environmental Impacts of Seismic Surveys, pg. 3.)

3. Due to the steep slope off of Cape Hatteras that causes nutrient rich upwelling, the cold waters of the Labrador Current, and the warm waters of the Gulf Stream, this location is an unusually dynamic area for foraging unlike any other region on the entire east coast. "In the pelagic and mid-water depths there is high diversity of verte-brates, migratory birds, mammals, and turtles as well as fish. On the bottom there is also diversity of invertebrates." (Blake, J. A et al., Gooday, A. J. et al, Hecker, B, Milliman, J. D.and Rhodas, D. C, et al) This is a foraging hotbed for an unusually high density of species. The seismic testing that will occur there will create enough noise to disrupt eating, mating, and navigation for 33 days straight, "792 hours of continuous airgun operations" according to the Lamont-Doherty report. Because it is a feeding site to many endangered species such as fin and the North Atlantic right whales, hawksbill, Kemp's ridley, loggerhead, and leatherback sea turtles, by law this area should be protected by the Endangered Species Act and listed as a priority ocean area for protection in the Mid-Atlantic. (www.nmfs.voaa.gov/pr/speicis/esa/listed.htm)

4. Because beaked whales are deep divers, they are found in areas where there are canyons and are heavily impacted by these surveys due to sound bouncing off the canyon walls. (Sounding the Depths, pg. 11) Cuvier's beaked whales are seen in this coastal region year round, traveling north and south along Hatteras Canyon off Cape Hatteras, and could potentially be more at risk for this reason. "In general, the heads of canyons are known to be nursery areas for many fish and crustaceans, including commercially important ones. The sessile corals, sponges, and anemones found in the northern canyons have restricted distributions in that they must live attached to hard substrates. Hence populations within the canyons could represent crucial stock populations of sessile organisms." (http://www.nrdc.org/water/oceans/priority/recheck.asp)

5. The Lamont-Doherty report states the testing will be as high as 180 decibels. " . . . a 174-decibel rumble . . . . about as strong as a commercial jet at takeoff, measured about three feet away." (Sounding the Depths, pg. 4) Prolonged exposure to continuous loud noise is known to cause hearing loss to humans as well as marine mammals. This hearing impairment is known as "threshold shift." (Sound the Depths II, pg. 13) Though marine mammals have eyes and a sense of smell, the sense they rely on the most is sound to navigate, forage for food, mate, care for their offspring, and protect themselves from predators. To introduce sound that interferes with the most important sensory for 33 days straight is similar to blinding people with flood lights continuously for 24 hours, for 33 days. How could people feed, care for their children, or stay out of harms way? It is our moral, scientific, and legislative duty to protect this region more so than other areas along the east coast.

6. The proposed sound source consists of a 36-airgun array with a total discharge volume of ~6600 in or an 18-airgun array with a total discharge of volume of ~3300. "A single airgun array can disrupt vital behavior in endangered whales over an area of at least 100,000 square nautical miles in size." (Boom, Baby, Boom: The Environmental Impacts of Seismic Surveys, pg. 3.) This underscores the harassment seismic testing will cause to the most endangered whale in the world – the North Atlantic right whale.

7. Other anthropogenic impacts that compromise the large whale populations are fishing gear entanglement and boat strikes. Right whales and fin whales are the most commonly reported species in the context of population size prone to vessel strikes. "Compared with the spatial extent of regulations, vessel-strike mortality continues to be highest in the mid-Atlantic coast." (Van Der Hoop, J. M. et al. 2012) Seismic testing will add yet another stressor on the already in periled species.

8. *Sargassum* is considered an essential fish habitat and is charged by law to minimize any adverse effects on such habitat. (Fishing North Carolina's Outer Banks: The complete Guide to Catching More, pg. 72). *Sargassum* found off North Carolina's coast is home to 81 fish species. Most of these fishes are juveniles that meander from the Gulf Stream. Commercially important dolphin fish, amberjacks, and tuna have also been documented to use this unique habitat as well as marine mammals (dolphins) and juvenile loggerhead sea turtles many of which are endangered. (http://oceanexplorer.noaa.gov/explorations/03edge/background/sargassum/sargassum.html) Influenced by the currents, large windrows of Sargassum mats consistently form just off of Cape Hatteras. The airgun blasts are not limited to just reaching the bottom but are also reported to be heard by mariners; thus, the *Sargassum* ecosystem stands to be impacted by the airgun operations. The NC Outer Banks fishing industry relies heavily on the Sargassum habitat. Communication with members from Pirates Cove Marina, the fishermen fear the negative impacts on fishing especially in hunting marlin.

Please consider this very unique aquatic region as a priority ocean area for protection in the Mid-Atlantic both for marine life and the fishing community, and not allow seismic testing incidental harassment to ever occur in this region.

Thank you for your consideration.

Bonnie Monteleone

Wilmington, NC 28403

910-962-3450

www.theplasticocean.blogspot.com

Walker, Michele

From: jmerriner@ec.rr.com
Sent: Sunday, August 17, 2014 10:06 PM
To: Walker, Michele
Cc: mhooper9@ec.rr.com
Subject: Carteret County Crossroads comment re NSF Seismic Survey

Michele Walker,
This note pertains to proposed NSF supported seismic studies off the NC coast scheduled for September-October 2014. Carteret County Crossroads has questions/misgivings about the reliability of methodology for sighting of marine mammals, sea turtles and aggregations of other significant biota in the survey area. We understand that the dB levels produced by the air gun array can range from 160-180 dB. These levels can harm MM and Endangered/threatened species, ie would be considered harassments or maybe takes of the animals. Other animals such as finfishes with airbladders would be subject to the concussive forces and possibly harmed.
With those aspects as background, we are concerned about the detection mechanism(s) for animals in the range while the air guns are operated. We note that visual scanning and acoustic monitoring would be employed but question their utility over the distances of potential organismal impact (up to 2 miles). Confirmed Marine Mammal sightings are difficult at those ranges even on a calm day. We conclude that a number of MMs and protected species likely will be impacted in the survey, but their presence will not detected by the scientific parties.

Yours, John V. Merriner, Sect. Carteret County Crossroads
P.O.Box 223
Beaufort, NC 28516

Walker, Michele

From: Chris <blishbell@bellsouth.net>
Sent: Tuesday, August 19, 2014 1:07 PM
To: Walker, Michele
Subject: Seismic testing

Dear Michele ,
Did someone forget to inform you and your group , that it is turtle season , and the hatchlings will be out in the ocean !
Along with numerous other sea creatures !
Who is actually behind all this ?
Why are you people bound and determined to destroy our natural resources ?
I can't help but think the oil companies are behind this , anyone that cares about our oceans would not make a decision like this.
Please reconsider what you are doing !
Chris Blish
Kure bch NC
Sent from my iPad

Walker, Michele

From: Govoni, Daniel
Sent: Monday, August 18, 2014 9:55 AM
To: 'CHRIS'
Cc: Walker, Michele
Subject: RE: opposition to seismic testing

Dear Mr. Mason,

Thank you for your email dated 8/18/14 concerning the Federal Consistency Determination submitted by the National Science Foundation proposing to conduct a Marine Geophysical Survey via seismic testing in the Atlantic Ocean off of the North Carolina coast. As you may be aware, the Division of Coastal Management is coordinating a state review. Your comments will be examined and taken into consideration prior to the Division making a final Consistency Determination, you will be informed of this final decision.

The Division appreciates you taking the time to comment on this proposal, and your email will be added to the official file. Please feel free to contact me at (252) 808-2808 (ext. 215), if you should have any additional questions or concerns relating to this proposal.

Sincerely,
Daniel Govoni

Daniel M. Govoni
Asst. Major Permits Coordinator
NC Division of Coastal Management
400 Commerce Ave.
Morehead City, NC 28557

(252) 808-2808
(252) 247-3330 fax
daniel.govoni@ncdenr.gov

From: CHRIS [mailto:seamason1@msn.com]
Sent: Monday, August 18, 2014 8:41 AM
To: Govoni, Daniel
Subject: opposition to seismic testing

Dear Mr. Govoni,

I am writing to you to voice my opposition to the proposed seismic testing off of the NC coast. There is little doubt this testing is in conjunction with oil exploration which I also adamantly oppose.

The effect of this on the marine environment will only be realized when it is to late and there are dead dolphins washing up on our shores or the fish population vacates the area completely.

The North Carolina coast is continuously ranked as a #1 destination for Scuba diving due to the health of the marine environment, which contributes to a positive commercial / recreational impact for our state. The negative downstream effects of this testing would be far reaching in to many other areas as well.

Thank you for your consideration of this request.

Chris Mason
Newport, NC

Walker, Michele

From: Govoni, Daniel
Sent: Tuesday, September 02, 2014 9:57 AM
To: 'Christine Bullen'
Cc: Walker, Michele
Subject: RE: NSF Seismic Testing off NC Coast

Dear Christine Bullen,

Thank you for your email dated 8/30/14 concerning the Federal Consistency Determination submitted by the National Science Foundation proposing to conduct a Marine Geophysical Survey via seismic testing in the Atlantic Ocean off of the North Carolina coast. As you may be aware, the Division of Coastal Management is coordinating a state review. Your comments will be examined and taken into consideration prior to the Division making a final Consistency Determination, you will be informed of this final decision.

The Division appreciates you taking the time to comment on this proposal, and your email will be added to the official file. Please feel free to contact me at (252) 808-2808 (ext. 215), if you should have any additional questions or concerns relating to this proposal.

Sincerely,
Daniel Govoni

Daniel M. Govoni
Asst. Major Permits Coordinator
NC Division of Coastal Management
400 Commerce Ave.
Morehead City, NC 28557

(252) 808-2808
(252) 247-3330 fax
daniel.govoni@ncdenr.gov

From: Christine Bullen [mailto:cvbullen@gmail.com]
Sent: Saturday, August 30, 2014 1:15 PM
To: Govoni, Daniel
Subject: NSF Seismic Testing off NC Coast

I am writing to express deep concern about the potential for loss of hearing for marine life due to the high dB levels proposed in the NSF testing. Dolphins and whales rely on sound for survival, and therefore mortality of the species is a potential outcome.

I think that the predominant factors that warrant a delay in the US NSF seismic testing are

- too many uncertainties relating to marine impacts

- lack of notice/information given to the public prior to the testing approval process

Please provide the residents of North Carolina more substantial information regarding impact, purpose, and testing location before allowing a federal entity to conduct a somewhat-experimental method of data collection off of our coast.

--
Christine V. Bullen, Ph.D.
931 Stately Pines Road
New Bern, NC 28560
Cell: 914-645-0605
Home: 252-288-6103
cvbullen@gmail.com
christine.bullen@gscouncil.org
Twitter | Facebook | LinkedIn | YouTube

Walker, Michele

From: Douglass, Claire <cdouglass@oceana.org>
Sent: Friday, August 22, 2014 5:06 PM
To: Walker, Michele
Subject: Oceana Comments Concerning the Marine Geophysical Survey Offshore North
Attachments: Comment Letter to North Carolina.pdf

Dear Mr. Davis:

Oceana is concerned about the National Science Foundation's proposal to use seismic airguns to study the Atlantic Ridge off the coast of Cape Hatteras this fall. Although scientific research is incredibly important to understand the world we live in, the timing of this study raises concern because it could affect Fall Fishing.

There has been little time to review this proposal and there is little scientific research on the effects of seismic airguns blasting on fish populations. The fall months are some of the most important times of the year for fishermen in North Carolina. Many fish species, including the spotted sea trout and striped bass, migrate south to the warmer waters off North Carolina in the fall. In addition, the king mackerel and spot fish are in a period of high activity to prepare for winter. The increased presence of fish in the waters is what drives Fall Fishing. North Carolina supports 8,800 commercial fishing jobs, in addition to 18,202 recreational fishing jobs. These industries combine to contribute some $1.4 billion to the North Carolina economy.

We will be sending more detailed public comments to the Bureau of Ocean Energy Management before its September 2nd deadline and will send you a copy for reference.

Sincerely,

Claire Douglass

Claire Douglass | Campaign Director, Climate and Energy
OCEANA | Protecting the World's Oceans
1350 Connecticut Ave. NW, 5th Floor | Washington, DC 20036 USA
T +1.202.467.1948 | **F** +1.202.833.2070
E cdouglass@oceana.org | **W** www.oceana.org

OCEANA | Protecting the World's Oceans

MEMORANDUM

1350 Connecticut Ave. NW, 5th Floor
Washington, DC 20036 USA
Toll free +1.877.7.OCEANA

P | +1.202.833.3900
F | +1.202.833.2070
oceana.org

August 22, 2014

Via E-mail

Braxton Davis
Director
c/o Michele Walker
North Carolina Division of Coastal Management
400 Commerce Ave.
Morehead City, NC 28557
Michele.Walker@ncdenr.gov

Re: Oceana Comments Concerning the Marine Geophysical Survey Offshore North Carolina, 79 Fed. Reg. 44550 (July 31, 2014)

Dear Mr. Davis:

Oceana is concerned about the National Science Foundation's proposal to use seismic airguns to study the Atlantic Ridge off the coast of Cape Hatteras this fall. Although scientific research is incredibly important to understand the world we live in, the timing of this study raises concern because it could affect Fall Fishing.

There has been little time to review this proposal and there is little scientific research on the effects of seismic airguns blasting on fish populations. The fall months are some of the most important times of the year for fishermen in North Carolina. Many fish species, including the spotted sea trout and striped bass, migrate south to the warmer waters off North Carolina in the fall. In addition, the king mackerel and spot fish are in a period of high activity to prepare for winter. The increased presence of fish in the waters is what drives Fall Fishing. North Carolina supports 8,800 commercial fishing jobs, in addition to 18,202 recreational fishing jobs. These industries combine to contribute some $1.4 billion to the North Carolina economy.

We will be sending more detailed public comments to the Bureau of Ocean Energy Management before its September 2nd deadline and will send you a copy for reference.

Sincerely,

Claire Douglass
Campaign Director

Walker, Michele

From: Michael Murdoch <memurdoch@gmail.com>
Sent: Sunday, August 17, 2014 3:29 PM
To: Walker, Michele
Cc: 'Paul Getty'; Penny Hooper; Matt Graham ; Courtney Mehurg; Robert Scull; Deede Miller; Zachary Keith; Cassie Gavin; Jessica Lewis; John Fussell; Don & Carolyn Hoss
Subject: Croatan Group of the Sierra Club Opposes Marine Geographical Survey proposed by the National Science Foundation
Attachments: Croatan Group Sierra Club Opposes Marine Survey.JPG

Dear Ms. Walker: The Croatan Group of the Sierra Club opposes the National Science Foundation's proposal to conduct a Marine Geophysical Survey via seismic testing in the Atlantic Ocean off of the North Carolina coast, Sept. 15-Oct. 22, 2014. Please see attached letter that is also being sent to Mr. Braxton Davis, NC Division of Coastal Management Director.

Croatan Group Sierra Club

Serving Carteret, Craven, Jones, Onslow, and Pamlico Counties

SIERRA CLUB
FOUNDED 1892

Mr. Braxton Davis, Division of Coastal Management Director
400 Commerce Avenue
Morehead City, NC 28557

August 15, 2014

Dear Mr. Davis:

The Croatan Group of the Sierra Club comprising over 500 members from Carteret, Craven, Onslow, Jones, and Pamlico counties strongly opposes the plan by the National Science Foundation to conduct seismic testing in the Atlantic Ocean off of the North Carolina coast, Sept. 15-Oct. 22, 2014.

The damaging effects of seismic blasting using 18-36 air guns is not understood and not worth the risk to the rich and fragile marine life off of our coast. Seismic guns create sound blasts in the area of 250 decibels - around double the amount one would experience at a loud rock concert. The potential impact to the fishing and tourism industry in our region could be substantial.

The use of ecosounders in conjunction with the seismic blasting has also been a problem with marine life. These devices produce high frequency sounds that have been proven to cause the death of whales.

Now is not the time to experiment off the coast of North Carolina where a rich diversity of marine life is at risk.

We urge you to deny the request and at the very least require a full environmental impact statement where public input is solicited.

Sincerely,

Michael E. Murdoch

Michael E. Murdoch, Chair
Croatan Group of the Sierra Club
415 Wildwood Road
Newport, NC 28570

RECEIVED
AUG 19 2014
DCM-MHD CITY

Note: Please provide us a decision regarding this matter.

Walker, Michele

From: Dain Eomar Nielsen <denielse@live.unc.edu>
Sent: Sunday, August 24, 2014 2:45 PM
To: Walker, Michele
Subject: Seismic Testing

Dear Ms Walker;

I am opposed to seismic testing. Clearly the research indicates there will be irreparable harm to much sea life.
Thank You;
Dain Nielsen

614 Robert E Lee Dr. Wilmington, NC 28412

Walker, Michele

From: Govoni, Daniel
Sent: Monday, August 18, 2014 11:43 AM
To: 'dive@discoverydiving.com'
Cc: Walker, Michele
Subject: RE: NSF Survey comments

Dear Debby Boyce,

Thank you for your email dated 8/18/14 concerning the Federal Consistency Determination submitted by the National Science Foundation proposing to conduct a Marine Geophysical Survey via seismic testing in the Atlantic Ocean off of the North Carolina coast. As you may be aware, the Division of Coastal Management is coordinating a state review. Your comments will be examined and taken into consideration prior to the Division making a final Consistency Determination, you will be informed of this final decision.

The Division appreciates you taking the time to comment on this proposal, and your email will be added to the official file. Please feel free to contact me at (252) 808-2808 (ext. 215), if you should have any additional questions or concerns relating to this proposal.

Sincerely,
Daniel Govoni

Daniel M. Govoni
Asst. Major Permits Coordinator
NC Division of Coastal Management
400 Commerce Ave.
Morehead City, NC 28557

(252) 808-2808
(252) 247-3330 fax
daniel.govoni@ncdenr.gov

From: dive@discoverydiving.com [mailto:dive@discoverydiving.com]
Sent: Monday, August 18, 2014 11:38 AM
To: Govoni, Daniel
Cc: Discovery Diving
Subject: NSF Survey comments

Good Morning Daniel

We have looked at the Draft Environmental Assessment and have some major concerns.

1. The timing of the survey is potentially devastating due to the timing in the middle of the last two productive months of our seasons these being the Dive Charter, Fishing Charter, Fishing Tournament, Diving and Fishing tourism and recreational boating industries.

2. It states they are avoiding the winter months of Jan thru March to avoid the whale migrations and potential negative affects; however they make no such efforts for the huge biomasses on each of the wrecks and hard bottom outcroppings in this area. With the abundance of these fish/biomass congregations in the planned survey path there is the potential of great animal distruction; this is very disturbing.

Although the information gleened from this survey may very interesteing the potential distruction and economic impact is not justified by the potentiael benefit.

Thank you Debby Boyce
Pres.

Discovery Diving Co., Inc.
& Beaufort Harbour Suites &
ACCET Accredited Discovery Diving Co., Inc School
Home of Eastern Carolina Artificial Reef Association
414 Orange St.
Beaufort, NC 28516
(p)252-728-2265 (252-scuba-ok)
(f)252-728-2581
www.DiscoveryDiving.com
www.DiscoveryDiving.edu
http://twitter.com/DiscoveryDiving
www.BeaufortHarbourSuites.com
stay@BeaufortHarbourSuites.com
www.CarolinaReefs.org

Walker, Michele

From: douglass swanson <wildagin@earthlink.net>
Sent: Tuesday, August 19, 2014 5:08 PM
To: Walker, Michele
Subject: seismic testing

Dear Ms. Walker,

I respectfully request that the seismic testing proposed by the National Science Foundation September 15 - October 22, 2014 be aborted. I cannot comprehend the reasoning of this at any time, because of our marine life. Whales, dolphins, turtles and others will be affected in a negative and harmful way. These blasts will disorient migration patterns and affect other behavior and habits. I vehemently oppose any further direction with this dangerous proposal.

Respectfully,

Douglass Swanson

115 Intracoastal Drive
Beaufort, NC 28516
252-728-2939

douglass swanson
wildagin@earthlink.net
EarthLink Revolves Around You.

Walker, Michele

From: Govoni, Daniel
Sent: Friday, September 05, 2014 12:35 PM
To: 'Ginger Taylor'
Cc: Walker, Michele
Subject: RE: Lamont Doherty proposal to conduct research using airguns off the coast of North Carolina

Dear Ms. Taylor,

Thank you for your email dated 9/5/14 concerning the Federal Consistency Determination submitted by the National Science Foundation proposing to conduct a Marine Geophysical Survey via seismic testing in the Atlantic Ocean off of the North Carolina coast. As you may be aware, the Division of Coastal Management is coordinating a state review. Your comments will be examined and taken into consideration prior to the Division making a final Consistency Determination, you will be informed of this final decision.

The Division appreciates you taking the time to comment on this proposal, and your email will be added to the official file. Please feel free to contact me at (252) 808-2808 (ext. 215), if you should have any additional questions or concerns relating to this proposal.

Sincerely,
Daniel Govoni

Daniel M. Govoni
Asst. Major Permits Coordinator
NC Division of Coastal Management
400 Commerce Ave.
Morehead City, NC 28557

(252) 808-2808
(252) 247-3330 fax
daniel.govoni@ncdenr.gov

From: Ginger Taylor [mailto:gingertaylor1@gmail.com]
Sent: Friday, September 05, 2014 11:55 AM
To: Govoni, Daniel
Subject: Lamont Doherty proposal to conduct research using airguns off the coast of North Carolina

I petition the Division of Coastal Management to find this proposal inconsistent with coastal zone management for the region to be affected along the east coast especially off of North Carolina for the following reasons:

1. Due to the unique diversity of marine biota, the Outer Banks' economy is heavily impacted by the success of the fish stocks. Airguns have been shown to dramatically depress catch rates of various commercial species. (Engas, A. et al., 1996)

2. The Federal Register's Revised Take Table as of July 25, 2014 is not completely accurate. According to their list, North Atlantic right and fin whales have a 0% take risk (both of which are endangered species). Fin whales are reportedly seen year round off of Hatteras. Right whales migrate in the fall from Bay of Fundy to Florida to calve. Though aerial surveys report rare sightings, they are RARE as a species. We cannot assume because we don't see them, they are not in the Cape Hatteras vicinity. Right whales have been seen off the coast of Fort Fisher, NC in early November making it possible that they could be feeding in the nutrient rich water off of Cape Hatteras in October. Furthermore, right whales do not travel in families and are far less audible than other whales making the potential of them being in the region yet undetected much greater.(http://www.starnewsonline.com/article/20091112/articles/911129985?p=1&tc=pg&tc=ar)Butregardless, seismic testing has been reported to travel 100,000 miles which spans the distance from the Bay of Fundy to Florida. (Boom, Baby, Boom: The Environmental Impacts of Seismic Surveys, pg. 3.)

3. Due to the steep slope off of Cape Hatteras that causes nutrient rich upwelling, the cold waters of the Labrador Current, and the warm waters of the Gulf Stream, this location is an unusually dynamic area for foraging unlike any other region on the entire east coast. "In the pelagic and mid-water depths there is high diversity of verte-brates, migratory birds, mammals, and turtles as well as fish. On the bottom there is also diversity of invertebrates." (Blake, J. A et al., Gooday, A. J. et al, Hecker, B, Milliman, J. D.and Rhodas, D. C, et al) This is a foraging hotbed for an unusually high density of species. The seismic testing that will occur there will create enough noise to disrupt eating, mating, and navigation for 33 days straight, "792 hours of continuous airgun operations" according to the Lamont-Doherty report. Because it is a feeding site to many endangered species such as fin and the North Atlantic right whales, hawksbill, Kemp's ridley, loggerhead, and leatherback sea turtles, by law this area should be protected by the Endangered Species Act and listed as a priority ocean area for protection in the Mid-Atlantic. (www.nmfs.voaa.gov/pr/speicis/esa/listed.htm)

4. Because beaked whales are deep divers, they are found in areas where there are canyons and are heavily impacted by these surveys due to sound bouncing off the canyon walls. (Sounding the Depths, pg. 11) Cuvier's beaked whales are seen in this coastal region year round, traveling north and south along Hatteras Canyon off Cape Hatteras, and could potentially be more at risk for this reason. "In general, the heads of canyons are known to be nursery areas for many fish and crustaceans, including commercially important ones. The sessile corals, sponges, and anemones found in the northern canyons have restricted distributions in that they must live attached to hard substrates. Hence populations within the canyons could represent crucial stock populations of sessile organisms." (http://www.nrdc.org/water/oceans/priority/recheck.asp)

5. The Lamont-Doherty report states the testing will be as high as 180 decibels. " . . . a 174-decibel rumble . . . . about as strong as a commercial jet at takeoff, measured about three feet away." (Sounding the Depths, pg. 4) Prolonged exposure to continuous loud noise is known to cause hearing loss to humans as well as marine mammals. This hearing impairment is known as "threshold shift." (Sound the Depths II, pg. 13) Though marine mammals have eyes and a sense of smell, the sense they rely on the most is sound to navigate, forage for food, mate, care for their offspring, and protect themselves from predators. To introduce sound that interferes with the most important sensory for 33 days straight is similar to blinding people with flood lights continuously for 24 hours,

for 33 days. How could people feed, care for their children, or stay out of harms way? It is our moral, scientific, and legislative duty to protect this region more so than other areas along the east coast.

6. The proposed sound source consists of a 36-airgun array with a total discharge volume of ~6600 in or an 18-airgun array with a total discharge of volume of ~3300. "A single airgun array can disrupt vital behavior in endangered whales over an area of at least 100,000 square nautical miles in size." (Boom, Baby, Boom: The Environmental Impacts of Seismic Surveys, pg. 3.) This underscores the harassment seismic testing will cause to the most endangered whale in the world – the North Atlantic right whale.

7. Other anthropogenic impacts that compromise the large whale populations are fishing gear entanglement and boat strikes. Right whales and fin whales are the most commonly reported species in the context of population size prone to vessel strikes. "Compared with the spatial extent of regulations, vessel-strike mortality continues to be highest in the mid-Atlantic coast." (Van Der Hoop, J. M. et al. 2012) Seismic testing will add yet another stressor on the already in periled species.

8. *Sargassum* is considered an essential fish habitat and is charged by law to minimize any adverse effects on such habitat. (Fishing North Carolina's Outer Banks: The complete Guide to Catching More, pg. 72). *Sargassum* found off North Carolina's coast is home to 81 fish species. Most of these fishes are juveniles that meander from the Gulf Stream. Commercially important dolphin fish, amberjacks, and tuna have also been documented to use this unique habitat as well as marine mammals (dolphins) and juvenile loggerhead sea turtles many of which are endangered. (http://oceanexplorer.noaa.gov/explorations/03edge/background/sargassum/sargassum.html) Influenced by the currents, large windrows of Sargassum mats consistently form just off of Cape Hatteras. The airgun blasts are not limited to just reaching the bottom but are also reported to be heard by mariners; thus, the *Sargassum* ecosystem stands to be impacted by the airgun operations. The NC Outer Banks fishing industry relies heavily on the Sargassum habitat. Communication with members from Pirates Cove Marina, the fishermen fear the negative impacts on fishing especially in hunting marlin.

Please consider this very unique aquatic region as a priority ocean area for protection in the Mid-Atlantic both for marine life and the fishing community, and not allow seismic testing incidental harassment to ever occur in this region.

Thank you for your consideration.

Ginger Taylor
6205 Mallard Drive
Wilmington, NC 28403

Walker, Michele

From: Govoni, Daniel
Sent: Tuesday, September 02, 2014 9:58 AM
To: 'Helen Livingston'
Cc: Walker, Michele
Subject: RE: Seismic Testing off of NC Coast

Dear Ms. Livingston,

Thank you for your email dated 8/30/14 concerning the Federal Consistency Determination submitted by the National Science Foundation proposing to conduct a Marine Geophysical Survey via seismic testing in the Atlantic Ocean off of the North Carolina coast. As you may be aware, the Division of Coastal Management is coordinating a state review. Your comments will be examined and taken into consideration prior to the Division making a final Consistency Determination, you will be informed of this final decision.

The Division appreciates you taking the time to comment on this proposal, and your email will be added to the official file. Please feel free to contact me at (252) 808-2808 (ext. 215), if you should have any additional questions or concerns relating to this proposal.

Sincerely,
Daniel Govoni

Daniel M. Govoni
Asst. Major Permits Coordinator
NC Division of Coastal Management
400 Commerce Ave.
Morehead City, NC 28557

(252) 808-2808
(252) 247-3330 fax
daniel.govoni@ncdenr.gov

From: Helen Livingston [mailto:livingston.helen@gmail.com]
Sent: Saturday, August 30, 2014 3:59 PM
To: Govoni, Daniel
Subject: Seismic Testing off of NC Coast

Daniel M. Govoni, Asst. Major Permits Coordinator
NC Division of Coastal Management

Dear Mr. Govoni,

I write regarding the request from the National Science Foundation's request for a permit to do seismic testing off of the NC Coast. I respectfully request that this permit be denied, on the basis of the information below:

There should not be a rush, nor a secretiveness regarding this endeavor. Why are we, the people, being asked to pay for something that, not only could bring devastating harm to marine life, our ocean and our land; but that chiefly benefits Big Oil? Precious few jobs or money from drilling would make it's way beyond the Big Corporations in the first place.

Why is there so little information available to citizens, and so little time for us to respond, in the face of an issue that involves our fishing industry, our tourism industry, and such a potentially heavy cost for remediation? This is the perfect opportunity to stand against Corporatism.

There is not enough information about the effect of testing (at up to 250 decibels) on marine biology. We do know that whales and dolphins navigate by sound, and it seems reasonable to assume that there could be serious impacts on these, and other marine animals.

Having been closely associated with the BP spill in the Gulf, and the miserable response to the people by BP and the government, I do not want the same thing to happen to our coast. Drilling off the Atlantic Coast holds more potential for disastrous problems than does drilling in the Gulf of Mexico. We know from the BP spill that there is no amount of money that will protect our coast from the effects of the inevitable spills from oil drilling in such treacherous waters.

Please stand with NC's people, not Big Oil, and deny this permit for seismic testing. Financing Big Oil is a step back into the past, while NC is in the forefront of Renewable Energy, our future, through investment in wind and solar.

With appreciation for your consideration,

Helen Livingston
311 Montrose Lane
Laurinburg, NC 28352
910-276-1797

Walker, Michele

From: Jade Walker <jadewalker@mindspring.com>
Sent: Tuesday, August 26, 2014 8:23 PM
To: Walker, Michele
Subject: Public Comment concerning survey of the ocean near the Outer Banks

Dear Ms. Walker,

I have recently heard about the survey planned to be conducted off the coast of North Carolina in September and October. While my livelihood does not depend on access to the ocean, my recreation, as well as the disposable income that goes with it, does. Those who will be denied income for a month can speak far more eloquently about the hardship this will cause than I can, so I will leave that task for them. However, I am concerned about the safety to both residents and tourists, when a far-reaching survey such as this occurs during the two months most prone to hurricanes along the North Carolina coast.

I assume that the survey crew has established guidelines and procedures for handling the inclement and dangerous weather that can be encountered at that time for its own operation and equipment. I admit to only a cursory perusal of the online proposal, but it revealed nothing in terms of guidelines and procedures on how the residents and tourists are to operate in an evacuation scenario if access to certain areas of the coastline and ocean are restricted. What does the populace do in this situation?

There is also the issue of safeguarding property of residents and business owners if a serious storm approaches. Boats must be taken to a place of safety, and almost all boat owners have arrangements with a particular location to house or shelter their boats during a storm. What if the survey equipment blocks access to that pre-arranged place? It would be a shame for a fishing company who has already been blocked from their source of income by this survey to lose such a major asset as well for the same reason.

I believe there are better times during the year for this survey to take place, when fewer businesses are affected, and the weather conditions are more conducive to smooth and constant operation of the survey. Please consider rescheduling this survey for a more opportune time.

Yours,

Jade L. Walker

215 Lakewater Drive
Cary, NC 27511
jadewalker@mindspring.com

Walker, Michele

From: Govoni, Daniel
Sent: Wednesday, September 03, 2014 9:51 AM
To: 'James Barton'
Cc: Walker, Michele
Subject: RE: Seismic testing over ordnance disposal sites

Dear Mr. Barton,

Thank you for your email dated 9/3/14 and attached letters concerning the Federal Consistency Determination submitted by the National Science Foundation proposing to conduct a Marine Geophysical Survey via seismic testing in the Atlantic Ocean off of the North Carolina coast. As you may be aware, the Division of Coastal Management is coordinating a state review. Your comments will be examined and taken into consideration prior to the Division making a final Consistency Determination, you will be informed of this final decision.

The Division appreciates you taking the time to comment on this proposal, and your email will be added to the official file. Please feel free to contact me at (252) 808-2808 (ext. 215), if you should have any additional questions or concerns relating to this proposal.

Sincerely,
Daniel Govoni

Daniel M. Govoni
Asst. Major Permits Coordinator
NC Division of Coastal Management
400 Commerce Ave.
Morehead City, NC 28557

(252) 808-2808
(252) 247-3330 fax
daniel.govoni@ncdenr.gov

From: James Barton [mailto:jamesbarton@uwuxo.com]
Sent: Wednesday, September 03, 2014 5:00 AM
To: Govoni, Daniel
Subject: Seismic testing over ordnance disposal sites

Nice talking with you earlier! Thank you for looking at this.

Jim

P.S. I never was able to locate a public comment access point on your website, but I found one at the National Science Foundation website and a few others to share my concerns with.

Walker, Michele

From: Jenna Nielsen <jennanielsen6@gmail.com>
Sent: Saturday, August 23, 2014 11:22 AM
To: Walker, Michele
Subject: Oppose Seismic Testing

Dear Officer Walker,

I am opposed to seismic testing. Clearly the research indicates there will be irreparable harm to sea life.

Thank You.
Jenna Nielsen
Wilmington, NC

Walker, Michele

From: jerryschill <jerryschill@ncfish.org>
Sent: Friday, August 22, 2014 10:10 AM
To: Walker, Michele
Subject: NSF Project

Mr. Braxton Davis, Director
NC Division of Coastal Management

Dear Mr. Davis:

It was only early this morning when I stumbled across an article in the Jacksonville Daily News about your Division asking for comments on the NSF seismic testing project. As a 61 year old trade association representing commercial fishermen in our state, one would think communications would be a little more open, especially when our folks have more interest in a project like this than most.

Since today is the deadline for comments, it is very difficult for me to circulate this information to our members in time so they can also comment.

I only became aware of this project when Louis Daniel sent me an e-mail a few days ago. (I was aware of the proposed testing, not your request for comments.) Upon my inquiry to the state of New Jersey, I found that many in that state opposed the same testing off their coast, including commercial fishermen and their organizations.

I certainly don't know enough about it, but cannot in the least concur with any effort to allow this testing to go on as scheduled. Commercial fishing is tough enough as it is and we certainly cannot risk any other obstacles for fishermen to make a living and providing food for consumers.

At the very least, one would expect a public meeting where the NSF can explain to the general public and the stakeholders about this proposal. However, that has not happened and most of us are in the dark about it.

Due to all the uncertainty about the project and how it would affect many aspects of our coastal life including but not limited to commercial and recreational fishing, the North Carolina Fisheries Association urges you to reject the NSF's consistency determination for this project.

Yours truly,

Jerry Schill, President
North Carolina Fisheries Association, Inc.
PO Box 335
Bayboro, NC 28515
Cell: (252) 361-3015
www.ncfish.org
jerryschill@ncfish.org

Walker, Michele

From: beach@mdurham.net
Sent: Tuesday, August 19, 2014 12:34 PM
To: Walker, Michele
Subject: Public Comment - No to seismic testing by NSF on Carolina Coast

Dear Ms. Walker,

I read with concern in the Star News that the National Science Foundation is requesting to conduct seismic testing next month on our coastline. As you are probably well aware, over 300 people came out in Kure Beach, NC several months ago to protest seismic testing for oil exploration. We were made aware of the dangers to our marine animals from the testing, regardless of its ultimate purpose. The whales and dolphins will be put at risk no matter who does this testing! I am amazed that a scientific foundation would request to violate the very laws of nature that cause such concern about our environment. Our ocean ecosystem is delicately balanced, and we do not need sonic booms adding to the many other disturbances that threaten that balance.

Please do not allow this testing to occur. We need to stand up against all types of seismic testing and threats to the coastal environment. One small step in this direction will only open the door to many more.

Thank you for your consideration.

Joanne and Mylie Durham
PO Box 452
Kure Beach, NC 28449

Walker, Michele

From: Judy Larrick <judylarrick@hotmail.com>
Sent: Tuesday, August 19, 2014 2:01 PM
To: Walker, Michele
Subject: NO TO SEISMIC TESTING

TO: Michele Walker, NC Division of Coastal Management

I read with horror today that the NC Division of Coastal Management is considering approval for a request by the National Science Foundation and Columbia University to conduct seismic testing off the coast of NC Sept 15 to Oct 22. This so-called Marine Geophysical Survey is another ploy by the Koch Brothers and financed by them to circumvent the seismic testing procedures for oil and gas exploration. I am also dismayed that the comment period ends Aug 22??? The public was given NO TIME to respond as well!

Sept and Oct are prime time for endangered sea turtle nest hatchings along the NC Coast, and thousands of hatchlings will be making their frenzied trek to the Gulf for survival. With only one in 1,000 survival rate today, this seismic testing is another nail in their coffin. Also, the Federal Government has designated the coast of North Carolina as a Critical Habitat for Sea Turtles and this certainly seems like a conflict of interest. It is also well documented that these seismic testing blasts will kill, maim and injure thousands of fish, dolphins, endangered whales, as well as sea turtles.

PLEASE, please, do not approve this testing. Do not allow "big Money" to destroy our natural resources and harm our wildlife and endangered sea turtles. As a child said in a public meeting on seismic testing in Kure Beach recently, "SOME THINGS JUST SHOULDN'T BE FOR SALE".

Judy F. Larrick
645 Settlers Lane
Kure Beach, NC 28449
910-458-3574

Walker, Michele

From: Govoni, Daniel
Sent: Friday, August 29, 2014 2:18 PM
To: 'Justin LeBlanc'
Cc: Walker, Michele
Subject: RE: Comments of Ocracoke Working Watermen's Association RE: Marine Geophysical Survey by the R/V Marcus G. Langseth in the Atlantic Ocean off Cape Hatteras, September–October 2014

Dear Mr. LeBlanc,

Thank you for your email dated 8/29/14 concerning the Federal Consistency Determination submitted by the National Science Foundation proposing to conduct a Marine Geophysical Survey via seismic testing in the Atlantic Ocean off of the North Carolina coast. As you may be aware, the Division of Coastal Management is coordinating a state review. Your comments will be examined and taken into consideration prior to the Division making a final Consistency Determination, you will be informed of this final decision.

The Division appreciates you taking the time to comment on this proposal, and your email will be added to the official file. Please feel free to contact me at (252) 808-2808 (ext. 215), if you should have any additional questions or concerns relating to this proposal.

Sincerely,
Daniel Govoni

Daniel M. Govoni
Asst. Major Permits Coordinator
NC Division of Coastal Management
400 Commerce Ave.
Morehead City, NC 28557

(252) 808-2808
(252) 247-3330 fax
daniel.govoni@ncdenr.gov

From: Justin LeBlanc [mailto:justin@capitolstrategies.com]
Sent: Friday, August 29, 2014 12:05 PM
To: Govoni, Daniel; Huggett, Doug; Daniel, Louis; hesmith@nsf.gov
Cc: laura.engleby@noaa.gov; beth.lowell@noaa.gov; rseagraves@mafmc.org; palmettobooks@bellsouth.net; mpaine@asmfc.org; dhiltoncfc@embarqmail.com; jerryschill@ncfish.org
Subject: Comments of Ocracoke Working Watermen's Association RE: Marine Geophysical Survey by the R/V Marcus G. Langseth in the Atlantic Ocean off Cape Hatteras, September–October 2014

Dear Mrs. Govoni, Huggett, Daniel & Ms. Smith:

I am writing on behalf of the Ocracoke Working Watermen's Association (OWWA) to express our concern with the proposal of the National Science Foundation (NSF) to conduct a high-energy, 3-D seismic survey from the R/V Langseth in the Atlantic Ocean ~6–430 km from the coast of Cape Hatteras in September–October 2014. The proposed seismic

survey would use a towed array of 36 airguns with a total discharge volume of ~6600in3 or 18 airguns with a total discharge volume of ~3300in3 and could have an adverse impact on fisheries resources, protected species, and fishing operations.

As reported in the Draft Environmental Assessment for the proposal; "Numerous species of marine mammals inhabit the northwest Atlantic Ocean. Several of these species are listed as endangered under the U.S. Endangered Species Act (ESA): the sperm, North Atlantic right, humpback, sei, fin, and blue whales. Other marine ESA-listed species that could occur in the area are the endangered leatherback, hawksbill, green, and Kemp's ridley turtles, roseate tern, and Bermuda petrel, and the threatened loggerhead turtle and piping plover. The endangered Atlantic sturgeon and shortnose sturgeon could also occur in or near the study area. ESA-listed candidate species that could occur in the area are the Nassau grouper, dusky shark, and great hammerhead shark."

As an industry severely regulated with regard to our interactions with these endangered species, we are greatly considered about the potential impacts of the seismic survey on their behaviors and movements. It is our understanding that acoustic impacts of the volume being proposed can cause confusion, disorientation, and panic among certain marine mammals. We are concerned that such impacts could result in increased interactions of such animals with lawfully placed and managed fishing gear. If such were to occur, we believe the interactions would be blamed on fishing activities instead of appropriately on the seismic survey. We have and continue to work very hard to minimize and mitigate any interactions of protected species with our fishing gear and do not want to be unfairly blamed for incidental takes for which the seismic survey is the real cause. We therefore request that, at a minimum, the seismic survey be scheduled for a time of year when fishing gear is not being actively worked in and around the proposed survey area.

We are also concerned that the seismic survey will change the behavior of our target species, including black drum, bluefish, flounder, and Spanish mackerel and could result in decreased landings or increased fishing effort to reach our catch limits. Furthermore, we understand that the survey could displace our fishing activities with its requirements for non-survey participants to remain a certain distance from the "blast zone". To address these potential impacts, we again request that the timing of the survey be changed.

While we would prefer that no seismic survey be conducted at all particularly if it leads to additional such surveys in search of oil and gas resources, we strongly urge the North Carolina Division of Marine Fisheries & Division of Coastal Management, the National Marine Fisheries Service, and the National Science Foundation ensure that impacts on fishery resources, protected species, and fishing operations be minimized the greatest extent possible.

Thank you for the opportunity to express these concerns.

Sincerely Yours,

Justin LeBlanc for the Ocracoke Working Watermen's Association
Senior Executive Consultant
202-213-4131

CAPITOL
STRATEGIES

Walker, Michele

From: Kathy <katatcb@yahoo.com>
Sent: Friday, August 22, 2014 12:13 PM
To: Walker, Michele
Subject: Seismic Testing

Dear Ms Walker,

Like many who live at the coast, I volunteer with the local sea turtle organization and am concerned about the use of seismic testing. The problem is compounded for endangered and threatened sea turtles if it is to be used during the nesting or hatching season. This includes the months of September and October.

From a 2012 study published by the BOEM...

"Leatherback hearing sensitivity overlaps with the frequencies and source levels produced by many anthropogenic sources, including seismic airgun arrays, drilling , low-frequency sonar, shipping, pile driving, and operating wind turbines, suggesting that leatherbacks are able to detect the sounds produced by these activities, and highlighting the need to investigate their potential physiological and behavioral impacts...

CONCLUSIONS & RECOMMENDATION

In this study, we made the first measurements of underwater and aerial hearing sensitivity of leatherback sea turtles. Leatherback sea turtle hatchlings are able to detect sounds underwater and in air, responding to stimuli between 50 and 1200 Hz in water and 50 and 1600 Hz in air with maximum sensitivity between 100 and 400 Hz in water (84 dB re: 1 µPa-rms at 300 Hz) and 50 and 400 Hz in air (62 dB re: 20 µPa-rms at 300 Hz). When the hearing sensitivity of leatherback sea turtles and are compared with the source level and frequency range many of the high intensity, low frequency marine anthropogenic sources of sound commonly considered when evaluating about effects of noise on marine life, it is clear that leatherbacks (and all other sea turtle species for which hearing has been tested) are able to detect many of these sources. Now that we have evidence that leatherback sea turtles can detect sources of low-frequency anthropogenic sound, we recommend future studies investigate the potential physiological (critical ratios and temporary and permanent threshold shifts) and behavioral effects of exposure to these sound sources."

http://www.cbd.int/doc/meetings/mar/mcbem-2014-01/other/mcbem-2014-01-submission-boem-05-en.pdf

Please do not allow this activity.
Thank you,
Kathy Martin

1603 South Lake Park Blvd. Apt 3
Carolina Beach, NC 28428
910-336-0246

Walker, Michele

From: Govoni, Daniel
Sent: Tuesday, September 02, 2014 10:02 AM
To: Walker, Michele
Subject: FW: 0648-XD394 Takes of Marine Mammals Incidental to Specified Activities; Marine Geophysical Survey in the Northwest Atlantic Ocean Offshore North Carolina
Attachments: Seismic Testing .Letter to HARRISON.8.29.2014.pdf; Seismic Testing.Letter to DAVIS.8.29.2014.pdf

Daniel M. Govoni
Asst. Major Permits Coordinator
NC Division of Coastal Management
400 Commerce Ave.
Morehead City, NC 28557

(252) 808-2808
(252) 247-3330 fax
daniel.govoni@ncdenr.gov

-----Original Message-----
From: Davis, Braxton C
Sent: Monday, September 01, 2014 9:49 AM
To: Govoni, Daniel
Subject: FW: 0648-XD394 Takes of Marine Mammals Incidental to Specified Activities; Marine Geophysical Survey in the Northwest Atlantic Ocean Offshore North Carolina

****
Braxton Davis
Director, Division of Coastal Management NC Department of Environment and Natural Resources 400 Commerce Avenue Morehead City, NC 28557
(252) 808-2808 x202

_____
From: Quidley, Mary [MARY@kdhnc.com]
Sent: Friday, August 29, 2014 5:52 PM
To: ITP.Cody@noaa.gov; Davis, Braxton C
Cc: Davies, Sheila F.; Debbie Diaz
Subject: 0648-XD394 Takes of Marine Mammals Incidental to Specified Activities; Marine Geophysical Survey in the Northwest Atlantic Ocean Offshore North Carolina

Friday, August 29, 2014

Dear Ms. Harrison and Mr. Davis –

The attached comments related to the above-referenced project are submitted by the Town of Kill Devil Hills (NC). We anticipate adoption of a resolution, which will also express the Town's opposition, at the Board's September 8th meeting. In the event the resolution is adopted it will be forwarded to each of your offices with the respectful request that our comments be appended to include the resolution.

Original documents have been mailed to your respective offices.

Thank you.

On behalf of the Kill Devil Hills Board of Commissioners,

Mary E. Quidley
KDH Town Clerk
mary@kdhnc.com<mailto:mary@kdhnc.com>
252.449.5302

TOWN OF KILL DEVIL HILLS

Post Office Box 1719, 102 Town Hall Drive
Kill Devil Hills, North Carolina 27948
252-449-5300
www.kdhnc.com

August 29, 2014

Ms. Jolie Harrison
Chief
Permits and Conservation Division
Office of Protected Resources
National Marine Fisheries Service
1315 East-West Highway
Silver Spring, MD 20910

RE: 0648-XD394, Takes of Marine Mammals Incidental to Specified Activities; Marine Geophysical Survey in the Northwest Atlantic Ocean Offshore North Carolina, September to October 2014

Dear Ms. Harrison:

On behalf of the Town of Kill Devil Hills Board of Commissioners, I am writing to comment on the application from the Lamont-Doherty Earth Observatory (Lamont-Doherty) in collaboration with the National Science Foundation, for an Incidental Harassment Authorization to take marine mammals, by harassment incidental to conducting a marine geophysical (seismic) survey in the northwest Atlantic Ocean off the North Carolina coast from September through October, 2014. According to the NOAA July 31, 2014 notice, the seismic survey will take place in the Atlantic Ocean, approximately 17 to 422 kilometers (km) (10 to 262 miles [mi]) off the coast of Cape Hatteras, North Carolina.

We were stunned and disappointed to hear about this application to use air guns to relentlessly blast the marine life off Dare County's coast in the name of science. With little public notice and a comment period only open until September 2, we consider ourselves lucky to know about this application at all. It appears to us that this application has been accelerated, without full disclosure to the public.

As a municipality located on a barrier island, we must be a good steward of our fragile and pristine environment. Whether it is monitoring Kill Devil Hills' water quality or protecting the turtles that nest on our

beautiful beach, we take great pride in doing everything we can to ensure that future generations will also be able to experience the magnificence of the Outer Banks.

Our area is home to many wildlife species, including the endangered right whale. Are these surveys so important that your organization is willing to ignore the major impacts to our ecosystem that will occur? Though the application states that the testing is not related to oil and natural gas exploration, we have a hard time believing that.

We strongly believe that more research should be completed to understand fully the impacts of seismic testing and how we can mitigate those impacts. Further information about the impacts of manmade sound on the underwater environment and its inhabitants and the nature and effects of seismic testing is needed before blasting should be conducted. How do we know if the impacts are immediate and dramatic or subtle and delayed?

We understand that alternative technologies to seismic airgun testing exist, which may be more costly, but less harmful to marine life. We would like to see these alternatives be given more consideration during the application process.

In closing, please deny this application. Seismic airgun testing causes catastrophic impacts to the marine ecosystem, including injury or death whales and dolphins. This, in turn, will set the stage for even more negative impacts to our area.

Thank you for your consideration.

Sincerely,

Sheila F. Davies
Mayor

cc: Dare County Board of Commissioners
Director, NC Department of Environment and Natural Resources, Division of Coastal Management
File

TOWN OF KILL DEVIL HILLS

Post Office Box 1719, 102 Town Hall Drive
Kill Devil Hills, North Carolina 27948
252-449-5300
www.kdhnc.com

August 29, 2014

Mr. Braxton Davis
Director
NC Department of Environment and Natural Resources
Division of Coastal Management
400 Commerce Avenue
Morehead City, NC 28557

RE: 0648-XD394, Takes of Marine Mammals Incidental to Specified Activities; Marine Geophysical Survey in the Northwest Atlantic Ocean Offshore North Carolina, September to October 2014

Dear Director Davis:

On behalf of the Town of Kill Devil Hills Board of Commissioners, I am writing to comment on the application from the Lamont-Doherty Earth Observatory (Lamont-Doherty) in collaboration with the National Science Foundation, for an Incidental Harassment Authorization to take marine mammals, by harassment incidental to conducting a marine geophysical (seismic) survey in the northwest Atlantic Ocean off the North Carolina coast from September through October, 2014. According to the NOAA July 31, 2014 notice, the seismic survey will take place in the Atlantic Ocean, approximately 17 to 422 kilometers (km) (10 to 262 miles (mi)) off the coast of Cape Hatteras, North Carolina.

We were stunned and disappointed to hear about this application to use air guns to relentlessly blast the marine life off Dare County's coast in the name of science. With little public notice and a comment period only open until September 2, we consider ourselves lucky to know about this application at all. It appears to us that this application has been accelerated, without full disclosure to the public.

As a municipality located on a barrier island, we must be a good steward of our fragile and pristine environment. Whether it is monitoring Kill Devil Hills' water quality or protecting the turtles that nest on our

beautiful beach, we take great pride in doing everything we can to ensure that future generations will also be able to experience the magnificence of the Outer Banks.

Our area is home to many wildlife species, including the endangered right whale. Are these surveys so important that your organization is willing to ignore the major impacts to our ecosystem that will occur? Though the application states that the testing is not related to oil and natural gas exploration, we have a hard time believing that.

We strongly believe that more research should be completed to understand fully the impacts of seismic testing and how we can mitigate those impacts. Further information about the impacts of manmade sound on the underwater environment and its inhabitants and the nature and effects of seismic testing is needed before blasting should be conducted. How do we know if the impacts are immediate and dramatic or subtle and delayed?

We understand that alternative technologies to seismic airgun testing exist, which may be more costly, but less harmful to marine life. We would like to see these alternatives be given more consideration during the application process.

In closing, please deny this application. Seismic airgun testing causes catastrophic impacts to the marine ecosystem, including injury or death whales and dolphins. This, in turn, will set the stage for even more negative impacts to our area.

Thank you for your consideration.

Sincerely,

Sheila F. Davies
Mayor

cc: Dare County local governments
Permits and Conservation Division, Office of Protected Resources, National Marine Fisheries Service
File

Walker, Michele

From: Lacy Jenkins <lacyj@ec.rr.com>
Sent: Monday, August 18, 2014 3:10 PM
To: Walker, Michele
Subject: Seismic Testing

Hi Michele,

My husband and I are very much opposed to the seismic testing off the coast of NC. Our marine life is very precious to us and we do not need anything that would result in their leaving or avoiding the area. We already have enough interruption in the peaceful surroundings in this area with the training exercises aboard Camp Lejeune. Please do all in your power to avoid seismic testing in North Carolina coastal waters.

Thank you very much,

Lacy and Tom Jenkins
Swansboro, NC

Walker, Michele

From: Linda Cheshire <beachpropertync@gmail.com>
Sent: Wednesday, August 20, 2014 2:33 PM
To: Walker, Michele
Subject: National Science Foundation Seismic Testing

Hi Michele,
As a resident of Kure Beach and a real estate agent selling properties on this island anything that could disturb or damage our ocean resources and marine life is of great concern to me. Please do not let the National Science Foundation to this to our coast.
Sincerely,
Linda Cheshire

Linda Cheshire Broker, REALTOR
BLUE WATER REALTY
1000 S. Lake Park Blvd.
Carolina Beach, NC 28428
cell: 910-617-5945
office: 910-458-3001
fax: 910-458-3055
Click here to view Working With Real Estate Agents Brochure

Walker, Michele

From: lleblanc922 <lleblanc922@gmail.com>
Sent: Thursday, August 21, 2014 5:19 PM
To: Walker, Michele
Subject: Coastal seismic testing

This is absurd. We know so little about our oceans, but yet we are going to try to proceed with such abusive testing. Studies show these test have grave consequences on the ocean environments. No testing off of our coast or any other, due to lack of knowledge for consequential consequences to our oceans. No specific reasons show positive outcomes to such actions.

Luanne LeBlanc
nautwheeler34@yahoo.com

Sent from my Verizon Wireless 4G LTE smartphone

Walker, Michele

From: Govoni, Daniel
Sent: Tuesday, September 02, 2014 9:56 AM
To: 'Lynn bensy'
Cc: Walker, Michele
Subject: RE: Seismic testing

Dear Ms. Bensy,

Thank you for your email dated 8/30/14 concerning the Federal Consistency Determination submitted by the National Science Foundation proposing to conduct a Marine Geophysical Survey via seismic testing in the Atlantic Ocean off of the North Carolina coast. As you may be aware, the Division of Coastal Management is coordinating a state review. Your comments will be examined and taken into consideration prior to the Division making a final Consistency Determination, you will be informed of this final decision.

The Division appreciates you taking the time to comment on this proposal, and your email will be added to the official file. Please feel free to contact me at (252) 808-2808 (ext. 215), if you should have any additional questions or concerns relating to this proposal.

Sincerely,
Daniel Govoni

Daniel M. Govoni
Asst. Major Permits Coordinator
NC Division of Coastal Management
400 Commerce Ave.
Morehead City, NC 28557

(252) 808-2808
(252) 247-3330 fax
daniel.govoni@ncdenr.gov

From: Lynn bensy [mailto:lynnbensy@gmail.com]
Sent: Saturday, August 30, 2014 10:18 AM
To: Govoni, Daniel
Subject: Seismic testing

NO seismic testing off our coast!

Lynn Bensy
Geeensboro, Nc

Please excuse any typos. This was sent from my iPad, and it has a mind of its own.

Walker, Michele

From: M Youngbluth <myoungbluth@hotmail.com>
Sent: Wednesday, August 20, 2014 8:58 PM
To: Walker, Michele
Subject: Seismic testing

Are we all going nuts? This state has such amazing features from mountains to sea...how are we willing to kill the whales, dolphins, sea turtles, etc. that the folks who live on the coast fight so hard to preserve? Please reconsider this terrible activity. There is no proof that it is not harmless to humans. We love our ocean!

M. Youngbluth
Kure Beach, NC

Sent from my iPad

Walker, Michele

From: Magen Eller <mageneller34@gmail.com>
Sent: Thursday, August 21, 2014 1:29 AM
To: Walker, Michele
Subject: Public Comments

Please reject the proposed seismic study off of the NC coast. Our wildlife and fisheries should be respected, especially during fishing season.

Now, Im not a scientist. I'm sure this proposed testing has some sort of deep and meaningful reason behind it. I'm just a simple mom, born and bred in NC, that loves our coast and the diversity of wild life. If the tests are unnecessary, and could harm or divert migrations, they should not be performed. Our economy has suffered enough without making it harder on those who earn their living on the coast, either with eco tourism or fishing.

Regards,
Magen Eller
2605 Deer Pl
Greensboro NC 27407

Walker, Michele

From: Mark Leblanc <bontonrouley@yahoo.com>
Sent: Wednesday, August 20, 2014 5:35 AM
To: Walker, Michele
Subject: Seismic Testing in My Back Yard

We respectfully ask that you not let Seismic Testing occur in our back yard. Is the Greed of a few so important that Marine Life has to Suffer. What have they done to you. Nothing! If this is allowed, what will our children see, the floating of dead carcasses on our beaches of once beautiful dolphins and whales. What will their children see when we kill everything that is harmless to us and beautiful to all. Nothing! But a polluted, Toxic, Dead Sea!! But you and who ever allows this to happen will have your money. We Beg Of You to Please Don't Let It Happen. Have we Humans not Destroyed enough of this Beautiful Planet we were made Stewards Of...

Thanks for Listening,
And Shame On You If Seismic Testing is Allowed off the North Carolina Coast.

Mark Le'Blanc
910-279-7474
mleblanc347@yahoo.com

Walker, Michele

From: Govoni, Daniel
Sent: Friday, September 05, 2014 10:28 AM
To: 'Meira Warshauer'
Cc: Walker, Michele
Subject: RE: comments re Lamont-Doherty application for airgun research of NC coast

Dear Ms. Warshauer,

Thank you for your email dated 9/4/14 concerning the Federal Consistency Determination submitted by the National Science Foundation proposing to conduct a Marine Geophysical Survey via seismic testing in the Atlantic Ocean off of the North Carolina coast. As you may be aware, the Division of Coastal Management is coordinating a state review. Your comments will be examined and taken into consideration prior to the Division making a final Consistency Determination, you will be informed of this final decision.

The Division appreciates you taking the time to comment on this proposal, and your email will be added to the official file. Please feel free to contact me at (252) 808-2808 (ext. 215), if you should have any additional questions or concerns relating to this proposal.

Sincerely,
Daniel Govoni

Daniel M. Govoni
Asst. Major Permits Coordinator
NC Division of Coastal Management
400 Commerce Ave.
Morehead City, NC 28557

(252) 808-2808
(252) 247-3330 fax
daniel.govoni@ncdenr.gov

From: Meira Warshauer [mailto:meira.warshauer@gmail.com]
Sent: Thursday, September 04, 2014 9:35 PM
To: Govoni, Daniel
Subject: comments re Lamont-Doherty application for airgun research of NC coast

to: North Carolina Division of Coastal Management
re: Lamont Doherty proposal to conduct research using airguns off the coast of North Carolina

I request the request the Division of Coastal Management find this proposal inconsistent with coastal zone management for the region to be affected.

1. Cape Hatteras is home to an unusually large number of species of marine life, because of the convergence of currents from cold waters, the Labrador Current, and warms waters of the Gulf Stream, as well as the upwelling from deep canyons near the continental shelf. The airguns will disrupt their feeding patterns, communication channels, and in the case of certain cetaceans, their diving and breathing patterns as well. Carried out continuously over the span of 33 days, the airguns will cause long term disruption of survival activities for fish, turtles, and cetaceans.

2. Cetaceans are especially sensitive to sound stimuli. The pulses will invade their primary feeding area and cause significant harassment. It is being presented as though the noise will be a short-term inconvenience, but for many species of cetaceans, there is no research on how the noise will affect them. (Federal Register vol. 79, no. 147, p. 44558) Disruption of survival patterns can hardly be viewed as a mere inconvenience.

3. The Cape Hatteras area includes deep canyons where beaked whales may be diving. The noise can trigger a panic response causing them to surface too quickly, and suffer the bends, which can lead to fatality. While the Lamont Doherty claims to have a track record of no associated fatalities, we would not like Cape Hatteras to be the exception to that record.

The over 30 stranded mammals on Cape Hatteras from Naval sonar operation in 2005 is a troublesome precedent. While the Navy's techniques may differ from the L.D. operation, the sensitivity of the cetacean population in the area remains a concern. The airguns will bring unnecessary stress to already declining populations of identified cetaceans in the area. Cuvier's beaked whales, for example, have been sighted year round. Right whales were sighted as far south as Fort Fisher in early Novmeber, 2009.

(http://www.starnewsonline.com/article/20091112/articles/911129985?p=2&tc=pg)

Fin whales are also seen in the area, as are others.

4. The proposed mitigation of stopping the airguns if cetaceans are observed is inadequate, since the animals could be far from any visual sighting area, but still harmed by the airgun due to the greater range of sound in the acoustically efficient sea and canyons.

5. I don't see the urgent need to conduct this research with the current airgun technology, which will cause harm, to an unknown degree, to the marine life up and down this coast. I recommend postponing the research project in this sensitive and exceptional area until a completely safe technology is developed.

6. The NC coast relies on fishing and tourism as primary economic engines. This project threatens to harm both.

7. The hurricane season is becoming more active. Lamont Doherty wants to conduct the project during a period of historic storm activity. It is not an auspicious time for this. I would hate to see the project begin, and then have to be discontinued and restarted at a later time, thus causing even more harassment to the marine life in the area.

Sincerely,
Meira Warshauer
16 Palmetto Drive
Wrightsville Beach, NC 28480

(Mailing address below)

--
Meira Warshauer
http://meirawarshauer.com/

3526 Boundbrook Lane
Columbia, SC 29206
803-787-4332 (home/studio)
803-546-9359 (cell)

Walker, Michele

From: Govoni, Daniel
Sent: Friday, September 05, 2014 11:48 AM
To: 'michael@kdhnc.com'
Cc: Davis, Braxton C; Walker, Michele
Subject: Federal Consistency Determination submitted by the National Science Foundation
Attachments: resolution (5).jpg; Attachment 1 Draft EA.pdf; CZMA Consistency Determination.pdf

Dear Commissioner Midgette,

Thank you for your email dated 9/4/14 concerning the Federal Consistency Determination submitted by the National Science Foundation proposing to conduct a Marine Geophysical Survey via seismic testing in the Atlantic Ocean off of the North Carolina coast. As you may be aware, the Division of Coastal Management (DCM) is coordinating a state review. Please see below clarification on the points requested:

#1 There are two separate tests currently requested - the first from NSF and the second from BOEM, is this correct? Are the two tests interrelated or are they independent from one another and being conducted for two separate purposes? If the study methods and the data collected are similar in nature, has the possibility been proposed for one joint seismic testing session rather than two separate sessions? Please clarify the purpose of the seismic tests requested, the proposed dates for the testing, and the areas that will be impacted as well as the extent of impact (fisheries closures?, etc.). The NSF and BOEM proposed geological and geophysical surveys via seismic testing are two separate studies and are independent of each other. The NSF proposes to fund several universities to conduct one seismic survey off the coast of North Carolina in order to analyze data along the mid-Atlantic coast of the East North American Margin to investigate how the continental crust stretched and separated during continental breakup. This activity is proposed to be conducted from September 15th to October 22 of 2014. BOEM is coordinating possible approvals for 9 applicants to conduct geological and geophysical exploration via seismic testing for possible offshore energy sources. DCM is not aware of when BOEM applicants propose to conduct these seismic surveys, the applicants are still in the preliminary stages of the permitting process. In summary, the NSF and BOEM seismic surveys will use similar technology, including the use of air guns, however the purpose and intent of the surveys differ. Both proposed surveys are located off the entire North Carolina coast. Please see attached draft EA and map (Figure 1) indicating the NSF proposed transects.

#2 It has been stated that the NC DMF requested the GPS coordinates of the seismic testing in order to perform their own observation of the study's impacts. Has the requested location information been provided to date? If so, please explain any plan currently in place for impact observation. DCM did receive the NSF proposed transects which can be viewed in the attached draft EA (see page 46 and 73). Regarding possible impact observation, DCM is still reviewing comments and coordinating within the Department of Environment and Natural Resources. DCM will have the final consistency determination concluded on 9/8/14 and you will be informed of this final decision.

#3 What are the environmental concerns related to seismic testing; has research been conducted that has substantiated or debunked the concerns? Please provide any specific case studies you may reference relating to marine life impacts from seismic testing. There has been several research papers published concerning this topic of which most have been cited in the NSF's draft EA, see attached (pages 78-98). Extensive compilations of research on impacts to marine life are also included in the NSF/USGS PEIS

(http://www.nsf.gov/geo/oce/envcomp/usgs-nsf-marine-seismic-research/nsf-usgs-final-eis-oeis_3june2011.pdf) and the BOEM PEIS (http://www.boem.gov/Atlantic-G-G-PEIS/).

#4 How often are 250dB seismic tests performed off of the coast of the United States? Is this a relatively common practice, or would NC be something of an experiment in evaluating the impacts of the seismic testing at 250 dB? Seismic testing via air guns has been conducted in the past off the coast of the United States, however, DCM is unaware of the total number of seismic activities that have been conducted.

The Division appreciates your concerns on this proposal, and your email will be added to the official file. Please feel free to contact me at (252) 808-2808 (ext. 215), if you should have any additional questions or concerns relating to this proposal.

Sincerely,
Daniel Govoni

Daniel M. Govoni
Asst. Major Permits Coordinator
NC Division of Coastal Management
400 Commerce Ave.
Morehead City, NC 28557

(252) 808-2808
(252) 247-3330 fax
daniel.govoni@ncdenr.gov

-----Original Message-----
From: Midgette, Michael [mailto:michael@kdhnc.com]
Sent: Thursday, September 04, 2014 6:39 PM
To: Govoni, Daniel
Subject:

I am seeking information pertaining to a resolution that will be coming before the Kill Devil Hills Town Board on Monday, September 8, 2014. I am writing to ask that you review the attached resolution and provide any professional feedback that you have to offer relating to the resolution's content as well as review and provide clarification on the points below:

#1 There are two separate tests currently requested - the first from NSF and the second from BOEM, is this correct? Are the two tests interrelated or are they independent from one another and being conducted for two separate purposes? If the study methods and the data collected are similar in nature, has the possibility been proposed for one joint seismic testing session rather than two separate sessions? Please clarify the purpose of the seismic tests requested, the proposed dates for the testing, and the areas that will be impacted as well as the extent of impact (fisheries closures?, etc.).

#2 It has been stated that the NC DMF requested the GPS coordinates of the seismic testing in order to perform their own observation of the study's impacts. Has the requested location information been provided to date? If so, please explain any plan currently in place for impact observation.

#3 What are the environmental concerns related to seismic testing; has research been conducted that has substantiated or debunked the concerns? Please provide any specific case studies you may reference relating to marine life impacts from seismic testing.

#4 How often are 250dB seismic tests performed off of the coast of the United States? Is this a relatively common practice, or would NC be something of an experiment in evaluating the impacts of the seismic testing at 250 dB?

I appreciate your assistance in this matter,

Michael Midgette Town Commissioner Kill Devil Hills, North Carolina

Resolution No. 14-04-007
Town of Nags Head
Opposition to seismic testing
BOC Meeting April 2, 2014

A Resolution of the Board of Commissioners of the Town of Nags Head, North Carolina Expressing opposition to seismic testing as proposed in the Bureau of Ocean Energy Management (BOEM) Programmatic Environmental Impact Statement (PEIS) - Option A and Option B

WHEREAS, seismic testing as proposed in the Bureau of Ocean Energy Management ("BOEM") Programmatic Environmental Impact Statement alternative A and alternative B has the potential to harm marine life; and

WHEREAS, seismic testing as proposed in BOEM Programmatic Environmental Impact Statement alternative A and alternative B has the potential to impact recreational and commercial fishing; and

WHEREAS, the Town of Nags Head is a municipality in Dare County where a major economic force is tourism related to the coastal environment; and

WHEREAS, the Town of Nags Head endeavors to be a good steward of the coastal environment and its resources; and

WHEREAS, the full impacts of seismic testing as proposed in BOEM Programmatic Environmental Impact Statement alternative A and alternative B are not yet fully understood by scientists, the Oil & Gas industry, or BOEM, and

WHEREAS, the Town of Nags Head believes that more research should be done to fully understand all impacts of seismic testing and options for mitigation those impacts; and

WHEREAS, the Town of Nags Head does not believe seismic testing as currently proposed in alternative A or alternative B of BOEM's Programmatic Environmental Impact Statement is the safest way to map oil & gas deposits in the mid-Atlantic region.

NOW, THEREFORE, BE IT RESOLVED, the Board of Commissioners of the Town of Nags Head, North Carolina, is opposed to seismic testing as proposed in in alternative A or alternative B of BOEM's Programmatic Environmental Impact Statement until such time as all testing options are evaluated and proper assurances for the protection of marine life are established.

This resolution adopted the 2nd of April 2014.

Robert C. Edwards, Mayor
Town of Nags Head

ATTEST

Carolyn F. Morris, Town Clerk

Walker, Michele

From: Govoni, Daniel
Sent: Tuesday, September 02, 2014 9:55 AM
To: 'Nichole Midgett'
Cc: Walker, Michele
Subject: RE: NO SEISMIC TESTING!

Dear Mr. Midgett,

Thank you for your email dated 8/29/14 concerning the Federal Consistency Determination submitted by the National Science Foundation proposing to conduct a Marine Geophysical Survey via seismic testing in the Atlantic Ocean off of the North Carolina coast. As you may be aware, the Division of Coastal Management is coordinating a state review. Your comments will be examined and taken into consideration prior to the Division making a final Consistency Determination, you will be informed of this final decision.

The Division appreciates you taking the time to comment on this proposal, and your email will be added to the official file. Please feel free to contact me at (252) 808-2808 (ext. 215), if you should have any additional questions or concerns relating to this proposal.

Sincerely,
Daniel Govoni

Daniel M. Govoni
Asst. Major Permits Coordinator
NC Division of Coastal Management
400 Commerce Ave.
Morehead City, NC 28557

(252) 808-2808
(252) 247-3330 fax
daniel.govoni@ncdenr.gov

From: Nichole Midgett [mailto:pipsypeach@hotmail.com]
Sent: Friday, August 29, 2014 4:59 PM
To: Govoni, Daniel
Subject: NO SEISMIC TESTING!

I am writing in response to the proposed seismic testing the state is proposing to do off the coast of North Carolina this Fall. PLEASE DO NOT DO THIS TESTING! We need to be investing in renewable resources!!!! NOT OIL AND NATURAL GAS!!!!!!!!!!!! Please do all you can to deter the government from doing this testing!!! There is no telling what irreparable damages will be done.

Walker, Michele

From: Gray, Alex <AGray@oceana.org>
Sent: Friday, August 22, 2014 4:01 PM
To: Walker, Michele
Subject: Comments submitted by Oceana on behalf of citizens concerned about proposed seismic blasting
Attachments: Comments on proposed seismic blasting collected by Oceana - 20140822.csv; Oceana_NC NSF Study Fall 2014_Draft-Comment.pdf

Good afternoon Ms. Walker,

I would like to submit comments collected by Oceana concerning the National Science Foundation's request to use seismic airguns to study the Atlantic Ridge off the North Carolina coast this September through October.

I have attached these comments and the submitting persons' information as an Excel document. I have also attached the initial draft letter, which many of these persons used to guide the writing of their comments.

Thank you for your time,

Alex Gray | Digital Campaigner
_____

OCEANA | Protecting the World's Oceans
1350 Connecticut Ave. NW, 5th Floor | Washington, DC 20036 USA
T +1.202.467.1919 | **F** +1.202.833.2070
E agray@oceana.org | **W** www.oceana.org

OCEANA | Protecting the World's Oceans
1350 Connecticut Ave. NW, 5th Floor
Washington, DC 20036 USA
+1.202.833.3900
oceana.org

Dear N.C. Division of Coastal Management Director Braxton Davis and Public Information Officer Michele Walker:

I am EXTREMELY concerned about the National Science Foundation's proposal to use seismic airguns to study the Atlantic Ridge off the coast of Cape Hatteras this fall. Although we believe that scientific research is incredibly important to understand the world we live in, the timing of this could hardly be worse for those fisherman and other businesses that depend on fall fishing.

Seismic airguns have been shown to decrease catch rates for certain fisheries, and at short distances can kill fish eggs and larvae. There has been little time to review this proposal and little scientific research on the effects of seismic airguns blasting on fish populations.

Moreover, "Fall Fishing" is a critical period for fisherman and fisheries because it is the same time many important species are highly active, including spotted sea trout, flounder, striped bass, king mackerel and spot. Commercial and recreational fishing are far too important to our state's economy and way of life to be put at risk.

Please consider our deep concern over seismic airgun blasting during the time period of the proposed study.

Sincerely,

SIGNER

Email	First Name	Last Name	Address	City	State	Zipcode
deborahburris11@gmail.com	Deborah	Burris	178 Potts Community Rd	Sylva	NC	28779
jmscreen@gmail.com	Jennifer	Screen	17205 Hedgerow Park Rd	Charlotte	NC	28277
eagmt1@gmail.com	Elizabeth	Grovenstein	225 Browntown Rd	Leicester	NC	28748
zandrat@gmail.com	Zandra	Talbert		Chapel Hill	NC	27517
drag0nsweb@netscape.net	frederick	valone	1260 Leonard Rd	Louisburg	NC	27549
spc.tleon@gmail.com	Susan	Couch	4129 Five Oaks Drive	Durham	NC	27707
melanie.beckmann@uni-bonn.de	Melanie	Beckmann		Cary	NC	27511
hellof_amom@yahoo.com	Nadine	Duckworth	804 Deal Farm Lane	Taylorsville	NC	28681
Vt_cmonster@hotmail.com	Candace	Lacy	103 twisted oak pl	Durham	NC	27705
annemoretz@hotmail.com	courtney	moretz	259 Furman Rd	Boone	NC	28607
dremerson1@yahoo.com	Joann	Emerson	1001 Schrams Beach Road	Belhaven	NC	27810
etroxler@isothermal.edu	Elizabeth	Troxler	230 Fernwood Drive	Rutherfordton	NC	28139
fsoler@sosglobal.com	fernando	soler	PO Box 12307	New Bern	NC	28561
jlvanfosson@hotmail.com	Julie	Robinson	5211 Mawood Avenue	Fayetteville	NC	28314
mdwisniewski@yahoo.com	Mark	Wisniewski	4924 Virginian Lane	Charlotte	NC	28226
Portostefono@gmail.com	Stefon	Lira	303 West Council St.	Salisbury	NC	28144
bathantijc@gmail.com	Joan	Bathanti		Vilas	NC	28692
Aliuncc@yahoo.com	Alison	Sherrill		Charlotte	NC	28211
barbosa10@hotmail.com	rafael	barbosa	2029 pembrooke forest dı	Winston-Salem	NC	27106
sungmakicima@yahoo.com	John Paul	Clark		Asheville	NC	28804
wordsbypeg@gmail.com	Peggy	Holliday	209 Wetherburn Ln	Raleigh	NC	27615
gawd_and_wills_angel_4_ever@live.	Brenda	Colbert	347 Carver Falls Rd.	Fayetteville	NC	28311
hadia.block@gmail.com	Hadia	Block	4337 Pine Springs Ct	Raleigh	NC	27613
emac610@aol.com	Eric	McManus	8019 Gera Emma Dr	Charlotte	NC	28215
cwhidby@nc.rr.com	Cynthia	Whidby		Knightdale	NC	27545
marvin-linda-scherl@triad.rr.com	Marvin	Scherl	6740 Germanton Road	Germanton	NC	27019
darkwarriorman@gmail.com	Duncan			Concord	NC	28025
katatcb@yahoo.com	Kathy	Martin		Carolina Beach	NC	28428
barry@gcp.com	Barry	Anderson		Kill Devil Hills	NC	27948
Robgiacomelli@gmail.com	Rob	Giacomelli		Wilmington	NC	28412
Walters.erin@yahoo.com	Erin	Cummings		Wilmington	NC	28412
btlawrence@juno.com	Betty	Lawrence	142 Hillside St.	Asheville	NC	28801
crjk10@aol.com	Samantha	Schipman	10307 Stornoway Ct.	Charlotte	NC	28227

white.m.eliz@gmail.com	Mary	White	1321 New Castle Rd	Durham	NC	27704
bearhare@triad.rr.com	bear	Vandergoot	1530 Trosper Rd.	Greensboro	NC	27455
wtripp@csc.com	William	Tripp	416 Withershinn Dr	Charlotte	NC	28262
jeharden85@gmail.com	Jessica	Womack		Greensboro	NC	27405
cknop@catocorp.com	Charlene	Knop	9307 Raintree Lane	Charlotte	NC	28277
renee.m.mcguire@gmail.com	Renee	McGuire		Raleigh	NC	27288
disonba3@aol.com	dianna	Dr		Wilmington	NC	28403
cictrfdirector@yahoo.com	Elizabeth	O'Nan	396 Sugar Cove Rd.	Marion	NC	28752
bkpower2@att.net	Barbara	Kepley	24 jennifer dr	Graham	NC	27253
ef2012@gmail.com	Evelyne	Dykhouse	7 Countryside Dr	Asheville	NC	28804
MMMaggie719@aol.com	Alisa	Ostwalt	232 Essic Road	Mocksville	NC	27028
mdcg1023@aol.com	Myra	Cave		Atlantic Beach	NC	28512
richardmchenry@me.com	Richard	McHenry	5532 Big Woods Rd.	Chapel Hill	NC	27517
rebelknap@sms.edu	Robert	Belknap	900 Hillsborough Street	Raleigh	NC	27603
jpiazza5914@yahoo.com	JOSEPH	PIAZZA	291 Church Meadows Wa	Fleetwood	NC	28626
tmsowder@msn.com	Timothy	Sowder	6625 Cow Hollow Drive #2	Charlotte	NC	28226
cjc648@yahoo.com	Cynthia	Castevens	648 Irving St.	Winston Salem	NC	27103
chelsearuth@gmail.com	Chelsea	Barnes	2505 Tryon Pines Drive	Raleigh	NC	27603
rgbw46@gmail.com	Ronald	White	1321 New Castle Road	Durham	NC	27704
seaq99@yahoo.com	Shelby	Sawyer	6158 N Boyd Rd	Pinetown	NC	27865
mmcdaniel@nc.rr.com	Michael	McDaniel	3805 Burwell Rollins Circle	Raleigh	NC	27612
jayne_boyer@med.unc.edu	Jayne	Boyer	4316 Thetford Rd	Durham	NC	27707
celestialprincess@cox.net	Joyce			high point	NC	27265
cbgipson@nc.rr.com	Carl	Gipson	728 Spartacus Ct	Cary	NC	27518
maxbiddle@yahoo.com	Maxine	Biddle		Wake Forest	NC	27587
rsavage1@gmail.com	Rick	Savage	101 Bonner Ct.	Cary	NC	27511
missiness@aol.com	Sara	Biggers	210 Old Greensboro Rd	Chapel Hill	NC	27516
jlmooney1@aol.com	Jeffrey	Mooney	1820 Running Brook Rd	Charlotte	NC	28214
cdeolloqui1@gmail.com	carol	deolloqui	607 webster street	cary	NC	27511
bobhakkila@hotmail.com	Robert	Hakkila	2900 Myrtle St Unit 13	Morehead City	NC	28557
steptech07@yahoo.com	Greg	Siegfried		Durham	NC	27707
sportznut112968@yahoo.com	James	Donahew	6413 Lebanon Rd	Mint Hill	NC	28227
tfalstott@mac.com	Tanya	Alstott	20 Hillcrest Drive	Weaverville	NC	28787
kmmorgan@email.unc.edu	Kathy	Morgan	4210 Oak Hill Rd.	Chapel Hill	NC	27514

info@cypressmooninn.com	Greg	Hamby	1206 Harbor Ct.	Kitty Hawk	NC	27949
murphymiles11@gmail.com	Miles	Murphy		Wilmington	NC	28405
tim.hubbard@att.net	Tim	Hubbard		Chapel Hill	NC	27517
mltru46@yahoo.com	Mary	Truman	8945 hope hill lane	apex	NC	27502
wmgupton@aol.com	William	Gupton	6725 Morganford Road	Charlotte	NC	28211
hkollros@gmail.com	Heather	Kollros	2267 Denwood St.	Kannapolis	NC	28083
cjo1942@hotmail.com	Robert	Obeid	477 George McKinney Rd	Bakersville	NC	28705
tarheel11@hotmail.com	Paul	Williams		Princeton	NC	27569
kharrison9257@hotmail.com	Kimberly	Harrison	220 Hunter St	Enfield	NC	27823
chgillen1@gmail.com	Christine	Gillen		Maitland	NC	28730
tomsnyder7@gmail.com	Tom	Snyder	62 Delphia Dr	Brevard	NC	28712
dr.jayne.boyer@gmail.com	Jayne	Boyer	4316 Thetford Rd	Durham	NC	27707
deewhy1939@aol.com	Mary	Sayler		Charlotte	NC	28226
VirginiaBaysden@yahoo.com	Virginia	Baysden		Richlands	NC	28574
dear_sherlock@hotmail.com	Nathaniel	Grubbs	3537 Sugar Tree Pl.	Durham	NC	27713
catslc@aol.com	Lynne	C.		Garner	NC	27529
rstyeast@aol.com	Lawrence	East	316 Richlands Ave Apt. 5	Jacksonville	NC	28540
nltsierra@msn.com	Nancy	Thomas	7 Galax lane	Hendersonville	NC	28791
cbgecko@charter.net	Kat			Wilmington	NC	28412
adkellum@gmail.com	Amy	Kellum	5323 Middleton Rd	Durham	NC	27713
bwheeler@hawaii.edu	Benjamin	Wheeler	4703 Heritage Dr	Durham	NC	27712
DEBBIE@PFSSALES.COM	Debbie	Durham		Raleigh	NC	27608
gpark32@hotmail.com	Gregry	Park	107 Jubilee Place	New Bern	NC	28560
darley@carolina.rr.com	Darley	Adare	2625 Bucknell Ave.	Charlotte	NC	28207
mccandless@northstate.net	Frances	McCandless	2423 Smithwick Rd	Kernersville	NC	27284
jencrawfordcook@yahoo.com	Jen	Cook	3010 elk ridge road	Durham	NC	27712
brendasioux@gmail.com	Brenda	Cooke	6 Clearbrook Rd	Asheville	NC	28805
manny173airbourne@yahoo.com	Emanuel	Grettano	3308 heritage spring cir	Wake Forest	NC	27587
daniellearіel@gmail.com	Danielle	Rogers		Chapel Hill	NC	27514
debbie@resort-brokerage.com	Deborah	Hines	6714 Roberta Rd SW	Ocean Isle Beach	NC	28469
aspectofentity@gmail.com	Family			Fayetteville	NC	28311
jerseypurr@gmail.com	Christy	Kuppler	Augusta Court	King	NC	27021
adhuskey@gmail.com	Angela	Huskey	810 Kiawah Lane	Wilmington	NC	28412
cbrunick@carolina.rr.com	Cathy	Brunick	14133 Walkers Crossing D	Charlotte	NC	28273

ebraunfeld@carolina.rr.com	Eugene	Braunfeld	11813 Hookston Lane	Charlotte	NC	28273
jfarring@med.unc.edu	Joseph	Farrington	3902 Hope Valley Road	Durham	NC	27707
milann_1@hotmail.com	millie	henry	130 Stonefield Ln	Salisbury	NC	28146
kentmcgill@yahoo.com	Kent	McGill		Lakeview	NC	28350
duke.shipman@yahoo.com	Charles	Shipman	PO Box 246	Edneyville	NC	28727
irishmachman7@aol.com	Richard	Burns	586 Raymond Tharrington	Louisburg	NC	27549
ldwood58@yahoo.com	leslie	Wood	8205 Kestrel Dr	Raleigh	NC	27615
meshawright@hotmail.com	Mesha	Wright	4300 Sharon Rd	Charlotte	NC	28211
margiestewart@frontier.com	Margie	Stewart	2606 Francis St	Durham	NC	27707
jmichaelthomas2005@gmail.com	James	Thomas	5900 Hathaway Ln	Chapel Hill	NC	27514
bigmikederr@gmail.com	Michael	Derr	123 park Ave	southport	NC	28461
matt_rubino@ncsu.edu	Matthew	Rubino	214 D. Clark Labs NC State	Raleigh	NC	27695
cpgpjax@ec.rr.com	Candy	Padgett		Wilmington	NC	28401
jocelyn2762@yahoo.com	Jocelyn	Patterson	5202 Gov. Scott Rd.	Cedar Grove	NC	27231
toddatloggerhead@gmail.com	Todd	Crawford	P.O. Box 2403	Surf City	NC	28445
tomtrescone@yahoo.com	Thomas	Trescone	13 Ivington Circle	Asheville	NC	28803
pamgator@gmail.com	Pam	Alterman	308 Frenchmans Bluff Dr	Cary	NC	27513
eartheyes@earthlink.net	Margaret	Hurt		Enka	NC	28728
peeplesmargaret@gmail.com	Margaret	Peeples	3705 edwards mill rd	Raleigh	NC	27612
teresammartin@excite.com	teresa	martin		Pittsboro	NC	27312
maloy.kate@gmail.com	Kate	Maloy		Winston Salem	NC	27101
slinden@bellsouth.net	Steven	Linden	501 Burge Mountain Rd	Hendersonville	NC	28792
kboswell13@yahoo.com	Keith	Boswell		Carolina Beach	NC	28428
sebmann@vespex.com	S	Vespermann		Raleigh	NC	27617
adylanfan@aol.com	Beejay	Grob		Wilmington	NC	28403
brettwithrow@yahoo.com	Bret	Withrow	1348 Mountain Shadows I	Morganton	NC	28655
stuart@follyi.com	Virginia	Milton		Charlotte	NC	28209
kathy_Schwabauer@hotmail.com	kathy	schwabauer		Pittsboro	NC	27312
bbowman@ncsu.edu	Bristol	Bowman		Durham	NC	27713
dkcc@live.com	Kay	Sokolovic		Winterville	NC	28590
dkard@carolina.rr.com	Debbie	Ard	6916 Tree Hill Road	Matthews	NC	28104
boleytodd@mindspring.com	Sam	Todd	8801 Brigadier Lane	Charlotte	NC	28227
angelboone6@gmail.com	Angel			Murfreesboro	NC	27855
rickgoines@hotmail.com	Rick	Goines	1205 North Main Street	Tarboro	NC	27886

marsilvers@gmail.com	Margaret	Silvers	404 Manor Ridge Drive	Carrboro	NC	27510
cplummer3@carolina.rr.com	Carmen	Plummer	12721 Hill Pine Rd.	Midland	NC	28107
joan.nicholson@ymail.com	Joan	Nicholson	326 Winter Star Loop	Burnsville	NC	28714
wolvesdenobx@gmail.com	Donald	Barker	23 13th Avenue	Southern Shores	NC	27949
ron@fuzzsonic.com	Ron	Thigpen		Raleigh	NC	27608
joyuus@bellsouth.net	Joyce	Weisent	18300 Nantz Rd	Cornelius	NC	28031
starspecialties@carolina.rr.com	John	La Stella	7000 ware rd	charlotte	NC	28212
te@georgetown.edu	Tatjana	Eres	210 N Church St	Charlotte	NC	28202
rshefner@gmail.com	Ronda	Hefner	108 EphesUnited States Cl	Chapel Hill	NC	27517
Swaterstone@bellsouth.net	Susan	Waterstone		Hampstead	NC	28443
RandySturgill@me.com	Randy	Sturgill	115 West Island Drive	Oak Island	NC	28465
jim.chaney@ymail.com	Jim	Chaney	4620 ellsmere ln	Raleigh	NC	27604
lindasalzinger@yahoo.com	Linda	Salzinger	2314White Cross Rd # 7	Chapel Hill	NC	27516
emily13allen13@gmail.com	Emily	Allen	224 Custer Trl	Cary	NC	27513
daddyruchir@yahoo.com	Ruchir	Vora	104 Waverly Forest Lane	Chapel Hill	NC	27516
jfowles@nc.rr.com	Jackque	Fowles		raleigh	NC	27612
hlaar@mac.com	Holly	Schakelaar	2811 oleander dr b	Wilmington	NC	28403
cshuford2@gmail.com	Carla	Shuford	116 Pitch Pine Lane	Chapel Hill	NC	27514
pollycrawshaw@mac.com	Pauline	Crawshaw		Hendersonville	NC	28791
pologuync@aol.com	Michael	Vaughn	3530 Beacon Hill Drive	Winston Salem	NC	27106
doug@douggraham.com	Douglas	Graham	145 Live Oak Lane	Mooresville	NC	28115
fwilson20@nc.rr.com	Fielding	Wilson	231 Fireweed Pl	Clayton	NC	27527
lrcullen@nc.rr.com	Linda	Cullen		Warrenton	NC	27589
bgdarnell8@gmail.com	Becky	Darnell		Wilmington	NC	28409
jmcabanis@frontier.com	Jeannette	Cabanis-Brewin	1267 Moody Bridge Rd.	Cullowhee	NC	28723
stephanie@stephanie-benson.com	Stephanie	Benson	6808 Palomino Ridge Ct	Summerfield	NC	27358
connieb@charter.net	Connie	Bishop	4827 Dentons Chapel Roa	Morganton	NC	28655
rhianna@ec.rr.com	Rhiannon	Harrell		Wilmington	NC	28409
rosemary.killion@bcbsnc.com	Rosemary	Killion	170 greenvalley road	winston salem	NC	27106
emmabogdan@gmail.com	Emma	Bogdan	1201 Braeburn rd	Charlotte	NC	28211
rbbewright@gmail.com	Robert	Wright		Denton	NC	27239
nodell22@gmail.com	Nancy	O'Dell	PO BOX 1407	MURPHY	NC	28906
Jmsc9003@msn.com	Mary and Joe	Sabol	76 Weaver Village Way	Weaverville	NC	28787
jodihorner77@hotmail.com	JoHanna	Horner	213 Vineland Drive	Fayetteville	NC	28306

katherine.meyer49@gmail.com	Katherine	Meyer	185 Windover Drive	Forest City	NC	28043
pjc46@juno.com	Pamela	Culp	130 Skyview Circle	Asheville	NC	28804
kimfanelly@aol.com	Kim	Fanelly		charlotte	NC	28227
lrieger@madisonk12.net	Lynn	Rieger	330 Hi-Alta Ave	Asheville	NC	28806
blairbohn@hotmail.com	Blair	Waldo	1505 Duplin Road	Raleigh	NC	27607
jbarbara_family@yahoo.com	Jennifer	Barbara	609 Appomatox Drive	Waxhaw	NC	28173
jv3free@yahoo.com	John	Ventre		Black Mountain	NC	28711
halifaxbgc@yahoo.com	Kim	Taresco	609 Marshall St	Roanoke Rapids	NC	27870
Milljenn9@gmail.com	Jennifer	Catlett	4025 berberis way	Wilmington	NC	28412
arlene_sandoval@med.unc.edu	Arlene	Sandoval	4053C NC Hwy 56	Franklinton	NC	27525
se-larvae@hotmail.com	Ronald	Clayton	545 E Dorsett Ave	Asheboro	NC	27203
Angela_Mishoe@Belk.com	Angela	Mishoe	1081 Ball Park Rd	Thomasville	NC	27360
manfromnc@suddenlink.net	Michael	Jones	1725 Hammond St	Rocky Mount	NC	27803
stemkowski@yahoo.com	Diana	Stemkowski	1125 Montpelier Dr	Greensboro	NC	27410
tuffie@centurylink.net	Sylvia	Smithwick	2623 Scott Town Rd	New Bern	NC	28560
cedougherty@gmail.com	C	Dougherty		Marshall	NC	28753
pstauffer@surfrider.org	Pete	Stauffer	4001 SE Ivon St	Portland	OR	97202
Richardsonj@suddenlink.net	June	Richardson	514 Irish Lane	Wville	NC	28690
kat819@outlook.com	Kathleen	Levesque	822 Kiawah Ln	Wilmington	NC	28412
judylarrick@hotmail.com	Judy	Larrick	645 Settlers Ln	Kure Beach	NC	28449
saa.action@gmail.com	Steve	A		Gastonia	NC	28052
melissafspencley@gmail.com	Melissa	spencley		Burlington	NC	27215
Lhcmlc@aol.com	Linda	Collins		Greensboro	NC	27405
susiejandray@gmail.com	Suzanne	Jolivette	242 Doral Drive	Hampstead	NC	28443
sierrasaver.joyce@gmail.com	Joyce	Berube	3 Bird Lane	Squaw Valley	CA	93657
zurclark@bellsouth.net	Diane	Clark	4115 Castleford Dr.	Colfax	NC	27235
eskinn44_40@yahoo.com	Edwin	Skinner	238 clifton road	rocky mount	NC	27804
patches0311@yahoo.com	Sheri	Liske	75 Rocky Mount Church R	Polkton	NC	28135
kcutler1@gmail.com	Keith	Cutler	99 Jackson St.	Davidson	NC	28036
mikruce@aol.com	Bruce	Bijesse	35 WindSong Dr.	Fairview	NC	28730
tcumbee1@ec.rr.com	Thurston	Cumbee		Southport	NC	28461
spoutcove@gmail.com	Hannah	Trickett	1042 N Respess	Washington	NC	27889
jtb3jar61@yahoo.com	Elizabeth	Riddle	3815 Angus Road	Whitsett	NC	27377
happychaos123@hotmail.com	April	Boryczewski		Monroe	NC	28112

su.allen50@gmail.com	Susan	Allen	6824 Gloucester Road	Raleigh	NC	27612
health@wardgroup.net	Aurelie	Ward	1409 Forest Park Drive	Statesville	NC	28677
branflakes12@hotmail.com	Brandy	Meadows		Marshville	NC	28103
wyingst@atmc.net	William	Yingst		Calabash	NC	28467
stanbackf@aol.com	Fred	Stanback	507 W Innes St. #270	Salisbury	NC	28144
tlthree@aol.com	Thomas	Leonard	2201 S. Live Oak Pkwy	Wilmington	NC	28403
balex06@live.com	Beth	Alexander	1400 recapture ct	wake forest	NC	27587
jeffrudick@hotmail.com	Linda	Rudick	1008 Park Rd SW	Sunset Beach	NC	28468
bjohnsonhome@yahoo.com	William	Johnson	227 E. 11th Street	Southport	NC	28461
macw@nc.rr.com	Kathy	Wright	305 Magnolia Cir	Southern Pines	NC	28387
rnd8325@uncw.edu	Roxanne	Daiz		Wilmington	NC	28403
gellar.Michael@gmail.com	Michael	Gellar	1613 Grace St	Charlotte	NC	28205
lorraine_sm@yahoo.com	Carolyn	Smith	1101 Grogan Road	Stoneville	NC	27048
lilmouse1213@earthlink.net	Lisa	Neste		High Point	NC	27265
office@firstchristianucc.org	Joan	Paschal		Snow Camp	NC	27349
nastygeorge59@earthlink.net	George	Neste	4437 Garden Club St	High Point	NC	27265
ebrophy@tlbgroup.com	Edward	Brophy	4909 Dewars Circle	Wilmington	NC	28409
2susanburns@gmail.com	Susan	Burns	5004 Bodie Ln	Greensboro	NC	27455
bprobasco@charter.net	Brenda	Probasco	808 Frances Ln	Kill Devil Hills	NC	27948
lhhatlestad@yahoo.com	Leesa	Hatlestad	603 Doris Ave	Jacksonville	NC	28540
Joanpaschal@gmail.com	Joan	Paschal	648 Lambe Road	Snow Camp	NC	27349
Meerkat71@aol.com	Naomi	Avissr		Morrisville	NC	27560
kristiskincare@yahoo.com	Kristi	Davis	5253 mulberry ave	Wilmington	NC	28403
Wastedglamour@hotmail.com	Marie-Soleil	Garneau		Raleigh	NC	27603
aboyer8@gmail.com	Alyson	Rode	3116 Courtney Creek Blvd	Durham	NC	27713
donnarsk@hotmail.com	Donna	Resek	4314 Highland Farm Rd	Hillsborough	NC	27278
emmym@nc.rr.com	Emmy	Moore	2110 St. Mary's Street	Raleigh	NC	27608
youngrobin2012@gmail.com	Robin	Young	1104 Flycatcher Way	Arden	NC	28704
gcheney@triad.rr.com	Gay	Cheney	6209 Bard's Lane	Browns Summit	NC	27214
WitchetGL@aol.com	Maryann	Avila	1684 Trouville Ave	Grover Beach	CA	93433
itsraysan@yahoo.com	Ray	Langan	269 Plaza Drive Ext	Chapel Hill	NC	27517
laughlins@gmail.com	Laughlin	Siceloff	1924 Price Creek Rd.	Chapel Hill	NC	27516
pasogirl791@gmail.com	Crissy	Anderson		pleasant garden	NC	27313
ssteers@live.com	Sandra	Steers		Asheville	NC	28805

Paigewoodruff14@gmail.com	Elizabeth	Woodruff	724A Bonham Ave	Wilmington	NC	28403
Teriandal@aol.com	Al	Meadowcroft	518 Plymouth Dr.	Wilmington	NC	28405
allnwood@msn.com	Keith	Allen	PO Box 11	Cedar Grove	NC	27231
leahstew@live.com	Leah	Stewart	392 Bald Eagle Lane	Kenly	NC	27542
ellenmfallon@gmail.com	Ellen	Fallon	PO Box 1123	Carrboro	NC	27510
hilstewart89054@aol.com	Hilary	Stewart	12 S Lexington st #504	Asheville	NC	28801
mchlct@yahoo.com	Michael	Aceto	221 Joseph St	Greenville	NC	27858
toomanycats@centurylink.net	Laura	Faber	6346 Pawling CT	Fayetteville	NC	28304
shindman@gmail.com	Susan	Hindman	421 Bywood Dr	Durham	NC	27712
elijez@frontier.com	E	Jezierski	1101 Norwood	Durham	NC	27707
gingertaylor1@gmail.com	Ginger	Taylor	6205 Mallard Drive	Wilmington	NC	28403
jodyford78@yahoo.com	Jody	Ford	101 Belles Way	New Bern	NC	28562
beccadupre@gmail.com	Rebecca	DuPre	507 S. Battleground Avenu	Kings Mountain	NC	28086
BlackwellWR@gmail.com	William	Blackwell	4311 Cove Loop Road	Hendersonville	NC	28739
blackwellpatr@gmail.com	Pat	Blackwell	4311 Cove Loop Road	Hendersonville	NC	28739
Denimrep1@aol.com	Don	Perry	9220 Stonecrop Ct	Charlotte	NC	28210
itsbeenruff@aol.com	Joann	Stringfellow	P.O. Box 294	Castalia	NC	27816
robert_luckett@att.net	Robert	Luckett	4105 Galway Dr	Greensboro	NC	27406
evnwilm@gmail.com	Evelyn	Meares	9913 ricer rd #16	Wilmington	NC	28412
justforbuyers@gmail.com	Kathleen	Baylies	126 Clementree Lane	Kure Beach	NC	28449
shanejoycenc@yahoo.com	Shane	Joyce	18616 coachmans trce	cornelius	NC	28031
csimpson5@bellsouth.net	Cyrus	Simpson	2630 Northstream Ct	Haw River	NC	27258
tomstruh@acpub.duke.edu	Thomas	T. Struhsaker	2953 Welcome Drive	Durham	NC	27705
grahamdn@bellsouth.net	Dan	Graham	123 Grace Ave.	Chapel Hill	NC	27517
irma2oc@yahoo.com	Donald	Courtney		Dunn	NC	28334
ncsurfhawk@hotmail.com	Jay	Hawekotte	107 Acorn Lane	Point Harbor	NC	27964
smgiven@gmail.com	Suzanne	Given	Antelope Dr	Mt Holly	NC	28120
famiv@yahoo.com	Fred	Martin	3215 Ravencliff Dr	Charlotte	NC	28226
cpgriff8@nc.rr.com	Chas	Griffin	106 Brownbark Rd	Seven Lakes	NC	27376
lmccall0@email.cpcc.edu	Lisa	McCall	3212 Twin Falls Ln	Matthews	NC	28105
chris.lewislaw@embarqmail.com	Christopher	Edwards	4128 Dale Drive	Farmville	NC	27828
daydreamz_project@hotmail.com	Starr	Hogan	96 johnson hill	waynesville	NC	28786
rcyoung4@nc.rr.com	Carol	Young	5808 Williamsburg Way	Durnam	NC	27713
deal99@gmail.com	Jeff	Deal		Boone	NC	28607

John.Shalanski@hotmail.com	John	Shalanski	821 N. Fort Fisher Blvd.	Kure Beach	NC	28449
spadbury@yahoo.com	Scott	Padbury	7412 Truelight Church Rd.	Mint Hill	NC	28227
tzimmerman@jcpsmail.org	Taylor	Zimmerman	100 Smoky Mountain Dr	Sylva	NC	28779
violetelise@gmail.com	Violet	Murray	845 Pine Forest Rd	Wilmington	NC	28409
emilygeorge00@yahoo.com	Emily	Nicholson	105 Kings Mountain Ct	Chapel Hill	NC	27516
reiki2008@att.net	Marge	Baney		Burlington	NC	27215
gwcacaca@yahoo.com	Gwendolyn	Brown	1377 Kison Ct NW	Concord	NC	28027
hmueller@live.unc.edu	Helmut	Mueller	409 Moonridge Rd.	Chapel Hill	NC	27516
odrone@yahoo.com	Scott	Tucker	6412 Lakerest Court	Raleigh	NC	27612
libbypatrick09@gmail.com	Patric	Libby	405 Carole Drive	Jacksonville	NC	28540
beverlyhammond@yahoo.com	Beverly	Hammond	100 Club Drive, Suite 17	Burnsville	NC	28714
cturtle68@earthlink.net	sonia	cardoso		Carolina Beach	NC	28428
echolovesdiving@yahoo.com	Echo	Woodsford	5362 New Centre Dr	Wilmington	NC	28403
betsysch@windstream.net	Elizabeth	Schenkel	927 Skyuka Rd.	Columbus	NC	28722
hmueller@email.unc.edu	Helmut	Mueller	409 Moonridge Road	Chapel Hill	NC	27516
richardstarling@bellsouth.net	Richard	Starling	3216 Hubbard Rd	Charlotte	NC	28269
lindatreadway@triad.rr.com	Linda	Treadway		Winston Salem	NC	27106
sherryl199@mac.com	Sherry	Lacroix	114 BLACKBROOK LANE	WILMINGTON	NC	28409
pvharris@yahoo.com	Patricia	Harris		Durham	NC	27701
echapple@wakemed.org	Evelyn	Chapple	4130E Dynasty dr	Cary	NC	27513
jeannegibbs@centurylink.net	Jeanne	Gibbs	78 brand lane	Coats	NC	27521
labsawyer@gmail.com	Laura	Sawyer	108 Covent Garden	Hertford	NC	27944
dhnlov@yahoo.com	Dhona	Lovick		Angier	NC	27501
shopsaway@live.com	M	Deheck		Hampstead	NC	28443
caramariposa@gmail.com	Cara	Davis	121 S. 3rd Ave	Mechanicville	NY	12118
irenes917@yahoo.com	Irene	Spitz	2756 Brigadoon Dr	Clayton	NC	27520
ajakef@gmail.com	Jake	Anderson		Winston Salem	NC	27106
thomas1766@comporium.net	Richard	Thomas	1766 Campbell Dr	Pisgah Forest	NC	28768
Jforbes988@aol.com	Jane	Forbes		Chapel Hill	NC	27517
athairaxaurora@gmail.com	Melissa	Santiago	Kenilworth Dr	High Point	NC	27260
alicemoncla@live.com	Alice	Moncla	1398 Belvidere Rd.	Belvidere	NC	27919
Heronswalk@bellsouth.net	Lynn	Archbold		Greensboro	NC	27407
sulaine@ymail.com	Susan	O'Neal	1917 E Greensboro Chape	Graham	NC	27253
slgagliardo@gmail.com	Sarah	Gagliardo	617 Glenarthur Drive	Wilmington	NC	28412

engle62@yahoo.com	Constance	Engle	244 Englewood Dr	Hendersonville	NC	28739
balexander36@live.com	Betty	Alexander	1400 Recapture Ct	Wake Forest	NC	27587
tclphz@yahoo.com	Tian	Chen	500 Umstead Dr Apt B303	Chapel Hill	NC	27516
sjsogol@gmail.com	Sydney	Sogol	402 B Jarvis St	Greenville	NC	27858
bah7482@uncw.edu	Brooke	Holler		Wilmington	NC	28403
kfriesian@gmail.com	Kim	Overton	3535 Hanover AVe	Castle Hayne	NC	28429
mcarneyv@aol.com	Michael	Carney	25 Bowers Ave.	Runnemede	NJ	8078
marycarter2@me.com	Mary	Carter		Southern Pines	NC	28387
perryt@nc.rr.com	Pericles	Tsombanis		Raleigh	NC	27613
katzer.alan@gmail.com	Alan	Katzer		Winston-Salem	NC	27106
pamelafbenbow@gmail.com	Pamela	Benbow	1321 Childs Dr	Hillsborough	NC	27278
kswenson42@gmail.com	kent	swenson	225 dennis ln	franklin	NC	28734
Brandonb@tidalcreek.coop	Brandon	Ballinger		Wil.	NC	28403
zookeeper6y@yahoo.com	John	Mawhinney	19 Sweetbriar Ct	Asheville	NC	28803
youknowryan@hotmail.com	Ryan	smith		winston salem	NC	27106
mowrey1234@hotmail.com	Glen	Mowrey	7465 CYPRESS DRIVE	GRAHAM	NC	27253
kimmer760@yahoo.com	Kimberly	Hurtt	1325 Harvard Park Way A	Garner	NC	27529
canoewnc@yahoo.com	Don	Read	23 Spring Cove Road	Asheville	NC	28804
scotttwins@gmail.com	Melinda	Scott	2010-F Quail Ridge Road	Greenville	NC	27858
rdtrtle@gmail.com	Beth	Stanberry	PO Box 468	Asheville	NC	28802
turtlehaul@hotmail.com	Nancy	Fahey	707 Darwin Dr.	Wilmington	NC	28405
joephil282@yahoo.com	Joe	Phillips	P. O. Box 282	Colfax	NC	27235
emosteg21@live.com	Daniel	Sunderland	25 Faded Oaks Rd.	Stollings	WV	25646
Cushingcon@aol.com	Elizabeth	Cushing	4013 grand manor court #	Raleigh	NC	27612
tuckerbailey@triad.rr.com	Bill	Bailey		Belews Creek	NC	27009
cfagan@methodist.edu	Carla	Fagan	6235 Carver Pine Loop, #8	Fayetteville	NC	28311
spauleavey@yahoo.com	Susan	Mock	2705 Chestnut St.	Wilmington	NC	28405
george810@spamarrest.com	George	McClelland	5202 Peacock Road	Whiteville	NC	28472
sjbales61@gmail.com	Susan	Bales		Clayton	NC	27527
bharperbradley@yahoo.com	Beth		101 timber ridge drive	Camillus	NY	13031
ivinkle@yahoo.com	Larry	Sparrow	3926 Old Chapel Hill Rd	Durham	NC	27707
sgw1960@hotmail.com	Sherri	Smith	124 Pheasantwood	Columbus	NC	28722
nancypyne@gmail.com	Nancy	Pyne	1301 Gallatin St NW	Washington, DC	DC	20011
jwseitz@hotmail.com	John	Seitz	721 Glascock St.	Raleigh	NC	27604

beachpropertync@gmail.com	Linda	Cheshire	323 S. 3rd Ave	Kure Beavh	NC	28449
tlrmeh@mindspring.com	Marguerite	Huggins	66 Points West Dr	Asheville	NC	28804
kodonnell@nc.rr.com	Kevin	O'Donnell	808 Ward St	Chapel Hill	NC	27516
DD1lovesthebeach@aol.com	Debbie	Busick	5499 Sunberry Drive	Brown Summit	NC	27214
sumner_rhonda@yahoo.com	Rhonda	Sumner	146 Coery Cir	Jacksonville	NC	28546
cbangley@gmail.com	Charles	Bangley	122 Squire Dr	Winterville	NC	28590
fiskw@bellsouth.net	William	Fisk	125 Chimney Glen Dr	Hendersonville	NC	28739
m_geenzier@yahoo.com	Maria	Geenzier	10 Alexander Drive, Apart	Asheville	NC	28801
dwight_koeberl@yahoo.com	Dwight	Koeberl	606 East Forest Hills Boule	Durham	NC	27707
jerryevans42@gmail.com	Jerry-Evans	Evans	3099 highway 58 south	kinston	NC	28504
dmw1nc@aol.com	David	Williams	12 Willoughby Run Drive	Asheville	NC	28803
rogerson1712@carolina.rr.com	James	Rogerson	9500 Robert Burns Ct	Charlotte	NC	28213
mezalesak@msn.com	Margie	Zalesak	205 McCleary Court	Raleigh	NC	27607
Dretheri@yahoo.com	Donna	Etheridge	1428 Princess Anne Rd	Rakeigh	NC	27607
jcollins@pappasventures.com	Jeffrey	Collins	5909 Hathaway Lane	Chapel Hill	NC	27514
fzachary@gmail.com	Frank	Zachary	1760 Spring Path Trail	Clemmons, NC	NC	27012
niuall@yahoo.com	Joseph	Nolan	270 1/2 Sand Hill Rd	Asheville	NC	28806
khodges@jungiananalyticpraxis.com	Karen	Hodges	2641 Palm Avenue	Charlotte	NC	28205
patholleman42@gmail.com	Pat	Holleman	317 Settlers Lane	Kure Beach	NC	28449
kc@casatortuga.org	Karen	Comstock	230 Pages Creek Dr	Wilmington	NC	28411
tessra2@gmail.com	Theresa	Rubin	729 Charleston Rd	Raleigh	NC	27606
dr_mcginty@live.com	Dawn	McGinty	206 w avondale	greensboro	NC	27403
galerullmann@embarqmail.com	Gale	Rullmann	435 Eagle Stone Ridge	Youngsville	NC	27596
sarahvanderwaall@ymail.com	Sarah	Vanderwaall	8632 beaver ck dr	Charlotte	NC	28269
artsbwithu@yahoo.com	karyn	drum	401 robert hunt dr	carrboro	NC	27510
daxteriana@gmail.com	Brandi	Jackson	2752 Hwy 55 W	Kinston	NC	28504
kicabcm@yahoo.com	Kicab	Castaneda-Men	112 Rhododendron Ct	Chapel Hill	NC	27517
cgkamini@gmail.com	Chanel	Kaminis		Asheville	NC	28804
pphelan@nc.rr.com	Patricia	Cabarga	107 Stateside Drive	Chapel Hill	NC	27514
mskd58@aol.com	Sharon	Swaney	7206 Whitetail Dr	Julian	NC	27283
mikeeeisen@yahoo.com	Michael	Eisenberg		Raleigh	NC	27613
pepperman7@embarqmail.com	Chris	Weeks	608 Timothy Drive	Elizabeth City	NC	27909
nsite2@hotmail.com	michele	rabey	3411 s. contentnea st.	farmville	NC	27828
zingara999@gmail.com	Judith	Wiseman	6509 Pencade Lane	Charlotte	NC	28215

fengshuicarole@yahoo.com	Margaret	Bollini	363 Daniel Drive	Boone	NC	28607
dharland1@hughes.net	Donald	Harland	PO Box 2080	Candler	NC	28715
rgrantmyre@bellsouth.net	Erica	Grantmyre	638 Chicamacomico Way	Bald Head Island	NC	28461
ealexg@yahoo.com	Edward A.	Gerster	1821-202 Avent Ridge Roa	Raleigh	NC	27606
bradytbradshaw@gmail.com	Brady	Bradshaw	4934 Wrightsville Ave	Wilmington	NC	28403
kp7986@yahoo.com	Kathy	Phares	13126 Ashford Park Dr	Raleigh	NC	27613
lindsayrm@mac.com	Lindsay	Murray	120 Kolbe Ct Apt 107	Wilmington	NC	28403
patron7@ec.rr.com	Pat	Harms		Morehead City	NC	28557
leoco@windstream.net	Kim	Leonard	1310 Shuping Mill Road	Rockwell	NC	28138
briannamackenzie@yahoo.com	Adrienne	Gardner	154 Ridgeview Drive	Mount Airy	NC	27030
fbeyer@nc.rr.com	Fred	Beyer	1709 Hatherleigh Place	Fayetteville	NC	28304
hootlois@yahoo.com	Lois	Hoot	405 Alderson	Washington	NC	27889
pace@mcdowell.main.nc.us	Elizabeth	O'Nan	396 Sugar Cove Rd.	Marion	NC	28752
jzizzo@ec.rr.com	James	Zizzo	2304 Wrightsville Ave. Ste	Wilmington	NC	28403
rsurface7@hotmail.com	Rachael	Surface	301 W. Main St.	Elizabeth City	NC	27909
caespinosa1@gmail.com	Carlos	Espinosa	212 Central Avenue	Black Mountain	NC	28711
starjet@mindspring.com	Janet	Tice	310 Umstead	Chapel Hill	NC	27516
jrobinke@gmail.com	Robin	Keller	1148 Sturdivant Dr.	Cary	NC	27511
sueb_nc@yahoo.com	Susan	Benitez	106 Home Ave	Graham	NC	27253
brotman27613@yahoo.com	Charles	Brotman	3601 Moss Bluff Ct	Raleigh	NC	27613
laurasbivins@gmail.com	Laura	Bivins		Wilmington	NC	28405
mcnham@clearwire.net	Traci	Hamilton	6138 Candlewood Drive	Charlotte	NC	28210
peterpan2121@earthlink.net	Linda	Muntner	6423 The Lakes Dr. - Apt. I	Raleigh	NC	27609
charmurr@msn.com	Ann	Charmak	12 Ridgeland Manor	Rye	NY	10580
lj1015@charter.net	Linda	Johnson	15 Academy St	Asheville	NC	28803
benadombm@appstate.edu	Brook	Benadom	Crocker rd	b.r.	NC	28605
david569@talktalk.net	David	Crawshaw	Beechfield	Leeds	Yorksh Ls12 5qs	
lapcevicn@gmail.com	Noelle	Lapcevic	217 Glascock St	Raleigh	NC	27604
timsteed@live.com	Reverend	Steedman	4600 crowne lake circle	Jamestown	NC	27282
jgs@med.unc.edu	Jim	Simmons	920 Cane Oaks Dr	Efland	NC	27243
pb@purplecat.net	Peter	Brezny	40 Highland Street	Asheville	NC	28801
goodshepherd@comporium.net	Heide	Coppotelli	383 Seldon Emerson Rd	Cedar Mountain	NC	28718
joy.ash333@gmail.com	Joy	Smith		Asheville	NC	28806
art4dh@aol.com	Diane	Hall	514 east davis st	burlington	NC	27215

isis69@hotmail.fr	Dorothee	Rossi	france	france	France	13780
slw0317@yahoo.com	Sara	Ward	123 Squire Dr	Winterville	NC	28590
droaten@mindspring.com	Doug	Roaten	13500 Andulusian Dr	Matthews	NC	28105
loisbill@bellsouth.net	Lois and Bill	Buenau	327 Marietta Road	Mooresville	NC	28117
dwbrewin@frontier.com	David	Brewin	1267 Moody Bridge Road	Cullowhee	NC	28723
dakota311@bellsouth.net	Cyndy	White	3721 Champaign St	Charlotte	NC	28210
raptured_night18@yahoo.com	Chanda	Farley	117 Ford St	Canton	NC	28716
nooawlinzboy@gmail.com	Gerald	Donaldson		Southport	NC	28461
naylorpaul@msn.com	Paul	Naylor, Ph.D.		Durham	NC	27707
lnirvine@bellsouth.net	Norbert	Irvine	44 faircrest road	Asheville	NC	28804
vpalacio13@gmail.com	Victoria	Palacio	603 sherbrooke circle	LAURINBURG	NC	28352
rockdoc_1@hotmail.com	Laura	Glover		Wilmington	NC	28409
reneetev@gmail.com	Renee	Tevelow	554 Grande Manor Court	Wilmington	NC	28405
ca2nc22@triad.rr.com	Steve	s		High Point	NC	27265
kjcoons@msn.com	Kathryn	Coons		Asheville	NC	28803
jhibbard@riseup.net	Jeff	Hibbard		Otto	NC	28763
samhhay@gmail.com	Sam	Hay		Mooresville	NC	28117
stevelupton@triad.rr.com	Stevenson	Lupton	2900 Turner Grove Dr. N.	Greensboro	NC	27455
p.j.reynolds@earthlink.net	Peter	Reynolds	1024 Edinborough Dr	Durham	NC	27703
apla4061@aol.com	Todd	Shelton	6590 Coltrane Mill Rd	Greensboro	NC	27406
tiffanybarbery4@aol.com	Tiffany	Barbery		Spring Lake	NC	28390
sungmin_nam@hotmail.com	Sung	Moy	308 Academia Ct	Durham	NC	27713
pat.pauljordan@yahoo.com	Patricia	Jordan	93 Oak Forest Hills	Hayesville	NC	28904
jdbrigman@atmc.net	Josh		605 lockwood folly rd.	bolivia	NC	28422
bogen@computerbarn.com	Bob	Bogen		Wrightsville Beach	NC	28480
Lmc6703@uncw.edu	Lindsey			Wrightsville beach	NC	28480
spencer_martha@hotmail.com	Martha	Spencer	988 Henry Mountain Roac	BREVARD	NC	28712
ebony.welborn@yahoo.com	Ebony	Welborb	111 East Lakeview Dr.	Thomasville	NC	27360
eallen925@aol.com	Emmanuel	Allen	6921 Folger Drive	Charlotte	NC	28270
athornlow@yahoo.com	Ann	Thornlow	5900 Dehaven Rd	Pleasant Garden	NC	27313
Philomene101@aol.com	Shirley	Rodman	606 Bruton Pl. S.	Greensboro	NC	27410
mike.edwards@raleighconvention.cc	Michael	Edwards	229 tamworth drive	willow spring	NC	27592
Hinze@wfu.edu	Willie	Hinze		winston salem	NC	27106
scarleteidolon@gmail.com	Judy	Katz	1419 manns chapel	pittsboro	NC	27312

swog.strowd@gmail.com	Richard	Strowd	4845 Manns Chapel Road	Chapel Hill	NC	27516
laynecaudle@att.net	Layne	Caudle		Hampstead	NC	28443
heathmariee@gmail.com	Heather	Erdody		calabash	NC	28467
jfreeze@triad.rr.com	John	Freeze	648 Chaney Road	Asheboro	NC	27205
sayrahpea@yahoo.com	Sarah	Pearson	1210 Chaney Rd.	Raleigh	NC	27606
Stevebrown145@hotmail.com	Steven	Brown		Concord	NC	28037
FairQueen1@aol.com	Donna	Varner-Sheaves	229 Haywicke Pl	Wake Forest	NC	27587
fshell1602@yahoo.com	Shelley	Frazier		Durham	NC	27705
dshaffer48@windstream.net	alma	shaffer	33834 shaver road	albemarle	NC	28001
shieldurlife@gmail.com	Kristina	Ford	200 B SPENCER FARLOW	Carolina Beach	NC	28428
larry.baldwin56@gmail.com	Larry	Baldwin	411 Church Road	New Bern	NC	28560
clavijo@uncw.edu	Ileana	Clavijo		Wilmington	NC	28405
sakur1@hotmail.com	Beryl	Perry	Lafayette's Tour	Ahoskie	NC	27910
ginger.evans@hotmail.com	Ginger	Evans	414Shasta Lane	Charlotte	NC	28211
liquidoshin@gmail.com	Derek	Walker	1325 Cherry Dr	Burlington	NC	27215
pjphilip12@gmail.com	Philip	DVM	12 Clover Drive	Chapel Hill	NC	27517
raleigh.stout@gmail.com	Raleigh	Stout	1001 YANCEYVILLE ST APT	Greensboro	NC	27405
Haileyfruchey@hotmail.com	Hailey		2917 Country Club Drive	Hampstead	NC	28443
kajbene@bellsouth.net	JULIANNA	BENEFIELD	104 Willoughby Lane	CARY	NC	27513
email@jeannerhea.com	Jeanne	Rhea	751 Dycus Road	Sanford	NC	27330
djtindell2@aol.com	Douglas	Tindell		Franklin	NC	28734
malcolm.johnson89@gmail.com	Malcolm	Johnson	227 E 11th St.	Southport	NC	28461
ginnysnolan@embarqmail.com	Ginny	Nolan	3204 S Memorial Ave	Nags Head	NC	27959
helsimon@yahoo.com	Heather	Payne	1300 Mason Farm Rd.	Chapel Hill	NC	27514
wynnepqueen@yahoo.com	Wynne	Queen		Forest City	NC	28043
elizabeth_tranter@yahoo.com	Elizabeth	Tranter	4907 Manning Drive	Greensboro	NC	27410
caherring@gmail.com	Carol	Herring	191 Persimmon Circle	Statesville	NC	28625
lysandrajoseph@gmail.com	Lysandra	Joseph	1514 Grande Harmony Pl	Cary	NC	27513
janp931@yahoo.com	Janice	Phillips	931-B South Main Street	Kernersville	NC	27284
andrea.crook@gmail.com	Andrea	Crook	5579 Nix road	Fayetteville	NC	28314
h.n.lambert919@gmail.com	Hope	Lambert	4105 Trotter Ridge Rd	Durham	NC	27707
hocky2u@embarqmail.com	Kim	Hockman	59 Kelly St	Gates	NC	27937
maglionic1@aol.com	Judith	Maglione	10 Moreview Dr	Asheville	NC	28803
gehepler@hotmail.com	Grace	Hepler	1879 Harper Road	Clemmons	NC	27012

elenalange33@gmail.com	Elena	Lange	294 Hillside St	Asheville	NC	28801
whewett1@ec.rr.com	Walter	Hewett		Wilmington	NC	28411
jennifermusco@yahoo.com	Jennifer	musco	7015 Sound Dr	Emerald Isle	NC	28594
alfaith14@aol.com	Arlene	Lane	502 S Race St	Statesville	NC	28677
charliekelly1345@yahoo.com	charLie	kelly	382 boundary st	Haw River	NC	27258
allison.hassell@gmail.com	Allison	Hassell	105 Kimberly Terrace	Greensboro	NC	27408
jpiazza@bellsouth.net	JOSEPH	PIAZZA	291 Church Meadows Wa	Fleetwood	NC	28626
drtbkr30@yahoo.com	Nicholas	Dodrill	509 Ann St.	Wilmington	NC	28401
shack694@gmail.com	Sharen	Oxman	66 Merrill Ln	Pisgah Forest	NC	28768
crc9181213@gmail.com	Christopher	Crouse		Waxhaw	NC	28173
wghoots@yahoo.com	Wanda	Hoots		Salter Path	NC	28575
marci@pookat.com	Marcia	Bentz	910 Constitution Dr	Durham	NC	27705
gwcheney@ymail.com	G.W.	Cheney	315 Hickory Lane	Boone	NC	28607
robert.underwood@embarqmail.con	Robert	Underwood	125 Ham Road	Hope Mills	NC	28348
Katzenfrau2000@yahoo.com	Marion	Kreh	127 mcdougald dr	Castle Hayne	NC	28429
Mikereedauto@yahoo.com	Michael	Reed	127 mcdougald dr	Castle Hayne	NC	28429
joannecmcgrath@aol.com	Joanne	McGrath		Sylva	NC	28779
elicelli@att.net	Eli	Celli	407 Legends Way	Chapel Hill	NC	27516
lpeterson@wcsr.com	Linda	Peterson	404 Woodlark Ct.	Indian Trail	NC	28079
mnolan8765@aol.com	Mary	Nolan		Carolina Beach	NC	28428
ruthmiller@me.com	Ruth	Miller	1819 Billabong Lane	Chapel Hill	NC	27516
heathe10@aol.com	Heather	Goeller	1141 Southern Meadows	Raleigh	NC	27603
etspike@gmail.com	Estelle	Spike	2330 Shade valley Rd. Apt	Charlotte	NC	28205
christy@surfnetusa.com	Christina	Dickson	109 Tabernacle Rd	Black Mountain	NC	28711
linettefoley@yahoo.com	Linette	Foley	103 W Herman St	Newton	NC	28658
raptorred01@yahoo.com	Ryan	Draper	101 Foxridge Road	Chapel Hill	NC	27514
samarcand280@aol.com	James	Taylor	6373 Bingham Place	Fayetteville	NC	28304
psychobrainwaves@yahoo.com	Andrew	Sossoman	3006 Sigman St	Fayetteville	NC	28303
tabashian@aol.com	Tamara	Abashian	1500 Tyler Ct	Durham	NC	27701
ladominy@gmail.com	Laurie	Dominy		Raleigh	NC	27607
rlbarnes01@yahoo.com	Robyn	Barnes	1211K Trillium Circle	Raleigh	NC	27606
ldurden@etinternet.net	Lynda	Durden	169 Bells Creek Ln	Ellerbe	NC	28338
lflewis96@gmail.com	Lisa	Lewis	112 Carrington drive	Garner	NC	27529
karen.willis@earthlink.net	Karen	Willis	2223 W Club Blvd	Durham	NC	27705

ansmoker@gmail.com	Art	Smoker	284 Arrowood Corner Rd.	Mars Hill	NC	28754
paulasquirewaterman@gmail.com	P.	Waterman	P. O, Box 1034	Wagram	NC	28396
Peaceeao7@aol.com	Ellen	Osborne	6731 Hunt Rd.	Pleasant Garden	NC	27313
kimbaslair@gmail.com	Kim	ONeil	200 Church Street	Black Mountain	NC	28711
zbethwegmann@yahoo.com	Elizabeth	Wegmann		Sugar Grove	NC	28679
lsemel@hotmail.com	Lori	Semel	1916 kings Manor Court	Matthews	NC	28105
sandyhoffman47@gmail.com	Sandy	Hoffman	105 Hollowood Court	Chapel Hill	NC	27514
Kpsrq@aol.com	Kimberly	Panarelli	401 N Church St	Charlotte	NC	28202
racegirl1971@yahoo.com	Christi	Dillon	175 Forest Ridge Rd.	Mooresville	NC	28117
zmpackman@att.net	Zola	Packman	1011 Nicholwood Drive #	Raleigh	NC	27605
gavco@me.com	Gavin	Dillard	528 Padgettown Road	Black Mountain	NC	28711
jlfray@ix.netcom.com	Jules	Fraytet	401 Hawthorne Lane	Charlotte	NC	28204
tde3@earthlink.net	Tim	Shaner	2516 Elderwood Lane	Burlington	NC	27215
tshilson2@gmail.com	Tom	Shilson	522 Alpine Drive	Wilmington	NC	28403
sevarner@aol.com	Sheri	Varner-Munt	2017 Valley Ct	Clayton	NC	27520
rtiffany@nc.rr.com	Robert	Tiffany	812 Norwood St	Fayetteville	NC	28305
lsbarnes@nc.rr.com	Linda	Barnes	6713 Wade-Stedman Roa	Wade	NC	28395
greeneyedgirl1871@gmail.com	Teresa	sanders	5005 blue clay road	castle hayne	NC	28429
ecoltman@bellsouth.net	Evelyn	Coltman	90 Evergreen Circle	Waynesville	NC	28786
marciabcelo@hotmail.com	marcia	bailey		Burnsville	NC	28714
Buffy12242@aol.com	Jamee	Warfle	30 Ocala St	Arden	NC	28704
iamdidi@aol.com	Frances	Mcaroy	5819 huffine ridge dr	gibsonville	NC	27249
joyslay55@gmail.com	Joy	Layton	108 Genora place	Jacksonville	NC	28540
Guerakiki2@aol.com	Kenna	Sommer	74 Crestmont Ave	Asheville	NC	28806
karenquacks@gmail.com	Karen	Hattman	2141 old graham rd	Pittsboro	NC	27312
agswake@gmail.com	Anna	Smith	310 W 4th Street, Ste 100	Winston-Salem	NC	27101
debbiemcmannis@gmail.com	Debbie	McMannis	PO Box 19252	Asheville	NC	28815
fouched@bellsouth.net	David	Fouche		Winston Salem	NC	27106
mxstanley@hotmail.com	M	Stanley	Central Blvd	Wilmington	NC	28401
beaufort@nc.rr.com	J	Jones		Durham	NC	27709
ckoz218@carolina.rr.com	Charlene	Kozloff	10309 Elven Ln.	Charlotte	NC	28269
shar.olivier@gmail.com	Shar	Olivier	114 Cheshire Dr	Hills borough	NC	27278
lucretia.dickson@gmail.com	lucretia	Dickson	705 Tinkerbell Rd	Chapel Hill	NC	27517
carribeanshirley@hotmail.com	Shirley	Harrell	3601 burris	N Myrtle Beach	SC	29582

nancyjessicagray@gmail.com	Jessica	Gray	126 Greenville Ave	Wilmington	NC	28403
ah1211@nc.rr.com	Amanda	Harding		Chapel Hill	NC	27517
cmolzahn@msn.com	Christina	Barbour		Reston	VA	20194
dolphins2001@gmail.com	Peter			Asheville	NC	28806
stacie.buff@gmail.com	Stacie	Buff	512 East 20th Street	Newton	NC	28658
debbieburroughs@hotmail.com	Debbie	Burroughs	111 Hobbs Acre Drive	Edenton	NC	27932
12turtles@bellsouth.net	Diana	Bayne		lincolnton	NC	28092
sailandskimom@yahoo.com	Tracy	Gourville		Wilmington	NC	28409
rldsack@aol.com	Robin	Sack	po box 535	Kure Beach	NC	28449
misllee@yahoo.com	Michelle	Lee	7614 Waterford Glen Loo	Charlotte	NC	28226
caroltao22@gmail.com	Carol	Tao	820 Old Marshall Hwy	Asheville	NC	28804
wyndera@aol.com	Margaret	Mirabella	232 Sweetbriar Court	Clayton	NC	27527
janny1028@aol.com	Jan	Gillespie	633 Windsong Lane	Durham	NC	27713
wilrobin@twave.net	Wilfred	Robin	549 11th Ave. Cir., NW	Hickory	NC	28601
ejs41248@me.com	Eric	Siebert	489 Brewington dr	Burgaw	NC	28425
burton@ryanscottdisplays.com	Burton	Brevda		Greensboro	NC	27408
jodi.sanderson@gmail.com	Nancy	Sanderson	8454 Coulwood Oak Lane	Charlotte	NC	28214
christineoneil7@yahoo.com	Christine	O'Neil	4409 Deer Knoll Ct	Raleigh	NC	27603
bevmaye69@hotmail.com	Beverly	Maye	2333 Ravenhill Dr	Raleigh	NC	27615
herman1938@frontier.com	Ralph	Herman	110 pyatt hts rd	marion	NC	28752
stevepath1@aol.com	Steven	Tracy	1118 Heatherloch Dr.	Gastonia	NC	28054
vmorton@carolina.rr.com	Vickie	Morton	110 Laurel Ridge Dr	Cherryville	NC	28021
franklorch@yahoo.com	Frank	Lorch	1522 Lynway Dr.	Charlotte	NC	28203
livitysound@gmail.com	William	Mesmer		Asheville	NC	28804
the_sleeping_beauty@charter.net	Marie	Kaplan	208 View Street	Black Mountain	NC	28711
sheelerjc@att.net	James	Sheeler	21 American Way	Asheville	NC	28806
MtWatson13@charter.net	Michael	Watson	2305 Liberty Church Road	Hickory	NC	28601
mrmoleandhisfriends@yahoo.com	Anna	Burton	5E River Oaks Dr	Greensboro	NC	27409
kimdaeyoon@gmail.com	Dae	Kim		Raleigh	NC	27604
kc1339@yahoo.com	Karen	Chappell		Rutherfordton	NC	28139
foamyislord42@gmail.com	Nick	Hood	5036 Peppertree Rd.	Clemmons	NC	27012
kcwaters2@kcwaters.com	Robert	Howland	176 Mountain Bluff Trl	Hendersonville	NC	28792
tailsoluv@yahoo.com	Barbara	Amalfi	1910 Kings Road	Shelby	NC	28150
clint_haywood@yahoo.com	Clinton	Haywood	150 Sharon Road	Cordova	NC	28330

collinsc@ecu.edu	Carol	Collins	1311 Fantasia St.	Greenville	NC	27858
lorihardison77@gmail.com	Lori	Hardison	P.O. Box	Williamston	NC	27846
gerardtetel@gmail.com	John	Tetel	1719 N Roxboro Road	Durham	NC	27701
zadazoo19@yahoo.com	Lesia	Mills		Clayton	NC	27528
tonyboy85@earthlink.net	Tony	McCarson	3608 Long Ridge Rd.	Durham	NC	27703
hellohempseeds@gmail.com	Tracy	Moss	3145 Luke Smith Ave	Morganton	NC	28655
claudiabonk@telefonica.net	CLAUDIA	Bonk		Madrid	NC	28707
blemin2037@gmail.com	Bonnie	LeMin	2037 wiley rd	spring hope	NC	27882
bonmon11@hotmail.com	Bonnie	Monteleone	4210 Wilshire Blvd	Wilmington	NC	28403
debkillinger@hotmail.com	Deb	Killinger		Hendersonville	NC	28739
sharon.mora31@yahoo.com	Sharon	Mora		Whittier	NC	28789
casaroonc@yahoo.com	Eric	DeYoung	519 Grace St	Wilmington	NC	28401
brash@triad.rr.com	Betty	Rash	37- K River Oaks Dr	Greensboro	NC	27409
celiabjones88@gmail.com	Celia	Jones	2400 N Lumina Ave	Wrightsville Beach	NC	28480
Speedicus35@Yahoo.com	Martin	Hillje		Nashville	NC	27856
dsurles1313@yahoo.com	Donna	Surles	1777 Asheville Highway	Waynesville	NC	28786
hughesnelson@netscape.net	Rayda	Hughes		Fletcher,	NC	28732
janel23@hotmail.com	Susan	Anspacher	210 rock field way	sylva	NC	28779
buehler@citcom.net	Marion	Buehler	333 Sunny Acre La.	Brevard	NC	28712
lazlo40@hotmail.com	r	Walker		Kill Devil Hills	NC	27948
mskittymartinmitchell@gmail.com	Catherine	Mitchell	P.O. Box 596	Ocracoke	NC	27960
calabadh723@yahoo.com	Callie	King	436 lighthouse rd	ocracoke	NC	27960
Obxjessacuna@gmail.com	Jessica	acuna	1672 countrywood st	Tarpon springs	FL	34689
kathy@card-blanc.com	Kathryn	Martin	3608 Kemble Ridge Drive	Wake Forest	NC	27587
mwbasilone@yahoo.com	Michael	Basilone	212 Woodard Rd	Kitty Hawk	NC	27949
n_cridlebaugh@yahoo.com	Nicole	Cridlebaugh	1314 Westminster Dr.	High Point	NC	27262
mlbdriver@gmail.com	Ben	Corbisiero	804 George Howe St	Manteo	NC	27954
sgates@charter.net	Shelli	Gates	4326 hesperides drive	nags head	NC	27959
dolce_1@att.net	Candace	Oakes		Saluda	NC	28773
jmckeny@msn.com	Jim	McKeny	936 Grassy Creek Road	Pinnacle	NC	27043
toni.m.valakas@gsk.com	Toni	Valakas	136 Shadow Ridge Pl	Chapel Hill	NC	27516
Jessie@hessmess.com	Jessie			Moyock	NC	27958
chanellovelyocean@yahoo.com	Brooke	Skakle	17 Croatan Ct.	Manteo	NC	27954
fitzholst@gmail.com	Mary	Holst	105 Brookwood ave	Wilmington	NC	28403

jgriggsbee@hotmail.com	Joyce	Riggsbee	Timber Ln	Matthews	NC	28104
ruthhettling@yahoo.com	Ruth	Hettling	109 E. Atlantic Street	Kill Devil Hills	NC	27948
Martabonatz@yahoo.com	Marta	Bonatz	928 East Beach Dr	Oak Island	NC	28465
bentgrass252@gmail.com	Mark	Roberts	600 Clamshell Dr	Kill Devil Hills	NC	27948
yarnjunkie2@hotmail.com	Pam	Thomas	140 Swan View Dr	Kill Devil Hills	NC	27948
dawnrchurch@charter.net	Dawn	Church	1713 Virginia Avenue	Kill Devil Hills	NC	27948
Ccampbell12@hotmail.com	Carrie	Dennis	19 Laroche St	Ludlow	MA	1056
cyvescio@hotmail.com	Cyrus	Vescio		Raleigh	NC	27613
agh2277@uncw.edu	Anita	Harrington	140 South Maple Avenue	Basking Ridge	NJ	7920
janhargett@hotmail.com	Jan	Hargett	8008 Sapwood Court	Matthews	NC	28104
Whitelightkiss@yahoo.com	Tanya	Fentress	4528 Caratoke Hwy	Barco	NC	27917
Ginbeadsobx@gmail.com	G	Flowers	3022 s Croatan hwy	Nags head	NC	27959
Msprouse11@gmail.com	Melissa	Sprouse	223 Pinetop Drive	Carthage	NC	28327
wilsonje176@gmail.com	John	Wilson	3408 S. Buccaneer Drive	Nags Head	NC	27959
ns.pelican@gmail.com	Nora		po 3087	kdh	NC	27948
CKARBORIST@AOL.COM	CYNTHIA	kiger	1316 thriftwood tr	lewisville	NC	27023
jbatten307@aol.com	Jerry	Batten		atlantic beach	NC	28512
awingerson21@gmail.com	Amber	Wingerson	431 Wake Drive	Salisbury	NC	28144
shyde45@gmail.com	Sarah			Manteo	NC	27954
wheelerja10@students.ecu.edu	Jamie	Heath	1525 Carlos Dr	Greenville	NC	27834
frnk1946@yahoo.com	Frank	McKennedy	128 W Kitty Hawk Rd	Kitty Hawk	NC	27949
sandigok@unlv.nevada.edu	Kat	Sandigo	210 Sonora Dr	Lillington	NC	27546
mkulignc@gmail.com	Mary	Kulig	2001 Fig Court	Fayetteville	NC	28305
dtleonard@hotmail.com	Debbie & Neal	Leonard	1408 Black Lake Rd	Thomasville	NC	27360
snd.forrest@gmail.com	Sandy	Forrest	612 Bethany Ch Rd	Moravian Falls	NC	28654
GLStaton@gmail.com	Carol	Staton	2123 caraway drive	Sophia	NC	27350
cooperna@sbcglobal.net	Nadene	Cooper		Jamesville	NC	27846
beachddsalt@gmail.com	James	DDS	104 Alder Branch Lm	Manteo	NC	27954
mrobertson6046@yahoo.com	MIchelle	Robertson	2031 newport news street	kill devil hills	NC	27948
dcwilson@rocketmail.com	Diane	Wilson	3408 S Buccaneer Dr.	Nags Head	NC	27959
lauren4beach@yahoo.com	Lauren	Nelson	220 Colington Ridge	Kill Devil Hills	NC	27948
cubscout72@gmail.com	Brad	McVaugh	756 Ridge Point Dr	Corolla	NC	27927
Selenamarie580@gmail.com	Selena	Arnette		Lenoir	NC	28645
bradley_t_@hotmail.com	T	Bradley	2934-A Saint Marks Road	Winston-Salem	NC	27103

bwcump@gmail.com	Brenda	Cumpston	2039 Otis Johnson Rd.	Pittsboro	NC	27312
anne625@bellsouth.net	Anne	Connolly	127 Big Sky Drive	Leicester	NC	28748
michellewookie@yahoo.com	Michelle	Wright	4073 brooksdale drive	franklinton	NC	27525
llilley@lakejunaluska.com	Loy	Lilley		Lake Junaluska	NC	28745
macturtle@att.net	Susan	Edelstein	308 Heidinger Drive	Cary	NC	27511
tloyx4@gmail.com	Tammy	Loy	2718 Janice Dr	High Point	NC	27263
sdny152@yahoo.com	Sarah	Davis		Raleigh	NC	27615
dbarnes7@triad.com	Denise	Barnes	508 Fairgrove Road	Thomasville	NC	27360
douglassmb1@comcast.net	Barbara	Douglass	245 Somervelle St.	Alexandria	VA	22304
shirleyj@email.unc.edu	Shirley	Jenkins	307 Granville Rd	Chapel Hill	NC	27514
robinhsmall@hotmail.com	Robin	Small	1834 Silverleaf Road	Zionville	NC	28698
ttetzlaf@uncc.edu	Tim	Tetzlaff	11930 Ulsten Lane	Huntersville	NC	28078
jdoyle@wfla.com	John	Doyle	200 Parker Street	Tampa	FL	33606
bedf08@aol.com	Doug	Faircloth		Evergreen	NC	28438
uncbrl@gmail.com	Barry	Lentz	179 Tradescant Dr	Chapel Hill	NC	27517
mdmcconney@gmail.com	Michael	McConney		Ocean Isle Beach	NC	28469
rainejune@msn.com	Augustus	Fricker	353 Sea Oats Trail	Southern Shores	NC	27949
alwa@embarqmail.com	Aleta	Cox	PO Box 4	Engelhard	NC	27824
dickchap@aol.com	Linda	Chapman	131 Cannon Road	Wilmington	NC	28411
peachmcd@frontier.com	Lezley	McDouall	1103 Chalk Level Rd	Durham	NC	27704
jcbaldwin@mindspring.com	John	Baldwin	4033 Brook Cross Dr	Apex	NC	27539
sawdawdesigns@gmail.com	Anthony	Leone	1804 apache st	kill devil hills	NC	27948
mgl_rns@yahoo.com	Miguel			Hendersonville	NC	28791
pswank38@gmail.com	Phyllis	Swank	750 Weaver Dairy Rd	Chapel Hill	NC	27514
lthompson128@yahoo.com	Elizabeth	Thompson		asheville	NC	28804
Gemonge1@hotmail.com	Grant	Sharp	116 Anna's way	Grandy	NC	27939
erb11light@yahoo.com	Ellen	Boyd	90 Welder'sLn.	Sylva	NC	28779
jkellam16@gmail.com	Jessica	Kellam	202 Ashland Drive Apartm	Greensboro	NC	27403
spro@charter.net	Sharon	Pro	1164 Burnside Road	Manteo	NC	27954
Gallegoskaren@comcast.net	Karen	Gallegos	795 Crown Point circle	Corolla	NC	27927
obxnc3@gmail.com	Sarah	Midgett-Balaba	3114 S Memorial Ave	Nags Head	NC	27959
Hazel@Poolos.com	Hazel	Poolos	42717 Caudle Rd	Richfield	NC	28137
jrswangerj@aol.com	Janice	Swanger	221 Green Valley Rd	Waynesville	NC	28786
bgrierjr@triad.rr.com	Bob	Grier	3125 Masonic Drive	Greensboro	NC	27403

gama49@embarqmail.com	Gary	McClure	PO Box 1029	Rutherford College	NC	28671
Lwilwerth60@hotmail.com	Maria	da Cunha	1470 NE 123 Street Apt 5(	North Miami	FL	33161
heynpc@yahoo.com	Pia	Heyn	1101 A Kensington Place	Asheville!	NC	28803
twohorsesforlinda@yahoo.com	Linda	Lentz	2839 owens community r(	vernon	FL	32462
bbrossman1@juno.com	charles	Brossman	205 crestline blvd	Greenville	NC	27834
darbydolittle6@hotmail.com	DARLENE	FALK	118 #2 Paul Carlton Rd.	Blowing Rock	NC	28605
janaobx@gmail.com	Jana	Murray	P.O. Box 261	Rodanthe	NC	27968
misswindy@aol.com	Windy	Champlin	PO Box 6	Nags Head	NC	27959
tctcme@gmail.com	Tania	Corbi	185 Sound View Drive	Wilmington	NC	28409
shellerelly@yahoo.com	Denise	Plymale	102 S Linwood Ave	Charlotte	NC	28208
jodie@joelambjr.com	Jodie	Herman	P.O. Box 1030	Kitty Hawk	NC	27949
btemp09@yahoo.com	Brooke	Templeton	631 Gannet Court	Corolla	NC	27927
teresa.clontz@yahoo.com	Ron & Teresa	Clontz	806 Cape Fear Blvd	Carolina Beach	NC	28428
edtupps@gmail.com	Edward	Tupper	310 W. Lookout Rd.	Nags Head	NC	27959
peaches@owensrestaurant.com	Peaches	Woodard	109 Bradford Lane	Manteo	NC	27954
angelbye1@yahoo.com	Susanne	Smith	208 w carolinian ct	nags head	NC	27959
dougturner1@verizon.net	Doug	Turner	16301 Midlothian Turnpik	Midlothian	VA	23113
haljerjen@aol.com	Ann	Cardew	2141 Maizefield Ln	Fuquay-Varina	NC	27526
info@wonriverkeeper.org	Douglas	Toltzman	120 Oak St	Hubert	NC	28539
Chaseascari@gmail.com	Chase	Ascari	510 St. Albans way	Richmond	VA	23229
shasha8676@hotmail.com	Shannon	Fussell	609 Carolina Sands Drive	Carolina Beach	NC	28428
roy.edlund@gmail.com	Roy	Edlund	PO Box 7232	Kill Devil Hills	NC	27948
webbdnc@aol.com	Charles	Webb	201 NC-54	Carrboro	NC	27510
bsbergst@gmail.com	Brittney	Bergstrom	6312 oakbrook cir	raleigh	NC	27609
bartonpmurray@gmail.com	Bart	Murray	PO Box 261	Rodanthe	NC	27968
hutchisongail61@gmail.com	Gail	Hutchison	6113	Manns Harbor	NC	27953
scottmbowl@yahoo.com	Scott	Bowling	220 Finley Forest Dr.	Chapel Hill	NC	27517
olv415@aol.com	Della	Oliver		Charlotte	NC	28269
beaverfalls1@yahoo.com	Lucy	Tyndall	3977 Flannery Ln	High Point	NC	27265
Scneas@aol.com	Kristen		Pond road	Wanchese	NC	27981
donhutson@yahoo.com	Don	Hutson	Sunrise Vw	Kitty Hawk	NC	27949
ptubilleja@gmail.com	Patrick	Tubilleja	4700 Winterlochen Rd	Raleigh	NC	27603
ppavlak001@gmail.com	Patrick	Pavlak		greensboro	NC	27455
obxhoney@aol.com	Michele	Desgain	1700 Seminole Street	Kill Devil Hill	NC	27948

marx_scott@msn.com	Christopher	Marx	7A OCEANIC ST	Wrightsville Beach	NC	28480
pixel_grrl@yahoo.com	Laura	Mitchell	2124 Rozzelles Ferry Rd	Charlotte	NC	28208
dinocolao@yahoo.com	Dino	Colao	1521 N. Croatan Hwy.	Kill Devil Hills	NC	27948
kchdavidson@gmail.com	Kym	Davidson	3 COLONIAL DR	wilmington	NC	28403
translatrice@gmail.com	Maria	Espina		Durham	NC	27701
rachael.hyde@gmail.com	Rachael	Hyde		Manteo	NC	27954
pntbtrandjelli@gmail.com	Angelica	Regueiro		Charlotte	NC	28214
amyhuggins@mac.com	Amy	Gaw	PO Box 1890	Kitty Hawk	NC	27949

Country	Phone	Comment
United States	8.29E+09	I am EXTREMELY concerned about the National Science Foundation's proposal to use seismic airguns to
United States		I am EXTREMELY concerned about the National Science Foundation's proposal to use seismic airguns to
United States		I am EXTREMELY concerned about the National Science Foundation's proposal to use seismic airguns to
United States	919-967-56	I am EXTREMELY concerned about the National Science Foundation's proposal to use seismic airguns to
United States		I am EXTREMELY concerned about the National Science Foundation's proposal to use seismic airguns to
United States	919-493-77	I am EXTREMELY concerned about the National Science Foundation's proposal to use seismic airguns to
United States	919 481671	I am EXTREMELY concerned about the National Science Foundation's proposal to use seismic airguns to
United States		I am EXTREMELY concerned about the National Science Foundation's proposal to use seismic airguns to
United States	919.358.75	I am EXTREMELY concerned about the National Science Foundation's proposal to use seismic airguns to
United States		I am EXTREMELY concerned about the National Science Foundation's proposal to use seismic airguns to
United States		I am EXTREMELY concerned about the National Science Foundation's proposal to use seismic airguns to
United States	828-395-42	I am EXTREMELY concerned about the National Science Foundation's proposal to use seismic airguns to
United States		I am EXTREMELY concerned about the National Science Foundation's proposal to use seismic airguns to
United States	910-864-42	I am EXTREMELY concerned about the National Science Foundation's proposal to use seismic airguns to
United States	7.05E+09	I am EXTREMELY concerned about the National Science Foundation's proposal to use seismic airguns to
United States		I am EXTREMELY concerned about the National Science Foundation's proposal to use seismic airguns to
United States		I am EXTREMELY concerned about the National Science Foundation's proposal to use seismic airguns to
United States	704-299-19	I am EXTREMELY concerned about the National Science Foundation's proposal to use seismic airguns to
United States		I am EXTREMELY concerned about the National Science Foundation's proposal to use seismic airguns to
United States		I am EXTREMELY concerned about the National Science Foundation's proposal to use seismic airguns to
United States		I am EXTREMELY concerned about the National Science Foundation's proposal to use seismic airguns to
United States	910-488-44	I am EXTREMELY concerned about the National Science Foundation's proposal to use seismic airguns to
United States		I am EXTREMELY concerned about the National Science Foundation's proposal to use seismic airguns to
United States	704-555-81	I am EXTREMELY concerned about the National Science Foundation's proposal to use seismic airguns to
United States		I am EXTREMELY concerned about the National Science Foundation's proposal to use seismic airguns to
United States	3.37E+09	I am EXTREMELY concerned about the National Science Foundation's proposal to use seismic airguns to
United States		I am EXTREMELY concerned about the National Science Foundation's proposal to use seismic airguns to
United States		I am EXTREMELY concerned about the National Science Foundation's proposal to use seismic airguns to
United States		I am EXTREMELY concerned about the National Science Foundation's proposal to use seismic airguns to
United States		I am EXTREMELY concerned about the National Science Foundation's proposal to use seismic airguns to
United States		I am EXTREMELY concerned about the National Science Foundation's proposal to use seismic airguns to
United States		I am EXTREMELY concerned about the National Science Foundation's proposal to use seismic airguns to
United States	7.05E+09	I am EXTREMELY concerned about the National Science Foundation's proposal to use seismic airguns to

United States		I am EXTREMELY concerned about the National Science Foundation's proposal to use seismic airguns to
United States		I am EXTREMELY concerned about the National Science Foundation's proposal to use seismic airguns to
United States	7.05E+09	I am EXTREMELY concerned about the National Science Foundation's proposal to use seismic airguns to
United States		I am EXTREMELY concerned about the National Science Foundation's proposal to use seismic airguns to
United States	(704) 814-8	I am EXTREMELY concerned about the National Science Foundation's proposal to use seismic airguns to
United States	3.37E+09	I am EXTREMELY concerned about the National Science Foundation's proposal to use seismic airguns to
United States		I am EXTREMELY concerned about the National Science Foundation's proposal to use seismic airguns to
United States	828 724 42	I am EXTREMELY concerned about the National Science Foundation's proposal to use seismic airguns to
United States		I am EXTREMELY concerned about the National Science Foundation's proposal to use seismic airguns to
United States		I am EXTREMELY concerned about the National Science Foundation's proposal to use seismic airguns to
United States		I am EXTREMELY concerned about the National Science Foundation's proposal to use seismic airguns to
United States		I am EXTREMELY concerned about the National Science Foundation's proposal to use seismic airguns to
United States	919 244-46	I am EXTREMELY concerned about the National Science Foundation's proposal to use seismic airguns to
United States	(231) 352-5	I am EXTREMELY concerned about the National Science Foundation's proposal to use seismic airguns to
United States		I am EXTREMELY concerned about the National Science Foundation's proposal to use seismic airguns to
United States		I am EXTREMELY concerned about the National Science Foundation's proposal to use seismic airguns to
United States		I am EXTREMELY concerned about the National Science Foundation's proposal to use seismic airguns to
United States	614-205-64	I am EXTREMELY concerned about the National Science Foundation's proposal to use seismic airguns to
United States		I am EXTREMELY concerned about the National Science Foundation's proposal to use seismic airguns to
United States	2.53E+09	I am EXTREMELY concerned about the National Science Foundation's proposal to use seismic airguns to
United States	919/424-61	I am EXTREMELY concerned about the National Science Foundation's proposal to use seismic airguns to
United States	919-489-49	I am EXTREMELY concerned about the National Science Foundation's proposal to use seismic airguns to
United States		I am EXTREMELY concerned about the National Science Foundation's proposal to use seismic airguns to
United States		I am EXTREMELY concerned about the National Science Foundation's proposal to use seismic airguns to
United States		I am EXTREMELY concerned about the National Science Foundation's proposal to use seismic airguns to
United States		I am EXTREMELY concerned about the National Science Foundation's proposal to use seismic airguns to
United States		I am EXTREMELY concerned about the National Science Foundation's proposal to use seismic airguns to
United States	980-333-45	I am EXTREMELY concerned about the National Science Foundation's proposal to use seismic airguns to
United States		I am EXTREMELY concerned about the National Science Foundation's proposal to use seismic airguns to
United States	252 269 92	I am EXTREMELY concerned about the National Science Foundation's proposal to use seismic airguns to
United States		I am EXTREMELY concerned about the National Science Foundation's proposal to use seismic airguns to
United States		I am EXTREMELY concerned about the National Science Foundation's proposal to use seismic airguns to
United States	828-484-92	I am EXTREMELY concerned about the National Science Foundation's proposal to use seismic airguns to
United States	919-419-16	I am EXTREMELY concerned about the National Science Foundation's proposal to use seismic airguns to

United States		I am EXTREMELY concerned about the National Science Foundation's proposal to use seismic airguns to
United States		I am EXTREMELY concerned about the National Science Foundation's proposal to use seismic airguns to
United States		I am EXTREMELY concerned about the National Science Foundation's proposal to use seismic airguns to
United States		I am EXTREMELY concerned about the National Science Foundation's proposal to use seismic airguns to
United States	704-367-00	I am EXTREMELY concerned about the National Science Foundation's proposal to use seismic airguns to
United States	704-453-64	I am EXTREMELY concerned about the National Science Foundation's proposal to use seismic airguns to
United States		I am EXTREMELY concerned about the National Science Foundation's proposal to use seismic airguns to
United States		I am EXTREMELY concerned about the National Science Foundation's proposal to use seismic airguns to
United States		I am EXTREMELY concerned about the National Science Foundation's proposal to use seismic airguns to
United States	4.08E+09	I am EXTREMELY concerned about the National Science Foundation's proposal to use seismic airguns to
United States		I am EXTREMELY concerned about the National Science Foundation's proposal to use seismic airguns to
United States	919-966-10	I am EXTREMELY concerned about the National Science Foundation's proposal to use seismic airguns to
United States		I am EXTREMELY concerned about the National Science Foundation's proposal to use seismic airguns to
United States		I am EXTREMELY concerned about the National Science Foundation's proposal to use seismic airguns to
United States		I am EXTREMELY concerned about the National Science Foundation's proposal to use seismic airguns to
United States		I am EXTREMELY concerned about the National Science Foundation's proposal to use seismic airguns to
United States	(910) 333-8	I am EXTREMELY concerned about the National Science Foundation's proposal to use seismic airguns to
United States	8.29E+09	I am EXTREMELY concerned about the National Science Foundation's proposal to use seismic airguns to
United States		I am EXTREMELY concerned about the National Science Foundation's proposal to use seismic airguns to
United States	9.2E+09	I am EXTREMELY concerned about the National Science Foundation's proposal to use seismic airguns to
United States		I am EXTREMELY concerned about the National Science Foundation's proposal to use seismic airguns to
United States		I am EXTREMELY concerned about the National Science Foundation's proposal to use seismic airguns to
United States	252.444.99	I am EXTREMELY concerned about the National Science Foundation's proposal to use seismic airguns to
United States		I am EXTREMELY concerned about the National Science Foundation's proposal to use seismic airguns to
United States		I am EXTREMELY concerned about the National Science Foundation's proposal to use seismic airguns to
United States		I am EXTREMELY concerned about the National Science Foundation's proposal to use seismic airguns to
United States		I am EXTREMELY concerned about the National Science Foundation's proposal to use seismic airguns to
United States		I am EXTREMELY concerned about the National Science Foundation's proposal to use seismic airguns to
United States		I am EXTREMELY concerned about the National Science Foundation's proposal to use seismic airguns to
United States		I am EXTREMELY concerned about the National Science Foundation's proposal to use seismic airguns to
United States		I am EXTREMELY concerned about the National Science Foundation's proposal to use seismic airguns to
United States		I am EXTREMELY concerned about the National Science Foundation's proposal to use seismic airguns to
United States	3.37E+09	I am EXTREMELY concerned about the National Science Foundation's proposal to use seismic airguns to
United States	7.04E+09	I am EXTREMELY concerned about the National Science Foundation's proposal to use seismic airguns to

United States	704-588-49	I am EXTREMELY concerned about the National Science Foundation's proposal to use seismic airguns to
United States		I am EXTREMELY concerned about the National Science Foundation's proposal to use seismic airguns to
United States		I am EXTREMELY concerned about the National Science Foundation's proposal to use seismic airguns to
United States		I am EXTREMELY concerned about the National Science Foundation's proposal to use seismic airguns to
United States		I am EXTREMELY concerned about the National Science Foundation's proposal to use seismic airguns to
United States		I am EXTREMELY concerned about the National Science Foundation's proposal to use seismic airguns to
United States		I am EXTREMELY concerned about the National Science Foundation's proposal to use seismic airguns to
United States		I am EXTREMELY concerned about the National Science Foundation's proposal to use seismic airguns to
United States		I am EXTREMELY concerned about the National Science Foundation's proposal to use seismic airguns to
United States	9.2E+09	I am EXTREMELY concerned about the National Science Foundation's proposal to use seismic airguns to
United States		I am EXTREMELY concerned about the National Science Foundation's proposal to use seismic airguns to
United States	919.807.13	I am EXTREMELY concerned about the National Science Foundation's proposal to use seismic airguns to
United States		I am EXTREMELY concerned about the National Science Foundation's proposal to use seismic airguns to
United States		I am EXTREMELY concerned about the National Science Foundation's proposal to use seismic airguns to
United States	910-328-09	I am EXTREMELY concerned about the National Science Foundation's proposal to use seismic airguns to
United States	312-343-05	I am EXTREMELY concerned about the National Science Foundation's proposal to use seismic airguns to
United States		I am EXTREMELY concerned about the National Science Foundation's proposal to use seismic airguns to
United States		I am EXTREMELY concerned about the National Science Foundation's proposal to use seismic airguns to
United States	919-789-90	I am EXTREMELY concerned about the National Science Foundation's proposal to use seismic airguns to
United States		I am EXTREMELY concerned about the National Science Foundation's proposal to use seismic airguns to
United States	5.41E+09	I am EXTREMELY concerned about the National Science Foundation's proposal to use seismic airguns to
United States		I am EXTREMELY concerned about the National Science Foundation's proposal to use seismic airguns to
United States		I am EXTREMELY concerned about the National Science Foundation's proposal to use seismic airguns to
United States		I am EXTREMELY concerned about the National Science Foundation's proposal to use seismic airguns to
United States		I am EXTREMELY concerned about the National Science Foundation's proposal to use seismic airguns to
United States		I am EXTREMELY concerned about the National Science Foundation's proposal to use seismic airguns to
United States		I am EXTREMELY concerned about the National Science Foundation's proposal to use seismic airguns to
United States		I am EXTREMELY concerned about the National Science Foundation's proposal to use seismic airguns to
United States		I am EXTREMELY concerned about the National Science Foundation's proposal to use seismic airguns to
United States		I am EXTREMELY concerned about the National Science Foundation's proposal to use seismic airguns to
United States		I am EXTREMELY concerned about the National Science Foundation's proposal to use seismic airguns to
United States		I am EXTREMELY concerned about the National Science Foundation's proposal to use seismic airguns to
United States		I am EXTREMELY concerned about the National Science Foundation's proposal to use seismic airguns to
United States		I am EXTREMELY concerned about the National Science Foundation's proposal to use seismic airguns to

United States	919-932-74	I am EXTREMELY concerned about the National Science Foundation's proposal to use seismic airguns to
United States	7.05E+09	I am EXTREMELY concerned about the National Science Foundation's proposal to use seismic airguns to
United States		I am EXTREMELY concerned about the National Science Foundation's proposal to use seismic airguns to
United States	252-489-93	I am EXTREMELY concerned about the National Science Foundation's proposal to use seismic airguns to
United States		I am EXTREMELY concerned about the National Science Foundation's proposal to use seismic airguns to
United States		I am EXTREMELY concerned about the National Science Foundation's proposal to use seismic airguns to
United States	704-536-43	I am EXTREMELY concerned about the National Science Foundation's proposal to use seismic airguns to
United States		I am EXTREMELY concerned about the National Science Foundation's proposal to use seismic airguns to
United States		I am EXTREMELY concerned about the National Science Foundation's proposal to use seismic airguns to
United States		I am EXTREMELY concerned about the National Science Foundation's proposal to use seismic airguns to
United States	910-713-82	I am EXTREMELY concerned about the National Science Foundation's proposal to use seismic airguns to
United States	9.2E+09	I am EXTREMELY concerned about the National Science Foundation's proposal to use seismic airguns to
United States		I am EXTREMELY concerned about the National Science Foundation's proposal to use seismic airguns to
United States		I am EXTREMELY concerned about the National Science Foundation's proposal to use seismic airguns to
United States	617-283-47	I am EXTREMELY concerned about the National Science Foundation's proposal to use seismic airguns to
United States		I am EXTREMELY concerned about the National Science Foundation's proposal to use seismic airguns to
United States	602 881 81	I am EXTREMELY concerned about the National Science Foundation's proposal to use seismic airguns to
United States		I am EXTREMELY concerned about the National Science Foundation's proposal to use seismic airguns to
United States		I am EXTREMELY concerned about the National Science Foundation's proposal to use seismic airguns to
United States		I am EXTREMELY concerned about the National Science Foundation's proposal to use seismic airguns to
United States	7.05E+09	I am EXTREMELY concerned about the National Science Foundation's proposal to use seismic airguns to
United States		I am EXTREMELY concerned about the National Science Foundation's proposal to use seismic airguns to
United States		I am EXTREMELY concerned about the National Science Foundation's proposal to use seismic airguns to
United States		I am EXTREMELY concerned about the National Science Foundation's proposal to use seismic airguns to
United States		I am EXTREMELY concerned about the National Science Foundation's proposal to use seismic airguns to
United States		I am EXTREMELY concerned about the National Science Foundation's proposal to use seismic airguns to
United States		I am EXTREMELY concerned about the National Science Foundation's proposal to use seismic airguns to
United States		I am EXTREMELY concerned about the National Science Foundation's proposal to use seismic airguns to
United States	336-201-41	I am EXTREMELY concerned about the National Science Foundation's proposal to use seismic airguns to
United States	7.05E+09	I am EXTREMELY concerned about the National Science Foundation's proposal to use seismic airguns to
United States		I am EXTREMELY concerned about the National Science Foundation's proposal to use seismic airguns to
United States	8.28E+09	I am EXTREMELY concerned about the National Science Foundation's proposal to use seismic airguns to
United States	5.7E+09	I am EXTREMELY concerned about the National Science Foundation's proposal to use seismic airguns to
United States		I am EXTREMELY concerned about the National Science Foundation's proposal to use seismic airguns to

United States		I am EXTREMELY concerned about the National Science Foundation's proposal to use seismic airguns to
United States	828-255-77	I am EXTREMELY concerned about the National Science Foundation's proposal to use seismic airguns to
United States	704-545-65	I am EXTREMELY concerned about the National Science Foundation's proposal to use seismic airguns to
United States		I am EXTREMELY concerned about the National Science Foundation's proposal to use seismic airguns to
United States		I am EXTREMELY concerned about the National Science Foundation's proposal to use seismic airguns to
United States	7.04E+09	I am EXTREMELY concerned about the National Science Foundation's proposal to use seismic airguns to
United States	(828) 712-7	I am EXTREMELY concerned about the National Science Foundation's proposal to use seismic airguns to
United States		I am EXTREMELY concerned about the National Science Foundation's proposal to use seismic airguns to
United States		I am EXTREMELY concerned about the National Science Foundation's proposal to use seismic airguns to
United States	919-528-73	I am EXTREMELY concerned about the National Science Foundation's proposal to use seismic airguns to
United States		I am EXTREMELY concerned about the National Science Foundation's proposal to use seismic airguns to
United States	336-491-16	I am EXTREMELY concerned about the National Science Foundation's proposal to use seismic airguns to
United States		I am EXTREMELY concerned about the National Science Foundation's proposal to use seismic airguns to
United States		I am EXTREMELY concerned about the National Science Foundation's proposal to use seismic airguns to
United States		I am EXTREMELY concerned about the National Science Foundation's proposal to use seismic airguns to
United States		I am EXTREMELY concerned about the National Science Foundation's proposal to use seismic airguns to
United States		I am EXTREMELY concerned about the National Science Foundation's proposal to use seismic airguns to
United States		I am EXTREMELY concerned about the National Science Foundation's proposal to use seismic airguns to
United States		I am EXTREMELY concerned about the National Science Foundation's proposal to use seismic airguns to
United States	910-458-35	I am EXTREMELY concerned about the National Science Foundation's proposal to use seismic airguns to
United States		I am EXTREMELY concerned about the National Science Foundation's proposal to use seismic airguns to
United States		I am EXTREMELY concerned about the National Science Foundation's proposal to use seismic airguns to
United States		I am EXTREMELY concerned about the National Science Foundation's proposal to use seismic airguns to
United States	9.1E+09	I am EXTREMELY concerned about the National Science Foundation's proposal to use seismic airguns to
United States		I am EXTREMELY concerned about the National Science Foundation's proposal to use seismic airguns to
United States		I am EXTREMELY concerned about the National Science Foundation's proposal to use seismic airguns to
United States	800-533-20	I am EXTREMELY concerned about the National Science Foundation's proposal to use seismic airguns to
United States		I am EXTREMELY concerned about the National Science Foundation's proposal to use seismic airguns to
United States		I am EXTREMELY concerned about the National Science Foundation's proposal to use seismic airguns to
United States		I am EXTREMELY concerned about the National Science Foundation's proposal to use seismic airguns to
United States	910 845 22	I am EXTREMELY concerned about the National Science Foundation's proposal to use seismic airguns to
United States		I am EXTREMELY concerned about the National Science Foundation's proposal to use seismic airguns to
United States		I am EXTREMELY concerned about the National Science Foundation's proposal to use seismic airguns to
United States		I am EXTREMELY concerned about the National Science Foundation's proposal to use seismic airguns to

United States	(919) 389-6	I am EXTREMELY concerned about the National Science Foundation's proposal to use seismic airguns to
United States	7.05E+09	I am EXTREMELY concerned about the National Science Foundation's proposal to use seismic airguns to
United States	(704) 207-7	I am EXTREMELY concerned about the National Science Foundation's proposal to use seismic airguns to
United States		I am EXTREMELY concerned about the National Science Foundation's proposal to use seismic airguns to
United States	704 633 30	I am EXTREMELY concerned about the National Science Foundation's proposal to use seismic airguns to
United States		I am EXTREMELY concerned about the National Science Foundation's proposal to use seismic airguns to
United States		I am EXTREMELY concerned about the National Science Foundation's proposal to use seismic airguns to
United States	9.11E+09	I am EXTREMELY concerned about the National Science Foundation's proposal to use seismic airguns to
United States		I am EXTREMELY concerned about the National Science Foundation's proposal to use seismic airguns to
United States		I am EXTREMELY concerned about the National Science Foundation's proposal to use seismic airguns to
United States		I am EXTREMELY concerned about the National Science Foundation's proposal to use seismic airguns to
United States	7.04E+09	I am EXTREMELY concerned about the National Science Foundation's proposal to use seismic airguns to
United States	336-548-56	I am EXTREMELY concerned about the National Science Foundation's proposal to use seismic airguns to
United States	336 259 60	I am EXTREMELY concerned about the National Science Foundation's proposal to use seismic airguns to
United States		I am EXTREMELY concerned about the National Science Foundation's proposal to use seismic airguns to
United States	(336) 847-8	I am EXTREMELY concerned about the National Science Foundation's proposal to use seismic airguns to
United States		I am EXTREMELY concerned about the National Science Foundation's proposal to use seismic airguns to
United States		I am EXTREMELY concerned about the National Science Foundation's proposal to use seismic airguns to
United States		I am EXTREMELY concerned about the National Science Foundation's proposal to use seismic airguns to
United States	910-238-42	I am EXTREMELY concerned about the National Science Foundation's proposal to use seismic airguns to
United States		I am EXTREMELY concerned about the National Science Foundation's proposal to use seismic airguns to
United States		I am EXTREMELY concerned about the National Science Foundation's proposal to use seismic airguns to
United States		I am EXTREMELY concerned about the National Science Foundation's proposal to use seismic airguns to
United States		I am EXTREMELY concerned about the National Science Foundation's proposal to use seismic airguns to
United States	856-889-29	I am EXTREMELY concerned about the National Science Foundation's proposal to use seismic airguns to
United States		I am EXTREMELY concerned about the National Science Foundation's proposal to use seismic airguns to
United States		I am EXTREMELY concerned about the National Science Foundation's proposal to use seismic airguns to
United States		I am EXTREMELY concerned about the National Science Foundation's proposal to use seismic airguns to
United States		I am EXTREMELY concerned about the National Science Foundation's proposal to use seismic airguns to
United States	805 481 02	I am EXTREMELY concerned about the National Science Foundation's proposal to use seismic airguns to
United States		I am EXTREMELY concerned about the National Science Foundation's proposal to use seismic airguns to
United States	9.19E+09	I am EXTREMELY concerned about the National Science Foundation's proposal to use seismic airguns to
United States		I am EXTREMELY concerned about the National Science Foundation's proposal to use seismic airguns to
United States		I am EXTREMELY concerned about the National Science Foundation's proposal to use seismic airguns to

United States		I am EXTREMELY concerned about the National Science Foundation's proposal to use seismic airguns AT
United States	(910) 799-9	I am EXTREMELY concerned about the National Science Foundation's proposal to use seismic airguns to
United States		I am EXTREMELY concerned about the National Science Foundation's proposal to use seismic airguns to
United States		I am EXTREMELY concerned about the National Science Foundation's proposal to use seismic airguns to
United States		I am EXTREMELY concerned about the National Science Foundation's proposal to use seismic airguns to
United States	8.28E+09	I am EXTREMELY concerned about the National Science Foundation's proposal to use seismic airguns to
United States		I am EXTREMELY concerned about the National Science Foundation's proposal to use seismic airguns to
United States		I am EXTREMELY concerned about the National Science Foundation's proposal to use seismic airguns to
United States		I am EXTREMELY concerned about the National Science Foundation's proposal to use seismic airguns to
United States		I am EXTREMELY concerned about the National Science Foundation's proposal to use seismic airguns to
United States	910 619-31	I am EXTREMELY concerned about the National Science Foundation's proposal to use seismic airguns to
United States		I am EXTREMELY concerned about the National Science Foundation's proposal to use seismic airguns to
United States		I am EXTREMELY concerned about the National Science Foundation's proposal to use seismic airguns to
United States	8.29E+09	I am EXTREMELY concerned about the National Science Foundation's proposal to use seismic airguns to
United States	828-891-25	I am EXTREMELY concerned about the National Science Foundation's proposal to use seismic airguns to
United States		I am EXTREMELY concerned about the National Science Foundation's proposal to use seismic airguns to
United States		I am EXTREMELY concerned about the National Science Foundation's proposal to use seismic airguns to
United States		I am EXTREMELY concerned about the National Science Foundation's proposal to use seismic airguns to
United States		I am EXTREMELY concerned about the National Science Foundation's proposal to use seismic airguns to
United States		I am EXTREMELY concerned about the National Science Foundation's proposal to use seismic airguns to
United States	704 757 23	I am EXTREMELY concerned about the National Science Foundation's proposal to use seismic airguns to
United States	336-578-30	I am EXTREMELY concerned about the National Science Foundation's proposal to use seismic airguns to
United States		I am EXTREMELY concerned about the National Science Foundation's proposal to use seismic airguns to
United States		I am EXTREMELY concerned about the National Science Foundation's proposal to use seismic airguns to
United States		I am EXTREMELY concerned about the National Science Foundation's proposal to use seismic airguns to
United States	252-491-84	I am EXTREMELY concerned about the National Science Foundation's proposal to use seismic airguns to
United States		I am EXTREMELY concerned about the National Science Foundation's proposal to use seismic airguns to
United States	7.05E+09	I am EXTREMELY concerned about the National Science Foundation's proposal to use seismic airguns to
United States		I am EXTREMELY concerned about the National Science Foundation's proposal to use seismic airguns to
United States		I am EXTREMELY concerned about the National Science Foundation's proposal to use seismic airguns to
United States	252-753-63	I am EXTREMELY concerned about the National Science Foundation's proposal to use seismic airguns to
United States		I am EXTREMELY concerned about the National Science Foundation's proposal to use seismic airguns to
United States		I am EXTREMELY concerned about the National Science Foundation's proposal to use seismic airguns to
United States	8.28E+09	I am EXTREMELY concerned about the National Science Foundation's proposal to use seismic airguns to

United States		I am EXTREMELY concerned about the National Science Foundation's proposal to use seismic airguns to
United States		I am EXTREMELY concerned about the National Science Foundation's proposal to use seismic airguns to
United States		I am EXTREMELY concerned about the National Science Foundation's proposal to use seismic airguns to
United States		I am EXTREMELY concerned about the National Science Foundation's proposal to use seismic airguns to
United States		I am EXTREMELY concerned about the National Science Foundation's proposal to use seismic airguns to
United States		I am EXTREMELY concerned about the National Science Foundation's proposal to use seismic airguns to
United States		I am EXTREMELY concerned about the National Science Foundation's proposal to use seismic airguns to
United States		I am EXTREMELY concerned about the National Science Foundation's proposal to use seismic airguns to
United States		I am EXTREMELY concerned about the National Science Foundation's proposal to use seismic airguns to
United States		I am EXTREMELY concerned about the National Science Foundation's proposal to use seismic airguns to
United States		I am EXTREMELY concerned about the National Science Foundation's proposal to use seismic airguns to
United States	910-795-38	I am EXTREMELY concerned about the National Science Foundation's proposal to use seismic airguns to
United States	9.1E+09	I am EXTREMELY concerned about the National Science Foundation's proposal to use seismic airguns to
United States		I am EXTREMELY concerned about the National Science Foundation's proposal to use seismic airguns to
United States	919-942-49	I am EXTREMELY concerned about the National Science Foundation's proposal to use seismic airguns to
United States		I am EXTREMELY concerned about the National Science Foundation's proposal to use seismic airguns to
United States		I am EXTREMELY concerned about the National Science Foundation's proposal to use seismic airguns to
United States		I am EXTREMELY concerned about the National Science Foundation's proposal to use seismic airguns to
United States	919-475-63	I am EXTREMELY concerned about the National Science Foundation's proposal to use seismic airguns to
United States	9.19E+09	I am EXTREMELY concerned about the National Science Foundation's proposal to use seismic airguns to
United States		I am EXTREMELY concerned about the National Science Foundation's proposal to use seismic airguns to
United States		I am EXTREMELY concerned about the National Science Foundation's proposal to use seismic airguns to
United States		I am EXTREMELY concerned about the National Science Foundation's proposal to use seismic airguns to
United States		I am EXTREMELY concerned about the National Science Foundation's proposal to use seismic airguns to
United States		I am EXTREMELY concerned about the National Science Foundation's proposal to use seismic airguns to
United States		I am EXTREMELY concerned about the National Science Foundation's proposal to use seismic airguns to
United States		I am EXTREMELY concerned about the National Science Foundation's proposal to use seismic airguns to
United States		I am EXTREMELY concerned about the National Science Foundation's proposal to use seismic airguns to
United States		I am EXTREMELY concerned about the National Science Foundation's proposal to use seismic airguns to
United States		I am EXTREMELY concerned about the National Science Foundation's proposal to use seismic airguns to
United States		I am EXTREMELY concerned about the National Science Foundation's proposal to use seismic airguns to
United States		I am EXTREMELY concerned about the National Science Foundation's proposal to use seismic airguns to
United States		I am EXTREMELY concerned about the National Science Foundation's proposal to use seismic airguns to
United States		I am EXTREMELY concerned about the National Science Foundation's proposal to use seismic airguns to

United States		I am EXTREMELY concerned about the National Science Foundation's proposal to use seismic airguns to
United States		I am EXTREMELY concerned about the National Science Foundation's proposal to use seismic airguns to
United States		I am EXTREMELY concerned about the National Science Foundation's proposal to use seismic airguns to
United States		I am EXTREMELY concerned about the National Science Foundation's proposal to use seismic airguns to
United States	(919) 414-6	I am EXTREMELY concerned about the National Science Foundation's proposal to use seismic airguns to
United States		I am EXTREMELY concerned about the National Science Foundation's proposal to use seismic airguns to
United States		I am EXTREMELY concerned about the National Science Foundation's proposal to use seismic airguns to
United States	(203) 273-2	I am EXTREMELY concerned about the National Science Foundation's proposal to use seismic airguns to
United States		I am EXTREMELY concerned about the National Science Foundation's proposal to use seismic airguns to
United States		I am EXTREMELY concerned about the National Science Foundation's proposal to use seismic airguns to
United States		I am EXTREMELY concerned about the National Science Foundation's proposal to use seismic airguns to
United States		I am EXTREMELY concerned about the National Science Foundation's proposal to use seismic airguns to
United States		I am EXTREMELY concerned about the National Science Foundation's proposal to use seismic airguns to
United States		I am EXTREMELY concerned about the National Science Foundation's proposal to use seismic airguns to
United States		I am EXTREMELY concerned about the National Science Foundation's proposal to use seismic airguns to
United States		I am EXTREMELY concerned about the National Science Foundation's proposal to use seismic airguns to
United States	919-803-73	I am EXTREMELY concerned about the National Science Foundation's proposal to use seismic airguns to
United States		I am EXTREMELY concerned about the National Science Foundation's proposal to use seismic airguns to
United States	2.53E+09	I am EXTREMELY concerned about the National Science Foundation's proposal to use seismic airguns to
United States	828-216-07	I am EXTREMELY concerned about the National Science Foundation's proposal to use seismic airguns to
United States	910-791-45	I am EXTREMELY concerned about the National Science Foundation's proposal to use seismic airguns to
United States		I am EXTREMELY concerned about the National Science Foundation's proposal to use seismic airguns to
United States		I am EXTREMELY concerned about the National Science Foundation's proposal to use seismic airguns to
United States		I am EXTREMELY concerned about the National Science Foundation's proposal to use seismic airguns to
United States	336-595-51	I am EXTREMELY concerned about the National Science Foundation's proposal to use seismic airguns to
United States		I am EXTREMELY concerned about the National Science Foundation's proposal to use seismic airguns to
United States	9.1E+09	I am EXTREMELY concerned about the National Science Foundation's proposal to use seismic airguns to
United States	910-640-09	I am EXTREMELY concerned about the National Science Foundation's proposal to use seismic airguns to
United States		I am EXTREMELY concerned about the National Science Foundation's proposal to use seismic airguns to
United States		I am EXTREMELY concerned about the National Science Foundation's proposal to use seismic airguns to
United States	919-402-94	I am EXTREMELY concerned about the National Science Foundation's proposal to use seismic airguns to
United States		I am EXTREMELY concerned about the National Science Foundation's proposal to use seismic airguns to
United States	202-486-64	I am EXTREMELY concerned about the National Science Foundation's proposal to use seismic airguns to
United States	919 834-39	I am EXTREMELY concerned about the National Science Foundation's proposal to use seismic airguns to

United States		I am EXTREMELY concerned about the National Science Foundation's proposal to use seismic airguns to
United States		I am EXTREMELY concerned about the National Science Foundation's proposal to use seismic airguns to
United States		I am EXTREMELY concerned about the National Science Foundation's proposal to use seismic airguns to
United States		I am EXTREMELY concerned about the National Science Foundation's proposal to use seismic airguns to
United States		I am EXTREMELY concerned about the National Science Foundation's proposal to use seismic airguns to
United States		I am EXTREMELY concerned about the National Science Foundation's proposal to use seismic airguns to
United States		I am EXTREMELY concerned about the National Science Foundation's proposal to use seismic airguns to
United States		I am EXTREMELY concerned about the National Science Foundation's proposal to use seismic airguns to
United States		I am EXTREMELY concerned about the National Science Foundation's proposal to use seismic airguns to
United States	2.53E+09	I am EXTREMELY concerned about the National Science Foundation's proposal to use seismic airguns to
United States		I am EXTREMELY concerned about the National Science Foundation's proposal to use seismic airguns to
United States		I am EXTREMELY concerned about the National Science Foundation's proposal to use seismic airguns to
United States	919-858-06	I am EXTREMELY concerned about the National Science Foundation's proposal to use seismic airguns to
United States		I am EXTREMELY concerned about the National Science Foundation's proposal to use seismic airguns to
United States	919-998-33	I am EXTREMELY concerned about the National Science Foundation's proposal to use seismic airguns to
United States	(336)-407-8	I am EXTREMELY concerned about the National Science Foundation's proposal to use seismic airguns to
United States		I am EXTREMELY concerned about the National Science Foundation's proposal to use seismic airguns to
United States		I am EXTREMELY concerned about the National Science Foundation's proposal to use seismic airguns to
United States		I am EXTREMELY concerned about the National Science Foundation's proposal to use seismic airguns to
United States	910-238-09	I am EXTREMELY concerned about the National Science Foundation's proposal to use seismic airguns to
United States		I am EXTREMELY concerned about the National Science Foundation's proposal to use seismic airguns to
United States		I am EXTREMELY concerned about the National Science Foundation's proposal to use seismic airguns to
United States		I am EXTREMELY concerned about the National Science Foundation's proposal to use seismic airguns to
United States		I am EXTREMELY concerned about the National Science Foundation's proposal to use seismic airguns to
United States		I am EXTREMELY concerned about the National Science Foundation's proposal to use seismic airguns to
United States		I am EXTREMELY concerned about the National Science Foundation's proposal to use seismic airguns to
United States	9.2E+09	I am EXTREMELY concerned about the National Science Foundation's proposal to use seismic airguns to
United States		I am EXTREMELY concerned about the National Science Foundation's proposal to use seismic airguns to
United States		I am EXTREMELY concerned about the National Science Foundation's proposal to use seismic airguns to
United States		I am EXTREMELY concerned about the National Science Foundation's proposal to use seismic airguns to
United States		I am EXTREMELY concerned about the National Science Foundation's proposal to use seismic airguns to
United States	252-335-75	I am EXTREMELY concerned about the National Science Foundation's proposal to use seismic airguns to
United States		I am EXTREMELY concerned about the National Science Foundation's proposal to use seismic airguns to
United States		I am EXTREMELY concerned about the National Science Foundation's proposal to use seismic airguns to

United States		I am EXTREMELY concerned about the National Science Foundation's proposal to use seismic airguns to
United States	828-665-92	I am EXTREMELY concerned about the National Science Foundation's proposal to use seismic airguns to
United States	910-457-55	I am EXTREMELY concerned about the National Science Foundation's proposal to use seismic airguns to
United States	305-271-08	I am EXTREMELY concerned about the National Science Foundation's proposal to use seismic airguns to
United States	(417) 722-9	I am EXTREMELY concerned about the National Science Foundation's proposal to use seismic airguns to
United States		I am EXTREMELY concerned about the National Science Foundation's proposal to use seismic airguns to
United States		I am EXTREMELY concerned about the National Science Foundation's proposal to use seismic airguns to
United States		I am EXTREMELY concerned about the National Science Foundation's proposal to use seismic airguns to
United States		I am EXTREMELY concerned about the National Science Foundation's proposal to use seismic airguns to
United States	3.37E+09	I am EXTREMELY concerned about the National Science Foundation's proposal to use seismic airguns to
United States	910-8818-6	I am EXTREMELY concerned about the National Science Foundation's proposal to use seismic airguns to
United States	252-975-59	I am EXTREMELY concerned about the National Science Foundation's proposal to use seismic airguns to
United States		I am EXTREMELY concerned about the National Science Foundation's proposal to use seismic airguns to
United States	910-762-62	I am EXTREMELY concerned about the National Science Foundation's proposal to use seismic airguns to
United States		I am EXTREMELY concerned about the National Science Foundation's proposal to use seismic airguns to
United States	915-526-81	I am EXTREMELY concerned about the National Science Foundation's proposal to use seismic airguns to
United States	919-968-04	Seismic airguns are NOT a good idea! No, no,no.
United States		I am EXTREMELY concerned about the National Science Foundation's proposal to use seismic airguns to
United States		I am EXTREMELY concerned about the National Science Foundation's proposal to use seismic airguns to
United States		I am EXTREMELY concerned about the National Science Foundation's proposal to use seismic airguns to
United States		I am EXTREMELY concerned about the National Science Foundation's proposal to use seismic airguns to
United States	704 553845	I am EXTREMELY concerned about the National Science Foundation's proposal to use seismic airguns to
United States	919-844-76	I am EXTREMELY concerned about the National Science Foundation's proposal to use seismic airguns to
United States		I am EXTREMELY concerned about the National Science Foundation's proposal to use seismic airguns to
United States	8.28E+09	I am EXTREMELY concerned about the National Science Foundation's proposal to use seismic airguns to
United States	916-834-05	I am EXTREMELY concerned about the National Science Foundation's proposal to use seismic airguns to
United Kingdom		I am EXTREMELY concerned about the National Science Foundation's proposal to use seismic airguns to
United States		I am EXTREMELY concerned about the National Science Foundation's proposal to use seismic airguns to
United States	336-323-11	I am EXTREMELY concerned about the National Science Foundation's proposal to use seismic airguns to
United States		I am EXTREMELY concerned about the National Science Foundation's proposal to use seismic airguns to
United States	8.28E+09	I am EXTREMELY concerned about the National Science Foundation's proposal to use seismic airguns to
United States		I am EXTREMELY concerned about the National Science Foundation's proposal to use seismic airguns to
United States		I am EXTREMELY concerned about the National Science Foundation's proposal to use seismic airguns to
United States		I am EXTREMELY concerned about the National Science Foundation's proposal to use seismic airguns to

France		I am EXTREMELY concerned about the National Science Foundation's proposal to use seismic airguns to
United States		I am EXTREMELY concerned about the National Science Foundation's proposal to use seismic airguns to
United States		I am EXTREMELY concerned about the National Science Foundation's proposal to use seismic airguns to
United States		I am EXTREMELY concerned about the National Science Foundation's proposal to use seismic airguns to
United States		I am EXTREMELY concerned about the National Science Foundation's proposal to use seismic airguns to
United States		I am EXTREMELY concerned about the National Science Foundation's proposal to use seismic airguns to
United States		I am EXTREMELY concerned about the National Science Foundation's proposal to use seismic airguns to
United States		I am EXTREMELY concerned about the National Science Foundation's proposal to use seismic airguns to
United States		I am EXTREMELY concerned about the National Science Foundation's proposal to use seismic airguns to
Ukraine		I am EXTREMELY concerned about the National Science Foundation's proposal to use seismic airguns to
United States	2.81E+09	I am EXTREMELY concerned about the National Science Foundation's proposal to use seismic airguns to
United States	9.11E+09	I am EXTREMELY concerned about the National Science Foundation's proposal to use seismic airguns to
United States		I am EXTREMELY concerned about the National Science Foundation's proposal to use seismic airguns to
United States		I am EXTREMELY concerned about the National Science Foundation's proposal to use seismic airguns to
United States		I am EXTREMELY concerned about the National Science Foundation's proposal to use seismic airguns to
United States		I am EXTREMELY concerned about the National Science Foundation's proposal to use seismic airguns to
United States		I am EXTREMELY concerned about the National Science Foundation's proposal to use seismic airguns to
United States		I am EXTREMELY concerned about the National Science Foundation's proposal to use seismic airguns to
United States	9.19E+09	I am EXTREMELY concerned about the National Science Foundation's proposal to use seismic airguns to
United States		I am EXTREMELY concerned about the National Science Foundation's proposal to use seismic airguns to
United States		I am EXTREMELY concerned about the National Science Foundation's proposal to use seismic airguns to
United States		I am EXTREMELY concerned about the National Science Foundation's proposal to use seismic airguns to
United States		I am EXTREMELY concerned about the National Science Foundation's proposal to use seismic airguns to
United States		I am EXTREMELY concerned about the National Science Foundation's proposal to use seismic airguns to
United States		I am EXTREMELY concerned about the National Science Foundation's proposal to use seismic airguns to
United States		I am EXTREMELY concerned about the National Science Foundation's proposal to use seismic airguns to
United States	828-885-26	I am EXTREMELY concerned about the National Science Foundation's proposal to use seismic airguns to
United States	(336) 561-3	I am EXTREMELY concerned about the National Science Foundation's proposal to use seismic airguns to
United States		I am EXTREMELY concerned about the National Science Foundation's proposal to use seismic airguns to
United States		I am EXTREMELY concerned about the National Science Foundation's proposal to use seismic airguns to
United States	(336)29296	I am EXTREMELY concerned about the National Science Foundation's proposal to use seismic airguns to
United States	9.19E+09	I am EXTREMELY concerned about the National Science Foundation's proposal to use seismic airguns to
United States	3.37E+09	I am EXTREMELY concerned about the National Science Foundation's proposal to use seismic airguns to
United States		I am EXTREMELY concerned about the National Science Foundation's proposal to use seismic airguns to

United States		I am EXTREMELY concerned about the National Science Foundation's proposal to use seismic airguns to
United States		I am EXTREMELY concerned about the National Science Foundation's proposal to use seismic airguns to
United States		I am EXTREMELY concerned about the National Science Foundation's proposal to use seismic airguns to
United States	336 629-22	I am EXTREMELY concerned about the National Science Foundation's proposal to use seismic airguns to
United States		I am EXTREMELY concerned about the National Science Foundation's proposal to use seismic airguns to
United States		I am EXTREMELY concerned about the National Science Foundation's proposal to use seismic airguns to
United States	919-554-98	I am EXTREMELY concerned about the National Science Foundation's proposal to use seismic airguns to
United States	9.2E+09	I am EXTREMELY concerned about the National Science Foundation's proposal to use seismic airguns to
United States		I am EXTREMELY concerned about the National Science Foundation's proposal to use seismic airguns to
United States		I am EXTREMELY concerned about the National Science Foundation's proposal to use seismic airguns to
United States		I am EXTREMELY concerned about the National Science Foundation's proposal to use seismic airguns to
United States	(910) 962-3	I am EXTREMELY concerned about the National Science Foundation's proposal to use seismic airguns to
United States		I am EXTREMELY concerned about the National Science Foundation's proposal to use seismic airguns to
United States		I am EXTREMELY concerned about the National Science Foundation's proposal to use seismic airguns to
United States		I am EXTREMELY concerned about the National Science Foundation's proposal to use seismic airguns to
United States	9.2E+09	I am EXTREMELY concerned about the National Science Foundation's proposal to use seismic airguns to
United States		I am EXTREMELY concerned about the National Science Foundation's proposal to use seismic airguns to
United States		I am EXTREMELY concerned about the National Science Foundation's proposal to use seismic airguns to
United States	919 460-97	I am EXTREMELY concerned about the National Science Foundation's proposal to use seismic airguns to
United States		I am EXTREMELY concerned about the National Science Foundation's proposal to use seismic airguns to
United States		I am EXTREMELY concerned about the National Science Foundation's proposal to use seismic airguns to
United States		I am EXTREMELY concerned about the National Science Foundation's proposal to use seismic airguns to
United States		I am EXTREMELY concerned about the National Science Foundation's proposal to use seismic airguns to
United States	9.2E+09	I am EXTREMELY concerned about the National Science Foundation's proposal to use seismic airguns to
United States	8.28E+09	I am EXTREMELY concerned about the National Science Foundation's proposal to use seismic airguns to
United States		I am extremely disturbed by the National Science Foundation's proposal to use seismic airguns to study the
United States		I am EXTREMELY concerned about the National Science Foundation's proposal to use seismic airguns to
United States		I am EXTREMELY concerned about the National Science Foundation's proposal to use seismic airguns to
United States		I am EXTREMELY concerned about the National Science Foundation's proposal to use seismic airguns to
United States		I am EXTREMELY concerned about the National Science Foundation's proposal to use seismic airguns to
United States		I am EXTREMELY concerned about the National Science Foundation's proposal to use seismic airguns to
United States		I am EXTREMELY concerned about the National Science Foundation's proposal to use seismic airguns to
United States		I am EXTREMELY concerned about the National Science Foundation's proposal to use seismic airguns to
United States	336-655-60	I am EXTREMELY concerned about the National Science Foundation's proposal to use seismic airguns to

United States		I am EXTREMELY concerned about the National Science Foundation's proposal to use seismic airguns to
United States		I am EXTREMELY concerned about the National Science Foundation's proposal to use seismic airguns to
United States		I am EXTREMELY concerned about the National Science Foundation's proposal to use seismic airguns to
United States	704-202-60	I am EXTREMELY concerned about the National Science Foundation's proposal to use seismic airguns to
United States	336---270+3	I am EXTREMELY concerned about the National Science Foundation's proposal to use seismic airguns to
United States	336-333-38	I am EXTREMELY concerned about the National Science Foundation's proposal to use seismic airguns to
United States		I am EXTREMELY concerned about the National Science Foundation's proposal to use seismic airguns to
United States		I am EXTREMELY concerned about the National Science Foundation's proposal to use seismic airguns to
United States		I am EXTREMELY concerned about the National Science Foundation's proposal to use seismic airguns to
United States		I am EXTREMELY concerned about the National Science Foundation's proposal to use seismic airguns to
United States		I am EXTREMELY concerned about the National Science Foundation's proposal to use seismic airguns to
United States		I am EXTREMELY concerned about the National Science Foundation's proposal to use seismic airguns to
United States	8.29E+09	I am EXTREMELY concerned about the National Science Foundation's proposal to use seismic airguns to
United States		I am EXTREMELY concerned about the National Science Foundation's proposal to use seismic airguns to
United States		I am EXTREMELY concerned about the National Science Foundation's proposal to use seismic airguns to
United States		I am EXTREMELY concerned about the National Science Foundation's proposal to use seismic airguns to
United States	7.17E+09	I am EXTREMELY concerned about the National Science Foundation's proposal to use seismic airguns to
United States	919-968-42	I am EXTREMELY concerned about the National Science Foundation's proposal to use seismic airguns to
United States	704-753-51	I am EXTREMELY concerned about the National Science Foundation's proposal to use seismic airguns to
United States		I am EXTREMELY concerned about the National Science Foundation's proposal to use seismic airguns to
United States	919-622-84	I am EXTREMELY concerned about the National Science Foundation's proposal to use seismic airguns to
United States		I am EXTREMELY concerned about the National Science Foundation's proposal to use seismic airguns to
United States		I am EXTREMELY concerned about the National Science Foundation's proposal to use seismic airguns to
United States	828-664-01	I am EXTREMELY concerned about the National Science Foundation's proposal to use seismic airguns to
United States		I am EXTREMELY concerned about the National Science Foundation's proposal to use seismic airguns to
United States		I am EXTREMELY concerned about the National Science Foundation's proposal to use seismic airguns to
United States		I am EXTREMELY concerned about the National Science Foundation's proposal to use seismic airguns to
United States		I am EXTREMELY concerned about the National Science Foundation's proposal to use seismic airguns to
United States	919-682-56	I am EXTREMELY concerned about the National Science Foundation's proposal to use seismic airguns to
United States		I am EXTREMELY concerned about the National Science Foundation's proposal to use seismic airguns to
United States	9.2E+09	I am EXTREMELY concerned about the National Science Foundation's proposal to use seismic airguns to
United States		I am EXTREMELY concerned about the National Science Foundation's proposal to use seismic airguns to
United States		I am EXTREMELY concerned about the National Science Foundation's proposal to use seismic airguns to
United States	919-416-98	I am EXTREMELY concerned about the National Science Foundation's proposal to use seismic airguns to

United States		I am EXTREMELY concerned about the National Science Foundation's proposal to use seismic airguns to
United States		I am EXTREMELY concerned about the National Science Foundation's proposal to use seismic airguns to
United States	1.34E+10	I am EXTREMELY concerned about the National Science Foundation's proposal to use seismic airguns to
United States		I am EXTREMELY concerned about the National Science Foundation's proposal to use seismic airguns to
United States		I am EXTREMELY concerned about the National Science Foundation's proposal to use seismic airguns to
United States		I am EXTREMELY concerned about the National Science Foundation's proposal to use seismic airguns to
United States	919-619-15	I am EXTREMELY concerned about the National Science Foundation's proposal to use seismic airguns to
United States		I am EXTREMELY concerned about the National Science Foundation's proposal to use seismic airguns to
United States	7.04E+09	I am EXTREMELY concerned about the National Science Foundation's proposal to use seismic airguns to
United States	919 835-47	I am EXTREMELY concerned about the National Science Foundation's proposal to use seismic airguns to
United States	(828) 357-8	I am EXTREMELY concerned about the National Science Foundation's proposal to use seismic airguns to
United States	704-236-04	I am EXTREMELY concerned about the National Science Foundation's proposal to use seismic airguns to
United States		I am EXTREMELY concerned about the National Science Foundation's proposal to use seismic airguns to
United States	(910) 262-2	I am EXTREMELY concerned about the National Science Foundation's proposal to use seismic airguns to
United States	919-553-41	I am EXTREMELY concerned about the National Science Foundation's proposal to use seismic airguns to
United States		I am EXTREMELY concerned about the National Science Foundation's proposal to use seismic airguns to
United States		I am EXTREMELY concerned about the National Science Foundation's proposal to use seismic airguns to
United States		I am EXTREMELY concerned about the National Science Foundation's proposal to use seismic airguns to
United States	(828) 648-3	I am EXTREMELY concerned about the National Science Foundation's proposal to use seismic airguns to
United States	8.29E+09	I am EXTREMELY concerned about the National Science Foundation's proposal to use seismic airguns to
United States	8.29E+09	I am EXTREMELY concerned about the National Science Foundation's proposal to use seismic airguns to
United States	3.37E+09	I am EXTREMELY concerned about the National Science Foundation's proposal to use seismic airguns to
United States		I am EXTREMELY concerned about the National Science Foundation's proposal to use seismic airguns to
United States	8.29E+09	I am EXTREMELY concerned about the National Science Foundation's proposal to use seismic airguns to
United States		I am EXTREMELY concerned about the National Science Foundation's proposal to use seismic airguns to
United States	336 391227	I am EXTREMELY concerned about the National Science Foundation's proposal to use seismic airguns to
United States		I am EXTREMELY concerned about the National Science Foundation's proposal to use seismic airguns to
United States		I am EXTREMELY concerned about the National Science Foundation's proposal to use seismic airguns to
United States		I am EXTREMELY concerned about the National Science Foundation's proposal to use seismic airguns to
United States		I am EXTREMELY concerned about the National Science Foundation's proposal to use seismic airguns to
United States	704-274-58	I am EXTREMELY concerned about the National Science Foundation's proposal to use seismic airguns to
United States	(910) 352-9	I am EXTREMELY concerned about the National Science Foundation's proposal to use seismic airguns to
United States	919 942328	I am EXTREMELY concerned about the National Science Foundation's proposal to use seismic airguns to
United States	843-424-35	I am EXTREMELY concerned about the National Science Foundation's proposal to use seismic airguns to

United States		I am EXTREMELY concerned about the National Science Foundation's proposal to use seismic airguns to
United States		No to the National Science Foundation's proposal to use seismic airguns to study the Atlantic Ridge off the
United States		I am EXTREMELY concerned about the National Science Foundation's proposal to use seismic airguns to
United States		I am EXTREMELY concerned about the National Science Foundation's proposal to use seismic airguns to
United States		I am EXTREMELY concerned about the National Science Foundation's proposal to use seismic airguns to
United States		I am EXTREMELY concerned about the National Science Foundation's proposal to use seismic airguns to
United States		I am EXTREMELY concerned about the National Science Foundation's proposal to use seismic airguns to
United States		I am EXTREMELY concerned about the National Science Foundation's proposal to use seismic airguns to
United States		I am EXTREMELY concerned about the National Science Foundation's proposal to use seismic airguns to
United States	7.04E+09	I am EXTREMELY concerned about the National Science Foundation's proposal to use seismic airguns to
United States		I am EXTREMELY concerned about the National Science Foundation's proposal to use seismic airguns to
United States	9.2E+09	I am EXTREMELY concerned about the National Science Foundation's proposal to use seismic airguns to
United States		I am EXTREMELY concerned about the National Science Foundation's proposal to use seismic airguns to
United States	828-256-68	I am EXTREMELY concerned about the National Science Foundation's proposal to use seismic airguns to
United States		I am EXTREMELY concerned about the National Science Foundation's proposal to use seismic airguns to
United States		I am EXTREMELY concerned about the National Science Foundation's proposal to use seismic airguns to
United States		I am EXTREMELY concerned about the National Science Foundation's proposal to use seismic airguns to
United States		I am EXTREMELY concerned about the National Science Foundation's proposal to use seismic airguns to
United States		I am EXTREMELY concerned about the National Science Foundation's proposal to use seismic airguns to
United States	828 652 29	I am EXTREMELY concerned about the National Science Foundation's proposal to use seismic airguns to
United States		I am EXTREMELY concerned about the National Science Foundation's proposal to use seismic airguns to
United States		I am EXTREMELY concerned about the National Science Foundation's proposal to use seismic airguns to
United States	7.04E+09	I am EXTREMELY concerned about the National Science Foundation's proposal to use seismic airguns to
United States		I am EXTREMELY concerned about the National Science Foundation's proposal to use seismic airguns to
United States		I am EXTREMELY concerned about the National Science Foundation's proposal to use seismic airguns to
United States		I am EXTREMELY concerned about the National Science Foundation's proposal to use seismic airguns to
United States	828-261-02	I am EXTREMELY concerned about the National Science Foundation's proposal to use seismic airguns to
United States	336-686-25	I am EXTREMELY concerned about the National Science Foundation's proposal to use seismic airguns to
United States		I am EXTREMELY concerned about the National Science Foundation's proposal to use seismic airguns to
United States		I am EXTREMELY concerned about the National Science Foundation's proposal to use seismic airguns to
United States	248-891-52	I am EXTREMELY concerned about the National Science Foundation's proposal to use seismic airguns to
United States		I am EXTREMELY concerned about the National Science Foundation's proposal to use seismic airguns to
United States		I am EXTREMELY concerned about the National Science Foundation's proposal to use seismic airguns to
United States		I am EXTREMELY concerned about the National Science Foundation's proposal to use seismic airguns to

United States		I am EXTREMELY concerned about the National Science Foundation's proposal to use seismic airguns to
United States		I am EXTREMELY concerned about the National Science Foundation's proposal to use seismic airguns to
United States	305-393-72	I am EXTREMELY concerned about the National Science Foundation's proposal to use seismic airguns to
United States		I am EXTREMELY concerned about the National Science Foundation's proposal to use seismic airguns to
United States	(919) 596-9	I am EXTREMELY concerned about the National Science Foundation's proposal to use seismic airguns to
United States		I am EXTREMELY concerned about the National Science Foundation's proposal to use seismic airguns to
United States		I am EXTREMELY concerned about the National Science Foundation's proposal to use seismic airguns to
United States		I am EXTREMELY concerned about the National Science Foundation's proposal to use seismic airguns to
United States	(910) 616-6	Did you know the diversity of marine mammal species alone that visit the region to feed? 15 different
United States		I am EXTREMELY concerned about the National Science Foundation's proposal to use seismic airguns to
United States	828 280-77	I am EXTREMELY concerned about the National Science Foundation's proposal to use seismic airguns to
United States		I am EXTREMELY concerned about the National Science Foundation's proposal to use seismic airguns to
United States	226-632-06	I am EXTREMELY concerned about the National Science Foundation's proposal to use seismic airguns to
United States		I am EXTREMELY concerned about the National Science Foundation's proposal to use seismic airguns to
United States	407-637-54	I am EXTREMELY concerned about the National Science Foundation's proposal to use seismic airguns to
United States	828-550-73	I am EXTREMELY concerned about the National Science Foundation's proposal to use seismic airguns to
United States		I am EXTREMELY concerned about the National Science Foundation's proposal to use seismic airguns to
United States		I am EXTREMELY concerned about the National Science Foundation's proposal to use seismic airguns to
United States		I am EXTREMELY concerned about the National Science Foundation's proposal to use seismic airguns to
United States		I am EXTREMELY concerned about the National Science Foundation's proposal to use seismic airguns to
United States	252-928-42	I am EXTREMELY concerned about the National Science Foundation's proposal to use seismic airguns to
United States		I am EXTREMELY concerned about the National Science Foundation's proposal to use seismic airguns to
United States		I am EXTREMELY concerned about the National Science Foundation's proposal to use seismic airguns to
United States	919-516-51	I am EXTREMELY concerned about the National Science Foundation's proposal to use seismic airguns to
United States		I am EXTREMELY concerned about the National Science Foundation's proposal to use seismic airguns to
United States		I am EXTREMELY concerned about the National Science Foundation's proposal to use seismic airguns to
United States		I am EXTREMELY concerned about the National Science Foundation's proposal to use seismic airguns to
United States		I am EXTREMELY concerned about the National Science Foundation's proposal to use seismic airguns to
United States		I am EXTREMELY concerned about the National Science Foundation's proposal to use seismic airguns to
United States	334-272-51	I am EXTREMELY concerned about the National Science Foundation's proposal to use seismic airguns to
United States	919 942 97	I am EXTREMELY concerned about the National Science Foundation's proposal to use seismic airguns to
United States		I am EXTREMELY concerned about the National Science Foundation's proposal to use seismic airguns to
United States		I am EXTREMELY concerned about the National Science Foundation's proposal to use seismic airguns to
United States		I am EXTREMELY concerned about the National Science Foundation's proposal to use seismic airguns to

United States		I am EXTREMELY concerned about the National Science Foundation's proposal to use seismic airguns to
United States		I am EXTREMELY concerned about the National Science Foundation's proposal to use seismic airguns to
United States		I am EXTREMELY concerned about the National Science Foundation's proposal to use seismic airguns to
United States		I am EXTREMELY concerned about the National Science Foundation's proposal to use seismic airguns to
United States		I am EXTREMELY concerned about the National Science Foundation's proposal to use seismic airguns to
United States		I am EXTREMELY concerned about the National Science Foundation's proposal to use seismic airguns to
United States		I am EXTREMELY concerned about the National Science Foundation's proposal to use seismic airguns to
United States		I am EXTREMELY concerned about the National Science Foundation's proposal to use seismic airguns to
United States		I am EXTREMELY concerned about the National Science Foundation's proposal to use seismic airguns to
United States		I am EXTREMELY concerned about the National Science Foundation's proposal to use seismic airguns to
United States		I am EXTREMELY concerned about the National Science Foundation's proposal to use seismic airguns to
United States		I am EXTREMELY concerned about the National Science Foundation's proposal to use seismic airguns to
United States		I am EXTREMELY concerned about the National Science Foundation's proposal to use seismic airguns to
United States		I am EXTREMELY concerned about the National Science Foundation's proposal to use seismic airguns to
United States		I am EXTREMELY concerned about the National Science Foundation's proposal to use seismic airguns to
United States		I am EXTREMELY concerned about the National Science Foundation's proposal to use seismic airguns to
United States		I am EXTREMELY concerned about the National Science Foundation's proposal to use seismic airguns to
United States	7.05E+09	I am EXTREMELY concerned about the National Science Foundation's proposal to use seismic airguns to
United States		I am EXTREMELY concerned about the National Science Foundation's proposal to use seismic airguns to
United States		I am EXTREMELY concerned about the National Science Foundation's proposal to use seismic airguns to
United States		I am EXTREMELY concerned about the National Science Foundation's proposal to use seismic airguns to
United States		I am EXTREMELY concerned about the National Science Foundation's proposal to use seismic airguns to
United States		I am EXTREMELY concerned about the National Science Foundation's proposal to use seismic airguns to
United States		As homeowners on Ocracoke island we are EXTREMELY concerned about the National Science
United States		I am EXTREMELY concerned about the National Science Foundation's proposal to use seismic airguns to
United States		I am EXTREMELY concerned about the National Science Foundation's proposal to use seismic airguns to
United States	772 971-92	I am EXTREMELY concerned about the National Science Foundation's proposal to use seismic airguns to
United States		I am EXTREMELY concerned about the National Science Foundation's proposal to use seismic airguns to
United States		I am EXTREMELY concerned about the National Science Foundation's proposal to use seismic airguns to
United States		I am EXTREMELY concerned about the National Science Foundation's proposal to use seismic airguns to
United States		I am EXTREMELY concerned about the National Science Foundation's proposal to use seismic airguns to
United States		I am EXTREMELY concerned about the National Science Foundation's proposal to use seismic airguns to
United States		I am EXTREMELY concerned about the National Science Foundation's proposal to use seismic airguns to
United States		I am EXTREMELY concerned about the National Science Foundation's proposal to use seismic airguns to

United States		I am EXTREMELY concerned about the National Science Foundation's proposal to use seismic airguns to
United States	828-683-16	I am EXTREMELY concerned about the National Science Foundation's proposal to use seismic airguns to
United States		I am EXTREMELY concerned about the National Science Foundation's proposal to use seismic airguns to
United States		I am EXTREMELY concerned about the National Science Foundation's proposal to use seismic airguns to
United States	(919) 876-6	I am EXTREMELY concerned about the National Science Foundation's proposal to use seismic airguns to
United States		I am EXTREMELY concerned about the National Science Foundation's proposal to use seismic airguns to
United States	(919) 612-8	I am EXTREMELY concerned about the National Science Foundation's proposal to use seismic airguns to
United States		I am EXTREMELY concerned about the National Science Foundation's proposal to use seismic airguns to
United States		I am EXTREMELY concerned about the National Science Foundation's proposal to use seismic airguns to
United States		I am EXTREMELY concerned about the National Science Foundation's proposal to use seismic airguns to
United States		I am EXTREMELY concerned about the National Science Foundation's proposal to use seismic airguns to
United States		I am EXTREMELY concerned about the National Science Foundation's proposal to use seismic airguns to
United States		I am EXTREMELY concerned about the National Science Foundation's proposal to use seismic airguns to
United States		I am EXTREMELY concerned about the National Science Foundation's proposal to use seismic airguns to
United States		I am EXTREMELY concerned about the National Science Foundation's proposal to use seismic airguns to
United States		I am EXTREMELY concerned about the National Science Foundation's proposal to use seismic airguns to
United States		I am EXTREMELY concerned about the National Science Foundation's proposal to use seismic airguns to
United States		I am EXTREMELY concerned about the National Science Foundation's proposal to use seismic airguns to
United States		I am EXTREMELY concerned about the National Science Foundation's proposal to use seismic airguns to
United States	919-471-27	As a resident of North Carolina, I am EXTREMELY UPSET about the National Science Foundation's proposal
United States		I am EXTREMELY concerned about the National Science Foundation's proposal to use seismic airguns to
United States		I am EXTREMELY concerned about the National Science Foundation's proposal to use seismic airguns to
United States		I am EXTREMELY concerned about the National Science Foundation's proposal to use seismic airguns to
United States		I am EXTREMELY concerned about the National Science Foundation's proposal to use seismic airguns to
United States	828-230-17	I am EXTREMELY concerned about the National Science Foundation's proposal to use seismic airguns to
United States		I am EXTREMELY concerned about the National Science Foundation's proposal to use seismic airguns to
United States		I am EXTREMELY concerned about the National Science Foundation's proposal to use seismic airguns to
United States	3.36E+09	I am EXTREMELY concerned about the National Science Foundation's proposal to use seismic airguns to
United States		I am EXTREMELY concerned about the National Science Foundation's proposal to use seismic airguns to
United States		I am EXTREMELY concerned about the National Science Foundation's proposal to use seismic airguns to
United States		I am EXTREMELY concerned about the National Science Foundation's proposal to use seismic airguns to
United States		I am EXTREMELY concerned about the National Science Foundation's proposal to use seismic airguns to
United States		I am EXTREMELY concerned about the National Science Foundation's proposal to use seismic airguns to
United States		I am EXTREMELY concerned about the National Science Foundation's proposal to use seismic airguns to

United States		I am EXTREMELY concerned about the National Science Foundation's proposal to use seismic airguns to
United States		I am EXTREMELY concerned about the National Science Foundation's proposal to use seismic airguns to
United States	828.651.02	I am EXTREMELY concerned about the National Science Foundation's proposal to use seismic airguns to
United States		I am EXTREMELY concerned about the National Science Foundation's proposal to use seismic airguns to
United States		I am EXTREMELY concerned about the National Science Foundation's proposal to use seismic airguns to
United States		I am EXTREMELY concerned about the National Science Foundation's proposal to use seismic airguns to
United States		I am EXTREMELY concerned about the National Science Foundation's proposal to use seismic airguns to
United States		I am EXTREMELY concerned about the National Science Foundation's proposal to use seismic airguns to
United States		I am EXTREMELY concerned about the National Science Foundation's proposal to use seismic airguns to
United States		I am EXTREMELY concerned about the National Science Foundation's proposal to use seismic airguns to
United States		I am EXTREMELY concerned about the National Science Foundation's proposal to use seismic airguns to
United States		I am EXTREMELY concerned about the National Science Foundation's proposal to use seismic airguns to
United States		I am EXTREMELY concerned about the National Science Foundation's proposal to use seismic airguns to
United States		I am EXTREMELY concerned about the National Science Foundation's proposal to use seismic airguns to
United States		I am EXTREMELY concerned about the National Science Foundation's proposal to use seismic airguns to
United States		I am EXTREMELY concerned about the National Science Foundation's proposal to use seismic airguns to
United States		I am EXTREMELY concerned about the National Science Foundation's proposal to use seismic airguns to
United States		I am EXTREMELY concerned about the National Science Foundation's proposal to use seismic airguns to
United States		I believe we should tolerate no further harm to marine mammals and other ocean inhabitants. I support
United States		I am EXTREMELY concerned about the National Science Foundation's proposal to use seismic airguns to
United States		I am EXTREMELY concerned about the National Science Foundation's proposal to use seismic airguns to
United States		I am EXTREMELY concerned about the National Science Foundation's proposal to use seismic airguns to
United States		I am EXTREMELY concerned about the National Science Foundation's proposal to use seismic airguns to
United States	3.36E+09	I am EXTREMELY concerned about the National Science Foundation's proposal to use seismic airguns to
United States		I am EXTREMELY concerned about the National Science Foundation's proposal to use seismic airguns to
United States		I am EXTREMELY concerned about the National Science Foundation's proposal to use seismic airguns to
United States		I am EXTREMELY concerned about the National Science Foundation's proposal to use seismic airguns to
United States	7.18E+09	I am EXTREMELY concerned about the National Science Foundation's proposal to use seismic airguns to
United States		I am EXTREMELY concerned about the National Science Foundation's proposal to use seismic airguns to
United States		I am EXTREMELY concerned about the National Science Foundation's proposal to use seismic airguns to
United States		I am EXTREMELY concerned about the National Science Foundation's proposal to use seismic airguns to
United States		I am EXTREMELY concerned about the National Science Foundation's proposal to use seismic airguns to
United States		I am EXTREMELY concerned about the National Science Foundation's proposal to use seismic airguns to
United States		I am EXTREMELY concerned about the National Science Foundation's proposal to use seismic airguns to

United States		I am EXTREMELY concerned about the National Science Foundation's proposal to use seismic airguns to
United States	7.04E+09	I am EXTREMELY concerned about the National Science Foundation's proposal to use seismic airguns to
United States		I am EXTREMELY concerned about the National Science Foundation's proposal to use seismic airguns to
United States		I am EXTREMELY concerned about the National Science Foundation's proposal to use seismic airguns to
United States	9.2E+09	I am EXTREMELY concerned about the National Science Foundation's proposal to use seismic airguns to
United States		I am EXTREMELY concerned about the National Science Foundation's proposal to use seismic airguns to
United States		I am EXTREMELY concerned about the National Science Foundation's proposal to use seismic airguns to
United States		I am EXTREMELY concerned about the National Science Foundation's proposal to use seismic airguns to

Walker, Michele

From: John, Trish, Jenna, Dain and Rebekah <TNIELSEN1@ec.rr.com>
Sent: Saturday, August 23, 2014 11:15 AM
To: Walker, Michele
Subject: No to seismic testing

Seismic testing is the equivalent of having no Noise limits set for music bands in public spaces. Actually it is worse- as you know this has great potential to gravely hurt much marine life!!!
Please act in a way that is consistent with your position- Protect the
ocean- thus protecting humans from ourselves!
Thank You;
Patricia Nielsen
Family Nurse Practitioner- BC
Internal Medicine and OB/GYN
Home address
614 Robert E Lee Drive
Wilmington, NC 28412
home phone
910-793-9777

Walker, Michele

From: NC Wreckdiving <admin@nc-wreckdiving.com>
Sent: Thursday, August 28, 2014 8:18 AM
To: Walker, Michele
Cc: Bobby Edwards; Dave /Ann Sommers; BFDC BFDC
Subject: Comment on Draft Environmental Analysis L-DEO Geophysical Survey off of Cape Hatteras

Comment on Draft Environmental Analysis L-DEO Geophysical Survey off of Cape Hatteras September 2014:

Based on the track data in Figure 6 and and wreck sites listed in Table 8, the conclusion stated on page 70 section 5 of the draft EA is grossly incorrect:

"Only a small percentage of the recreational dive sites (wrecks in water depths <100 m) are within 25 km of the survey track lines."

In fact the survey track will cover the vast majority of the dive sites actually dived or visited on a given day off the Cape Hatteras and Cape Lookout regions of the NC coast. When these regions are analyzed separately, which they should be diving purposes due to the distances between them, the mistake is even more profound.

The wrecks listed within the Cape Lookout portion of the track are among the most frequent destinations for dive charters off that portion of the coast: U352, Aeolus, Schurz, Papoose, Spar, Indra, Suloide, Parker, Box wreck. These represent the destination of an estimated 80-90% of the dive charters out of the Morehead City area.

The wrecks listed off the Cape Hatteras portion of the track would exclude all wrecks on the Diamond Shoals region which are also very popular dive destinations. These include the British Splendour, Australia, Kassandra, Lancing, Empire Gem, etc. Given the location of the Splendour, these would almost also have to include the Proteus, Tarpon and Manuela, although those are not named on Table 8. This would represent an estimated 70 to 80% of the actual destinations of dive charters out of Cape Hatteras.

If prohibited from diving these destinations, the economic impact, both direct to the local area dive charter fleet and dive shops and indirect to the related tourism industry, would be significant and could reach the level of millions of dollars lost over the course of the scheduled surveys.

Thank you

Paul Hudy

www.nc-wreckdiving.com

Walker, Michele

From: Paulette Playce <pplayce@aol.com>
Sent: Thursday, August 21, 2014 11:11 AM
To: Walker, Michele
Subject: SEISMIC TESTING

MS. Walker

Please let our governor and legislature know that I AM OPPOSED TO SEISMIC TESTING. As a recent transplant to this beautiful state, I wish it to remain as wild, pure and beautiful as possible . The NC Coast is a treasure to protect for all of us now, and for the future generations. I live on Pleasure Island, which is heavily dependent on tourism related to the coastal life. One spill could destroy not only the sea life, but also many jobs.

I would rather pay more at the pump, than lose my homeland forever……

Thank you for your attention

“"Change is the law of life. And those who look only to the past or present are certain to miss the future."

- John F. Kennedy

Paulette Playce
314-406-4248

Walker, Michele

From: Govoni, Daniel
Sent: Monday, August 25, 2014 9:17 AM
To: 'Charles H Peterson'
Cc: Walker, Michele
Subject: RE: CRFL & BOEM site information -- for NSF study conflict resolution

Dear Charles H. Peterson,

Thank you for your email dated 8/25/14 with attachments concerning the Federal Consistency Determination submitted by the National Science Foundation proposing to conduct a Marine Geophysical Survey via seismic testing in the Atlantic Ocean off of the North Carolina coast. As you may be aware, the Division of Coastal Management is coordinating a state review. Your comments will be examined and taken into consideration prior to the Division making a final Consistency Determination, you will be informed of this final decision.

The Division appreciates you taking the time to comment on this proposal, and your email will be added to the official file. Please feel free to contact me at (252) 808-2808 (ext. 215), if you should have any additional questions or concerns relating to this proposal.

Sincerely,
Daniel Govoni

Daniel M. Govoni
Asst. Major Permits Coordinator
NC Division of Coastal Management
400 Commerce Ave.
Morehead City, NC 28557

(252) 808-2808
(252) 247-3330 fax
daniel.govoni@ncdenr.gov

From: Charles H Peterson [mailto:cpeters@email.unc.edu]
Sent: Monday, August 25, 2014 9:09 AM
To: Govoni, Daniel
Cc: Avery Paxton; Davis, Braxton C
Subject: Fwd: CRFL & BOEM site information -- for NSF study conflict resolution

Dear Mr. Govoni:

I am contacting you in your role with NC DCM as a permit reviewer in the matter of an NSF research project to be conducted during Sept and Oct 2014 in waters of Onslow and Raleigh Bay not far off the coast of North Carolina. Only last week were we made aware of this project. We extend a strong objection to this study on the grounds that it interferes directly with our (UNC IMS and NC DMF) ability to carry out research funded by the NC CRFL funds. We are supported to study the reef systems and the processes affecting dynamics of reef

fishes in state and federal waters off Onslow Bay. We are evaluating how the reef habitat, especially epibiotic communities but also the degree of sedimentation, vary among natural, artificial, and wreck reefs seasonally as a function of location, depth, reef structure, and physical forcing. Sept and Oct are the most critical months for our dive-based research and we use virtually every day calm enough to dive safely in those two months. Exclusion from our research sites by the Columbia-based and NSF-funded study is incompatible with our need to fulfill the research contractual obligations.

Hence, we strongly oppose this NSF project - on grounds of inconsistency with the Coastal Area Management Act as it fosters state-funded research and study in state and federal waters of these key Essential Fish Habitats. We also challenge the legal right of another funded project to drive us off a dive site at which we are operating. Any prior notice supposedly given by posting on a federal NSF web site is totally inadequate and inconsistent with State of North Carolina commitments to public notice for any proposed substantive disruption to existing uses on our waters and the seafloor below them. We also object to this NSF project on behalf of the dive industry, the commercial fishing industry, and the recreational fishing industry of North Carolina. These two months are perhaps the most important months of the year for these existing uses.

We appreciate the opportunity to make our comments to you.

Sincerely,

Charles H. "Pete" Peterson
Alumni Distinguished Professor
Marine Sciences, Biology, and Ecology
University of North Carolina at Chapel Hill

Addendum

Please find attached names, coordinates, and maps of our survey sites for the CRFL and BOEM research. Only the CRFL sites are affected by the proposed NSF geophysical surveys. The BOEM sites are outside of the 25km range.

The NSF draft EA explicitly identifies the following CRFL sites as within 25km of their proposed transects (Table 8, page 57 of NSF document):

- Titan Tug (AR-345)
- Indra Shipwreck
- Theodore Parker Shipwreck
- SCGC Spar (AR-305) Shipwreck

However, they failed to mention all the other artificial reefs that don't contain shipwrecks (e.g., our sites that contain concrete pipes and/or bridge rubble). Additionally, they didn't include any natural hard-bottom sites.

Likely, all 16 of our CRFL-supported research sites are affected. However, 3 sites (Keypost Rock, Station Rock, and Pipes 2007, may lie a bit outside of the 25km range (it's difficult to tell from their low resolution map (fig 6, p. 56 that has dive sites plotted with the proposed survey tracts). If this is the case, only 13 sites would be inaccessible. Either way, it is seriously in conflict with our state-funded research.

Walker, Michele

From: Govoni, Daniel
Sent: Monday, August 18, 2014 9:15 AM
To: 'Richard LaPalme'
Cc: Walker, Michele
Subject: RE: NSF Draft EA for Seismic Testing

Dear Mr. LaPalme:

Thank you for your email dated 8/15/14 concerning the Federal Consistency Determination submitted by the National Science Foundation proposing to conduct a Marine Geophysical Survey via seismic testing in the Atlantic Ocean off of the North Carolina coast. As you may be aware, the Division of Coastal Management is coordinating a state review. I can assure you that your comments will be examined and taken into consideration prior to the Division making a final Consistency Determination, you will be informed of this final decision.

The Division appreciates you taking the time to comment on this proposal, and your email will be added to the official file. Please feel free to contact me at (252) 808-2808 (ext. 215), if you should have any additional questions or concerns relating to this proposal.

Sincerely,
Daniel Govoni

Daniel M. Govoni
Asst. Major Permits Coordinator
NC Division of Coastal Management
400 Commerce Ave.
Morehead City, NC 28557

(252) 808-2808
(252) 247-3330 fax
daniel.govoni@ncdenr.gov

-----Original Message-----
From: Richard LaPalme [mailto:rlapalme@ec.rr.com]
Sent: Friday, August 15, 2014 9:43 PM
To: Govoni, Daniel
Subject: NSF Draft EA for Seismic Testing

Dear Mr. Govoni:

The Draft Environmental Assessment for a Marine Geophysical Survey by the R/V Marcus G. Langseth in the Atlantic Ocan off Cape Hatteras, September-October 2014 contains no cost-benefit analysis and no objective, scientifically based deterministic assessment of the level of damage and the number of marine organisms by damage level.

The Draft EA contains only subjective conclusions based upon the authors supposition of minimal to no lasting effects. Extensive scientific data is presented to discuss the mechanisms for damage to marine life, yet no actual assessment is performed with this data. The authors repeatedly state that they do not expect any serious, lasting harm to marine life. The authors do not actually provide verifiable evidence to substantiate there claims.

Based upon the lack of credible benefit to the citizens of North Carolina and to the communities of the Atlantic East Coast from the proposed seismic testing I must request that you object to the Consistency Determination in this case. I ask that you seek further details of the cost to the marine ecosystem resulting from this testing and a verifiable assessment of the associated benefits to the citizens of North Carolina.

Respectfully,
Richard LaPalme
USCG Master Mariner

Walker, Michele

From: Rick Allen - Nautilus Productions HD <nautilusvideo@earthlink.net>
Sent: Thursday, August 28, 2014 9:26 AM
To: Walker, Michele
Subject: Comment on Draft Environmental Analysis L-DEO Geophysical Survey off of Cape Hatteras September 2014:

Dear Ms. Walker,

I am writing in opposition to the proposed Marine Geophysical Survey via seismic testing in the Atlantic Ocean off of the North Carolina coast from Sept. 15 to Oct. 22. I have two main concerns: A) Damage/adverse effects to marine mammals & fish in the survey area. B) Negative economic impact to coastal businesses.

A. While more study is needed the deleterious effects of seismic testing to marine mammals and auditory damage to fish specious are demonstrable. A study of beaked whales determined;
(1) gas-bubble disease induced in supersaturated tissue by a behavioural response to acoustic exposure, is a plausible pathologic mechanism for the morbidity and mortality seen in cetaceans associated with sonar exposure and merits further investigation; and (2) current monitoring and mitigation methods for beaked whales are ineffective for detecting these animals and protecting them from adverse sound exposure. In addition, four major research priorities, needed to address information gaps on the impacts of sound on beaked whales, are identified: (1) controlled exposure experiments to assess beaked whale responses to known sound stimuli; (2) investigation of physiology, anatomy, pathobiology and behaviour of beaked whales; (3) assessment of baseline diving behaviour and physiology of beaked whales; and (4) a retrospective review of beaked whale strandings.
(*http://scholar.google.com/scholar_url?hl=en&q=http://www.dtic.mil/cgi-bin/GetTRDoc%3FAD%3DADA593622&sa=X&scisig=AAGBfm1e3Ccl4yB5xhQ83pELrToLzSfGHQ&oi=scholarr*). Using this study as a basis it is incredibly easy to correlate similar damage to other marine mammals. Further a study entitled "High intensity anthropogenic sound damages fish ears" (*http://scitation.aip.org/content/asa/journal/jasa/113/1/10.1121/1.1527962*) determined that "the ears of fish exposed to an operating air-gun sustained extensive damage to their sensory epithelia that was apparent as ablated hair cells. The damage was regionally severe, with no evidence of repair or replacement of damaged sensory cells up to 58 days after air-gun exposure." How does this benefit an incredibly important fishery?

B. Based on the track data in Figure 6 and and wreck sites listed in Table 8, the conclusion stated on page 70 section 5 of the draft EA is grossly incorrect:

"Only a small percentage of the recreational dive sites (wrecks in water depths <100 m) are within 25 km of the survey track lines."

In fact the survey track will cover the vast majority of the dive sites actually dived or visited on a given day off the Cape Hatteras and Cape Lookout regions of the NC coast. When these regions are analyzed separately, which they should be due to the distances between them, the mistake is even more profound.

The wrecks listed within the Cape Lookout portion of the track are among the most frequent destinations for dive charters off that portion of the coast: U352, Aeolus, Schurz, Papoose, Spar, Indra, Suloide, Parker, Box wreck. These represent the destination of an estimated 80-90% of the dive charters out of the Morehead City area.

The wrecks listed off the Cape Hatteras portion of the track would exclude all wrecks on the Diamond Shoals region which are also very popular dive destinations. These include the British Splendour, Australia, Kassandra,

Lancing, Empire Gem, etc. Given the location of the Splendour, these would almost also have to include the Proteus, Tarpon and Manuela, although those are not named on Table 8. This would represent an estimated 70 to 80% of the actual destinations of dive charters out of Cape Hatteras.

If prohibited from diving these destinations, the economic impact, both direct to the local area dive charter fleet and dive shops and indirect to the related tourism industry, would be significant and could reach the level of millions of dollars lost over the course of the scheduled surveys. (Paul Hudy, *http://www.nc-wreckdiving.com/*)

I hope you will consider the negative environmental & economic impacts of the survey in your assessment of the project.

Sincerely,
Rick Allen

--
Rick Allen
Nautilus Productions LLC
P.O. Box 53269
Fayetteville, NC 28305

910-826-9961 Office
910-624-7488 Mobile

nautilusvideo@earthlink.net
www.nautilusproductions.com

Nautilus Productions is the exclusive licensor of footage from Blackbeard the Pirate's flagship – the Queen Anne's Revenge. The Nautilus Productions staff has been the official video crew for the study and recovery of the infamous pirate Blackbeard's ship since the project’s inception.

Walker, Michele

From: Skillman, Roger <RogerSkillman@anderson5.net>
Sent: Thursday, September 04, 2014 10:23 PM
To: Walker, Michele
Subject: Seismic Testing Project Questions

Michele,

If the seismic testing project offshore proceeds as planned for September/October 2014, will there be compensation for lost business and crew pay during this period?

I work for a scuba diving charter boat, and we have numerous charters scheduled for this time frame.

Thanks,
Roger Skillman

Walker, Michele

From: Sara Smith <sara.ml.smith@gmail.com>
Sent: Tuesday, August 19, 2014 5:22 PM
To: Walker, Michele
Subject: Seismic Testing off of the NC Coast

I am opposed to the seismic testing in the Atlantic Ocean. Input was requested; please stop before it starts.

Sara Smith
665 Settlers Lane
Kure Beach, NC

Sent from my iPhone

Walker, Michele

From: scott.hughes18@frontier.com
Sent: Wednesday, August 20, 2014 10:22 PM
To: Walker, Michele
Subject: subj: Comments on article in Star news 08/19 Ref: NC Seismic tests this fall-NSF request

Michele, just saw 08/19 article in Star News article on NC Seismic tests this fall. Just want to make several points on the NSF request to dfo seismic testing off the Carolina coast from Sept 15 to Oct 22:

Point 1. NSF Timing. NSF request coming on heels of US Government ok'ing seismic tests for private companies doing profile for potential oil deposits. Coincidental?? Yeah, Right.

Point 2. Purpose. Proposed NSF activities are unrelated to activities for energy resources. However, survey is very similar in methodology and location/timing. Coincidental? Yeah, Right.

Point 3. Injurious Impacts. NSF says that injurious impacts to marine mammals, sea turtles, seabirds have not been proven to occur near seismic airgun arrays. What size rocks have the NSF official's heads been under?? NSF's own EA says that 'potential impacts of their survey on the environment would primarily be a result of the operation of the airgun array. The result would be increased underwater moise, which could result in avoidance behavior by marine mammals,sea turtles, and seabirds/fish. Is NSF for REAL??

Point 4. Mitigation Efforts. As I understand it, the only mitigation efforts NSF is contemplating is to have someone look out for whales, dolphins, and other fish "on the surface'. If they spot something on the surface, they will then do their mitigation plan. Forget the thousands of fish and other ocean life under water. Just react if they see ocean life on the surface. Again, how big is the rock that NSF has its collective heads under??

I love NC. I am a native north carolinean. I live at Topsail Island. I love the beach areas-- and I am alarmed at the NSF's request to do their seismic testing-which to me, is the beginning of utter deteriation of our beaches and waters. Their profiling, baselining, whatever you want to call it- is the beginning of destruction of our beaches and oceans as we know them. All for money in some way....
Thank you
Henry S (Scott) Hughes Topsail Beach, NC

Walker, Michele

From: Govoni, Daniel
Sent: Monday, August 18, 2014 2:55 PM
To: 'Simon Campbell'
Cc: Walker, Michele
Subject: RE: Proposed seismic testing off the NC coast Sept-Oct

Dear Mr. Campbell,

Thank you for your email dated 8/18/14 concerning the Federal Consistency Determination submitted by the National Science Foundation proposing to conduct a Marine Geophysical Survey via seismic testing in the Atlantic Ocean off of the North Carolina coast. As you may be aware, the Division of Coastal Management is coordinating a state review. Your comments will be examined and taken into consideration prior to the Division making a final Consistency Determination, you will be informed of this final decision.

The Division appreciates you taking the time to comment on this proposal, and your email will be added to the official file. Please feel free to contact me at (252) 808-2808 (ext. 215), if you should have any additional questions or concerns relating to this proposal.

Sincerely,
Daniel Govoni

Daniel M. Govoni
Asst. Major Permits Coordinator
NC Division of Coastal Management
400 Commerce Ave.
Morehead City, NC 28557

(252) 808-2808
(252) 247-3330 fax
daniel.govoni@ncdenr.gov

From: Simon Campbell [mailto:simonmufc@gmail.com]
Sent: Monday, August 18, 2014 1:31 PM
To: Govoni, Daniel
Subject: Proposed seismic testing off the NC coast Sept-Oct

Daniel,
I would like to lodge my opposition to the proposed seismic testing that may occur between mid-September and mid-October. I do not think there has been sufficient time for full public review and comment regarding the merits of the study versus the impact to marine wildlife and economic activity. The proposal does not provide details regarding why the research vessel can only be in NC waters between September and October. The proposal seems like an added on activity just because of expedient timing for the people submitting the proposal. Specifically, the notice also has not been sufficient for SCUBA divers to plan appropriately for trips.

The economic disruption to the diver operators and other businesses will be severe as many divers plan trips months in advance.

I know of 5 divers that are planning to visit from Britain to dive the coast during the proposed period. If the proposed activity proceeds they will take their business to another state. Please contact if you have any questions or would like further comment.

Thank you for your attention.

Simon Campbell
Garner, NC
919-609-5696

Walker, Michele

From: Sophina <willthechange@hotmail.com>
Sent: Tuesday, August 19, 2014 4:54 PM
To: Walker, Michele
Subject: This is not what we want!

1. I vote!
2. Seismic testing from September 15 – October 22 off the North Carolina coast, for research purposes???
3. NOT COOL with this voter!!!!!
4. Sea item # 1. please

Have a super day,
Sophina White

Walker, Michele

From: Govoni, Daniel
Sent: Friday, September 05, 2014 10:34 AM
To: 'stanbozarth@gmail.com'
Cc: Walker, Michele
Subject: RE: Seismic Testing - Outer Banks

Dear Mr. Bozarth,

Thank you for your email dated 8/28/14 concerning the Federal Consistency Determination submitted by the National Science Foundation proposing to conduct a Marine Geophysical Survey via seismic testing in the Atlantic Ocean off of the North Carolina coast. As you may be aware, the Division of Coastal Management is coordinating a state review. Your comments will be examined and taken into consideration prior to the Division making a final Consistency Determination, you will be informed of this final decision.

The Division appreciates you taking the time to comment on this proposal, and your email will be added to the official file. Please feel free to contact me at (252) 808-2808 (ext. 215), if you should have any additional questions or concerns relating to this proposal.

Sincerely,
Daniel Govoni

Daniel M. Govoni
Asst. Major Permits Coordinator
NC Division of Coastal Management
400 Commerce Ave.
Morehead City, NC 28557

(252) 808-2808
(252) 247-3330 fax
daniel.govoni@ncdenr.gov

-------- Original Message --------
Subject: Seismic Testing - Outer Banks
From: Stan Bozarth <stanbozarth@gmail.com>
To: "Davis, Braxton C" <Braxton.Davis@NCDENR.Gov>
CC:

Dear Sir,
I cannot find any indication as to where I might make a formal comment on the proposed subject testing, so I am directing my comment to you in hopes it will be forwarded to the appropriate party.

I believe the proposed seismic testing is too intense and too prolonged. It will, if past experience counts for anything, likely result in extreme negative consequences to marine mammals and other vital parts of the important Outer Banks ecosystem.

I am hopeful the NC Coastal Commission will oppose this activity, or at least demand that it be conducted over a much longer period

of time. I realize those doing the testing would oppose such demands because it would be more "economical" to do otherwise. Economics should not be the ruling measure of how such activity is to be conducted.

Thank you,
Stan Bozarth
Wilmington, NC 28411
Sent from my iPad

Walker, Michele

From: Govoni, Daniel
Sent: Monday, August 18, 2014 10:00 AM
To: 'terry@discoverydiving.com'
Cc: Walker, Michele
Subject: RE: NSF survey

Dear Terry Leonard,

Thank you for your email dated 8/18/14 concerning the Federal Consistency Determination submitted by the National Science Foundation proposing to conduct a Marine Geophysical Survey via seismic testing in the Atlantic Ocean off of the North Carolina coast. As you may be aware, the Division of Coastal Management is coordinating a state review. Your comments will be examined and taken into consideration prior to the Division making a final Consistency Determination, you will be informed of this final decision.

The Division appreciates you taking the time to comment on this proposal, and your email will be added to the official file. Please feel free to contact me at (252) 808-2808 (ext. 215), if you should have any additional questions or concerns relating to this proposal.

Sincerely,
Daniel Govoni

Daniel M. Govoni
Asst. Major Permits Coordinator
NC Division of Coastal Management
400 Commerce Ave.
Morehead City, NC 28557

(252) 808-2808
(252) 247-3330 fax
daniel.govoni@ncdenr.gov

From: terry@discoverydiving.com [mailto:terry@discoverydiving.com]
Sent: Monday, August 18, 2014 9:58 AM
To: Govoni, Daniel
Cc: terry@discoverydiving.com
Subject: NSF survey

Sir
I operate a dive charter vessel out of Beaufort, NC. I have looked at this proposed survey in regards to its impact on my business and am against it during this time frame . Sept and Oct are the last two months of the dive season in NC. Myself and the other dive operators have numerous trips scheduled during this time period. These trips are generally not able to be rescheduled and are the last income of the year for most of the boats .

Thanks

Terry Leonard
Owner Outrageous V
414 Orange Street
Beaufort,NC 28516

Walker, Michele

From: Govoni, Daniel
Sent: Tuesday, September 02, 2014 9:56 AM
To: 'TKERNHICKORY@aol.com'
Cc: Walker, Michele
Subject: RE: Offshore Seismic Testing

Dear Mr. Kern,

Thank you for your email dated 8/30/14 concerning the Federal Consistency Determination submitted by the National Science Foundation proposing to conduct a Marine Geophysical Survey via seismic testing in the Atlantic Ocean off of the North Carolina coast. As you may be aware, the Division of Coastal Management is coordinating a state review. Your comments will be examined and taken into consideration prior to the Division making a final Consistency Determination, you will be informed of this final decision.

The Division appreciates you taking the time to comment on this proposal, and your email will be added to the official file. Please feel free to contact me at (252) 808-2808 (ext. 215), if you should have any additional questions or concerns relating to this proposal.

Sincerely,
Daniel Govoni

Daniel M. Govoni
Asst. Major Permits Coordinator
NC Division of Coastal Management
400 Commerce Ave.
Morehead City, NC 28557

(252) 808-2808
(252) 247-3330 fax
daniel.govoni@ncdenr.gov

From: TKERNHICKORY@aol.com [mailto:TKERNHICKORY@aol.com]
Sent: Saturday, August 30, 2014 12:47 AM
To: Govoni, Daniel
Subject: Offshore Seismic Testing

Mr Govoni:

I am asking that you not issue the permits or allow the Seismic Testing of the shore of NC. No one understand the effects of Marine Life such as dolphins and whales that already under extreme environmental pressure and this could damage their ability to hear which they rely on for survival. What has been said this could do nothing to this marine life up to death .....kind of a large spread there. This was expressed by NC DMF Director Louis Daniel. The will also close commerical fishing during the fall run for 37 days. Their are too many unknow factors to allow a Federal enitity to conduct and experimental method of data off our coast. The lack of real notice and information to possible bad effects to the public is alarming. Lets all just look a little deeper into this. The lack of transparency really is apparent.

Repectfully,

Thomas S. Kern III

1650 20th Ave Ct NE
Hickory NC 28601

828-312-1127

President of Catawba Valley Tea Party.

Walker, Michele

From: Govoni, Daniel
Sent: Monday, August 18, 2014 9:43 AM
To: 'LINDA HARTLE'
Cc: Walker, Michele
Subject: RE: Opposed to Seismic Ocean Survey off NC Coast

Dear Ms. Hartle,

Thank you for your email dated 8/17/14 concerning the Federal Consistency Determination submitted by the National Science Foundation proposing to conduct a Marine Geophysical Survey via seismic testing in the Atlantic Ocean off of the North Carolina coast. As you may be aware, the Division of Coastal Management is coordinating a state review. Your comments will be examined and taken into consideration prior to the Division making a final Consistency Determination, you will be informed of this final decision.

The Division appreciates you taking the time to comment on this proposal, and your email will be added to the official file. Please feel free to contact me at (252) 808-2808 (ext. 215), if you should have any additional questions or concerns relating to this proposal.

Sincerely,
Daniel Govoni

Daniel M. Govoni
Asst. Major Permits Coordinator
NC Division of Coastal Management
400 Commerce Ave.
Morehead City, NC 28557

(252) 808-2808
(252) 247-3330 fax
daniel.govoni@ncdenr.gov

From: LINDA HARTLE [mailto:avatar3@yadtel.net]
Sent: Sunday, August 17, 2014 9:25 PM
To: Govoni, Daniel
Subject: Opposed to Seismic Ocean Survey off NC Coast

I was born and raised in NC and my wife has lived here with me for over 30 years. During that time we have not only enjoyed the nature and wildlife of our coast but are also frequent SCUBA divers and think that the proposed Seismic Survey will be both detrimental to our coastal economic development and devastating to marine life.

You obviously have not had the chance to enjoy our coast as we have if you support this measure.

--

Tony and Linda Hartle

Walker, Michele

From: Tonya Byrum <tonyalbyrum@gmail.com>
Sent: Monday, August 25, 2014 11:49 AM
To: Walker, Michele
Subject: Seismic tests

Anything that negatively effects our local community and our fishermen on the outer banks, is not o.k. with me.
This is my comment: NO!
Tonya L. Byrum
Nags Head, N.C.
Beach Waves Too
Salon By The Sea

Robert C. Edwards
Mayor

Susie Walters
Mayor Pro Tem

Cliff Ogburn
Town Manager

Town of Nags Head

Post Office Box 99
Nags Head, North Carolina 27959
Telephone 252-441-5508
Fax 252-441-0776
www.nagsheadnc.gov

M. Renée Cahoon
Commissioner

John Ratzenberger
Commissioner

Marvin Demers
Commissioner

August 19, 2014

Mr. Braxton Davis
Director
NC Department of Environment and Natural Resources
Division of Coastal Management
400 Commerce Ave.
Morehead City, 28557

RE: 0648-XD394, Takes of Marine Mammals Incidental to Specified Activities; Marine Geophysical Survey in the Northwest Atlantic Ocean Offshore North Carolina, September to October 2014

Dear Braxton:

On behalf of Nags Head's Board of Commissioners, I am writing to comment on the application from the Lamont-Doherty Earth Observatory (Lamont-Doherty) in collaboration with the National Science Foundation (Foundation), for an Incidental Harassment Authorization (Authorization) to take marine mammals, by harassment incidental to conducting a marine geophysical (seismic) survey in the northwest Atlantic Ocean off the North Carolina coast from September through October, 2014. According to the NOAA July 31, 2014 notice, the seismic survey will take place in the Atlantic Ocean, approximately 17 to 422 kilometers (km) (10 to 262 miles (mi)) off the coast of Cape Hatteras, North Carolina.

We were stunned and disappointed to hear about this application to use air guns to relentlessly blast the marine life off Dare County's coast in the name of science. With little public notice and a comment period only open until September 2, we consider ourselves lucky to know about this application at all. It appears to us that this application has been accelerated, without full disclosure to the public.

As a municipality located on a barrier island, we must be a good steward of our fragile and pristine environment. Whether it is monitoring Nags Head's water quality or protecting the turtles that nest on our beautiful beach, we take great pride in doing everything we can to ensure that future generations will also be able to experience the magnificence of the Outer Banks.

Our area is home to many wildlife species, including the endangered right whale. Are these surveys so important that the government is willing to ignore the major impacts to our ecosystem that will occur? Though the application states that the testing is not related to oil and natural gas exploration, we have a hard time believing that.

As you can see by the resolution our Board adopted April 2, 2014, we strongly believe that more research should be completed to fully understand the impacts of seismic testing and how we can mitigate those impacts. Further information about the impacts of manmade sound on the underwater environment and its inhabitants and the nature and effects of seismic testing is needed before blasting should be conducted. How do we know if the impacts are immediate and dramatic or subtle and delayed?

We understand that alternative technologies to seismic airgun testing exist, which may be more costly, but less harmful to marine life. We would like to see these alternatives be given more consideration during the application process.

In closing, we have asked Jolie Harrision at the National Marine Fisheries Service to deny this application. Seismic airgun testing causes catastrophic impacts to the marine ecosystem, including injury or death whales and dolphins. This, in turn, will set the stage for even more negative impacts to our area.

Sincerely,

Robert C. Edwards
Mayor

Enclosure

RCE/rlt

Walker, Michele

From: Victoria Driscoll <vmdriscoll@gmail.com>
Sent: Tuesday, August 19, 2014 2:07 PM
To: Walker, Michele
Subject: Seismic testing on eastern Atlantic coastal water

Please do not do this testing. there is so much evidence that it harms marine life to do this testing in the ocean please do not do this. I am an active volunteer with sea turtle project in the Fort Fisher aquarium in coastal North Carolina.
Please Do not do this seismic testing September 2014 or ever.

Sincerely
Victoria Driscoll
MBA accounting

Walker, Michele

From: McLellan, William <mclellanw@uncw.edu>
Sent: Tuesday, August 19, 2014 2:17 PM
To: Walker, Michele
Cc: McLellan, William; Pabst, D. Ann
Subject: Comments on Seismic Testing off the Outer Banks of North Carolina in Sept and Oct, 2014
Attachments: William McLellan NCDENR Comments on Seismic Testing off the Outer Banks of North Carolina.pdf

Comments on Seismic Testing off the Outer Banks of North Carolina in Sept and Oct, 2014: 0648-XD394

William McLellan
Biology and Marine Biology
UNC Wilmington
601 South College Road
Wilmington, NC 28403

This proposal to conduct seismic surveys off the Outer Banks of North Carolina greatly concerns me for two reasons.

The first concern is with the use of full scale industrial seismic exploration vessels in the exact habitat that we have found high beaked whale abundances. For the past three years, a joint program with Duke University and UNC Wilmington has been conducting monthly aerial surveys for seasonal distribution and vessel operations focused on tagging and identification of marine mammals. The aerial surveys track from the coastal shelf east over the first and second shelf breaks to pelagic waters. Sightings data have been uploaded to OBIS SEAMAP, presented at annual Navy meetings with NOAA staff present, and recently been forwarded to senior NOAA research staff from the NE Science Center. The proposed tracklines for seismic testing track directly over the highest density of beaked whale sightings, but the proposal barely mentions the potential for beaked whale interactions. In essence, beaked whales will be present within the seismic testing area for the entire sampling period. In my opinion, standard operating procedures to shut down seismic activity when marine mammals are sighted are not effective when mitigating interactions specifically with beaked whales. Beaked whale dive times have now been extended to over two hours for Cuvier's beaked whales (*Ziphius cavirostris*) (Schorr et al. 2014). Our Lab recently published myoglobin data for cetaceans collected from strandings from the exact locations associated with these seismic surveys. One of animals presented in the recent publication (Velten et. at 2013) was an adult female True's beaked whale (*Mesoplodon mirus*) testing out with the highest level of myoglobin EVER measured in a mammal. This extreme level of myoglobin implies this animal could dive on a breath hold for extended periods of time. The combined dive time lengths and potential for extended breath hold diving violate the ability for vessel based observers to shut down seismic operations based on visual sightings of animals surfacing near the operations vessel.

If seismic operations are not able to alter their testing as beaked whales are encountered in real time there is a likelihood that those beaked whales will be directly affected by the seismic energy inputs into the surrounding ocean. While the proposal states there will be little effect on local marine mammals, there have been many publications that link anthropogenic sound sources, both commercial and military, with morbidity and mortality of cetaceans, especially beaked whales. The location of beaked whales continuously in the same space and time as the proposed seismic surveys suggests there could be negative interactions between these two. As the Marine Mammal Stranding Coordinator for the State of North Carolina I am extremely troubled by the use of seismic testing off the coast of North Carolina and the possibility of cetacean strandings. We are still responding to the largest Unusual Mortality Event ever investigated on the east coast, which has involved over 1400 bottlenose dolphins (*Tursiops truncatus*) and nearly 300 in North Carolina. The North Carolina stranding network received NO Prescott stranding grant support in 2013. Yet, this seismic activity

could increase beaked whales and other cetacean strandings that are known to inhabit these waters. Strandings of these species require vastly more time, effort and resources than is exerted for response to the more common bottlenose and other dolphins species. Beaked whales require a team to commit 2-3 days of stranding response, diagnostic testing and necropsy effort for each individual animal. I have personally spent one week per each beaked whale stranding that has occurred in the state over the past 3-4 years. Short-finned pilot whales (*Globicephala macrorhynchus*) also overlap the geographic region of the proposed seismic tests. In 2005, a mass stranding of 35 short-finned pilot whales occurred along the coast near the site of the proposed seismic tests. This mass stranding event was investigated by NOAA as it occurred coincident with Navy sonar exercises. NOAA's report (Hohn et al. 2006) stated that it could not be determined whether there was or was not a causal link between the exposure to anthropogenic sound source and the stranding event. It is frankly unacceptable that this seismic activity will be conducted with no plan to investigate strandings and no additional support provided to the state stranding network. Funded science cannot simply push responsible oversight off to unfunded scientists!

The second concern is simply the compressed timing for this public comment period. The proposal states seismic activity will begin off Cape Hatteras in the middle of September, 2014. The current comment period ends on Sept 2, 2014 which leaves less than two weeks to compile and act on suggestions proposed during the comment period. The proposed seismic activities should be postponed until all comments are received and acted upon. If that does not take place it brings in to question the validity of the entire comment process.

Literature Cited

Hohn, A. A., Rotstein, D. S., Harms, C. A., and Southall, B. L. (2006). Report on marine mammal unusual mortality event UMESE0501Sp: Multispecies mass stranding of pilot whales (*Globicephala macrorhynchus*), minke whales (*Balaenoptera acutorostrata*), and dwarf sperm whales (*Kogia sima*) in North Carolina on 15-16 January 2005. NOAA Technical Memorandum NMFS-SEFSC-537

Schorr, G.S., Falcone, E.A., Moretti, D.J., and R.D. Andrews. 2014. First long-term behavioral records from Cuvier's beaked whales (*Ziphius cavirostris*) reveal record-breaking dives. PLOS One 9(3)e92633.

Velten, B.P., Dillaman, R. M., Kinsey, S. T., McLellan, W. A. and D. A. Pabst. 2013. Novel locomotor muscle design in extreme deep-diving whales. Journal of Experimental Biology. 216:1862-1871.

Comments on Seismic Testing off the Outer Banks of North Carolina in Sept and Oct, 2014: 0648-XD394

William McLellan
Biology and Marine Biology
UNC Wilmington
601 South College Road
Wilmington, NC 28403

This proposal to conduct seismic surveys off the Outer Banks of North Carolina greatly concerns me for two reasons.

The first concern is with the use of full scale industrial seismic exploration vessels in the exact habitat that we have found high beaked whale abundances. For the past three years, a joint program with Duke University and UNC Wilmington has been conducting monthly aerial surveys for seasonal distribution and vessel operations focused on tagging and identification of marine mammals. The aerial surveys track from the coastal shelf east over the first and second shelf breaks to pelagic waters. Sightings data have been uploaded to OBIS SEAMAP, presented at annual Navy meetings with NOAA staff present, and recently been forwarded to senior NOAA research staff from the NE Science Center. The proposed tracklines for seismic testing track directly over the highest density of beaked whale sightings, but the proposal barely mentions the potential for beaked whale interactions. In essence, beaked whales will be present within the seismic testing area for the entire sampling period. In my opinion, standard operating procedures to shut down seismic activity when marine mammals are sighted are not effective when mitigating interactions specifically with beaked whales. Beaked whale dive times have now been extended to over two hours for Cuvier's beaked whales (*Ziphius cavirostris*) (Schorr *et al.* 2014). Our Lab recently published myoglobin data for cetaceans collected from strandings from the exact locations associated with these seismic surveys. One of animals presented in the recent publication (Velten *et. at* 2013) was an adult female True's beaked whale (*Mesoplodon mirus*) testing out with the highest level of myoglobin EVER measured in a mammal. This extreme level of myoglobin implies this animal could dive on a breath hold for extended periods of time. The combined dive time lengths and potential for extended breath hold diving violate the ability for vessel based observers to shut down seismic operations based on visual sightings of animals surfacing near the operations vessel.

If seismic operations are not able to alter their testing as beaked whales are encountered in real time there is a likelihood that those beaked whales will be directly affected by the seismic energy inputs into the surrounding ocean. While the proposal states there will be little effect on local marine mammals, there have been many publications that link anthropogenic sound sources, both commercial and military, with morbidity and mortality of cetaceans, especially beaked whales. The location of beaked whales continuously in the same space and time as the proposed seismic surveys suggests there could be negative interactions between these two. As the Marine Mammal Stranding Coordinator for the State of North Carolina I am extremely troubled by the use of seismic testing off the coast of North Carolina and the possibility of cetacean strandings. We are still responding to the largest Unusual Mortality Event ever investigated on the east coast, which has involved over 1400 bottlenose dolphins (*Tursiops truncatus*) and nearly 300 in North Carolina. The North Carolina stranding network received NO Prescott

stranding grant support in 2013. Yet, this seismic activity could increase beaked whales and other cetacean strandings that are known to inhabit these waters. Strandings of these species require vastly more time, effort and resources than is exerted for response to the more common bottlenose and other dolphins species. Beaked whales require a team to commit 2-3 days of stranding response, diagnostic testing and necropsy effort for each individual animal. I have personally spent one week per each beaked whale stranding that has occurred in the state over the past 3-4 years. Short-finned pilot whales (*Globicephala macrorhynchus*) also overlap the geographic region of the proposed seismic tests. In 2005, a mass stranding of 35 short-finned pilot whales occurred along the coast near the site of the proposed seismic tests. This mass stranding event was investigated by NOAA as it occurred coincident with Navy sonar exercises. NOAA's report (Hohn *et al.* 2006) stated that it could not be determined whether there was or was not a causal link between the exposure to anthropogenic sound source and the stranding event. It is frankly unacceptable that this seismic activity will be conducted with no plan to investigate strandings and no additional support provided to the state stranding network. Funded science cannot simply push responsible oversight off to unfunded scientists!

The second concern is simply the compressed timing for this public comment period. The proposal states seismic activity will begin off Cape Hatteras in the middle of September, 2014. The current comment period ends on Sept 2, 2014 which leaves less than two weeks to compile and act on suggestions proposed during the comment period. The proposed seismic activities should be postponed until all comments are received and acted upon. If that does not take place it brings in to question the validity of the entire comment process.

Literature Cited

Hohn, A. A., Rotstein, D. S., Harms, C. A., and Southall, B. L. (2006). Report on marine mammal unusual mortality event UMESE0501Sp: Multispecies mass stranding of pilot whales (*Globicephala macrorhynchus*), minke whales (*Balaenoptera acutorostrata*), and dwarf sperm whales (*Kogia sima*) in North Carolina on 15-16 January 2005. NOAA Technical Memorandum NMFS-SEFSC-537

Schorr, G.S., Falcone, E.A., Moretti, D.J., and R.D. Andrews. 2014. First long-term behavioral records from Cuvier's beaked whales (*Ziphius cavirostris*) reveal record-breaking dives. PLOS One 9(3)e92633.

Velten, B.P., Dillaman, R. M., Kinsey, S. T., McLellan, W. A. and D. A. Pabst. 2013. Novel locomotor muscle design in extreme deep-diving whales. *Journal of Experimental Biology*. 216:1862-1871.

DCM Director Braxton Davis
400 Commerce Avenue
Morehead City NC 28557

August 27, 2014

Dear Director Davis,

In regard to the seismic testing by the Marine Geophysical Survey, the North Carolina Watermen United (NCWU) does not agree to any testing that will in any way cause a disturbance to our marine life, or the ways, means or times in which we work in various fisheries. Many of our fisheries are already greatly affected now because of the possibility of interacting with marine life, e.g., the Loggerhead sea turtle. We cannot agree to any testing that has such a high probability of potential harm.

We are especially opposed to the use of "sonic booms," which has proven in the past to cause avoidance, stunning and even FishKill for marine animals. We would like to request further research on the impacts of manmade sound on the underwater environment. We also understand that alternative technologies exist and hope they will be considered for the survey.

We are also concerned about the timing of the testing since it is currently scheduled to occur in productive fishing areas at a time when fishing is still going on. The winter months, December – February, would not cause nearly as many inconveniences - many changes in days or places for recreational, charter/headboat and commercial trips.

Yours truly,

Britton Shackelford

Britton Shackelford
President, NCWU
brittonshack@gmail.com
252-473-8078

Table 1. List of annual coastal fishing tournaments off the coast of North Carolina and their homeport locations. Nearshore < 20 nm from shore and offshore > 20 nm from shore.

Month	Tournament	Location
April	Masonboro Sportfishing Tournament *Wrightsville Beach, NC*	Offshore
May	Reelin' for Research *Morehead City, NC*	Offshore
	Far Out Shoot Out *Ocean Isle Beach, NC*	Offshore
	Hatteras Village Offshore Open *Hatteras Village, NC*	Offshore
	Swansboro Rotary 2014 Memorial Day Blue Water Fishing Tournament Swansboro, NC	Offshore
	Cape Fear Blue Marlin Tournament *Wrightsville Beach, NC*	Offshore
	JWR Gaffer Dolphin Tournament *Morehead City, NC*	Offshore
	Boy Scout Gulf Stream Open *Wrightsville Beach, NC*	Offshore
June	Big rock Blue Marlin Tournament *Morehead City, NC*	Offshore
	Jolly Mon King Classic *Ocean Isle Beach, NC*	Nearshore/ Offshore
	Hatteras Marlin Club Blue Marlin Release Tournament *Hatteras Village, NC*	Offshore
July	Hatteras Grand Slam *Hatteras Village, NC*	Offshore
	The East Coast Got-Em-On Classic *Carolina Beach, NC*	Nearshore/ Offshore
	Barta Boys and Girls Club Billfish Tournament *Beaufort, NC*	Offshore
	Dare County Boatbuilders Tournament *Manteo, NC*	Offshore
	Ducks Unlimited "Band the Billfish" Tournament *Morehead City, NC*	Offshore
	CCCF Spanish Mackerel Challenge *Beaufort, NC*	Nearshore/ Offshore
	Raleigh Saltwater Sportfishing Club King Mackerel Tournament *Morehead City, NC*	Nearshore/ Offshore
	S.H.A.R.E. King Mackerel Tournament *Wrightsville Beach, NC*	Nearshore/ Offshore
	Capt. Eddy Haneman Sailfish Tournament *Wrightsville Beach, NC*	Offshore
August	Onslow Bay Open King Mackerel Tournament *Morehead City, NC*	Nearshore/ Offshore

	Pirate's Cove Billfish Tournament *Manteo, NC*	Offshore
	Rotary Club of Sneads Ferry King Mackerel Tournament *Sneads Ferry, NC*	Nearshore/ Offshore
September	Atlantic Beach King Mackerel Tournament *Atlantic Beach, NC*	Nearshore/ Offshore
	New Bridge Bank Wild King Classic *Wrightsville Beach, NC*	Nearshore/ Offshore
	King of the Cape Open King Mackerel Tournament *Beaufort, NC*	Nearshore/ Offshore
	Oregon Inlet Billfish Roundup *Manteo, NC*	Offshore
October	Brown Bag Wahoo Tournament *Morehead City, NC*	Offshore
	US Open King Mackerel Tournament *South Port, NC*	Nearshore/ Offshore
	Fall Brawl King Classic *Ocean Isle Beach, NC*	Nearshore/ Offshore
	Swansboro Rotary King Mackerel Tournament *Swansboro, NC*	Nearshore/ Offshore
	NC Troopers Association Offshore – Inshore Saltwater Challenge *Morehead City, NC*	Nearshore/ Offshore
	Martini's Fall Hook-A-Hoo Rodeo *Wrightsville Beach, NC*	Offshore
November	Cape Hatteras Anglers Club Team and Open Individual Invitational Tournament *Buxton, NC*	Nearshore

NATIONAL SCIENCE FOUNDATION
4201 WILSON BOULEVARD
ARLINGTON, VIRGINIA 22230

June 18, 2014

Doug Huggett
Federal Consistency Coordinator
NC Division of Coastal Management
400 Commerce Avenue
Morehead City, NC 28557-3421

RE: Draft Environmental Assessment for a Marine Geophysical Survey by the R/V *Marcus G. Langseth* in the Atlantic Ocean off Cape Hatteras, September-October 2014

Dear Mr. Huggett:

NSF is considering support of a collaborative research project proposed to be conducted during the period September-October 2014 that would include a marine geophysical survey in the Atlantic Ocean off of Cape Hatteras and associated land-based activities in North Carolina and Virginia. The proposed seismic survey would be funded entirely by the National Science Foundation (NSF) and led by Drs. H. van Avendonk (University of Texas at Austin), M. Nedimovic (Dalhousie University); M. Long (Yale University); B. Dugan (Rice University); M. Hornback and B. Magnani (Southern Methodist University); P. Witta (The College of New Jersey); S. Harder (University of Texas at El Paso); D. Lizarralde (Woods Hole Oceanographic Institution); and D. Shillington, A. Becel, and J. Gaherty (L-DEO). The collaborative research efforts would collect and analyze data along the mid-Atlantic coast of the East North American Margin (ENAM) to investigate how the continental crust stretched and separated during the opening of the Atlantic Ocean, and what the role of magmatism was during continental breakup. The proposed seismic survey would be conducted on the NSF-owned research vessel (R/V) *Marcus G. Langseth* (R/V *Langseth*), which is operated by Columbia University's Lamont-Doherty Earth Observatory (LDEO). The proposed activities are not related to energy resources or facilities, including oil and gas exploration, development, production, or lease sales, and therefore are not subject to Bureau of Ocean Energy Management regulatory jurisdiction pursuant to the Outer Continental Shelf Lands Act. The proposed activities are also not related to ocean mining.

Attached please find the NSF Consistency Determination for the proposed seismic survey. This determination is based on review of the proposed activities conformance with North Carolina's coastal program policies, which are primarily found in Chapter 7 of Title 15A of North Carolina's Administrative Code. Details of the determination are provided through submission of a Draft Environmental Assessment prepared pursuant to the National Environmental Policy Act of 1969, as amended, for the proposed activities (Attachment 1). The NC State Historic Preservation Office (SHPO) HPOWEB GIS service was used to evaluate whether there would be

any historic resources within the area of proposed land shot sites (Attachment 2). The proposed activity is consistent (to the maximum extent practicable) with the enforceable policies of North Carolina's Coastal Management Program.

Pursuant to CFR 930.41, the North Carolina Coastal Management Program has 60 days from the receipt of this letter in which to concur with or object to this Consistency Determination, or to request an extension under 15 CFR Section 930.41(b). The NSF would be appreciative, however, if the North Carolina Coastal Management Program could inform us of their perspective on the consistency determination at their earliest possible convenience within this time period. The State's concurrence will be presumed if the States response is not received by the NSF on the 60th day from receipt of this Determination.

Should you have any questions about the information provided, please feel free to contact me at hesmith@nsf.gov or (703) 292-7713.

Sincerely,

Holly Smith

Holly Smith
Environmental Compliance Officer

Attachment 1: Draft Environmental Assessment for a Marine Geophysical Survey by the R/V *Marcus G. Langseth* in the Atlantic Ocean off Cape Hatteras

Attachment 2: Active Land Shot Sites - Historic Resources

NSF COASTAL ZONE MANAGEMENT ACT (CZMA)

CONSISTENCY DETERMINATION

This document provides the North Carolina (NC) Coastal Management Program (CMP) with the National Science Foundation's (NSF) Consistency Determination under CZMA Section 15 CFR Part 930, subpart C for a collaborative research project entitled, "Collaborative Research: A community seismic experiment targeting the pre-, syn-, and post-rift evolution of the Mid Atlantic US margin." The collaborative research proposal has been reviewed under the NSF merit review process and identified as an NSF program priority to meet NSF's critical need to foster a better understanding of Earth processes. The information in this Consistency Determination is provided pursuant to 15 CFR Part 930.39.

The collaborative research activities are proposed to be conducted during the period September - October 2014 and would include a marine geophysical survey in the Atlantic Ocean off Cape Hatteras and associated land-based activity in NC and Virginia. The proposed activities would be funded entirely by the National Science Foundation (NSF) and led by Drs. H. van Avendonk (University of Texas at Austin), M. Nedimovic (Dalhousie University); M. Long (Yale University); B. Dugan (Rice University); M. Hornback and B. Magnani (Southern Methodist University); P. Witta (The College of New Jersey); S. Harder (University of Texas at El Paso); D. Lizarralde (Woods Hole Oceanographic Institution); and D. Shillington, A. Becel, and J. Gaherty (L-DEO).

Pursuant to the National Environmental Policy Act, as amended, NSF has prepared a Draft Environmental Assessment (Draft EA) to evaluate the potential impacts on the human and natural environment associated with the proposed activities, including to endangered and threatened species listed under the Endangered Species Act. The Draft EA, entitled, "Draft Environmental Assessment of a Marine Geophysical Survey by the R/V *Marcus G. Langseth* in the Atlantic Ocean off Cape Hatteras, September - October 2014", was prepared on our behalf by LGL Limited environmental research associates (LGL) (Attachment 1). The Draft EA tiers to a Programmatic Environmental Impact Statement/Overseas Environmental Impact Statement for Marine Seismic Research Funded by the National Science Foundation or Conducted by the U.S. Geological Survey (NSF/USGS PEIS) (Attachment 1, page 1). The conclusions from the Draft EA will be used to inform the Division of Ocean Sciences (OCE) management of potential environmental impacts of the proposed activities. OCE's review of the Draft EA concurs with the report's findings that implementation of the proposed activities would not have a significant impact on the environment. OCE will continue to review information between now and the time of the issuance of the Final EA and if any contrary conclusion is reached during this timeframe regarding environmental impacts, I will immediately notify you of such a conclusion.

The proposed marine seismic survey would take place within the Exclusive Economic Zones of the U.S. and outside of NC state waters. The proposed seismic survey would be conducted on the NSF-owned research vessel *Marcus G. Langseth* (R/V *Langseth*), which is operated by Columbia University's Lamont-Doherty Earth Observatory (LDEO). The proposed activities are not related to oil and gas exploration, development, production, or lease sales, and therefore are

not subject to Bureau of Ocean Energy Management regulatory jurisdiction pursuant to the Outer Continental Shelf Lands Act (OCSLA).

The purpose of the proposed collaborative research activities is to collect and analyze data along the mid-Atlantic coast of the East North American Margin (ENAM). The study area covers a portion of the rifted margin of the eastern U.S., from unextended continental lithosphere onshore to mature oceanic lithosphere offshore. The data set would therefore allow scientists to investigate how the continental crust stretched and separated during the opening of the Atlantic Ocean, and what the role of magmatism was during continental breakup. The study also covers several features representing the post-rift modification of the margin by slope instability and fluid flow. To achieve the project's goals, the PIs propose to use a 2-D marine seismic reflection and refraction survey to map sequences off Cape Hatteras and land seismometers along two 200-km SE–NW trending transects from the coast into North Carolina and southern Virginia. Arrays of small, passive seismometers placed along land-based extensions of two of the marine transects as well as limited active source work on land would allow for obtaining critical information on continental crust extension.

Additional objectives that would be met from conducting the proposed research include gaining insight in slope stability and the occurrence of past landslides. Slope stability is important for estimating the risk of future landslides. Landslides can result in tsunamis, such as the tsunami that occurred offshore eastern Canada in the early 20th century, and resulted in the loss of lives. The risk for landslides off the eastern U.S. is not known.

Marine Activity

The proposed survey area is located between approximately (~) 32–37°N and ~71.5–77°W in the Atlantic Ocean ~6–430 km off the coast of Cape Hatteras (Attachment 1, Figure 1). Water depths in the survey area are 30–4300 m. The seismic survey would be conducted outside of state waters and mostly within the U.S. EEZ, and partly in International Waters, and is scheduled to occur for ~38 days during 15 September–22 October 2014. Proposed activities would avoid the North Atlantic right whale migration period.

The survey would involve one source vessel, the *Langseth*, which is owned by NSF and operated on its behalf by Columbia University's L-DEO; LDEO's operation of the *Langseth* is funded by NSF through a cooperative agreement entered into in 2012. The proposed energy source was considered by the PIs during planning efforts and tailored to use the least amount of energy to meet the research goals for this particular survey site. The *Langseth* would deploy an array of 36 airguns in 4 strings as an energy source with a total volume of ~6600 in^3 or an array of 18 airguns in 2 strings with a total discharge volume of ~3300 in^3. The airgun arrays are described in § 2.2.3.1 of the NSF/USGS PEIS, and the airgun configurations are illustrated in Figures 2-11 to 2-13 of the PEIS. The 4-string array would be towed at a depth of 9 m for the OBS and MCS lines of the survey, and the 2-string array would be towed at a depth of 6 m. Shot intervals would be 65 s (~150 m) during OBS seismics and ~22 s (50 m) during MCS seismics. The receiving system would consist of an 8-km hydrophone streamer or 94 ocean bottom seismometers (OBSs) (for a description of OBSs, see Attachment 1, page 5). The OBSs would be deployed and retrieved by a second vessel, the R/V *Endeavor*. As the airgun array is towed along the survey lines, the hydrophone streamer would receive the returning acoustic signals and

transfer the data to the on-board processing system. The OBSs record the returning acoustic signals internally for later analysis.

A total of ~5000 km of 2-D survey lines, including turns (~3650 km MCS and ~1350 km OBS lines) are oriented perpendicular to and parallel to shore (Attachment 1, Figure 1). The OBS lines would be shot a second time with the streamer, for a total of ~6350 km. There would be additional seismic operations in the survey area associated with turns, airgun testing, and repeat coverage of any areas where initial data quality is sub-standard. In our calculations (Attachment 1, page 64), 25% has been added for those additional operations.

In addition to the operations of the airgun array, a multibeam echosounder (MBES), a sub-bottom profiler (SBP), and an acoustic Doppler current profiler (ADCP) would also be operated from the *Langseth* continuously throughout the survey. All planned geophysical data acquisition activities would be conducted by L-DEO with on-board assistance by the scientists who have proposed the study. The vessel would be self-contained, and the crew would live aboard the vessel with some personnel transfer on/off the *Langseth* by a small vessel.

Standard monitoring and mitigation measures would be implemented during the survey, including use of Protected Species Visual Observers, Passive Acoustic Monitoring, exclusion zones calculated for both source levels and tow depths, speed or course alterations, power or shut downs, and ramp-up procedures (Attachment 1, page 14).

Land-based Activity

On land, wide-angle reflection and refraction seismic data would be acquired along two 200 km-long dip profiles trending SE–NW and by the passive EarthScope Transportable Array, providing detailed regional-scale data. The two land-based transects are between ~34.5–37°N and ~76–79.5°W (Attachment 1, Figure 1). EarthScope, an NSF-funded earth science program to explore the 4-D structure of the entire North American continent, has been moving thousands of passive seismometers across North America over a period of years. The ENAM land deployment of seismometers would consist of three components: 1) 400 "Reftek 125" seismometers (~12 cm × 6 cm diameter) deployed at the surface along each profile at 500-m intervals along roadsides, 2) 80 "Reftek 130" seismometers (~30 cm × 6 cm diameter) deployed on both profiles at 5-km intervals, buried about 45 cm deep along roadsides in small boxes, and 3) 3 Trillium Compact Post-hole sensors (~17.5 cm x 9.5 cm diameter), a solar panel, and a case (~89 cm x 53 cm x 43 cm) containing two marine-cell deep-cycle 12-volt batteries, a charge controller connected to the solar panel, and a Reftek RT130 data logger deployed at 3 separate coastal community sites. Reftek seismometer installation would involve digging with hand tools a small trench about six inches deep and wide and about 18 inches long, and would take ~5 min each. Because installation would involve digging and placement along roads, seismometer sites would be cleared by 811 services and county road, bridge departments, and state Department of Transportation offices. Trillium seismometer installation would involve digging using hand tools postholes ~1 m deep for the seismometers and holes ~ 1 m x 1 m x 1 m for the battery case.

All of these passive units would record continuously throughout the offshore shooting of the main OBS/MCS profiles by the *Langseth*, the coastal Trillium sensors would be left in place for ~1 y, and all of the passive units would also record 14 planned land shots at 7 points along each

200-km profile, performed by the UTEP NSF National Seismic Source Facility. UTEP would obtain all licenses and permitting required for the land shot points. This work would involve drilling 20 cm diameter, 25 m deep holes. The drill rig would be a 30-tonne, tandem-axle truck ~10.5 m long, 2.6 m wide, and 4 m high, with a mast-up height of 12 m. The water truck that accompanies it would be a 20-tonne, tandem-axle truck. The size of these vehicles constrains them from operating in areas such as forests and wetlands. Land shots would be located in pre-disturbed areas with easy access, such as along the edges of agricultural fields and along logging roads; safe distances would be maintained from any structures such as houses, wells, or pipelines. One site may be coordinated to occur within Marine Corps Base Camp Lejeune. Location of shotpoints would be done in conjunction with 811 (call before you dig) services. Local county fire marshals and sheriffs would be informed of explosive use within their jurisdictions and any requirements followed. All sensitive environmental areas and ESA-listed species would be avoided (Attachment 1, § III and § IV[5]).

Each land shot would consist of detonating ~450 kg of emulsion explosives at the bottom of 20-cm diameter, 25-m deep holes sealed over the upper 15 m so little sound would be emitted to the atmosphere. Shot holes would be drilled with mud rotary drilling techniques using bentonite drilling mud to lift cuttings out of the hole and cool the drill bit. Bentonite is a naturally occurring clay. The drilling mud would be recirculated through a steel tank on the surface and disposed of in accordance with state regulations. The drilled holes would be charged with emulsion blasting agent: a mixture of ammonium, calcium, and sodium nitrates, and diesel fuel. It would be designed to be waterproof and would be packaged in cartridges to keep it from mixing with drilling mud or groundwater. Once charged, the hole would be plugged first with angular crushed gravel to contain the detonation, followed by drill cuttings and bentonite chips. Plugging of the hole would be done in accordance with state regulations. Drilling, charging, and stemming at each shot site would take approximately a half-day.

Once shots have been charged and seismographs deployed, shots would be detonated one at a time. This would be done by a licensed shooter who would ensure the shot site was clear of people and animals before shooting. The sound of the detonation would be comparable to distant thunder without the rolling coda. Ground vibration would only be felt within a few hundred meters of the shot. Accidental and unauthorized detonation of shots would be prevented by use of electronic detonators, which must receive a coded signal at the time of detonation. If material were ejected from shot holes after detonation, it would be plugged again in accordance with state regulations. The nominal charge size would be 450 kg of emulsion, which would detonate with the energy of ~35 L of diesel fuel. The benign byproducts of the explosion would be carbon dioxide, water, and nitrogen, so negligible impact to the environment would be expected. The closest approach to the ocean would be more than 2 km, so no impact to the ocean water column would be expected from vibrations on land.

Consultations

NSF has initiated consultations with the National Marine Fisheries Service and U.S. Fish and Wildlife Service under Section 7 of the Endangered Species Act, and the ship operator of the R/V *Langseth* is seeking an Incidental Harassment Authorization under the Marine Mammal Protection Act (MMPA) for the survey. NSF will also consult on Essential Fish Habitat pursuant to the Magnuson Stevens Act. The proposed activities are not related to oil and gas exploration,

development, production, or lease sales, and therefore are not subject to Bureau of Ocean Energy Management regulatory jurisdiction pursuant to the Outer Continental Shelf Lands Act.

Potential Effects to North Carolina Coastal Resources

During preparation of the Draft EA and in accordance with the Coastal Zone Management Act (CZMA) (16 USC §1451, *et seq.*), NSF considered whether the proposed activity would have any effect on coastal uses or resources of the state of North Carolina. Potential impacts of the seismic survey on the environment, if any, would be primarily a result of the operation of the airgun array. The increased underwater noise may result in avoidance behavior by marine mammals, sea turtles, seabirds, and fish, and other forms of disturbance. At most, effects on marine mammals may be interpreted as falling within the U.S. Marine Mammal Protection Act (MMPA) definition of "Level B Harassment" for those species managed by NMFS. No long-term or significant effects would be anticipated on individual marine mammals, sea turtles, seabirds, fish, the populations to which they belong, or their habitats as a result of this proposed action. Mitigation measures proposed in the Draft EA for the survey would reduce potential risks to marine species (Attachment 1, pages 7-15). The marine seismic survey, which would be conducted outside of state waters, would not preclude fisheries from operating within or around the survey area. A safe distance, however, would need to be kept between the R/V Langseth and other vessels to avoid entanglement with the towed seismic equipment, and a chase boat would also be employed to assist the Langseth by identifying, location, and/or removing obstacles as required (Attachment 1, page 69). LDEO would use vessel based radio broadcasts to issue Notice to Mariners to alert mariners, including fishermen and scuba divers, of survey activities. During the proposed seismic survey, only a small fraction of the survey area would be ensonified at any given time (Attachment 1, page 70). Disturbance to fish species would be short-term, and fish would return to their pre-disturbance behavior once the seismic activity ceased (Attachment 1, page 70). Given the proposed activities, including the short duration of the survey, temporary nature of potential impacts to marine species, and distance from the survey to the coastal zone, impacts on marine species within state waters are possible but would not be anticipated to be significant. Access to North Carolina beaches and fisheries in state waters would not be impeded by the marine- or land-based proposed activities. The proposed marine geophysical survey would not interfere with commercial or recreational fisheries activities.

No significant impacts on dive sites, including shipwrecks, would be anticipated. Airgun sounds would have no effects on solid structures, and the R/V *Endeavor* would avoid deploying OBSs on any wrecks along the survey track lines. The only potential effects could be temporary displacement of fish and invertebrates from the structures. (Attachment 1, page 70)

Significant impacts on, or conflicts with, divers or diving activities would be avoided through communication with the diving community before and during the survey and publication of a Notice to Mariners about operations in the area. In particular, dive operators with dives scheduled during the survey within 25 km of the track lines would be contacted directly. Only a small percentage of the recreational dive sites (wrecks in water depths <100 m) are within 25 km of the survey track lines. Further, although a space-use conflict could exist with divers at sites near the survey vessel, given the proposed survey time and short duration of time that the survey vessel would be in water depths <100m this would not be a significant conflict. (Attachment 1, page 70)

Effects of the terrestrial component of the project would be very limited because of the nature of the activities. Small, passive Reftek seismometers would be placed at or just under the soil surface along two 200-km SE-NW transects, primarily beside state roads. Trillium sensors deployed at coastal sites would be buried in three coastal communities, well above the high-tide line and not on the beach. No impact to the environment would be expected from this activity. The active source component would be limited to 14 small detonations along the 200-km transects in pre-disturbed areas with easy access, such as along the edges of agricultural fields and along logging roads, buried ~25 m deep and sealed over the upper 15 m. Because the holes would be sealed, negligible impact to the environment would be expected from the detonations. (Attachment 1, page 70)

No activities would occur in any protected lands, preserves, sanctuaries, or Critical Habitat for ESA-listed species. All required stated, county and local permits and licenses required for the activities would be obtained by the PIs. Many of the ESA-listed species that were identified using the USFWS's Information, Planning, and Conservation System (IPAC) in the general areas (20 km x 20 km) around the nominal drill sites would not be encountered because their habitat is not conducive to the methods required to do the work. For example, the large drill rig and water truck cannot operate in wetlands or forests; see further in Attachment 1, § II(2)(f). Some of the ESA-listed plant species could occur at potential drill sites (e.g., along road sides), and they would be avoided by inspection, identification, and locating the actual (vs. nominal) drill sites away from them. (Attachment 1, page 70)

Coastal Management Program Objectives and Policies

Projects within Areas of Environmental concern

It is not anticipated that land based activities would be located within any Area of Environmental Concern (AEC). The marine based activities would occur entirely outside of any AEC, as the survey would take place outside of state waters. The project is consistent with North Carolina's coastal program policies and objectives regarding AECs as outlined below.

Pursuant to 15A NCAC 07H .0205, management objectives have been established for conservation of coastal wetlands for the purpose of preserving and perpetuating their biological, social, economic and aesthetic values. To fulfill these objectives uses which are not water dependent are not allowed in coastal wetlands pursuant to 15A NCAC 07H .0208(a)(1). The proposed land and marine based activities would not take place in any wetlands (coastal or noncoastal) nor would the activities have any impacts on wetlands; therefore, the proposed activities are consistent with the management objectives of 15A NCAC 07H .0205.

Pursuant to 15A NCAC 07H .0206, management objectives have been established for conservation of estuarine waters for the purpose of preserving and perpetuating their biological, social, economic and aesthetic values. To fulfill these objectives uses which are not water dependent are not allowed in estuarine waters pursuant to 15A NCAC 07H .0208(a)(1). The proposed land- and marine- based activities are not located within estuarine waters and impacts to estuarine waters from the proposed land based activities would not be anticipated; therefore the proposed activities are consistent with the management objectives of 15A NCAC 07H .0206.

Pursuant to 15A NCAC 07H .0207, management objectives have been established for development of public trust areas for the purpose of protecting public rights for navigation and recreation, and management of public trust areas for the purpose of saving and perpetuating their biological, economic and aesthetic values. To fulfill these objectives uses which are not water dependent are not allowed in public trust areas pursuant to 15A NCAC 07H .0208(a)(1). The proposed land and marine based activities would be conducted outside of public trust areas. Therefore, the proposed activities are consistent with management objectives of 15A NCAC 07H .0207.

Pursuant to 15A NCAC 07H .0209, management objectives have been established to ensure that shoreline development is compatible with the dynamic nature of the shoreline, and North Carolina's objectives for conserving and managing the important natural features of the estuarine and ocean systems. Proposed land and marine based activities would not involve development of the shoreline. Land-based activities would take place ~1 km from the nearest shoreline, (Attachment 1, Figure 1) and due to the nature of the activities would avoid any Outstanding Resource Waters (Attachment 1, pages 5-7). Furthermore, based on analysis contained in the Draft EA (Attachment 1, § III and IV), alteration of coastal wetlands, degradation of submerged aquatic vegetation or shellfish beds, or irreversible damage to historic resources were not identified as potential impacts of the proposed activities. Therefore, the proposed activities are consistent with the management objectives of 15A NCAC 07H .0209.

Pursuant to 15A NCAC 07H .0303, management objectives have been established to ensure that development in ocean hazard areas is compatible with the goals of eliminating unreasonable danger to life while achieving a balance between the financial, safety, and social factors involved in development of these areas. Ocean hazard areas include ocean erodible areas, where there exists a substantial possibility of excessive erosion and significant shoreline fluctuation; high hazard flood areas; inlet hazard areas; and unvegetated beach areas. The proposed activities are not located within any ocean hazard areas as defined at 15A NCAC 07H .034 (Attachment 1, Figure 1); therefore, no further analysis is required regarding the proposed project's consistency with the objective of 15A NCAC 07H .0303.

Pursuant to 15A NCAC 07H .0403 the CRC objective in regulating development within critical water supply areas is the protection and preservation of public water supply well fields and A-II streams and to coordinate and establish a management system capable of maintaining public water supplies so as to perpetuate their values to the public health, safety, and welfare. The proposed marine-based activities would be located outside of state waters and not located near public water supplies. Due to the nature of the activities, the proposed land-based activities would be sited to avoid public water supplies or any water resource or wetland (Attachment 1, pages 5-6). Therefore the proposed activities are consistent with the management objectives of 15A NCAC 07H .0403.

Pursuant to 15A NCAC 07H .0505, management objectives have been established to both protect habitats necessary for survival of threatened and endangered plants and animals, and minimize land use impacts that might jeopardize these habitats. As described in the Draft EA, no activities would occur in any protected lands, preserves, sanctuaries, or Critical Habitat for ESA-listed

species (Attachment 1, § III). Some federally listed endangered and threatened species, or species currently proposed for listing under the Endangered Species Act of 1973, as amended, may be located in or near the proposed land-based research activity (Attachment 1, pages 45-53). Mitigation measures would be employed to avoid impacts to endangered and threatened species (Attachment 1, pages 70-72). Researchers would inspect sites in advance of activities and relocated activities to avoid any impacts to endangered and threatened species. Section 7 consultation with the US Fish and Wildlife Service (USFWS) has been initiated. Given that land-based activities would take place on previously disturbed lands (such as road sides), and mitigation measures would be implemented, the proposed activities would not be expected to have an adverse impact on protected habitats, animals, or plants. For these reasons, the proposed activities are consistent with the management objectives of 15A NCAC 07H .0505.

Pursuant to 15A NCAC 07H .0506, management objectives have been established to protect the features of designated coastal complex natural areas for the purpose of safeguarding these areas' biological relationships, and educational, scientific and aesthetic values. The Coastal Resources Commission has not specifically identified any coastal complex natural areas. As described in the Draft EA, no activities would occur in any protected lands, preserves, sanctuaries, or Critical Habitat for ESA-listed species (Attachment 1, § III). Some federally listed endangered and threatened species, or species currently proposed for listing under the Endangered Species Act of 1973, as amended, may be located in or near the proposed land based research activity (Attachment 1, pages 45-53). Mitigation measures would be employed to avoid impacts to endangered and threatened species (Attachment 1, pages 70-72). Researchers would inspect sites in advance of activities and relocate activities to avoid any impacts to endangered and threatened species or critical habitat. Section 7 consultation with the USFWS has been initiated. Given that land-based activities would take place on previously disturbed lands (such as road sides), and mitigation measures would be implemented, the proposed activities would not be expected to have an adverse impact on protected habitats, animals, or plants. Marine-based activities would occur outside of state waters, outside any AEC. For these reasons, the proposed activities are consistent with the management objectives of 15A NCAC 07H .0506.

Pursuant to 15A NCAC 07H .0507, management objectives have been established to protect unique coastal geologic formations for the purpose of preserving the formation's physical components that serve as important scientific and educational sites, or as valuable scenic resources. Presently, the only designated unique coastal geologic formation is Jockey's Ridge (15A NCAC 07H .0507[c][3]). Jockey's Ridge is located within the Town of Nags Head. The proposed activities would avoid Jockey's Ridge; therefore, the proposed activities would have no effect to this unique coastal geologic formation and it is consistent with the management objectives of 15A NCAC 07H .0507.

Pursuant to 15A NCAC 07H .0509, management objectives have been established to conserve significant coastal archeological resources for the purpose of preserving their value as scientific, educational, and aesthetic resources. Land-based activities would take place on pre-disturbed lands (Attachment 1, pages 5-6). Passive seismometers would be placed along roadsides, within ~20 feet of the roads. Three seismometers would be located at a 3 separate coastal community sites. Land shots would be conducted at 14 sites, 11 of which would occur in NC. The NC State Historic Preservation Office (SHPO) HPOWEB GIS service was used to evaluate whether there

would be any historic resources within the area of the proposed NC land shot sites (Attachment 2). No historic resources were identified within ~.5 km of the land shot sites. Permuda Island has been designated as a significant coastal archaeological resource area of environmental concern. The proposed land-based activities would not take place on Permuda Island and would remain approximately 30 km away. Ship wrecks within 25 km of the marine-based activities in water depths less than 100 m have been identified in Attachment 1, figure 6. Marine-based activities would be conducted outside of state waters; deployment of OBSs outside of state waters would be conducted to avoid shipwrecks. The coordinates of any shipwrecks on survey track lines in water depths >100 m would be given to the crew conducting OBS deployment (Attachment 1, page 45). Shipwrecks within state waters would not be affected by marine-based activities (Attachment 1, page 70). Based on the review of historical resources, it appears that no historic resources would be near or affected by the proposed activities; therefore, the proposed activities are consistent with the management objectives of 15A NCAC 07H .0509.

Pursuant to 15A NCAC 07H .0510, management objectives have been established to conserve significant coastal historic architectural resources for the purpose of preserving their value as scientific, educational, and aesthetic resources. Land-based activities would avoid any structures or buildings (Attachment 1, page 6). Land shots would be conducted at 14 sites, 11 of which would occur in NC. The NC State Historic Preservation Office (SHPO) HPOWEB GIS service was used to evaluate whether there would be any historic resources within the area of the proposed NC land shot sites (Attachment 2). No historic resources were identified within ~.5 km of the land shot sites. No historic resources were identified near proposed land-based activities or would be affected by the proposed activities; therefore, the proposed activities are consistent with the management objectives of 15A NCAC 07H .0510.

Pursuant to 15A NCAC 07H .0600, management objectives have been established for all AECs for the purpose of preventing pollution of shellfish waters, maintaining aircraft safety, and preventing noise pollution resulting from airspace activity. The proposed activities would not affect any of these resources within AECs; therefore, the proposed activities are consistent with the management objectives of 15A NCAC 07H .0600.

Projects outside of Areas of Environmental concern

The proposed activities would occur outside of AECs. The proposed activities that would occur outside of AECs are consistent with the North Carolina coastal program policies as outlined below.

Pursuant to 15A NCAC 07M .0301, it is the policy of NC to foster, improve, enhance, and ensure optimum access to the public beaches and waters of the 20 coastal counties concurrent with needs of private property owners and protection of important coastal natural resources. Land based activities would not inhibit access to public beaches or waters. Because the proposed marine geophysical survey is ~6-430 km (4-270 mi) from the coast and is outside of state waters, the project activities would have no impact on access to public beaches and waters of the 20 coastal counties. Therefore, the proposed activities are consistent with the public access policy outlined at 15 NCAC 07M .030.

Pursuant to 15A NCAC 07M .0401, it is the policy of NC that development of energy resources and facilities shall avoid significant adverse impacts upon vital coastal resources or uses, and public trust or access areas. To foster compliance with this policy, Impact Assessments are required for Major Energy Facilities as defined at 15A NCAC 07M .0402(b). The proposed activities do not meet the definition of a Major Energy Facility. Furthermore, the proposed activities are not related to exploration or development of outer continental shelf resources and other relevant energy facilities. Therefore, no further action is required regarding the consistency of the proposed activities with the energy policy outlined at 15 NCAC 07M .0401.

Pursuant to 15A NCAC 07M .0501, it is the policy of NC that all state agencies coordinate activities in coastal areas for the purpose of reducing the damage from coastal disasters. In accordance with this policy, local governments must include disaster planning activities in their land use plans, temporary emergency housing must be located outside of hazardous areas, and building repair and reconstruction activities must comply with the standards of the Guidelines for Areas of Environmental Concern, North Carolina Building Code (including wind resistant standards), the National Flood Insurance Program, and local reconstruction plans. The proposed research activities would not involve construction or installation of permanent structures and would be of short duration, not requiring disaster planning efforts. Therefore, the proposed activities are consistent with the guidelines and policies of 15A NCAC 07M .0501.

Pursuant to 15A NCAC 07M .0601, it is the policy of NC that floating structures used for residential or commercial purposes not infringe upon public trust rights nor discharge into public trust waters. The proposed activities do not involve construction or use of a floating structure or discharge into public trust waters; therefore, no further action is required regarding the consistency of the proposed activities with the floating structure policy outlined at 15A NCAC 07M .0601.

Pursuant to 15A NCAC 07M .0701, it is the policy of NC that adverse impacts to coastal lands and waters will be mitigated through proper planning, site selection, compliance with development standards, and creation or restoration of coastal resources. For a project requiring mitigation to be approved, pursuant to 15A NCAC 07M .0703 the following conditions must be met: there must be no reasonable and prudent alternatives to the project design or site; the entire project must be dependent upon close proximity to public trust waters and coastal wetlands; the public benefits must clearly outweigh the long range adverse effects to the environment; and all reasonable means and measures to lessen the impacts of the project are incorporated into the project design. The proposed activities are intended specifically to investigate geologic features of the ENAM located off of the coast of North Carolina. Some of the ESA-listed plant species could occur at potential drill sites (e.g., along road sides), and they would be avoided by inspection, identification, and locating the actual (vs. nominal) drill sites away from them (Attachment 1, page 6). The proposed marine geophysical survey may have minor, temporary effects on marine species, such as marine mammals in the waters surrounding the survey, and potentially within state waters. Potential impacts from the proposed marine geophysical survey on the marine environment are described in detail in the Draft EA (Attachment 1, pages 53-75). The proposed marine geophysical survey includes a monitoring and mitigation plan that would reduce any potential impacts on the marine environment, such as on marine mammals, to a level of insignificance (Attachment 1, pages 7-15). Therefore, the proposed activities are consistent with

the mitigation guidelines and policies outlined at 15 NCAC 07M .0701 and no further action is required.

Pursuant to 15A NCAC 07M .0801, it is the policy of NC that no land or water use shall cause the degradation of water quality so as to impair traditional uses of coastal water such as fishing, swimming, hunting, boating, and commerce. All of the waters of the state within the coastal area have a potential for uses which require optimal water quality. Therefore, at every possible opportunity, existing development adjacent to these waters shall be upgraded to reduce discharge of pollutants. Basinwide management to control sources of pollution both within and outside of the coastal area which will impact waters flowing into the rivers and sounds of the coastal area is necessary to preserve the quality of coastal waters. The adoption of methods to control development so as to eliminate harmful runoff which may impact the sounds and rivers of the coastal area and the adoption of best management practices to control runoff from undeveloped lands is necessary to prevent the deterioration of coastal waters. Land-based activities would avoid areas with wetlands or water (Attachment 1, page 6) and would not be anticipated to affect water quality. The proposed marine geophysical survey would occur outside of state waters and would follow all international and federal regulatory requirements for vessel discharges. The proposed marine geophysical survey would not be anticipated to effect water quality (NSF/USGS PEIS, page 3-1). The proposed activities would not degrade water quality and are therefore consistent with 15A NCAC 07M .0801.

Pursuant to 15A NCAC 07M .0901, it is the policy of North Carolina that use of aircraft for the purpose of managing and protecting coastal resources, detecting violations of environmental rules and laws, and performing public health, safety and welfare services is of vital public interest. To insure access to airspace, pursuant to 15A NCAC 07M .0902, access corridors free of special use airspace designations shall be preserved along the length of the barrier island and laterally at intervals not to exceed 25 miles for the purpose of providing unobstructed access to the coastline, and development of aviation-related projects shall to the maximum extent practicable facilitate use of aircraft by local, state, and federal government agencies. The proposed activities are not aviation related, nor would they impact aircraft access corridors; therefore, the proposed activities are consistent with the aircraft usage policy outlined at 15 NCAC 07M .0901.

Pursuant to 15A NCAC 07M .1001 the use of water and wetland-based target areas for military training purposes may result in adverse impacts on coastal resources and on the exercise of public trust rights. The public interest requires that, to the maximum extent practicable, use of such targets not infringe on public trust rights, cause damage to public trust resources, violate existing water quality standards or result in public safety hazards. The proposed activities are not related to military activities; therefore, no further action is required regarding the consistency of the proposed activities with the policies on water and wetland-based target areas for military training activities outlined at 15A NCAC 07M .1001.

Pursuant to 15A NCAC 07M .1101, it is the policy of the State of North Carolina that material resulting from the excavation or maintenance of navigation channels be used in a beneficial way wherever practicable. The proposed activities would not involve the excavation or maintenance of navigation channels; therefore, no further action is required regarding the consistency of the

proposed activities with the policies on beneficial use and availability of materials resulting from the excavation or maintenance of navigational channels outlined at 15A NCAC 07M .1101.

Pursuant to 15A NCAC 07M .1201, mining activities impacting the federal jurisdiction ocean and its resources can, and probably would, also impact the state jurisdictional ocean and estuarine systems and vice-versa. Therefore, it is state policy that every avenue and opportunity to protect the physical ocean environment and its resources as an integrated and interrelated system will be utilized. The usefulness, productivity, scenic, historic and cultural values of the state's ocean waters will receive the greatest practical degree of protection and restoration. No ocean mining shall be conducted unless plans for such mining include reasonable provisions for protection of the physical environment, its resources, and appropriate reclamation or mitigation of the affected area as set forth and implemented under authority of the Mining Act (G.S. 74-48) and Coastal Area Management Act (G.S. 113A-100). Mining activities in state waters, or in federal waters insofar as the activities affect any land, water use or natural or historic resource of the state waters, shall be done in a manner that provides for protection of those resources and uses. The siting and timing of such activities shall be consistent with established state standards and regulations and shall comply with applicable local land use plan policies, and AEC use standards. The proposed activities are a collaborative research effort which includes a marine geophysical survey. These activities, however, are not related to ocean mining. The proposed activities do not involve ocean mining; therefore, no further action is required regarding the consistency of the proposed project with the ocean mining policies outlined at 15A NCAC 07M .1201.

North Carolina Dredge and Fill Law (NCGS 113-229)

The proposed project would not result in any excavation or filling within any estuarine waters, tidelands, or State-owned lakes; therefore, no further action is required regarding compliance with NCGS 113-229.

Required State and Local Permits

All necessary state, county, and local permits for land-based activities would be obtained by the PIs for the proposed activities.

Conclusion

The proposed activities are situated outside of AECs. Proposed activities would not have any significant impacts to coastal resources. Therefore, the proposed activities are consistent, to the maximum extent practicable with the enforceable policies of North Carolina's federally approved coastal management program.

Pursuant to CFR 930.41, the North Carolina Coastal Management Program has 60 days from the receipt of this letter in which to concur with or object to this Consistency Determination, or to request an extension under 15 CFR Section 930.41(b). NSF would be appreciative however if the North Carolina Coastal Management Program could inform us of their perspective on the consistency determination at the earliest possible convenience within this time period. The State's concurrence will be presumed if the States response is not received by NSF on the 60th day from receipt of this Determination.

The States's response should be sent via email to:

Holly Smith
National Science Foundation
Division of Ocean Sciences
4201 Wilson Blvd.
Room 725
Arlington, VA 22230
Email: hesmith@nsf.gov

Attachment 1: Draft Environmental Assessment for a Marine Geophysical Survey by the R/V *Marcus G. Langseth* in the Atlantic Ocean off Cape Hatteras

Attachment 2: Active Land Shot Sites - Historic Resources

Draft Environmental Assessment of a Marine Geophysical Survey by the R/V *Marcus G. Langseth* in the Atlantic Ocean off Cape Hatteras, September–October 2014

Prepared for

Lamont-Doherty Earth Observatory
61 Route 9W, P.O. Box 1000
Palisades, NY 10964-8000

and

National Science Foundation
Division of Ocean Sciences
4201 Wilson Blvd., Suite 725
Arlington, VA 22230

by

LGL Ltd., environmental research associates
22 Fisher St., POB 280
King City, Ont. L7B 1A6

13 February 2014
Revised 2 May 2014

LGL Report TA8350-1

TABLE OF CONTENTS

ABSTRACT

Lamont-Doherty Earth Observatory (L-DEO), with funding from the U.S. National Science Foundation (NSF), proposes to conduct a high-energy, 3-D seismic survey from the R/V *Langseth* in the Atlantic Ocean ~6–430 km from the coast of Cape Hatteras in September–October 2014. The proposed seismic survey would use a towed array of 36 airguns with a total discharge volume of ~6600 in^3 or 18 airguns with a total discharge volume of ~3300 in^3. The seismic survey would take place outside of U.S. state waters, mostly within the U.S. Exclusive Economic Zone (EEZ) and partly in International Waters, in water depths 30–4300 m.

NSF, as the funding and action agency, has a mission to "promote the progress of science; to advance the national health, prosperity, and welfare; to secure the national defense…". The proposed seismic survey would collect data in support of a research proposal that has been reviewed under the NSF merit review process and identified as an NSF program priority. It would provide data necessary to study how the continental crust stretched and separated during the opening of the Atlantic Ocean, and what the role of magmatism was during continental breakup.

This Draft Environmental Assessment (EA) addresses NSF's requirements under the National Environmental Policy Act (NEPA) and Executive Order 12114, "Environmental Effects Abroad of Major Federal Actions", for the proposed NSF federal action. L-DEO is requesting an Incidental Harassment Authorization (IHA) from the U.S. National Marine Fisheries Service (NMFS) to authorize the incidental, i.e., not intentional, harassment of small numbers of marine mammals should this occur during the seismic survey. The analysis in this document also supports the IHA application process and provides information on marine species that are not addressed by the IHA application, including seabirds and sea turtles that are listed under the U.S. Endangered Species Act (ESA), including candidate species. As analysis on endangered/threatened species was included, this document will also be used to support ESA Section 7 consultations with NMFS and U.S. Fish and Wildlife Service (USFWS). Alternatives addressed in this Draft EA consist of a corresponding program at a different time with issuance of an associated IHA and the no action alternative, with no IHA and no seismic survey. This document tiers to the Programmatic Environmental Impact Statement/Overseas Environmental Impact Statement for Marine Seismic Research Funded by the National Science Foundation or Conducted by the U.S. Geological Survey (June 2011) and Record of Decision (June 2012), referred to herein as PEIS.

Numerous species of marine mammals inhabit the northwest Atlantic Ocean. Several of these species are listed as ***endangered*** under the U.S. Endangered Species Act (ESA): the sperm, North Atlantic right, humpback, sei, fin, and blue whales. Other marine ESA-listed species that could occur in the area are the ***endangered*** leatherback, hawksbill, green, and Kemp's ridley turtles, roseate tern, and Bermuda petrel, and the ***threatened*** loggerhead turtle and piping plover. The ***endangered*** Atlantic sturgeon and shortnose sturgeon could also occur in or near the study area. ESA-listed ***candidate species*** that could occur in the area are the Nassau grouper, dusky shark, and great hammerhead shark. Terrestrial ESA-listed species that could occur around the land drill sites are the red-cockaded woodpecker, the wood stork, Saint Francis' satyr butterfly, seabeach amaranth, golden sedge, pondberry, rough-leaved loosestrife, harperella, Michaux's sumac, American chaffseed, and Cooley's meadowrue. The northern long-eared bat, proposed for listing, could also occur.

Potential impacts of the seismic survey on the environment would be primarily a result of the operation of the airgun array. A multibeam echosounder, sub-bottom profiler, and acoustic Doppler current profiler would also be operated. Impacts would be associated with increased underwater noise,

which could result in avoidance behavior by marine mammals, sea turtles, seabirds, and fish, and other forms of disturbance. An integral part of the planned survey is a monitoring and mitigation program designed to minimize potential impacts of the proposed activities on marine animals present during the proposed research, and to document as much as possible the nature and extent of any effects. Injurious impacts to marine mammals, sea turtles, and seabirds have not been proven to occur near airgun arrays, and are not likely to be caused by the other types of sound sources to be used. However, a precautionary approach would still be taken and the planned monitoring and mitigation measures would reduce the possibility of any effects.

Protection measures designed to mitigate the potential environmental impacts to marine mammals and sea turtles would include the following: ramp ups; typically two, but a minimum of one dedicated observer maintaining a visual watch during all daytime airgun operations; two observers 30 min before and during ramp ups during the day and at night; no start ups during poor visibility or at night unless at least one airgun has been operating; passive acoustic monitoring (PAM) via towed hydrophones during both day and night to complement visual monitoring (unless the system and back-up systems are damaged during operations); and power downs (or if necessary shut downs) when marine mammals or sea turtles are detected in or about to enter designated exclusion zones. L-DEO and its contractors are committed to applying these measures in order to minimize effects on marine mammals and sea turtles and other environmental impacts.

With the planned monitoring and mitigation measures, unavoidable impacts to each species of marine mammal and sea turtle that could be encountered would be expected to be limited to short-term, localized changes in behavior and distribution near the seismic vessel. At most, effects on marine mammals may be interpreted as falling within the U.S. Marine Mammal Protection Act (MMPA) definition of "Level B Harassment" for those species managed by NMFS. No long-term or significant effects would be expected on individual marine mammals, sea turtles, seabirds, fish, the populations to which they belong, or their habitats.

An associated land-based program would consist of passive and active components under permitting authorized by state and local agencies. Small, passive seismometers would be placed primarily alongside state roads in two 200-km SE-NW transects at or just under the soil surface, and at three coastal locations. No impact to the environment would be expected from this activity. The active source component would be limited to 14 small detonations along the transects, buried ~25 m deep and sealed over the upper 15 m. This component would be carried out by the University of Texas-El Paso (UTEP), which would obtain all permits and licenses required for these activities. No activities would occur in any protected lands, preserves, or sanctuaries, and because the holes would be sealed, negligible impact to the environment would be expected from the detonations. ESA-listed species would be avoided, thus no impacts would be anticipated. The closest approach to the ocean would be more than 2 km, so no impact to water column would be expected from vibrations on land.

LIST OF ACRONYMS

~	approximately
ADCP	Acoustic Doppler current profiler
AMVER	Automated Mutual-Assistance Vessel Rescue
BOEM	Bureau of Ocean Energy Management
CETAP	Cetacean and Turtle Assessment Program
CITES	Convention on International Trade in Endangered Species
dB	decibel
DoN	Department of the Navy
EA	Environmental Assessment
EEZ	Exclusive Economic Zone
EFH	Essential Fish Habitat
EIS	Environmental Impact Statement
ENAM	East North American Margin
EO	Executive Order
ESA	(U.S.) Endangered Species Act
EZ	Exclusion Zone
FAO	Food and Agriculture Organization of the United Nations
FM	Frequency Modulated
GIS	Geographic Information System
h	hour
HAPC	Habitat Areas of Particular Concern
hp	horsepower
HRTRP	Harbor Porpoise Take Reduction Plan
Hz	Hertz
IHA	Incidental Harassment Authorization (under MMPA)
in	inch
IOC	Intergovernmental Oceanographic Commission of UNESCO
IODP	Integrated Ocean Drilling Program
IUCN	International Union for the Conservation of Nature
kHz	kilohertz
km	kilometer
kt	knot
L-DEO	Lamont-Doherty Earth Observatory
LFA	Low-frequency Active (sonar)
m	meter
MAFMC	Mid-Atlantic Fishery Management Council
MBES	Multibeam Echosounder
MFA	Mid-frequency Active (sonar)
min	minute
MMPA	(U.S.) Marine Mammal Protection Act
ms	millisecond
n.mi.	nautical mile
NEPA	(U.S.) National Environmental Policy Act
NJ	New Jersey

NEFSC	Northeast Fisheries Science Center
NMFS	(U.S.) National Marine Fisheries Service
NRC	(U.S.) National Research Council
NSF	National Science Foundation
OAWRS	Ocean Acoustic Waveguide Remote Sensing
OBIS	Ocean Biogeographic Information System
OCS	Outer Continental Shelf
OEIS	Overseas Environmental Impact Statement
p or pk	peak
PEIS	Programmatic Environmental Impact Statement
PI	Principal Investigator
PTS	Permanent Threshold Shift
PSO	Protected Species Observer
PSVO	Protected Species Visual Observer
RL	Received level
rms	root-mean-square
R/V	research vessel
s	second
SAFMC	South Atlantic Fishery Management
SAR	U.S. Marine Mammal Stock Assessment Report
SBP	Sub-bottom Profiler
SEFSC	Southeast Fisheries Science Center
SEL	Sound Exposure Level (a measure of acoustic energy)
SPL	Sound Pressure Level
TTS	Temporary Threshold Shift
UNEP	United Nations Environment Programme
U.S.	United States of America
USCG	U.S. Coast Guard
USGS	U.S. Geological Survey
USFWS	U.S. Fish and Wildlife Service
USN	U.S. Navy
μPa	microPascal
vs.	versus
WCMC	World Conservation Monitoring Centre

I. PURPOSE AND NEED

The purpose of this Draft Environmental Assessment (EA) is to provide the information needed to assess the potential environmental impacts of a collaborative research project entitled, "A community seismic experiment targeting the pre-, syn-, and post-rift evolution of the Mid Atlantic US margin", which includes both marine and land-based geophysical survey components. The Draft EA was prepared under the National Environmental Policy Act (NEPA) and Executive Order 12114, "Environmental Effects Abroad of Major Federal Actions" (EO 12114). This Draft EA tiers to the Final Programmatic Environmental Impact Statement (EIS)/Overseas Environmental Impact Statement (OEIS) for Marine Seismic Research funded by the National Science Foundation or Conducted by the U.S. Geological Survey (NSF and USGS 2011) and Record of Decision (NSF 2012), referred to herein as the PEIS. The Draft EA provides details of the proposed action at the site-specific level and addresses potential impacts of the proposed seismic surveys on marine mammals, as well as other species of concern in the area, including sea turtles, seabirds, fish, and invertebrates. The Draft and Final EAs will also be used in support of an application for an Incidental Harassment Authorization (IHA) from the National Marine Fisheries Service (NMFS), and Section 7 consultations under the Endangered Species Act (ESA). The requested IHA would, if issued, allow the non-intentional, non-injurious "take by harassment" of small numbers of marine mammals during the proposed seismic survey by L-DEO in the Atlantic Ocean off Cape Hatteras during September–October 2014.

To be eligible for an IHA under the U.S. Marine Mammal Protection Act (MMPA), the proposed "taking" (with mitigation measures in place) must not cause serious physical injury or death of marine mammals, must have negligible impacts on the species and stocks, must "take" no more than small numbers of those species or stocks, and must not have an unmitigable adverse impact on the availability of the species or stocks for legitimate subsistence uses.

Mission of NSF

The National Science Foundation (NSF) was established by Congress with the National Science Foundation Act of 1950 (Public Law 810507, as amended) and is the only federal agency dedicated to the support of fundamental research and education in all scientific and engineering disciplines. Further details on the mission of NSF are described in § 1.2 of the PEIS.

Purpose of and Need for the Proposed Action

As noted in the PEIS, § 1.3, NSF has a continuing need to fund seismic surveys that enable scientists to collect data essential to understanding the complex Earth processes beneath the ocean floor. The purpose of the proposed action is to collect data along the mid-Atlantic coast of East North American Margin (ENAM). The study area covers a portion of the rifted margin of the eastern U.S., from unextended continental lithosphere onshore to mature oceanic lithosphere offshore. The data set would therefore allow scientists to investigate how the continental crust stretched and separated during the opening of the Atlantic Ocean, and what the role of magmatism was during continental breakup. The study also covers several features representing the post-rift modification of the margin by slope instability and fluid flow. The proposed activities would continue to meet NSF's critical need to foster a better understanding of Earth processes.

Background of NSF-funded Marine Seismic Research

The background of NSF-funded marine seismic research is described in § 1.5 of the PEIS.

Regulatory Setting

The regulatory setting of this Draft EA is described in § 1.8 of the PEIS, including the

- National Environmental Protection Act (NEPA);
- Marine Mammal Protection Act (MMPA); and
- Endangered Species Act (ESA).

II. ALTERNATIVES INCLUDING PROPOSED ACTION

In this Draft EA, three alternatives are evaluated: (1) the proposed seismic survey and issuance of an associated IHA, (2) a corresponding seismic survey at an alternative time, along with issuance of an associated IHA, and (3) no action alternative. Additionally, two alternatives were considered but were eliminated from further analysis. A summary table of the proposed action, alternatives, and alternatives eliminated from further analysis is provided at the end of this section.

Proposed Action

The project objectives and context, activities, and mitigation measures for L-DEO's planned seismic survey are described in the following subsections.

(1) Project Objectives and Context

L-DEO proposes to conduct a 3-D seismic survey using the R/V *Marcus G. Langseth* (*Langseth*) along the mid-Atlantic coast (Fig. 1). As noted previously, the goal of the proposed research is to collect and analyze data along the mid-Atlantic coast of the East North American Margin (ENAM). The study area covers a portion of the rifted margin of the eastern U.S., from unextended continental lithosphere onshore to mature oceanic lithosphere offshore. The data set would therefore allow scientists to investigate how the continental crust stretched and separated during the opening of the Atlantic Ocean, and what the role of magmatism was during continental breakup. The study also covers several features representing the post-rift modification of the margin by slope instability and fluid flow. To achieve the project's goals, the Principal Investigators (PIs), Drs. H. Van Avendonk and G. Christeson (University of Texas at Austin), D. Shillington and A. Bécel (L-DEO), B. Magnani and M. Hornbach (Southern Methodist University), B. Dugan (Rice University), and S. Harder (University of Texas at El Paso), propose to use a 2-D marine seismic reflection and refraction survey to map sequences off Cape Hatteras and land seismometers along two 200-km SE–NW trending transects from the coast into North Carolina and southern Virginia. Arrays of small, passive seismometers placed along land-based extensions of two of the marine transects as well as limited active source work on land would allow for obtaining critical information on continental crust extension.

Additional objectives that would be met from conducting the proposed research include gaining insight in slope stability and the occurrence of past landslides. Slope stability is important for estimating the risk of future landslides. Landslides can result in tsunamis; such as the tsunami that occurred offshore eastern Canada in the early 20th century, and resulted in the loss of lives. The risk for landslides off the eastern U.S. is not known.

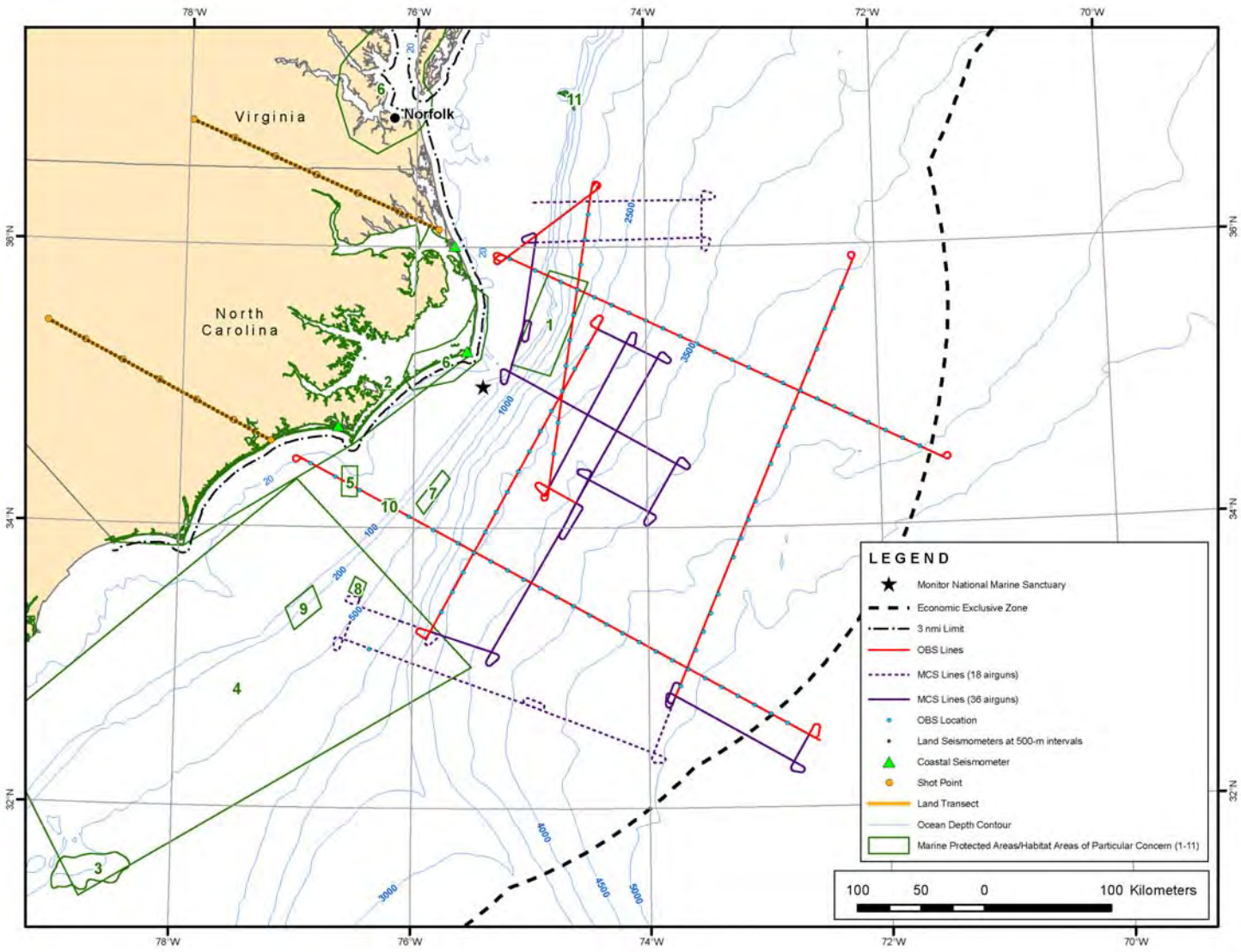


Figure 1. Location of the proposed seismic survey at the proposed survey site in the Atlantic Ocean off Cape Hatteras during September–October 2014. Also shown are a National Marine Sanctuary, one marine protected area, and 10 habitat areas of particular concern (see text).

(2) Proposed Activities

(a) Location of the Activities

The proposed survey area is located between ~32–37°N and ~71.5–77°W in the Atlantic Ocean ~6–430 km off the coast of Cape Hatteras (Fig. 1). The two land-based transects are between ~34.5–37°N and ~76–79.5°W (Fig. 1). Water depths in the survey area are 30–4300 m. The seismic survey would be conducted outside of state waters and mostly within the U.S. EEZ, and partly in International Waters, and is scheduled to occur for ~38 days during 15 September–22 October 2014. Some minor deviation from these dates is possible, depending on logistics and weather. Proposed activities, however, would avoid the North Atlantic right whale migration period.

(b) Description of the Activities

The procedures to be used for the marine geophysical survey would be similar to those used during previous surveys by L-DEO and would use conventional seismic methodology. The survey would involve one source vessel, the *Langseth*, which is owned by NSF and operated on its behalf by Columbia University's L-DEO. The *Langseth* would deploy an array of 36 airguns as an energy source with a total volume of ~6600 in^3 or an array of 18 airguns with a total discharge volume of ~3300 in^3. The receiving system would consist of an 8-km hydrophone streamer or 94 ocean bottom seismometers (OBSs). The OBSs would be deployed and retrieved by a second vessel, the R/V *Endeavor*. As the airgun array is towed along the survey lines, the hydrophone streamer would receive the returning acoustic signals and transfer the data to the on-board processing system. The OBSs record the returning acoustic signals internally for later analysis.

A total of ~5000 km of 2-D survey lines, including turns (~3650 km MCS and ~1350 km OBS lines) are oriented perpendicular to and parallel to shore (Fig. 1). The OBS lines would be shot a second time with the streamer, for a total of ~6350 km. There would be additional seismic operations in the survey area associated with turns, airgun testing, and repeat coverage of any areas where initial data quality is sub-standard. In our calculations [see § IV(3)], 25% has been added for those additional operations.

In addition to the operations of the airgun array, a multibeam echosounder (MBES), a sub-bottom profiler (SBP), and an acoustic Doppler current profiler (ADCP) would also be operated from the *Langseth* continuously throughout the survey. All planned geophysical data acquisition activities would be conducted by L-DEO with on-board assistance by the scientists who have proposed the study. The vessel would be self-contained, and the crew would live aboard the vessel with some personnel transfer on/off the *Langseth* by a small vessel.

(c) Schedule

The *Langseth* would depart from Norfolk, Virginia, on 15 September and spend one day in transit to the proposed survey area. Setup, deployment, and streamer ballasting would take ~3 days. The seismic survey would take ~33 days, and the *Langseth* would spend one day for gear retrieval and transit back to Norfolk, arriving on 22 October.

(d) Vessel Specifications

The *Langseth* is described in § 2.2.2.1 of the PEIS. The vessel speed during seismic operations would be ~4.5 kt (~8.3 km/h).

The R/V *Endeavor* has a length of 56.4 m, a beam of 10.1 m, and a maximum draft of 5.6 m. The *Endeavor* has been operated by the University of Rhode Island's Graduate School of Oceanography for over thirty years to conduct oceanographic research throughout U.S. and world marine waters. The ship is powered by one GM/EMD diesel engine, producing 3050 hp, which drives the single propeller directly at a maximum of 900 revolutions per minute (rpm). The vessel also has a 320-hp bowthruster. The *Endeavor* can cruise at 18.5 km/h and has a range of 14,816 km.

Other details of the *Endeavor* include the following:

Owner:	National Science Foundation
Operator:	University of Rhode Island
Flag:	United States of America
Date Built:	1976 (Refit in 1993)
Gross Tonnage:	298
Accommodation Capacity:	30 including ~17 scientists

The chase vessel would be a multi-purpose offshore utility vessel similar to the *Northstar Commander*, which is 28 m long with a beam of 8 m and a draft of 2.6 m. It is powered by a twin-screw Volvo D125-E, with 450 hp for each screw.

(e) Airgun Description

During the survey, two energy source configurations would be used: the *Langseth* full array consisting of four strings with 36 airguns (plus 4 spares) and a total volume of ~6600 in^3, or a two-string array consisting of 18 airguns and a total volume of 3300 in^3. The airgun arrays are described in § 2.2.3.1 of the PEIS, and the airgun configurations are illustrated in Figures 2-11 to 2-13 of the PEIS. The 4-string array would be towed at a depth of 9 m for the OBS and MCS lines of the survey, and the 2-string array would be towed at a depth of 6 m. Shot intervals would be 65 s (~150 m) during OBS seismic, and ~22 s (50 m) during MCS seismic.

(f) OBS and Land-based Operations Description and Deployment

For the study, 47 OBSs would be deployed by the *Endeavor* before the first half of the OBS survey then retrieved, redeployed for the second half of the OBS survey, and retrieved thereafter. The OBSs that would be used during the cruise are Woods Hole Oceanographic Institute (WHOI) or Scripps Institution of Oceanography (SIO) OBSs. The WHOI OBSs have a height of ~1 m and a maximum diameter of 50 cm. The anchor is made of hot-rolled steel and weighs 23 kg. The anchor dimensions are 2.5 × 30.5 × 38.1 cm. The SIO OBSs have a height of ~0.9 m and a maximum diameter of 97 cm. The anchors are 36-kg iron grates with dimensions 7 × 91 × 91.5 cm.

Once an OBH/S is ready to be retrieved, an acoustic release transponder interrogates the instrument at a frequency of 9–11 kHz, and a response is received at a frequency of 10–12 kHz. The burn-wire release assembly is then activated, and the instrument is released from the anchor to float to the surface.

On land, wide-angle reflection and refraction seismic data would be acquired along two 200 km-long dip profiles trending SE–NW and by the passive EarthScope Transportable Array, providing detailed regional-scale data. EarthScope, an NSF-funded earth science program to explore the 4-D structure of the entire North American continent, has been moving thousands of passive seismometers across North America over a period of years. The ENAM land deployment of seismometers would consist of three components: 1) 400 "Reftek 125" seismometers (~12 cm × 6 cm diameter) deployed at the surface along each profile at 500-m intervals along roadsides, 2) 80 "Reftek 130" seismometers (~30 cm × 6 cm

diameter) deployed on both profiles at 5-km intervals, buried about 45 cm deep along roadsides in small boxes, and 3) 3 Trillium Compact Post-hole sensors (~17.5 cm x 9.5 cm diameter), a solar panel, and a case (~89 cm x 53 cm x 43 cm) containing two marine-cell deep-cycle 12-volt batteries, a charge controller connected to the solar panel, and a Reftek RT130 data logger deployed at 3 separate coastal community sites. Reftek seismometer installation would involve digging with hand tools a small trench about six inches deep and wide and about 18 inches long and would take ~5 min each. Because installation would involve digging and placement along roads, seismometer sites would be cleared by 811 services and county road, bridge departments, and state Department of Transportation offices. Trillium seismometer installation would involve digging using hand tools postholes ~1 m deep for the seismometers and holes ~ 1 m x 1 m x 1 m for the battery case.

All of these passive units would record continuously throughout the offshore shooting of the main OBS/MCS profiles by the *Langseth*, the coastal Trillium sensors would be left in place for ~1 y, and all of the passive units would also record 14 planned land shots at 7 points along each 200-km profile, performed by the UTEP NSF National Seismic Source Facility. UTEP would obtain all licenses and permitting required for the land shot points. The drill rig would be a 30-tonne, tandem-axle truck ~10.5m long, 2.6 m wide, and 4 m high, with a mast-up height of 12 m. The water truck that accompanies it would be a 20-tonne, tandem-axle truck. The size of these vehicles constrains them from operating in areas such a forests and wetlands. Land shots would be located in pre-disturbed areas with easy access, such as along the edges of agricultural fields and along logging roads; safe distances would be maintained from any structures such as houses, wells, or pipelines. One site may be coordinated to occur within Marine Corps Base Camp Lejeune. Location of shotpoints would be done in conjunction with 811 (call before you dig) services. Local county fire marshals and sheriffs would be informed of explosive use within their jurisdictions and any requirements followed. All sensitive environmental areas and ESA-listed species would be avoided (see further in § III and § IV[5]).

Each land shot would consist of detonating ~450 kg of emulsion explosives at the bottom of 20-cm diameter, 25-m deep holes sealed over the upper 15 m so little sound would be emitted to the atmosphere. Shot holes would be drilled with mud rotary drilling techniques using bentonite drilling mud to lift cuttings out of the hole and cool the drill bit. Bentonite is a naturally occurring clay. The drilling mud would be recirculated through a steel tank on the surface and disposed of in accordance with state regulations. The drilled holes would be charged with emulsion blasting agent: a mixture of ammonium, calcium, and sodium nitrates, and diesel fuel. It would be designed to be waterproof and would be packaged in cartridges to keep it from mixing with drilling mud or groundwater. Once charged, the hole would be plugged first with angular crushed gravel to contain the detonation, followed by drill cuttings and bentonite chips. Plugging of the hole would be done in accordance with state regulations. Drilling, charging, and stemming at each shot site would take approximately a half-day.

Once shots have been charged and seismographs deployed, shots would be detonated one at a time. This would be done by a licensed shooter who would ensure the shot site was clear of people and animals before shooting. The sound of the detonation would be comparable to distant thunder without the rolling coda. Ground vibration would only be felt within a few hundred meters of the shot. Accidental and unauthorized detonation of shots would be prevented by use of electronic detonators, which must receive a coded signal at the time of detonation. If material were ejected from shot holes after detonation, it would be plugged again in accordance with state regulations. The nominal charge size would be 450 kg of emulsion, which would detonate with the energy of ~35 L of diesel fuel. The benign byproducts of the explosion would be carbon dioxide, water, and nitrogen, so negligible impact to the environment would

be expected. The closest approach to the ocean would be more than 2 km, so no impact to the ocean water column would be expected from vibrations on land.

(f) Additional Acoustical Data Acquisition Systems

Along with the airgun operations, three additional acoustical data acquisition systems would be operated from the *Langseth* during the survey: a multibeam echosounder (MBES), sub-bottom profiler (SBP), and an acoustic Doppler current profiler (ADCP). The ocean floor would be mapped with the Kongsberg EM 122 MBES and a Knudsen Chirp 3260 SBP. These sources are described in § 2.2.3.1 of the PEIS.

Currents would be measured with a Teledyne OS75 75-kHz ADCP. The ADCP is configured as a 4-beam phased array with a beam angle of 30°. The source level is proprietary information. The PEIS stated that ADCPs (make and model not specified) had a maximum acoustic source level of 224 dB re 1 μPa · m.

Three acoustical data acquisition systems would be operated from the *Endeavor* during OBS deployment: a Teledyne OS75 75-kHz ADCP (see above), a Teledyne WH300 300-kHz ADCP, which is configured as a 4-beam phased array with a beam angle of 20°, and a Knudsen 320BR 12-kHz depth sounder.

(3) Monitoring and Mitigation Measures

Standard monitoring and mitigation measures for seismic surveys are described in § 2.4.4.1 of the PEIS and are described to occur in two phases: pre-cruise planning and during operations. The following sections describe the efforts during both stages for the proposed actions. Mitigation for land based operational activities would include inspection, identification, and avoidance, as described in this document in § II.2(f) and IV.5.

(a) Planning Phase

As discussed in § 2.4.1.1 of the PEIS, mitigation of potential impacts from the proposed activities begins during the planning phase of the proposed activities. Several factors were considered during the planning phase of the proposed activities, including

Energy Source.—Part of the considerations for the proposed marine seismic survey was to evaluate whether the research objectives could be met with a smaller energy source than the full, 36-airgun, 6600-in^3 *Langseth* array, and it was decided that the scientific objectives for most of the survey could not be met using a smaller source because of the need to image the crust-mantle boundary at a depth of 30 km beneath the continental shelf and slope. For some lines of the survey, the target of interest is at a shallower depth, and it was decided that the 18-airgun, 3300-in^3 subarray would be adequate to image it.

Survey Timing.—The PIs worked with L-DEO and NSF to identify potential times to carry out the survey taking into consideration key factors such as environmental conditions (i.e., the seasonal presence of marine mammals, sea turtles, and seabirds), weather conditions, equipment (including the EarthScope Transportable Array), and optimal timing for other proposed seismic surveys using the *Langseth*. Some marine mammal species are expected to occur in the area year-round, so altering the timing of the proposed project likely would result in no net benefits for those species. Some migratory species, such as the North Atlantic right whale, are expected to be farther north at the time of the survey, so the survey timing is beneficial for those species.

Mitigation Zones.—During the planning phase, mitigation zones for the proposed marine seismic survey were calculated based on modeling by L-DEO for both the exclusion and the safety zones.

Received sound levels have been predicted by L-DEO's model (Diebold et al. 2010, provided as Appendix H in the PEIS), as a function of distance from the airguns, for the 36-airgun array at any tow depth and for a single 1900LL 40-in^3 airgun, which would be used during power downs. This modeling approach uses ray tracing for the direct wave traveling from the array to the receiver and its associated source ghost (reflection at the air-water interface in the vicinity of the array), in a constant-velocity half-space (infinite homogeneous ocean layer, unbounded by a seafloor). In addition, propagation measurements of pulses from the 36-airgun array at a tow depth of 6 m have been reported in deep water (~1600 m), intermediate water depth on the slope (~600–1100 m) and shallow water (~50 m) in the Gulf of Mexico (GoM) in 2007–2008 (Tolstoy et al. 2009; Diebold et al. 2010).

For deep and intermediate-water cases, the field measurements cannot be used readily to derive mitigation radii, as at those sites the calibration hydrophone was located at a roughly constant depth of 350–500 meters, which may not intersect all the sound pressure level (SPL) isopleths at their widest point from the sea surface down to the maximum relevant water depth for marine mammals of ~2000 m. Figures 2 and 3 in Appendix H of the PEIS show how the values along the maximum SPL line that connects the points where the isopleths attain their maximum width (providing the maximum distance associated with each sound level) may differ from values obtained along a constant depth line. At short ranges, where the direct arrivals dominate and the effects of seafloor interactions are minimal, the data recorded at the deep and slope sites are suitable for comparison with modeled levels at the depth of the calibration hydrophone. At larger ranges, the comparison with the mitigation model—constructed from the maximum SPL through the entire water column at varying distances from the airgun array—is the most relevant. The results are summarized below.

In deep and intermediate water depths, comparisons at short ranges between sound levels for direct arrivals recorded by the calibration hydrophone and model results for the same array tow depth are in good agreement (Figs. 12 and 14 in Appendix H of the PEIS). As a consequence, isopleths falling within this domain can be reliably predicted by the L-DEO model, although they may be imperfectly sampled by measurements recorded at a single depth. At larger distances, the calibration data show that seafloor-reflected and sub-seafloor-refracted arrivals dominate, whereas the direct arrivals become weak and/or incoherent (Figs. 11, 12, and 16 in Appendix H of the PEIS). Aside from local topography effects, the region around the critical distance (~5 km in Figs. 11 and 12, and ~4 km in Fig. 16 in Appendix H of the PEIS) is where the observed levels rise very close to the mitigation model curve. However, the observed sound levels are found to fall almost entirely below the mitigation model curve (Figs. 11, 12, and 16 in Appendix H of the PEIS). Thus, analysis of the GoM calibration measurements demonstrates that although simple, the L-DEO model is a robust tool for estimating mitigation radii.

In shallow water (<100 m), the depth of the calibration hydrophone (18 m) used during the GoM calibration survey was appropriate to sample the maximum sound level in the water column, and the field measurements reported in Table 1 of Tolstoy et al. (2009) for the 36-airgun array at a tow depth of 6 m can be used to derive mitigation radii.

The proposed survey on the ENAM off Cape Hatteras would acquire data with the 36-airgun array at a tow depth of 9 m, and the 18-airgun array at a tow depth of 6 m. For deep water (>1000 m), we used the deep-water radii obtained from L-DEO model results down to a maximum water depth of 2000 m (Figs. 2 and 3). The radii for intermediate water depths (100–1000 m) are derived from the deep-water ones by applying a correction factor (multiplication) of 1.5, such that observed levels at very near offsets fall below the corrected mitigation curve (Fig. 16 in Appendix H of the PEIS). For the 18-airgun array, the shallow-water radii are the empirically derived measurements from the GoM calibration survey

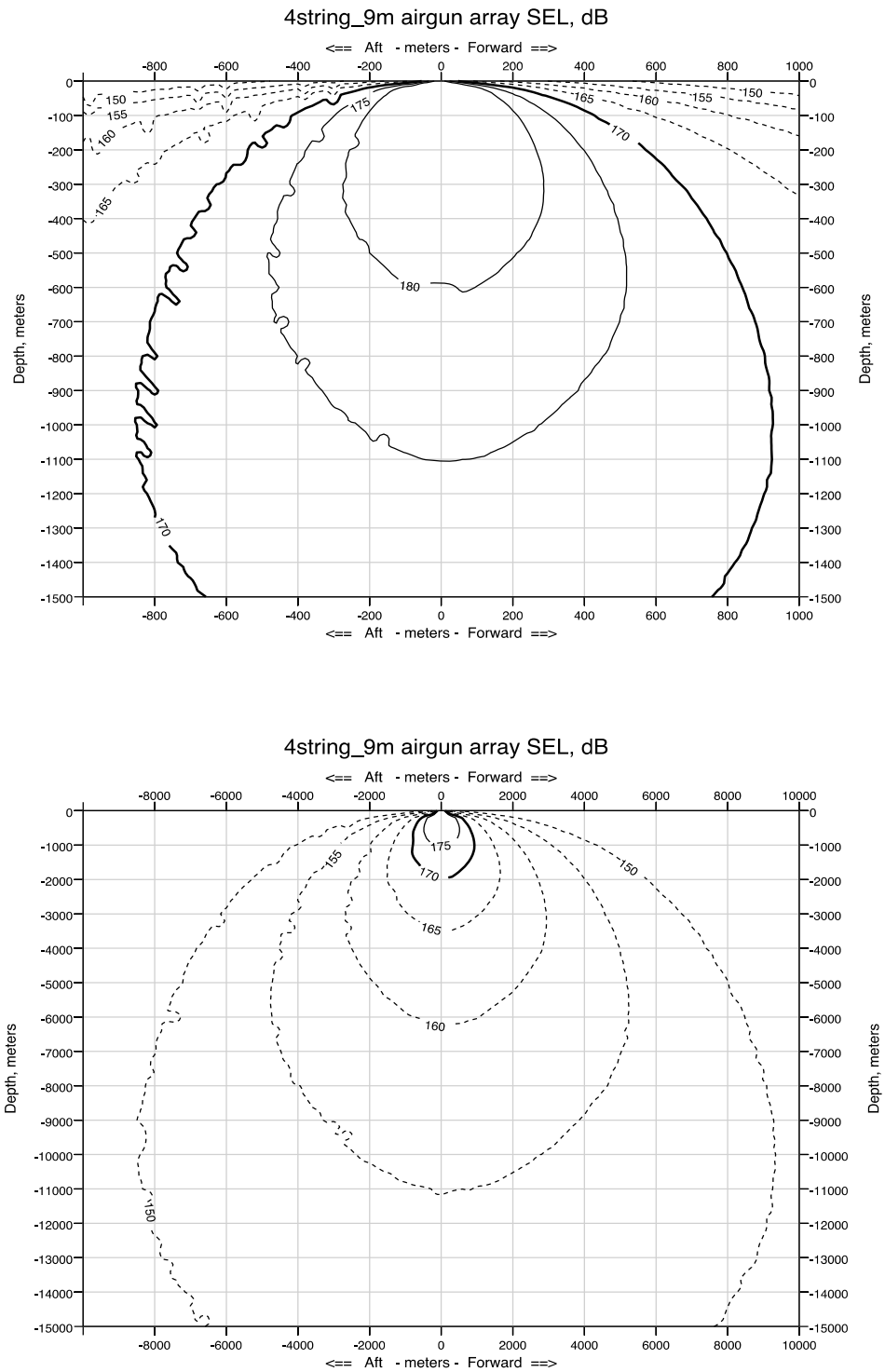


FIGURE 2. Modeled deep-water received sound levels (SELs) from the 36-airgun array planned for use during the survey off Cape Hatteras, at a 9-m tow depth. Received rms levels (SPLs) are expected to be ~10 dB higher. The plot at the top provides the radius to the 170-dB SEL isopleth as a proxy for the 180-dB rms isopleth, and the plot at the bottom provides the radius to the 150-dB SEL isopleth as a proxy for the 160-dB rms isopleth.

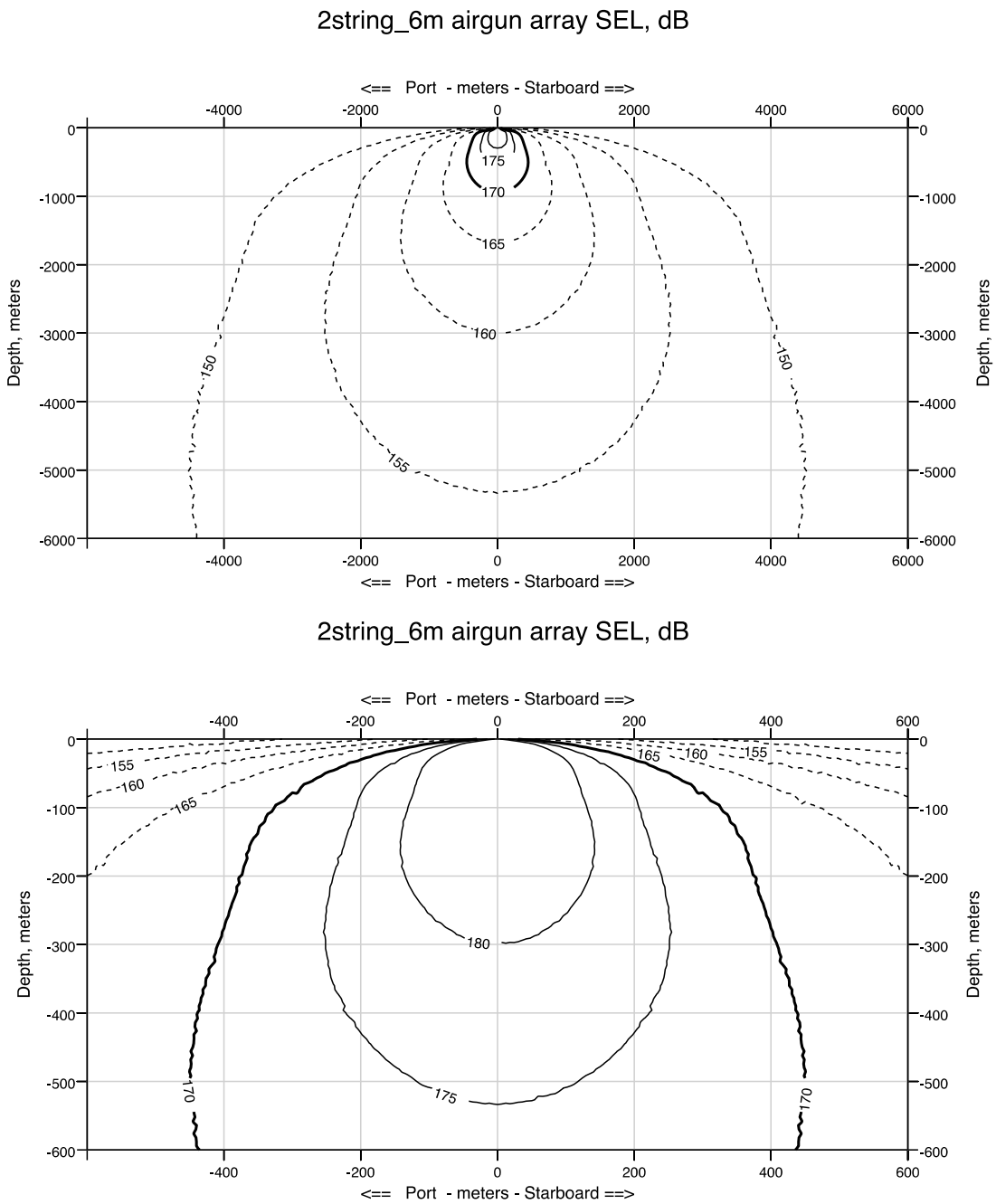


FIGURE 3. Modeled deep-water received sound levels (SELs) from the 18-airgun array planned for use during the survey off Cape Hatteras, at a 6-m tow depth. Received rms levels (SPLs) are expected to be ~10 dB higher. The plot at the top provides the radius to the 170-dB SEL isopleth as a proxy for the 180-dB rms isopleth, and the plot at the bottom provides the radius to the 150-dB SEL isopleth as a proxy for the 160-dB rms isopleth.

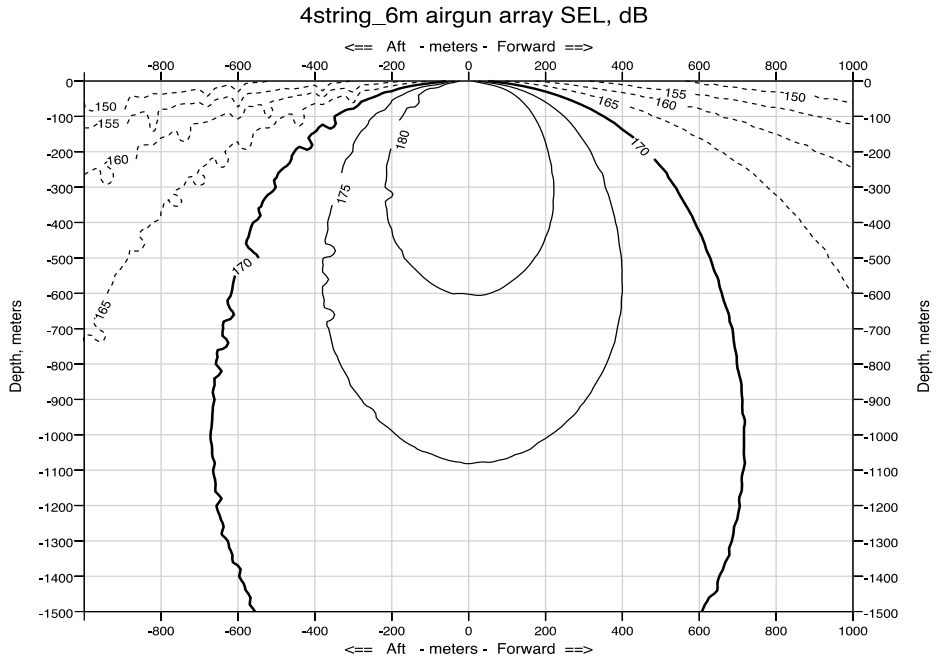
(Fig. 5a in Appendix H of the PEIS), which are 1097 m for 170 dB SEL (proxy for 180 dB RMS) and 15.28 km for 150 dB SEL (proxy for 160 dB RMS), respectively. For the 36-airgun array, the shallow-water radii are obtained by scaling the empirically derived measurements from the GoM calibration survey to account for the difference in tow depth between the calibration survey (6 m) and the proposed survey (9 m). A simple scaling factor is calculated from the ratios of the isopleths calculated by the deep-water L-DEO model, which are essentially a measure of the energy radiated by the source array: the 150-decibel (dB) Sound Exposure Level (SEL)[1] corresponds to a deep-water radius of 9334 m for 9-m tow depth (Fig. 2) and 7244 m for 6-m tow depth (Fig. 4), yielding a scaling factor of 1.29 to be applied to the shallow-water 6-m tow depth results. Similarly, the 170 dB SEL corresponds to a deep-water radius of 927 m for 9-m tow depth (Fig. 2) and 719 m for 6-m tow depth (Fig. 4), yielding the same 1.29 scaling factor. Measured 160 and 180 dB re 1μPa_{rms} distances in shallow water for the 36-gun array towed at 6 m depth were 17.5 km and 1.6 km, respectively, based on a 95th percentile fit (Tolstoy et al. 2009, Table 1). Multiplying by 1.29 to account for the tow depth difference yields distances of 22.6 km and 2.1 km, respectively.

Measurements have not been reported for the single 40-in^3 airgun. The 40-in^3 airgun fits under the PEIS low-energy sources. In § 2.4.2 of the PEIS, Alternative B (the Preferred Alternative) conservatively applies a 180 dB_{rms} exclusion zone (EZ) of 100 m for all low-energy acoustic sources in water depths >100 m. This approach is adopted here for the single Bolt 1900LL 40-in^3 airgun that would be used during power downs. L-DEO model results are used to determine the 160-dB radius for the 40-in^3 airgun in deep water (Fig.5). For intermediate-water depths, a correction factor of 1.5 was applied to the deep-water model results. For shallow water, a scaling of the field measurements obtained for the 36-gun array is used: the 150-dB SEL level corresponds to a deep-water radius of 388 m for the 40-in^3 airgun at 9-m tow depth (Fig. 4) and 7244 for the 36-gun array at 6-m tow depth (Fig. 2), yielding a scaling factor of 0.0536. Similarly, the 170-dB SEL level corresponds to a deep-water radius of 39 m for the 40-in^3 airgun at 9-m tow depth (Fig. 4) and 719 m for the 36-gun array at 6-m tow depth (Fig. 2), yielding a scaling factor of 0.0542. Measured 160- and 180-dB re 1μPa_{rms} distances in shallow water for the 36-gun array towed at 6-m depth were 17.5 km and 1.6 km, respectively, based on a 95th percentile fit (Tolstoy et al. 2009, Table 1). Multiplying by 0.0536 and 0.0542 to account for the difference in array sizes and tow depths yields distances of 938 m and 86 m, respectively.

Table 1 shows the distances at which the 160- and 180- dB re 1μPa_{rms} sound levels are expected to be received for the 36-airgun array, the 18-airgun array, and the single (mitigation) airgun. The 180-dB re 1 μPa_{rms} distance is the safety criterion as specified by NMFS (2000) for cetaceans. Southall et al. (2007) made detailed recommendations for new science-based noise exposure criteria. In December 2013, NOAA published draft guidance for assessing the effects of anthropogenic sound on marine mammals(NOAA 2013a), although at the time of preparation of this Draft EA, the date of release of the final guidelines and how they will be implemented are unknown. As such, this Draft EA has been prepared in accordance with the current NOAA acoustic practices, and the procedures are based on best practices noted by Pierson et al. (1998), Weir and Dolman (2007), and Nowacek et al. (2013).

---

[1] SEL (measured in dB re 1 $\mu Pa^2 \cdot s$) is a measure of the received energy in the pulse and represents the SPL that would be measured if the pulse energy were spread evenly across a 1-s period. Because actual seismic pulses are less than 1 s in duration in most situations, this means that the SEL value for a given pulse is usually lower than the SPL calculated for the actual duration of the pulse. In this EA, we assume that rms pressure levels of received seismic pulses would be 10 dB higher than the SEL values predicted by L-DEO's model.



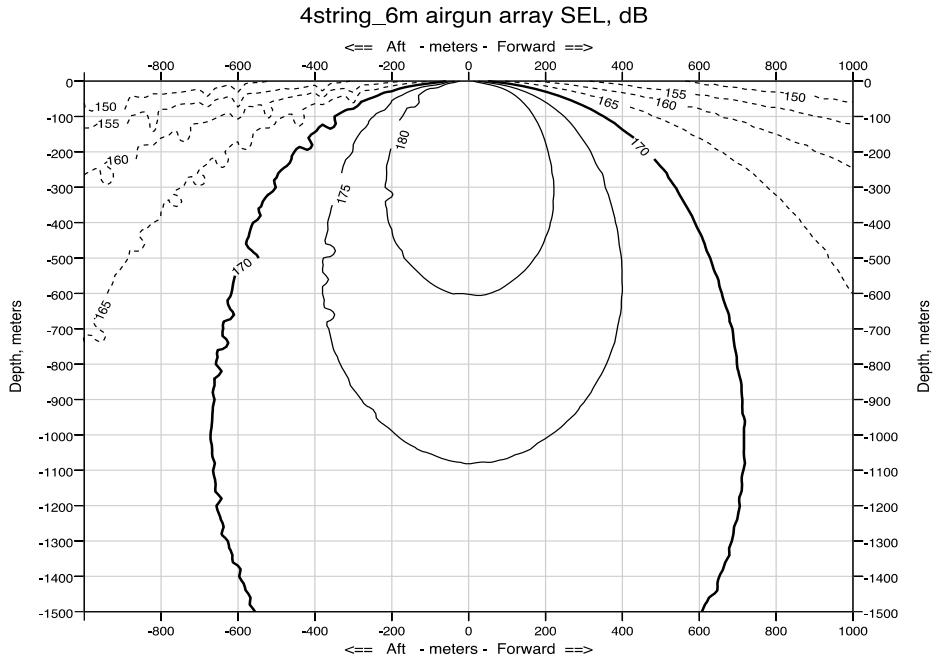
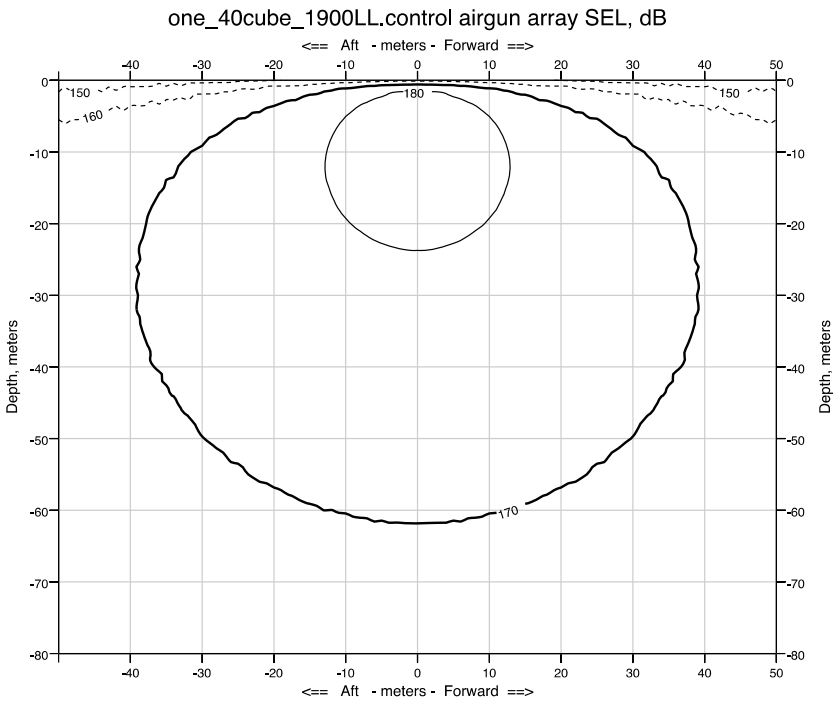


FIGURE 4. Modeled deep-water received sound levels (SELs) from the 36-airgun array at a 6-m tow depth used during the GoM calibration survey. Received rms levels (SPLs) are expected to be ~10 dB higher. The plot at the top provides the radius to the 170 dB SEL isopleth as a proxy for the 180-dB rms isopleth, and the plot at the bottom provides the radius to the 150-dB SEL isopleth as a proxy for the 160-dB rms isopleth.



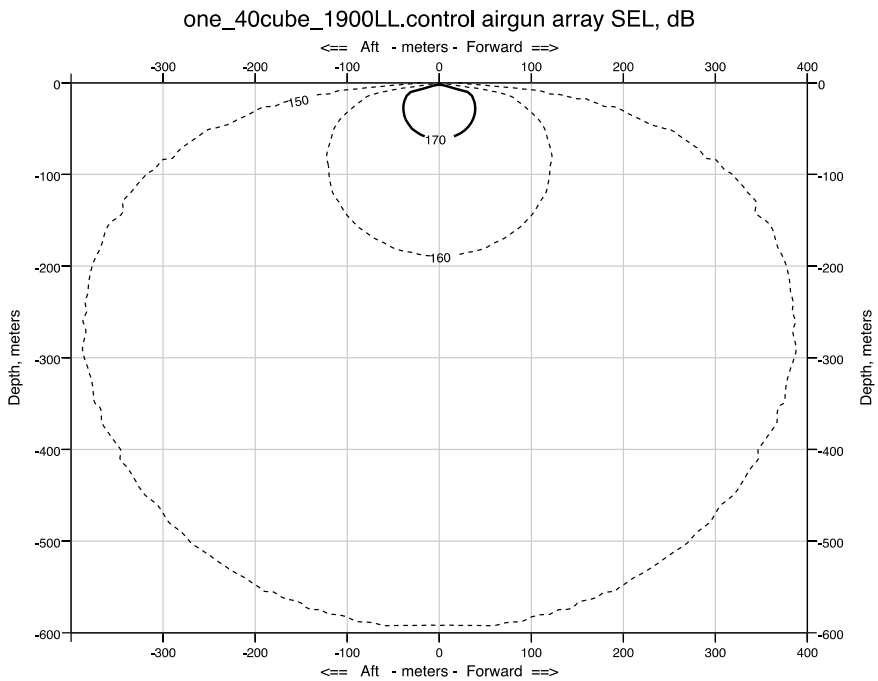


FIGURE 5. Modeled deep-water received sound levels (SELs) from a single 40-in^3 airgun towed at 9 m depth, which is planned for use as a mitigation gun during the proposed survey off Cape Hatteras. Received rms levels (SPLs) are expected to be ~10 dB higher. The plot at the top provides the radius to the 170-dB SEL isopleths as a proxy for the 180-dB rms isopleth, and the plot at the bottom provides the radius to the 150-dB SEL isopleth as a proxy for the 160-dB rms isopleth.

TABLE 1. Predicted distances to which sound levels ≥180- and 160-dB re 1 μPa$_{rms}$ are expected to be received during the proposed survey off Cape Hatteras in September–October 2014. For the single mitigation airgun, the EZ is the conservative EZ for all low-energy acoustic sources in water depths >100 m defined in the PEIS.

Source and Volume	Tow Depth (m)	Water Depth (m)	Predicted rms Radii (m)	
			180 dB	160 dB
Single Bolt airgun, 40 in^3	6 or 9	>1000 m	100	388[1]
		100–1000 m	100	582[2]
		<100 m	86[3]	938[3]
4 strings, 36 airguns, 6600 in^3	9	>1000 m	927[1]	5780[1]
		100–1000 m	1391[2]	8670[2]
		<100 m	2060[3]	22,600[3]
2 strings, 18 airguns, 3300 in^3	6	>1000 m	450[1]	3760[1]
		100-1000 m	675[2]	5640[2]
		<100 m	1097[4]	15,280[4]

[1] Distance is based on L-DEO model results
[2] Distance is based on L-DEO model results with a 1.5 x correction factor between deep and intermediate water depths
[3] Distance is based on empirically derived measurements in the GoM with scaling applied to account for differences in tow depth
[4] Distance is based on empirically derived measurements in the GoM

The 180-dB distance would also be used as the exclusion zone for sea turtles, as required by NMFS in most other seismic projects (e.g., Smultea et al. 2004; Holst et al. 2005a,b; Holst and Beland 2008; Holst and Smultea 2008; Hauser et al. 2008; Holst 2009; Antochiw et al. n.d.). Enforcement of mitigation zones via power and shut downs would be implemented in the Operational Phase.

(b) Operational Phase

Marine mammals and sea turtles are known to occur in the proposed survey area. However, the number of individual animals expected to be approached closely during the proposed activities would be relatively small in relation to regional population sizes. To minimize the likelihood that potential impacts could occur to the species and stocks, monitoring and mitigation measures proposed during the operational phase of the proposed activities, which are consistent with the PEIS and past IHA requirements, include

1. monitoring by protected species visual observers (PSVOs) for marine mammals and sea turtles;
2. passive acoustic monitoring (PAM);
3. PSVO data and documentation; and
4. mitigation during operations (speed or course alteration; power-down, shut-down, and ramp-up procedures; and special mitigation measures for rare species, species concentrations, and sensitive habitats).

The proposed operational mitigation measures are standard for all high energy seismic cruises, per the PEIS, and therefore are not discussed further here. Special mitigation measures were considered for this cruise. Although it is very unlikely that a North Atlantic right whale would be encountered, the airgun array would be shut down if one is sighted at any distance from the vessel because of its rarity and conservation status. It is also unlikely that concentrations of large whales would be encountered, but if so, they would be avoided.

With the proposed monitoring and mitigation provisions, potential effects on most if not all individuals would be expected to be limited to minor behavioral disturbance. Those potential effects would be expected to have negligible impacts both on individual marine mammals and on the associated species and stocks. Ultimately, survey operations would be conducted in accordance with all applicable U.S. federal regulations and IHA requirements.

Alternative 1: Alternative Survey Timing

An alternative to issuing the IHA for the period requested and to conducting the project then would be to conduct the project at an alternative time, implementing the same monitoring and mitigation measures as under the Proposed Action, and requesting an IHA to be issued for that alternative time. The proposed time for the cruise in September–October 2014 is the most suitable time logistically for the *Langseth* and the participating scientists, and coincides with the availability of the EarthScope Transportable Array. The EarthScope Transportable Array is scheduled to leave the survey area in 2015. If the IHA is issued for another period, it could result in significant delay and disruption not only of this cruise, but also of additional studies that are planned on the *Langseth* for 2014 and beyond. An evaluation of the effects of this Alternative is given in § IV.

Alternative 2: No Action Alternative

An alternative to conducting the proposed activities is the “No Action” alternative, i.e., do not issue an IHA and do not conduct the research operations. If the research was not conducted, the “No Action” alternative would result in no disturbance to marine mammals due to the proposed activities.

The “No Action” alternative could also, in some circumstances, result in significant delay of other studies that would be planned on the *Langseth* for 2014 and beyond, depending on the timing of the decision. Not conducting this cruise (no action) would result in less data and support for the academic institutions involved. Data collection would be an essential first step for a much greater effort to analyze and report information for the significant topics indicated. The field effort provides material for years of analyses involving multiple professors, students, and technicians. The lost opportunity to collect valuable scientific information would be compounded by lost opportunities for support of research infrastructure, training, and professional career growth. An evaluation of the effects of this Alternative is given in § IV.

Alternatives Considered but Eliminated from Further Analysis

(1) Alternative E1: Alternative Location

The survey location has been specifically identified because the Cape Hatteras area represents a discontinuity in the margin of the eastern U.S., with the Carolina Trough to the south and the Baltimore Canyon Trough to the north. One of the purposes of this study is to understand how a step in the margin is formed during the breakup of a continent.

There are many seismic data sets available for the continental shelf and slope of the eastern U.S. However, the quality of these data is not sufficient to meet the goals of this project. The proposed research underwent the NSF merit review process, and the science, including the site location, was determined to be meritorious.

(2) Alternative E2: Use of Alternative Technologies

As described in § 2.6 of the PEIS, alternative technologies to the use of airguns were investigated to conduct high-energy seismic surveys. At the present time, these technologies are still not feasible, commercially viable, or appropriate to meet the Purpose and Need. NSF currently owns the *Langseth*, and its primary capability is to conduct seismic surveys.

Table 2 provides a summary of the proposed action, alternatives, and alternatives eliminated from further analysis.

III. AFFECTED ENVIRONMENT

As described in the PEIS, Chapter 3, the description of the affected environment focuses only on those resources potentially subject to impacts. Accordingly, the discussion of the affected environment (and associated analyses) has focused mainly on those related to marine biological resources, as the proposed short-term activities have the potential to impact marine biological resources within the Project area. These resources are identified in § III, and the potential impacts to these resources are discussed in § IV. Initial review and analysis of the proposed Project activities determined that the following resource areas did not require further analysis in this Draft EA:

- *Air Quality/Greenhouse Gases*—Project vessel and vehicle emissions would result from the proposed activities; however, these short-term emissions would not result in any exceedance of Federal Clean Air standards. Emissions would be expected to have a negligible impact on the air quality within the survey area;
- *Land Use*—The majority of activities are proposed to occur in the marine environment. Marine and land-based activities, however, have been coordinated with the EarthScope Transportable Array, further extending data collection capabilities. No changes to current land uses or activities within the Project area would result from the proposed Project;
- *Safety and Hazardous Materials and Management*—No hazardous materials would be generated during proposed marine activities. Small amounts of emulsion explosives materials would be used for the 14 land based active shot points. Each land shot would consist of detonating ~450 kg of emulsion blasting agent in holes with a minimum of 15 m of stemming above the charge. In cases where shots would be in close proximity to houses (< 800 m), charges would be divided into three separate charges and detonated individually. The benign byproducts of the explosion would be carbon dioxide, water, and nitrogen, so negligible impact to the environment would be expected. Materials would be handled by experienced and licensed personnel of UTEP, following all federal, state, and local requirements. All Project-related wastes would be disposed of in accordance with state, Federal, and international requirements;

TABLE 2. Summary of Proposed Action, Alternatives Considered, and Alternatives Eliminated

Proposed Action	Description
Proposed Action: Conduct a marine geophysical survey and associated activities in the Atlantic Ocean off Cape Hatteras	Under this action, a 2-D seismic reflection and refraction survey is proposed with associated land-based activities. When considering transit; equipment deployment, maintenance, and retrieval; weather; marine mammal activity; and other contingencies, the proposed activities would be expected to be completed in ~38 days. The affected environment, environmental consequences, and cumulative impacts of the proposed activities are described in § III and IV. The standard monitoring and mitigation measures identified in the NSF PEIS would apply, along with any additional requirements identified by regulating agencies. All necessary permits and authorizations, including an IHA, would be requested from regulatory bodies.
Alternatives	Description
Alternative 1: Alternative Survey Timing	Under this Alternative, L-DEO would conduct survey operations with associated land-based activities at a different time of the year to reduce impacts on marine resources and users, and improve monitoring capabilities. Some marine mammal species are probably year-round residents in the survey area and others would be farther north at the time of the survey, so altering the timing of the proposed project likely would not result in net benefits. Further, consideration would be needed for constraints for vessel operations and availability of equipment (including the vessel and EarthScope Transportable Array) and personnel. Limitations on scheduling the vessels include the additional research studies planned on the vessels for 2014 and beyond. The standard monitoring and mitigation measures identified in the NSF PEIS would apply. These measures are described in further detail in this document (§ II [3]) and would apply to survey activities conducted during an alternative survey time period, along with any additional requirements identified by regulating agencies as a result of the change. All necessary permits and authorizations, including an IHA, would be requested from regulatory bodies.
Alternative 2: No Action	Under this Alternative, no proposed activities would be conducted and seismic data would not be collected. Whereas this alternative would avoid impacts to marine resources, it would not meet the purpose and need for the proposed action. Geological data of scientific value and relevance increasing our understanding of how the continental crust stretched and separated during the opening of the Atlantic Ocean, and what the role of magmatism was during continental breakup would not be collected. The collection of new data, interpretation of these data, and introduction of new results into the greater scientific community and applicability of these data to other similar settings would not be achieved. No permits and authorizations, including an IHA, would be needed from regulatory bodies as the proposed action would not be conducted.
Alternatives Eliminated from Further Analysis	Description
Alternative E1: Alternative Location	The survey location has been specifically identified because the Cape Hatteras area represents a discontinuity in the margin of the eastern U.S., with the Carolina Trough to the south and the Baltimore Canyon Trough to the north. One of the purposes of this study is to understand how a step in the margin is formed during the breakup of a continent. The proposed science underwent the NSF merit review process, and the science, including the site location, was determined to be meritorious.
Alternative E2: Alternative Survey Techniques	Under this alternative, L-DEO would use alternative survey techniques, such as marine vibroseis, that could potentially reduce impacts on the marine environment. Alternative technologies were evaluated in the PEIS, § 2.6. At the present time, however, these technologies are still not feasible, commercially viable, or appropriate to meet the Purpose and Need. NSF currently owns the *Langseth*, and its primary capability is to conduct seismic surveys.

- *Geological Resources (Topography, Geology and Soil)*—The proposed Project would result in only a minor displacement of soil and seafloor sediments. Proposed marine or land-based activities would not adversely affect geologic resources, thus no significant impacts would be anticipated;

- *Water Resources*—Land activities are no closer than 2 km from the coast, and no discharges to the marine environment are proposed within the Project area that would adversely affect marine water quality. Terrestrial water resources and wetlands would be avoided. Therefore, there would be no impacts to water resources resulting from the proposed Project activities;
- *Visual Resources*—No visual resources would be anticipated to be negatively impacted by marine activities as the area of operation is significantly outside of the land and coastal view shed. Land-based activities would be short-term, primarily along roadsides, and would not be anticipated to affect the local view shed; and
- *Socioeconomic and Environmental Justice*—Implementation of the proposed Project would not affect, beneficially or adversely, socioeconomic resources, environmental justice, or the protection of children. Land-based activities would be short term. No changes in the population or additional need for housing or schools would occur. Human activities in the area around the survey vessel would be limited to commercial and recreational fishing activities and other vessel traffic. Fishing, vessel traffic, and potential impacts are described in further detail in § III and IV. No other socioeconomic impacts would be anticipated as result of the proposed activities.

Oceanography

The water off the U.S. east coast consists of three water masses: coastal or shelf waters, slope waters, and the Gulf Stream. Coastal waters off Canada, which originate mostly in the Labrador Sea, move southward over the continental shelf until they reach Cape Hatteras, where they are entrained between the Gulf Stream and slope waters. The salinity of shelf water usually increases with depth and is generally lower than the salinity of water masses farther offshore primarily because of the low-salinity outflow from rivers and estuaries.

Slope waters in the mid Atlantic are a mixture zone of water from the shelf and the Gulf Stream. North of Cape Hatteras, an elongated cyclonic gyre of slope water that forms because of the southwest flow of coastal water and the northward flowing Gulf Stream is present most of the year and shifts seasonally relative to the position of the north edge of the Gulf Stream. Slope water eventually merges with the Gulf Stream water.

The Gulf Stream flows through the Straits of Florida and then parallel to the continental margin, becoming stronger as it moves northward. It has a mean speed of 1 m/s, and the surface speed is higher in summer than in winter. It turns seaward near Cape Hatteras and moves northeast into the open ocean.

The continental shelf off the U.S. east coast is very narrow off Cape Hatteras, broadening to form the mid-Atlantic Bight to the north and the Florida-Hatteras Shelf to the south. South of Cape Hatteras, the shelf gives way to the relatively steep Florida-Hatteras Slope at 100–500 m depths, the Blake Plateau, 700−1000 m deep and extending ~300–500 km offshore, and the Blake Escarpment, which slopes steeply to the abyssal plain at 400–5000 m. North of Cape Hatteras, the continental slope is steep from 200 to 2000 m deep extending <200 m offshore, then sloping gradually to 5000-m depth.

Protected Areas

Several federal Marine Protected Areas (MPAs) or sanctuaries have been established along the east coast of the U.S., primarily with the intention of preserving cetacean habitat (Hoyt 2005; CetaceanHabitat 2013). A number of these are located to the north of the proposed survey area off New England or south of the proposed survey area. The Monitor National Marine Sanctuary, a sanctuary established to preserve

a cultural resource (the wreck of the Civil War ironclad USS *Monitor*), is located in ~70 m of water to the southeast of Cape Hatteras, in the proposed survey area (Fig. 1). The sanctuary consists of the column of water 1.6 km in diameter from the bottom to the surface centred on the wreck. Regulations prohibit a number of activities in the sanctuary, including "Detonating below the surface of the water any explosive or explosive mechanism" (NOAA 2013b). One of the proposed transect lines would approach the sanctuary within ~24 km, but the vessel would not enter the sanctuary.

The South Atlantic Fishery Management Council (SAFMC) established eight deep-water MPAs to protect a portion of the long-lived, "deep water" snapper grouper species such as snowy grouper, speckled hind, and blueline tilefish (SAFMC 2013). One of the eight MPAs, the Snowy Grouper Wreck, is just west of the southwest corner of the proposed survey area (MPA/HAPC #9 in Fig. 1). SAFMC regulations prohibit the fishing for or possession of any snapper-grouper species, and the use of shark bottom longline gear within the MPAs. There are also 10 HAPC shown in Figure 1; those are described in the section dealing with fish, below.

The Harbor Porpoise Take Reduction Plan (HPTRP) is intended to reduce the interactions between harbor porpoises and commercial gillnets in four management areas: waters off New Jersey, Mudhole North, Mudhole South, and Southern Mid Atlantic (NOAA 2010). The HPTRP is not relevant to this EA because harbor porpoises are not expected to occur in the survey area.

Marine Mammals

Thirty-one cetacean species (6 mysticetes and 25 odontocetes) could occur near the proposed survey site (Table 3). Six of the 31 species are listed under the U.S. Endangered Species Act (ESA) as ***Endangered***: the North Atlantic right, humpback, blue, fin, sei, and sperm whales. Bryde's whale (*Balaenoptera brydei*) likely would not occur near the proposed survey area, because its distribution generally does not extend as far north as ~32–37°N. An additional three cetacean species, although present in the wider western North Atlantic Ocean, likely would not be found near the proposed survey area because their ranges generally do not extend as far south (northern bottlenose whale, *Hyperoodon ampullatus*; Sowerby's beaked whale, *Mesoplodon bidens*; and white-beaked dolphin, *Lagenorhynchus albirostris*).

Similarly, no pinnipeds are included; harp seals (*Pagophilus groenlandicus*) and hooded seals (*Cystophora cristata*) are rare in the proposed survey area, and gray (*Halichoerus grypus*) and harbor seals (*Phoca vitulina*) have a more northerly distribution during the summer (DoN 2005) and are not expected to occur there during the survey.

General information on the taxonomy, ecology, distribution and movements, and acoustic capabilities of marine mammals are given in § 3.6.1 and § 3.7.1 of the PEIS. The general distributions of mysticetes and odontocetes in this region of the Northwest Atlantic Ocean are discussed in § 3.6.2.1 and § 3.7.2.1 of the PEIS, respectively. Additionally, information on marine mammals in this region is included in § 4.2.2.1 of the Bureau of Ocean Energy Management (BOEM) draft PEIS for Atlantic OCS Proposed Geological and Geophysical Activities, Mid-Atlantic and South Atlantic Planning Areas (BOEM 2012), and in § 3.7.2 of the Final EIS/OEIS for the Virginia Capes and the Cherry Point Range Complexes (DoN 2009a,b). The rest of this section focuses on species distribution in and near the proposed survey area off the coasts of Virginia and North Carolina.

TABLE 3. The habitat, occurrence, regional population sizes, and conservation status of marine mammals that could occur in or near the proposed survey area in the Northwest Atlantic Ocean.

Species	Habitat	Occurrence in survey area in fall	Regional/SAR abundance estimates[1]	ESA[2]	IUCN[3]	CITES[4]
Mysticetes						
North Atlantic right whale	Coastal and shelf	Rare	455 / 455[5]	EN	EN	I
Humpback whale	Mainly nearshore, banks; pelagic	Uncommon	11,600[6] / 823[7]	EN	LC	I
Minke whale	Mainly coastal	Uncommon	138,000[8] / 20,741[9]	NL	LC	I
Sei whale	Mainly offshore	Rare	10,300[10] / 357[11]	EN	EN	I
Fin whale	Slope, pelagic	Uncommon	26,500[12] / 3522[5]	EN	EN	I
Blue whale	Shelf, pelagic	Rare	855[13] / 440[5]	EN	EN	I
Odontocetes						
Sperm whale	Pelagic	Common	13,190[14] / 2288[15]	EN	VU	I
Pygmy sperm whale	Off shelf	Uncommon	N.A. / 3785[16]	NL	DD	II
Dwarf sperm whale	Off shelf	Uncommon	N.A. / 3785[16]	NL	DD	II
Cuvier's beaked whale	Pelagic	Uncommon	N.A. / 6532[5]	NL	LC	II
True's beaked whale	Pelagic	Rare	N.A. / 7092[17]	NL	DD	II
Gervais' beaked whale	Pelagic	Rare	N.A. / 7092[17]	NL	DD	II
Blainville's beaked whale	Pelagic	Rare	N.A. / 7092[17]	NL	DD	II
Rough-toothed dolphin	Mainly pelagic	Uncommon	N.A. / 271[5]	NL	LC	II
Bottlenose dolphin	Coastal, offshore	Common	N.A. / 86,705[18]	NL^	LC	II
Pantropical spotted dolphin	Mainly pelagic	Common	N.A. / 3333[5]	NL	LC	II
Atlantic spotted dolphin	Shelf, slope, pelagic	Common	N.A. / 44,715[5]	NL	DD	II
Spinner dolphin	Coastal, pelagic	Rare	N.A. / N.A.	NL	DD	II
Striped dolphin	Off shelf	Common	N.A. / 54,807[5]	NL	LC	II
Clymene dolphin	Pelagic	Uncommon	N.A. / N.A.	NL	DD	II
Short-beaked common dolphin	Shelf, pelagic	Common	N.A. / 173,486[5]	NL	LC	II
Atlantic white-sided dolphin	Shelf and slope	Rare	10s to 100s of 1000s[19] / 48,819[5]	NL	LC	II
Fraser's dolphin	Pelagic	Rare	N.A. / N.A.	NL	LC	II
Risso's dolphin	Mainly shelf, slope	Common	N.A. /18,250[5]	NL	LC	II
Melon-headed whale	Mainly pelagic	Rare	N.A. / N.A.	NL	LC	II
False killer whale	Pelagic	Rare	N.A. / N.A.	NL	DD	II
Pygmy killer whale	Mainly pelagic	Rare	N.A. / N.A.	NL	DD	II
Killer whale	Coastal	Rare	N.A. / N.A.	NL*	DD	II
Long-finned pilot whale	Mainly pelagic	Common	780K[20] / 26,535[5]	NL†	DD	II
Short-finned pilot whale	Mainly pelagic	Common	780K[20] / 21,515[5]	NL	DD	II
Harbor porpoise	Coastal	Rare	~500K[21] / 79,883[22]	NL	LC	II

N.A. = Data not available

[1] SAR (stock assessment report) abundance estimates are from the 2012 U.S. Atlantic and Gulf of Mexico Marine Mammal Stock Assessments (Waring et al. 2013) as noted, and regional abundance estimates are for the North Atlantic regions as noted.

[2] U.S. Endangered Species Act; EN = Endangered, NL = Not listed

[3] Codes for IUCN classifications from IUCN Red List of Threatened Species (IUCN 2013): EN = Endangered; VU = Vulnerable; LC = Least Concern; DD = Data Deficient

[4] Convention on International Trade in Endangered Species of Wild Fauna and Flora (UNEP-WCMC 2013): Appendix I = Threatened with extinction; Appendix II = not necessarily now threatened with extinction but may become so unless trade is closely controlled

[5] Estimate for the Western North Atlantic Stock (Waring et al. 2013)

[6] Best estimate for the western North Atlantic in 1992–1993 (IWC 2013)
[7] Minimum estimate for the Gulf of Maine stock (Waring et al. 2013)
[8] Best estimate for the North Atlantic in 2002–2007 (IWC 2013)
[9] Estimate for the Canadian East Coast Stock (Waring et al. 2013)
[10] Estimate for the Northeast Atlantic in 1989 (Cattanach et al. 1993)
[11] Estimate for the Nova Scotia Stock (Waring et al. 2013)
[12] Best estimate for the North Atlantic in 2007 (IWC 2013)
[13] Estimate for the central and northeast Atlantic in 2001 (Pike et al. 2009)
[14] Estimate for the North Atlantic (Whitehead 2002)
[15] Estimate for the North Atlantic Stock (Waring et al. 2013)
[16] Combined estimate for pygmy and dwarf sperm whales (Waring et al. 2013)
[17] Combined estimate for *Mesoplodon* spp. (Waring et al. 2013)
[18] Combined estimate for the Western North Atlantic Offshore Stock and the Southern Migratory Coastal Stock (Waring et al. 2013)
[19] Tens to low hundreds of thousands in the North Atlantic (Reeves et al. 1999)
[20] Estimate for both long- and short-finned pilot whales in the central and eastern North Atlantic in 1989 (IWC 2013)
[21] Estimate for the North Atlantic (Jefferson et al. 2008)
[22] Estimate for the Gulf of Maine/Bay of Fundy Stock (Waring et al. 2013)
* Killer whales in the eastern Pacific Ocean, near Washington state, are listed as endangered under the U.S. ESA but not in the Atlantic Ocean.
^ The Western North Atlantic Coastal Morphotype stocks, ranging from NJ to FL, are listed as depleted under the U.S. Marine Mammal Protection Act, as are some other stocks to the south of the proposed survey area.
† Considered a strategic stock

The main sources of information used here are the 2010 and 2012 U.S. Atlantic and Gulf of Mexico marine mammal stock assessment reports (SARs: Waring et al. 2010, 2012), the Ocean Biogeographic Information System (OBIS: IOC 2013), and the Cetacean and Turtle Assessment Program (CETAP 1982). The SARs include maps of sightings for most species from NMFS' Northeast and Southeast Fisheries Science Centers (NEFSC and SEFSC) surveys in summer 1995, 1998, 1999, 2002, 2004, 2006, 2007, 2008, 2010, and 2011. OBIS is a global database of marine species sightings. CETAP covered 424,320 km of trackline on the U.S. outer continental shelf from Cape Hatteras to Nova Scotia. Aerial and shipboard surveys were conducted over a 39-month period from 1 November 1978 to 28 January 1982. The mid-Atlantic area referred to in the following species accounts included waters south of Georges Bank down to Cape Hatteras, and from the coast out to ~1830 m depth.

(1) Mysticetes

North Atlantic Right Whale (*Eubalaena glacialis*)

The North Atlantic right whale is known to occur primarily in the continental shelf waters off the eastern U.S. and Canada, from Florida to Nova Scotia (Winn et al. 1986; Jefferson et al. 2008). There are five well-known habitats in the northwest Atlantic used annually by right whales (Winn et al. 1986; NMFS 2005). These include the winter calving grounds in coastal waters of the southeastern U.S. (Florida/Georgia); spring feeding grounds in the Great South Channel (east of Cape Cod); late winter/spring feeding grounds and nursery grounds in Massachusetts Bay and Cape Cod Bay; summer/fall feeding and nursery grounds in the Bay of Fundy; and summer/fall feeding grounds on the Nova Scotian Shelf. In addition, Jeffreys Ledge, off the coast of northern Massachusetts, New Hampshire, and Maine, could be an important fall feeding area for right whales and an important nursery area during summer, especially in July and August (Weinrich et al. 2000). The first three habitats were designated as Critical Habitat Areas by NMFS (1994).

There is a general seasonal north-south migration of the North Atlantic population between feeding and calving areas, but right whales could be seen anywhere off the Atlantic U.S. throughout the year (Gaskin 1982). The migration route between the Cape Cod summer feeding grounds and the

Georgia/Florida winter calving grounds, known as the mid-Atlantic corridor, has not been considered to include "high use" areas, yet the whales clearly move through these waters regularly in all seasons (Reeves and Mitchell 1986; Winn et al. 1986; Kenney et al. 2001; Reeves 2001; Knowlton et al. 2002; Whitt et al. 2013).

North Atlantic right whales are found commonly on the northern feeding grounds off the north-eastern U.S. during early spring and summer. The highest abundance in Cape Cod Bay is in February and April (Winn et al. 1986; Hamilton and Mayo 1990) and from April to June in the Great South Channel east of Cape Cod (Winn et al. 1986; Kenney et al. 1995). Throughout the remainder of summer and into fall (June–November), they are most commonly seen farther north on feeding grounds in Canadian waters, with a peak abundance during August, September, and early October (Gaskin 1987). Morano et al. (2012) and Mussoline et al. (2012) indicated that right whales are present in the southern Gulf of Maine year-round and that they occur there over longer periods than previously thought.

Some whales, including mothers and calves, remain on the feeding grounds through the fall and winter. However, the majority of the right whale population leaves the feeding grounds for unknown wintering habitats and returns when the cow-calf pairs return. The majority of the right whale population is unaccounted for on the southeastern U.S. winter calving ground, and not all reproductively-active females return to the area each year (Kraus et al. 1986; Winn et al. 1986; Kenney et al. 2001). Other wintering areas have been suggested, based upon sparse data or historical whaling logbooks; these include the Gulf of St. Lawrence, Newfoundland and Labrador, coastal waters of New York and between New Jersey and North Carolina, Bermuda, and Mexico (Payne and McVay 1971; Aguilar 1986; Mead 1986; Lien et al. 1989; Knowlton et al. 1992; Cole et al. 2009; Patrician et al. 2009).

Knowlton et al. (2002) provided an extensive and detailed analysis of survey data, satellite tag data, whale strandings, and opportunistic sightings along State waters of the mid-Atlantic migratory corridor[2], from the border of Georgia/South Carolina to south of New England, spanning the period from 1974 to 2002. The majority of sightings (94%) along the migration corridor were within 56 km of shore, and more than half (64%) were within 18.5 km of shore (Knowlton et al. 2002). Water depth preference was for shallow waters; 80% of all sightings were in depths <27 m, and 93% were in depths <45 m (Knowlton et al. 2002). Most sightings farther than 56 km from shore occurred at the northern end of the corridor, off New York and south of New England. North of Cape Hatteras, most sightings were reported for March–April; south of Cape Hatteras, most sightings occurred during February–April (Knowlton et al. 2002). Similarly, sighting data analyzed by Winn et al. (1986) dating back to 1965 showed that the occurrence of North Atlantic right whales in the Cape Hatteras region, including the proposed survey area, peaked in March; in the mid-Atlantic area, it peaked in April.

A review of the mid-Atlantic whale sighting and tracking data archive from 1974 to 2002 showed North Atlantic right whale sightings off the coasts of Virginia and North Carolina during fall, winter, and spring; there were no sightings for July–September (Beaudin Ring 2002). Three sightings were reported for the month of October near the coast of North Carolina; there were no sightings off Virginia during October (Beaudin Ring 2002). Right whale sighting data mapped by DoN (2008a,b) showed the greatest

[2] Multi-year datasets for the analysis were provided by the New England Aquarium (NEAQ), North Atlantic Right Whale Consortium (NARWC), Oregon State University, Coastwise Consulting Inc, Georgia Department of Natural Resources, University of North Carolina Wilmington (UNCW), Continental Shelf Associates, Cetacean and Turtle Assessment Program (CETAP), NOAA, and University of Rhode Island.

occurrence off Virginia and North Carolina during the winter (December–April), with many fewer sightings during spring and fall.

The Interactive North Atlantic Right Whale Sighting Map showed 30 sightings in the shelf waters off Virginia and North Carolina between 2005 and 2013, and one sighting seaward of the shelf off Virginia (NEFSC 2013b). All sightings were made from December through July, and six sightings were made within the proposed survey area during 2013. There are 69 sightings of right whales off Virginia/ North Carolina in OBIS (IOC 2013) including sightings made during the 1978–1982 CETAP surveys (CETAP 1982); none of the OBIS sightings were made during September or October.

Palka (2006) reviewed North Atlantic right whale density in the U.S. Navy Northeast Operating Area based on summer abundance surveys conducted during 1998–2004. One of the lowest whale densities (including right whales) was found in the mid-Atlantic stratum, which included the waters off Virginia. However, survey effort for this stratum was also the lowest; only two surveys were conducted. No right whales were sighted.

Whitt et al. (2013) surveyed for right whales off the coast of New Jersey using acoustic and visual techniques from January 2008 to December 2009. Whale calls were detected off New Jersey year-round and four sightings were made from November to January. In light of these findings, Whitt et al. (2013) suggested expanding the existing critical habitat to include waters of the mid Atlantic. NMFS (2010) previously noted that such a revision could be warranted, but no revisions have been made to the critical habitat yet.

North Atlantic right whales likely would not be encountered at the time of the proposed survey.

Federal and Other Action.—In 2002, NMFS received a petition to revise and expand the designation of critical habitat for the North Atlantic right whale. The revision was declined and the critical habitat designated in 1994 remained in place (NMFS 2005). Another petition for a revision to the critical habitat was received in 2009, which sought to expand the currently designated critical feeding and calving habitat areas and include a migratory corridor as critical habitat (NMFS 2010a). NMFS noted that the requested revision may be warranted, but no revisions have been made as of September 2013. The designation of critical habitat does not restrict activities within the area or mandate any specific management action. However, actions authorized, funded, or carried out by Federal agencies that may have an impact on critical habitat must be consulted upon in accordance with Section 7 of the ESA, regardless of the presence of right whales at the time of impacts. Impacts on these areas that could affect primary constituent elements such as prey availability and the quality of nursery areas must be considered when analyzing whether habitat may be adversely modified.

A number of other actions have been taken to protect North Atlantic right whales, including establishing the Right Whale Sighting Advisory System designed to reduce collisions between ships and right whales by alerting mariners to the presence of the whales (see NEFSC 2012); a Mandatory Ship Reporting System implemented by the U.S. Coast Guard in the right whale nursery and feeding areas (USCG 1999, 2001; Ward-Geiger et al. 2005); recommended shipping routes in key right whale aggregation areas (NOAA 2006, 2007, 2013c); and regulations to implement seasonal mandatory vessel speed restrictions in specific locations (Seasonal Management Areas) during times when whales are likely present, including ~37 km around points near the mouth of Chesapeake Bay (37.006ºN, 75.964ºW) and the Ports of Morehead City and Beaufort, NC (34.962ºN, 76.669ºW) during 1 November–30 April (NMFS 2008). Furthermore, the Bureau of Ocean Energy Management (BOEM) proposed that no seismic surveys would be authorized within right whale critical habitat areas in its draft PEIS (BOEM 2012). The proposed survey area is not in any of these areas.

Humpback Whale (*Megaptera novaeangliae*)

Although considered to be mainly a coastal species, humpback whales often traverse deep pelagic areas while migrating (e.g., Calambokidis et al. 2001). In the North Atlantic, a Gulf of Maine stock of the humpback whale is recognized off the northeastern U.S. coast as a distinct feeding stock (Palsbøll et al. 2001; Vigness-Raposa et al. 2010). Whales from this stock feed during spring, summer, and fall in areas ranging from Cape Cod to Newfoundland. In spring and summer, the greatest concentrations of humpback whales occur in the southern Gulf of Maine and east of Cape Cod, with a few sightings ranging south to North Carolina (Clapham et al. 1993; DoN 2005). Similar distribution patterns are seen in fall, although with fewer sightings. Off Virginia and North Carolina, most sightings mapped by DoN (2008a,b) are in winter, mostly nearshore; there were fewer in spring, most along the shelf break or in deep, offshore water; none in summer, and five in fall, mostly nearshore. During CETAP surveys, three sightings of humpbacks where made off Virginia: one each during spring, fall, and winter (CETAP 1982). There are 63 OBIS sighting records of humpback whales in and near the proposed survey area off the coasts of Virginia and North Carolina; most sightings were made over the continental shelf (IOC 2013).

Common Minke Whale (*Balaenoptera acutorostrata*)

Four populations of the minke whale are recognized in the North Atlantic, including the Canadian East Coast stock that ranges from the eastern U.S. coast to Davis Strait (Waring et al. 2013). Minke whales are common off the U.S. east coast over continental shelf waters, especially off New England during spring and summer (CETAP 1982; DoN 2005). Seasonal movements in the northwest Atlantic are apparent, with animals moving south and offshore from New England waters during winter (DoN 2005; Waring et al. 2013). Sightings off Virginia and North Carolina are less common; 15 sightings were mapped by DoN (2008a,b), most in winter and spring with 1 in summer and 1 in fall, and most on the shelf or near the shelf break. There are ~17 OBIS sighting records of minke whales for the shelf waters off Virginia and North Carolina and another two sightings in deep offshore waters (IOC 2013); half the sightings were made during spring and summer CETAP surveys (CETAP 1982).

Sei Whale (*Balaenoptera borealis*)

Two stocks of the sei whale are recognized in the North Atlantic: the Labrador Sea Stock and the Nova Scotia Stock; the latter has a distribution that includes continental shelf waters from the northeastern U.S. to areas south of Newfoundland (Waring et al. 2013). The southern portion of the Nova Scotia stock's range includes the Gulf of Maine and Georges Bank during spring and summer (Waring et al. 2013). Peak sightings occur in spring and are concentrated along the eastern edge of Georges Bank into the Northeast Channel and the southwestern edge of Georges Bank (DoN 2005; Waring et al. 2013). Mitchell and Chapman (1977) suggested that this stock moves from spring feeding grounds on or near Georges Bank to the Scotian Shelf in June and July, eastward to Newfoundland and the Grand Banks in late summer, back to the Scotian Shelf in fall, and offshore and south in winter. During summer and fall, most sei whale sightings occur in feeding grounds in the Bay of Fundy and on the Scotian Shelf; sightings south of Cape Cod are rare (DoN 2005). DoN (2008a) reported only six sightings off Virginia and North Carolina, all during winter and spring, and all north of Cape Hatteras. There are two OBIS sightings of sei whales off North Carolina (IOC 2013), including one in deep offshore water that was made during a CETAP survey in 1980 (CETAP 1982) and one on the shelf. Sei whales likely would not be encountered during the proposed survey.

Fin Whale (*Balaenoptera physalus*)

The fin whale is present in U.S. shelf waters during winter, and is sighted more frequently than any other large whale at this time (DoN 2005). Winter sightings are most concentrated around Georges Bank and in Cape Cod Bay. During spring and summer, most fin whale sightings are north of 40ºN, with smaller numbers on the shelf south of there (DoN 2005). During fall, almost all fin whales move out of U.S. waters to feeding grounds in the Bay of Fundy and on the Scotian Shelf, remain at Stellwagen Bank and Murray Basin (DoN 2005), or begin a southward migration (Clark 1995).

The occurrence of fin whales off Virginia and North Carolina appears to be highest during winter and spring, with more sightings close to shore during winter and farther offshore, mostly on the outer shelf and along the shelf break, during spring; only a few sightings were made in summer and fall (DoN 2008a,b). There are ~100 OBIS sightings of fin whales in and near the proposed survey area off Virginia and North Carolina, mainly in shelf waters (IOC 2013); some of these sightings were made during the CETAP surveys (CETAP 1982). Three fin whale sightings were made near the shelf break off Virginia and North Carolina during NEFSC and SEFSC summer surveys between 1995 and 2011 (Waring et al. 2013).

Blue Whale (*Balaenoptera musculus*)

In the western North Atlantic, the distribution of the blue whale extends as far north as Davis Strait and Baffin Bay (Sears and Perrin 2009). Little is known about the movements and wintering grounds of the stocks (Mizroch et al. 1984). The acoustic detection of blue whales using the U.S. Navy's Sound Surveillance System (SOSUS) program has tracked blue whales throughout most of the North Atlantic, including deep waters east of the U.S. Atlantic EEZ and subtropical waters north of the West Indies (Clark 1995).

Wenzel et al. (1988) reported the occurrence of three blue whales in the Gulf of Maine in 1986 and 1987, which were the only reports of blue whales in shelf waters from Cape Hatteras to Nova Scotia. Several other sightings for the waters off the east coast of the U.S. were reported by DoN (2005). Wenzel et al. (1988) suggested that it is unlikely that blue whales occur regularly in the shelf waters off the U.S. east coast. Similarly, Waring et al. (2010) suggested that the blue whale is, at best, an occasional visitor in the U.S. Atlantic EEZ.

During the 1978–1982 CETAP surveys, the only two sightings of blue whales were made just south of Nova Scotia (CETAP 1982). Two offshore sightings of blue whales during spring have been reported just to the northeast of the proposed survey area: one off the coast of North Carolina and the other off Virginia (IOC 2013). DoN (2008a) also reported one blue whale sighting to the northeast of the proposed survey area in deep water off North Carolina during spring. Blue whales likely would not be encountered during the proposed survey.

(2) Odontocetes

Sperm Whale (*Physeter macrocephalus*)

In the northwest Atlantic, the sperm whale generally occurs in deep water along the continental shelf break from Virginia to Georges Bank, and along the northern edge of the Gulf Stream (Waring et al. 2001). Shelf edge, oceanic waters, seamounts, and canyon shelf edges are also predicted habitats of sperm whales in the Northwest Atlantic (Waring et al. 2001). Off the eastern U.S. coast, they are also

known to concentrate in regions with well-developed temperature gradients, such as along the edges of the Gulf Stream and warm core rings, which may aggregate their primary prey, squid (Jaquet 1996).

Sperm whales appear to have a well-defined seasonal cycle in the northwest Atlantic. In winter, most historical records are in waters east and northeast of Cape Hatteras, with few animals north of 40ºN; in spring, they shift the center of their distribution northward to areas east of Delaware and Virginia, but they are widespread throughout the central area of the Mid-Atlantic Bight and southern tip of Georges Bank (DoN 2005; Waring et al. 2013). During summer, they expand their spring distribution to include areas east and north of Georges Bank, the Northeast Channel, and the continental shelf south of New England (inshore of 100 m deep). By fall, sperm whales are most common south of New England on the continental shelf but also along the shelf edge in the Mid-Atlantic Bight (DoN 2005; Waring et al. 2013).

Sperm whales occur in deep, offshore waters of Virginia and North Carolina throughout the year, on the shelf, along the shelf break, and offshore, including in and near the proposed survey area; the lowest number of sightings was in fall (DoN 2008a,b). There are several hundred OBIS records of sperm whales in deep waters off Virginia and North Carolina (IOC 2013), and numerous sightings were reported on and seaward of the shelf break during CETAP surveys (CETAP 1982) and during summer NEFSC and SEFSC surveys between 1998 and 2011 (Waring et al. 2013).

Pygmy and Dwarf Sperm Whales (*Kogia breviceps* and *K. sima*)

In the northwest Atlantic, both pygmy and dwarf sperm whales are thought to occur as far north as the Canadian east coast, with the pygmy sperm whale ranging as far as southern Labrador; both species prefer deep, offshore waters (Jefferson et al. 2008). Between 2006 and 2010, 127 pygmy and 32 dwarf sperm whale strandings were recorded from Maine to Puerto Rico, mostly off the southeastern U.S. coast; 11 strandings of *Kogia* spp. were reported for Virginia and 48 for North Carolina (Waring et al. 2013). There are eight OBIS sightings of pygmy or dwarf sperm whales in offshore waters off Virginia and North Carolina (IOC 2013). DoN (2008a,b) mapped 22 sightings of *Kogia* spp. off Virginia and North Carolina, most in winter and spring with 2 in summer and 1 in fall, and most near the shelf break or offshore. Several sightings of *Kogia* sp. (either pygmy or dwarf sperm whales) were also reported by DoN (2008a) and Waring et al. (2013) in deep, offshore waters off Virginia and North Carolina, all in summer.

Cuvier's Beaked Whale (*Ziphius cavirostris*)

In the northwest Atlantic, Cuvier's beaked whale has stranded and been sighted as far north as the Nova Scotian shelf, and occurs most commonly from Massachusetts to Florida (MacLeod et al. 2006). Most sightings in the northwest Atlantic occur in late spring or summer, particularly along the continental shelf edge in the mid-Atlantic region (CETAP 1982; DoN 2005; Waring et al. 2001, 2013).

Off North Carolina, 14 sightings of Cuvier's beaked whales were mapped by DoN (2008a,b), most along the shelf break or offshore; there were 7 in spring, 4 in winter, 2 in summer, and 1 in fall. Several sightings were made along the shelf break off North Carolina in the spring and summer during the 1978–1982 CETAP surveys (CETAP 1982). Palka (2012) reported one Cuvier's beaked whale sighting in deep offshore waters off Virginia during June–August 2011 surveys. There are four and nine OBIS sighting records of Cuvier's beaked whale in offshore waters off Virginia and North Carolina, respectively, including the CETAP sightings (IOC 2013).

True's Beaked Whale (*Mesoplodon mirus*)

In the Northwest Atlantic, True's beaked whale occurs from Nova Scotia to Florida and the Bahamas (Rice 1998). Carwardine (1995) suggested that this species could be associated with the Gulf Stream. One sighting was reported on the shelf break off North Carolina during spring (DoN 2008a,b), and there are three stranding records of True's beaked whale for North Carolina (DoN 2008a,b). Macleod et al. (2006) reported numerous other stranding records for the east coast of the U.S. Several sightings of unidentified beaked whales were reported off Virginia and North Carolina during summer NEFSC and SEFSC surveys between 1995 and 2011 (Waring et al. 2013). True's beaked whales likely would not be encountered during the proposed survey.

Gervais' Beaked Whale (*Mesoplodon europaeus*)

Based on stranding records, Gervais' beaked whale appears to be more common in the western Atlantic than in the eastern Atlantic (Macleod et al. 2006; Jefferson et al. 2008). Off the U.S. east coast, it occurs from Cape Cod Bay, Massachusetts (Moore et al. 2004) to Florida, with a few records in the Gulf of Mexico (Mead 1989). Numerous strandings were mapped by DoN (2008a,b) in North Carolina during all seasons, but there were no sightings. DoN (2005) also reported numerous other sightings along the shelf break off the northeast coast of the U.S. Palka (2012) reported one sighting in deep offshore waters off Virginia during June–August 2011 surveys. There are four OBIS stranding records of Gervais' beaked whale for Virginia (IOC 2013).

Blainville's Beaked Whale (*Mesoplodon densirostris*)

In the western North Atlantic, Blainville's beaked whale is found from Nova Scotia to Florida, the Bahamas, and the Gulf of Mexico (Würsig et al. 2000). There are numerous stranding records along the east coast of the U.S. (Macleod et al. 2006). DoN (2008a,b) mapped a number of strandings but no sightings of Blainville's beaked whale off Virginia or North Carolina; however, numerous sightings of unidentified beaked whales were mapped off Virginia and North Carolina by DoN (208a.b) and during summer NEFSC and SEFSC surveys between 1995 and 2011 (Waring et al. 2013). There is one OBIS sighting record in offshore waters off Virginia (IOC 2013). Blainville's beaked whales likely would not be encountered during the proposed survey.

Rough-toothed Dolphin (*Steno bredanensis*)

The rough-toothed dolphin is distributed worldwide in tropical, subtropical, and warm temperate waters (Miyazaki and Perrin 1994). It is generally seen in deep, oceanic water, although it can occur in shallow coastal waters in some locations (Jefferson et al. 2008). The rough-toothed dolphin rarely ranges north of 40°N (Jefferson et al. 2008). There are eight OBIS sighting records of rough-toothed dolphins off North Carolina (IOC 2013), including four sightings made during SEFSC surveys during 1992–1999 (Waring et al. 2010). Five of the OBIS sightings were made on the shelf, and three were made in deep, offshore water. DoN (2008a,b) reported two sightings off North Carolina, one in summer and one in fall. In addition, Palka (2012) reported three sightings in deep offshore waters off Virginia during June–August 2011 surveys.

Common Bottlenose Dolphin (*Tursiops truncatus*)

In the northwest Atlantic, the common bottlenose dolphin occurs from Nova Scotia to Florida, the Gulf of Mexico and the Caribbean, and south to Brazil (Würsig et al. 2000). There are regional and seasonal differences in the distribution of the offshore and coastal forms of bottlenose dolphins off the

U.S. east coast. Although strandings of bottlenose dolphins are a regular occurrence along the U.S. east coast, since July 2013, an unusually high number of dead or dying bottlenose dolphins (971 as of 8 December 2013; 1175 as of 16 March 2014; and 1219 as of 13 April 3014) have washed up on the mid-Atlantic coast from New York to Florida (NOAA 2013d). NOAA declared an unusual mortality event (UME), the tentative cause of which is thought to be cetacean morbillivirus. As of 8 December 2013, 163 of 174 dolphins tested (203 of 212 as of 14 April 2014) were confirmed positive or suspect positive for morbillivirus. NOAA personnel observed that the dolphins affected live in nearshore waters, whereas dolphins in offshore waters >50 m deep did not appear to be affected (Environment News Service 2013), but have stated that it is uncertain exactly what populations have been affected (NOAA 2013d). In addition to morbillivirus, the bacteria *Brucella* was confirmed in 11 of 43 dolphins tested (NOAA 2013d). The NOAA web site is updated frequently, and it is apparent that the strandings have been extending south; in the 4 November update, dead or dying dolphins had been reported only as far south as South Carolina, in the 8 December update, strandings were also reported in Georgia and Florida, whereas as of 13 April, there have been no reported strandings in New York or New Jersey in 2014.

Evidence of year-round or seasonal residents and migratory groups exist for the coastal form of bottlenose dolphins, with the so-called "northern migratory management unit" occurring from north of Cape Hatteras to New Jersey, but only during summer and in waters <25 m deep (Waring et al. 2010). The offshore form appears to be most abundant along the shelf break and is differentiated from the coastal form by occurring in waters typically >40 m deep (Waring et al. 2010). Bottlenose dolphin records in the northwest Atlantic suggest that they generally can occur year-round from the continental shelf to deeper waters over the abyssal plain, from the Scotian Shelf to North Carolina (DoN 2005, 2008a,b).

Palka (2012) reported several sightings off Virginia in water depths >2000 m during June–August 2011 surveys. There are also several thousand OBIS records for waters off Virginia and North Carolina, including sightings in the proposed survey area on the shelf, slope, and in offshore waters (IOC 2013).

Pantropical Spotted Dolphin (*Stenella attenuata*)

Pantropical spotted dolphins generally occur in deep offshore waters between 40°N and 40°S (Jefferson et al. 2008). Very few sightings were mapped by DoN (2008a,b) off Virginia and North Carolina: four in spring, one in winter, one in summer, and none in fall, although there were numerous sightings of unidentified spotted dolphins. Waring et al. (2010) reported one sighting off North Carolina and one off South Carolina during NEFSC and SEFSC surveys in the summer during 1998–2004. In addition, there are 91 OBIS sighting records for waters off Virginia and North Carolina, mostly in shelf waters, including the proposed survey area (IOC 2013).

Atlantic Spotted Dolphin (*Stenella frontalis*)

In the western Atlantic, the distribution of the Atlantic spotted dolphin extends from southern New England, south to the Gulf of Mexico, the Caribbean Sea, Venezuela, and Brazil (Leatherwood et al. 1976; Perrin et al. 1994a; Rice 1998). Numerous Atlantic spotted dolphin sightings off Virginia and North Carolina were mapped by DoN (2008a,b), especially in spring and summer, mainly near the shelf edge but also in shelf waters, on the slope, and offshore. Also mapped were numerous sightings of unidentified spotted dolphins. Numerous sightings were reported during summer NEFSC and SEFSC surveys between 1998 and 2011 on the shelf off North Carolina and seaward of the shelf break off Virginia and North Carolina (Waring et al. 2013). Palka (2012) also reported several sightings for offshore waters off Virginia during June–August 2011 surveys. There are 162 OBIS sighting records for

the waters off Virginia and North Carolina, mostly in shelf waters, including the proposed survey area (IOC 2013).

Spinner dolphin (*Stenella longirostris*)

The spinner dolphin is pantropical in distribution, with a range nearly identical to that of the pantropical spotted dolphin, including oceanic tropical and sub-tropical waters between 40ºN and 40ºS (Jefferson et al. 2008). The distribution of spinner dolphins in the Atlantic is poorly known, but they are thought to occur in deep waters along most of the U.S. coast; sightings off the northeast U.S. coast have occurred exclusively in offshore waters >2000 m (Waring et al. 2010). Five sightings off Virginia and North Carolina were mapped by DoN (2008a,b), all just outside the shelf break in winter, spring, and summer; there were also sightings of unidentified *Stenella* in all seasons, near the shelf break, on the slope, and in offshore waters. There are two OBIS sighting records of spinner dolphins (IOC 2013): one at the shelf break off North Carolina and one in deep, offshore waters off Virginia, made during CETAP surveys (CETAP 1982). Spinner dolphins likely would not be encountered during the proposed survey.

Striped Dolphin (*Stenella coeruleoalba*)

In the western North Atlantic, the striped dolphin occurs from Nova Scotia to the Gulf of Mexico and south to Brazil (Würsig et al. 2000). Off the northeastern U.S. coast, striped dolphins occur along the continental shelf edge and over the continental slope from Cape Hatteras to the southern edge of Georges Bank (Waring et al. 2013). In all seasons, striped dolphin sightings have been centered along the 1000-m depth contour, and sightings have been associated with the north edge of the Gulf Stream and warm core rings (Waring et al. 2013). Their occurrence off the northeastern U.S. coast seems to be highest in summer and lowest in fall (DoN 2005).

Off Virginia and North Carolina, striped dolphin sightings are made year-round, with the fewest number of sightings during fall (DoN 2008a,b). All were north of Cape Hatteras and almost all were in deep, offshore water. There are 126 OBIS sighting records of striped dolphins off Virginia and North Carolina, at the shelf break and in deep, offshore water, including the proposed survey area (IOC 2013). Several sightings were also reported off the shelf break during summer NEFSC and SEFSC surveys between 1998 and 2011 (Waring et al. 2013). Palka (2012) also reported several sightings for offshore waters off Virginia during June–August 2011 surveys.

Clymene Dolphin (*Stenella clymene*)

The Clymene dolphin only occurs in tropical and subtropical waters of the Atlantic Ocean (Jefferson et al. 2008). In the western Atlantic, it occurs from New Jersey to Florida, the Caribbean Sea, the Gulf of Mexico, and south to Venezuela and Brazil (Würsig et al. 2000; Fertl et al. 2003). It is generally sighted in deep waters beyond the shelf edge (Fertl et al. 2003). There are a few sightings for waters off the coast of Virginia and North Carolina, including in fall, and almost all in deep, offshore water (Fertl et al. 2003; DoN 2008a,b). There are also six OBIS sighting records for shelf and deep waters off North Carolina (IOC 2013).

Short-beaked Common Dolphin (*Delphinus delphis*)

The short-beaked common dolphin occurs from Cape Hatteras to Georges Bank during mid January–May, moves onto Georges Bank and the Scotian Shelf during mid summer and fall, and has been observed in large aggregations on Georges Bank in fall (Selzer and Payne 1988; Waring et al. 2013). Sightings off Virginia and North Carolina were made during all seasons, with most sightings during

winter and spring; in winter and spring, sightings were on the shelf, near the shelf break, and in offshore water, whereas in summer and fall, sightings were close to the shelf break (DoN 2008a,b). There are several hundred OBIS sighting records off the coasts of Virginia and North Carolina, including within the proposed survey area, with sightings on the shelf, near the shelf edge, and in offshore waters (IOC 2013).

Atlantic white-sided dolphin (*Lagenorhynchus acutus*)

The Atlantic white-sided dolphin occurs in cold temperate to subpolar waters of the North Atlantic in deep continental shelf and slope waters (Jefferson et al. 2008). Along the northeastern coast of the U.S., it ranges south to ~37ºN (CETAP 1982). There are seasonal shifts in its distribution off the northeastern U.S. coast, with low numbers in winter from Georges Basin to Jeffrey's Ledge and high numbers in spring in the Gulf of Maine (CETAP 1982; DoN 2005). In summer, Atlantic white-sided dolphins are mainly distributed northward from south of Cape Cod (DoN 2005). Sightings south of ~40ºN are infrequent during all seasons (CETAP 1982; DoN 2005). DoN (2008a) mapped 10 sightings off Virginia and North Carolina in all seasons, with most (4) in winter and fewest (1) in fall. During the CETAP surveys, two sightings were made during summer off Virginia, but no sightings were made off North Carolina (CETAP 1982). There is one OBIS sighting record in shelf waters off North Carolina and nine for Virginia just north of the proposed survey area, in shelf and deep, offshore waters (IOC 2013). White-sided dolphins likely would not be encountered during the proposed survey.

Fraser's Dolphin (*Lagenodelphis hosei*)

Fraser's dolphin is a tropical species distributed between 30ºN and 30ºS (Dolar 2009). It only rarely occurs in temperate regions, and then only in relation to temporary oceanographic anomalies such as El Niño events (Perrin et al. 1994b). The distribution of this species in the Atlantic is poorly known, but it is believed to be most abundant in the deep waters of the Gulf of Mexico (Dolar 2009). The only sighting during NMFS surveys was one off-transect sighting of an estimated 250 Fraser's dolphins in 1999 off Cape Hatteras, in waters 3300 m deep (NMFS 1999 *in* Waring et al. 2010); this sighting occurred within the proposed survey area. Fraser's dolphins likely would not be encountered during the proposed survey.

Risso's Dolphin (*Grampus griseus*)

The highest densities of Risso's dolphin occur in mid latitudes ranging from 30° to 45°, and primarily in outer continental shelf and slope waters (Jefferson et al. 2013). According to Payne et al. (1984 *in* Waring et al. 2013), Risso's dolphins are distributed along the continental shelf edge from Cape Hatteras to Georges Bank during spring, summer, and autumn, but they range in the North Atlantic Bight and into oceanic waters during winter (Waring et al. 2013). Mapping of Risso's dolphin sightings off the U.S. east coast suggests that they could occur year-round from the Scotian Shelf to the coast of the southeastern U.S. in waters extending from the continental shelf to the continental rise (DoN 2005). DoN (2008a,b) mapped numerous sightings throughout the year off the coasts of Virginia and North Carolina, most in spring, and almost all on the shelf break or in deeper water. Palka (2012) also made several sightings of Risso's dolphins in deep, offshore waters off Virginia. Several sightings were also reported during summer NEFSC and SEFSC surveys between 1998 and 2011 for the shelf break off Virginia and North Carolina (Waring et al. 2013). There are 199 OBIS records off the coasts of Virginia and North Carolina, including shelf and shelf break, and offshore waters within the proposed survey (IOC 2013).

Melon-headed Whale (*Peponocephala electra*)

The melon-headed whale is a pantropical species usually occurring between 40ºN and 35ºS (Jefferson et al. 2008). Occasional occurrences in temperate waters are extralimital, likely associated with warm currents (Perryman et al. 1994; Jefferson et al. 2008). Melon-headed whales are oceanic and occur in offshore areas (Perryman et al. 1994), as well as around oceanic islands. Off the east coast of the U.S., sightings have been of two groups (20 and 80) of melon-headed whales off Cape Hatteras in waters >2500 m deep during vessel surveys in 1999 and 2002 (NMFS 1999, 2002 *in* Waring et al. 2010). Melon-headed whales likely would not be encountered during the proposed survey.

Pygmy Killer Whale (*Feresa attenuata*)

The pygmy killer whale is pantropical/subtropical, generally occurring between 40ºN and 35ºS (Jefferson et al. 2008). There is no abundance estimate for the pygmy killer whale off the U.S. east coast because it is rarely sighted during surveys (Waring et al. 2010). One group of six pygmy killer whales was sighted off Cape Hatteras in waters >1500 m deep during a NMFS vessel survey in 1992 (Hansen et al. 1994 *in* Waring et al. 2010). There are also two OBIS sighting records off Virginia, in deep, offshore water (Palka et al. 1991 *in* IOC 2013). DoN (2008a,b) mapped one sighting in deep water off North Carolina in winter, one stranding in spring, and one stranding in fall. Pygmy killer whales likely would not be encountered during the proposed survey.

False Killer Whale (*Pseudorca crassidens*)

The false killer whale is found worldwide in tropical and temperate waters generally between 50ºN and 50ºS (Odell and McClune 1999). It is widely distributed, but not abundant anywhere (Carwardine 1995). In the western Atlantic, it occurs from Maryland to Argentina (Rice 1998). Very few false killer whales were sighted off the U.S. northeast coast in the numerous surveys mapped by DON (2005, 2008a,b): off Virginia and North Carolina, two sightings were made during summer and one during spring (DoN 2008a,b). There are five OBIS sighting records for the waters off Virginia and North Carolina, on the shelf, along the shelf edge, and in deep water (IOC 2013), including one sighting during the 1978–1982 CETAP surveys (CETAP 1982). False killer whales likely would not be encountered during the proposed survey.

Killer Whale (*Orcinus orca*)

In the western North Atlantic, the killer whale occurs from the polar ice pack to Florida and the Gulf of Mexico (Würsig et al. 2000). Based on historical sightings and whaling records, killer whales apparently were most often found along the shelf break and offshore in the northwest Atlantic (Katona et al. 1988). They are considered uncommon or rare in waters of the U.S. Atlantic EEZ (Katona et al. 1988). Killer whales represented <0.1 % of all cetacean sightings (12 of 11,156 sightings) in CETAP surveys during 1978–1981 (CETAP 1982). Four of the 12 sightings made during the CETAP surveys were made offshore from North Carolina. DoN (2008a,b) mapped eight sightings off Virginia and North Carolina, all during spring and almost all along the shelf break and in deep, offshore water. There are 39 OBIS sighting records for the waters off the eastern U.S., four of which were off North Carolina, on the shelf, along the shelf edge, and in deep water (IOC 2013). Killer whales likely would not be encountered during the proposed survey.

Long- and short-finned pilot whales (*Globicephala melas* and *G. macrorhynchus*)

There are two species of pilot whale, both of which could occur in the survey area. The long-finned pilot whale (*G. melas*) is distributed antitropically, whereas the short-finned pilot whale (*G. macrorhynchus*) is found in tropical, subtropical, and warm temperate waters (Olson 2009). In the northwest Atlantic, pilot whales often occupy areas of high relief or submerged banks and associated with the Gulf Stream edge or thermal fronts along the continental shelf edge (Waring et al. 1992). The ranges of the two species overlap in the shelf/shelf-edge and slope waters of the northeastern U.S. between New Jersey and Cape Hatteras, with long-finned pilot whales occurring to the north (Bernard and Reilly 1999).

Pilot whales are common off North Carolina and Virginia year-round, and almost all were along the shelf break or in deeper water (DoN 2008a,b). There are several hundred OBIS sighting records for pilot whales for shelf, slope, and offshore waters off Virginia and North Carolina, including within the proposed survey area; these sightings include *G. macrorhynchus* and *G. melas* (IOC 2013). Numerous sightings were also reported during summer NEFSC and SEFSC surveys between 1998 and 2007 for the shelf break off North Carolina and Virginia (Waring et al. 2010). Palka (2012) reported two sightings of short-finned pilot whales and two sightings of *Globicephala* spp. off Virginia during June–August 2011 surveys.

Harbor porpoise (*Phocoena phocoena*)

The harbor porpoise inhabits cool temperate to subarctic waters of the Northern Hemisphere (Jefferson et al. 2008). There are likely four populations in the western North Atlantic: Gulf of Maine/Bay of Fundy, Gulf of St. Lawrence, Newfoundland, and Greenland (Gaskin 1984, 1992). Individuals found off the eastern U.S. coast likely would be almost exclusively from the Gulf of Maine/Bay of Fundy stock.

Harbor porpoises concentrate in the northern Gulf of Maine and southern Bay of Fundy during July–September, with a few sightings ranging as far south as Georges Bank and one sighting off Virginia (Waring et al. 2013). In summer, sightings mapped from numerous sources generally extended only as far south as Long Island, New York (DoN 2005). During October–December and April–June, harbor porpoises are dispersed and range from New Jersey to Maine, although there are lower densities at the northern and southern extremes (DoN 2005; Waring et al. 2013). Most animals are found over the continental shelf, but some are also encountered over deep water (Westgate et al. 1998). During January–March, harbor porpoises concentrate farther south, from New Jersey to North Carolina, with lower densities occurring from New York to New Brunswick (DoN 2005; Waring et al. 2013).

There are five OBIS sighting records for shelf waters off Virginia and North Carolina, and hundreds of stranding records (IOC 2013). Also for the waters off Virginia and North Carolina, DoN (2008a,b) mapped 7 sighting records and 10 bycatch records in winter, 1 sighting and 1 bycatch record in spring, and 1 sighting in fall. There were also numerous stranding records in winter and spring, and one in fall (DoN 2008a,b). Harbor porpoises likely would not be encountered during the proposed survey.

Sea Turtles

Two species of sea turtle, the leatherback and loggerhead turtles, are common off the U.S. east coast. Kemp's ridley and green turtles also occur in this area at much lower densities. A fifth species, the hawksbill turtle, is considered very rare in the eastern U.S. General information on the taxonomy, ecology, distribution and movements, and acoustic capabilities of sea turtles are given in § 3.4.1 of the PEIS. The general distribution of sea turtles in the northwest Atlantic is discussed in § 3.4.2.1 of the

PEIS, § 4.2.3.1 of the BOEM Draft PEIS (BOEM 2012), and in § 3.8.2 of the Final EIS/OEIS for the Virginia Capes and the Cherry Point Range Complexes (DoN 2009a,b). The rest of this section focuses on their distribution off Virginia and North Carolina.

(1) Leatherback Turtle (*Dermochelys coriacea*)

Leatherback turtles commonly occur along the eastern U.S. coast and as far north as New England (Eckert 1995a), although important nesting areas occur only as far north as Florida (NMFS and USFWS 2013a). Leatherbacks tagged off Cape Breton and mainland Nova Scotia during summer remained off eastern Canada and the northeastern U.S. coast before most began migrating south in October (James et al. 2005); foraging adults off Nova Scotia mainly originate from Trinidad (NMFS and USFWS 2013a). Some of the tags remained attached long enough to observe northward migrations, with animals leaving nesting grounds during February–March and typically arriving north of 38ºN during June, usually in areas within several hundred km of where they were observed in the previous year.

Leatherback turtle sightings off Virginia and North Carolina mapped by (DoN 2008a,b) are most numerous during spring and summer, although sightings were reported for all seasons; most sightings were on the shelf, with fewer along the shelf break and in offshore waters. Palka (2012) reported one sighting off Virginia during June–August 2011 surveys. There are over 200 OBIS sighting records off Virginia and North Carolina, on the shelf, along the shelf edge, and in deep water (IOC 2013). During CETAP surveys, leatherback turtles were sighted off North Carolina during spring, summer, and fall, and off Virginia during summer.

(2) Green Turtle (*Chelonia mydas*)

Important feeding areas for green turtles in U.S. waters are primarily located in Florida and southern Texas, but Long Island Sound and inshore waters of North Carolina appear to be important to juveniles during summer months (NMFS and USFWS 2007). There are few sighting records in the northeastern U.S., but DoN (2005) suggested that small numbers could be found from spring to fall as far north as Cape Cod Bay. DoN (2008a,b) mapped 61 sightings off Virginia and North Carolina, mostly on the shelf, in all seasons with the highest number in spring and the lowest in winter. There are 31 OBIS sightings of green turtles off the coasts of Virginia and North Carolina, on the shelf, along the shelf edge, and in deep water (IOC 2013).

(3) Loggerhead Turtle (*Caretta caretta*)

Major nesting areas for loggerheads in the western North Atlantic are located in the southeastern U.S., principally southern Florida, but also as far north as the Carolinas and occasionally Virginia; the nesting season is from May to August (Spotila 2004). Most females tagged on North Carolina nesting beaches traveled north to forage at higher latitudes (primarily off New Jersey, Maryland, and Delaware) during summer, and south to wintering grounds off the southeastern U.S. in the fall (Hawkes et al. 2007). Some juveniles make seasonal foraging migrations into temperate latitudes as far north as Long Island, New York (Shoop and Kenney 1992 *in* Musick and Limpus 1997).

DoN (2008a,b) mapped numerous sightings of loggerheads off the coasts of Virginia and North Carolina, especially during spring and summer; most records are for shelf waters, but there are also sightings on the shelf break and farther offshore. Sightings of loggerhead turtles were by far the most numerous of any sea turtle. There are thousands of OBIS sighting records off the coasts of Virginia and

North Carolina, mostly on the shelf but also along the shelf edge and in deep water, including in the proposed survey area (IOC 2013).

In 2013, NMFS proposed 36 areas in the range of the Northwestern Atlantic Ocean Distinct Population Segment (DPS) of the loggerhead turtle, from Virginia to the Gulf of Mexico (NMFS 2013a). The areas contain one or more of nearshore reproductive habitat, winter area, breeding areas, and migratory corridors. In the proposed survey area, the inner end (20-100 m) of the southern on-offshore transect is in winter habitat, and there are a few transects north of Cape Hatteras that extend into migratory habitat, which extends from shore to 200 m depth.

(4) Hawksbill Turtle (*Eretmochelys imbricata*)

The hawksbill is the most tropical of all sea turtles, generally occurring between ~30ºN and ~30ºS (Eckert 1995b). In the Atlantic Ocean, most nesting beaches are in the Caribbean Sea as far north as Cuba and the Bahamas (NMFS and USFWS 2013b). It is considered very rare and possibly extralimital in the northwest Atlantic (Lazell 1980; Eckert 1995b). DoN (2008a,b) mapped 16 sightings of hawksbill turtles off the coasts of Virginia and North Carolina throughout the year, with fewest in fall and most on the shelf. There are five OBIS sighting records in shelf waters off Virginia and North Carolina (IOC 2013).

(5) Kemp's Ridley Turtle (*Lepidochelys kempii*)

Kemp's ridley turtle has a more restricted distribution than other sea turtles, with adults primarily located in the Gulf of Mexico; some juveniles also feed along the U.S. east coast, including Chesapeake Bay, Delaware Bay, Long Island Sound, and waters off Cape Cod (Spotila 2004). Nesting occurs primarily along the central and southern Gulf of Mexico coast during May–late July (Morreale et al. 2007). There have also been some rare records of females nesting on Atlantic beaches of Florida, North Carolina, and South Carolina (Plotkin 2003). After nesting, female Kemp's ridley turtles travel to foraging areas along the coast of the Gulf of Mexico, typically in waters <50 m deep from Mexico's Yucatan Peninsula to southern Florida; males tend to stay near nesting beaches in the central Gulf of Mexico year-round (Morreale et al. 2007). Only juvenile and immature Kemp's ridley turtles appear to move beyond the Gulf of Mexico into more northerly waters along the U.S. east coast.

Hatchlings are carried by the prevalent currents off the nesting beaches and do not reappear in the neritic zone until they are about two years old (Musick and Limpus 1997). Those juvenile and immature Kemp's ridley turtles that migrate northward past Cape Hatteras probably do so in April and return southward in November (Musick et al. 1994). North of Cape Hatteras, juvenile and immature Kemp's ridleys prefer shallow-water areas, particularly along North Carolina and in Chesapeake Bay, Long Island Sound, and Cape Cod Bay (Musick et al. 1994; Morreale et al. 1989; Danton and Prescott 1988; Frazier et al. 2007). Virtually all sighting records of Kemp's ridley turtles off the northeastern U.S. were in summer in the shelf waters off the coast of New Jersey, with fewer sightings off Delaware, Maryland, and Virginia (DoN 2005). DoN (2008a,b) mapped numerous sightings off Virginia and North Carolina in all seasons, with most in winter and summer; numerous strandings occurred in all seasons but winter, mostly in spring and fall. There was one sighting off North Carolina during 1978–1982 CETAP surveys (CETAP 1982). There are 124 OBIS sighting records off the coast of Virginia and North Carolina, most in shelf waters with a few in deep offshore waters, including in the proposed survey area (IOC 2013).

Seabirds

Three ESA-listed seabird species could occur in or near the Project area: the ***Threatened*** piping plover and the ***Endangered*** roseate tern and Bermuda petrel. General information on the taxonomy, ecology, distribution and movements, and acoustic capabilities of seabird families are given in § 3.5.1 of the PEIS.

(1) Piping Plover (*Charadrius melodus*)

The Atlantic Coast Population of the piping plover is listed as ***Threatened*** under the U.S. ESA, and the species is listed as ***Near Threatened*** on the IUCN Red List of Threatened Species (IUCN 2013). It breeds on coastal beaches from Newfoundland to North Carolina during March–August and it winters along the Atlantic Coast from North Carolina south, along the Gulf Coast, and in the Caribbean (USFWS 1996). Its marine nesting habitat consists of sandy beaches, sandflats, and barrier islands (Birdlife International 2013). Feeding areas include intertidal portions of ocean beaches, mudflats, sandflats, and shorelines of coastal ponds, lagoons, or salt marshes (USFWS 1996). Wintering plovers are generally found on barrier islands, along sandy peninsulas, and near coastal inlets (USFWS 1996).

Because it is strictly coastal, the piping plover likely would not be encountered at the proposed survey site.

(2) Roseate Tern (*Sterna dougallii*)

The Northeast Population of the roseate tern is listed as ***Endangered*** under the U.S. ESA, and the species is listed as ***Near Threatened*** on the IUCN Red List of Threatened Species (IUCN 2013). It breeds on islands along the northeast coast of the U.S from New York to Maine and north into Canada, and historically as far south as Virginia (USFWS 1998, 2010). It is thought to migrate beginning in mid September through the eastern Caribbean and along the north coast of South America, and to winter mainly on the east coast of Brazil (USFWS 2010). During the breeding season, roseate terns forage over shallow coastal waters, especially in water depths <5 m, sometimes near the colony and at other times at distances of over 30 km. They usually forage over shallow bays, tidal inlets and channels, tide rips, and sandbars (USFWS 2010).

(3) Bermuda Petrel (*Pterodroma cahow*)

The Bermuda petrel is listed as ***Endangered*** under the U.S. ESA and ***Endangered*** on the IUCN Red List of Threatened Species (IUCN 2013). It was thought to be extinct by the 17th century until it was rediscovered in 1951, at which time the population consisted of 18 pairs; by 2011, the population had reached 98 nesting pairs (Birdlife International 2013b). Currently, all known breeding pairs breed on islets in Castle Harbour, Bermuda (Maderios et al. 2012). In the non-breeding season (mid June–mid October), it is though that birds move north into the Atlantic and following the warm waters on the western edges of the Gulf Stream. There are confirmed sightings off North Carolina Birdlife International 2013b). Small numbers of Bermuda petrels could be encountered over deep water at the eastern edge of the proposed survey area.

Fish, Essential Fish Habitat, and Habitat Areas of Particular Concern

(1) ESA-Listed Fish and Invertebrate Species

There are two fish species listed under the ESA as ***Endangered*** that could occur in the study area: the Carolina distinct population segment (DPS) of the Atlantic sturgeon, and the shortnose sturgeon. There are three species that are candidates for ESA listing: the Nassau grouper, the Northwest Atlantic and Gulf of Mexico DPS of the dusky shark, and the great hammerhead shark. There are no listed or candidate invertebrate species.

Atlantic Sturgeon (*Acipenser oxyrinchus oxyrinchus*)

Five DPSs of the Atlantic sturgeon are listed under the U.S. ESA, one as ***Threatened*** and four as ***Endangered***, including the Carolina DPS, and the species is listed as ***Critically Endangered*** on the IUCN Red List of Threatened Species (IUCN 2013). It is a long-lived, late maturing (11–21 years in the Hudson River), anadromous fish. Spawning adults migrate upriver in spring, beginning in April–May in the mid Atlantic. The Carolina DPS primarily uses the Roanoke River, Tar and Neuse rivers, Cape Fear, and Winyah Bay for spawning. Following spawning, males can remain in the river or lower estuary until fall, and females usually exit the rivers within 4–6 weeks. Juveniles move downstream and inhabit brackish waters for a few months before moving into nearshore coastal waters (NOAA 2012a).

Shortnose Sturgeon (*Acipenser brevirostrum*)

The shortnose sturgeon is listed as ***Endangered*** throughout its range under the U.S. ESA and ***Vulnerable*** on the IUCN Red List of Threatened Species (IUCN 2013). It is an anadromous species that spawns in coastal rivers along the east coast of North America from Canada to Florida. The shortnose sturgeon prefers the nearshore marine, estuarine, and riverine habitats of large river systems, and apparently does not make long-distance offshore migrations (NOAA 2013e).

Nassau Grouper (*Epinephelus striatus*)

The Nassau grouper is an ESA ***Candidate Species*** throughout its range, and is listed as ***Endangered*** on the IUCN Red List of Threatened Species (IUCN 2013). It ranges from North Carolina south to Florida and throughout the Bahamas and Caribbean (Hall 2010). Nassau groupers occur to ~100 m depth and are usually found near high-relief coral reefs or rocky substrate (NMFS 2012). They are solitary fish except when they congregate to spawn in very large numbers (NMFS 2012).

Dusky Shark (*Carcharhinus obscurus*)

The Northwest Atlantic and Gulf of Mexico DPS of the dusky shark is an ESA ***Candidate Species***, and the species is listed as ***Vulnerable*** on the IUCN Red List of Threatened Species (IUCN 2013). It is a coastal-pelagic species that inhabits warm temperate and tropical waters throughout the world. In the Northwest Atlantic, it is found from southern Massachusetts and Georges Bank to Florida and the northern Gulf of Mexico. The dusky shark occurs in both inshore and offshore waters, although it avoids areas of low salinity from the surface to depths of 575 m. Along U.S. coasts, it undertakes long temperature-related migrations, moving north in summer and south in fall (NMFS 201b).

Great Hammerhead Shark (*Carcharhinus mokarran*)

The great hammerhead shark is an ESA ***Candidate Species***, and has not been assessed for the IUCN Red List. It is a highly migratory species found in coastal, warm temperate and tropical waters

throughout the World, usually in coastal waters and over continental shelves, but also adjacent deep waters. Along the U.S. east coast, the great hammerhead shark can be found in waters off Massachusetts, although it is rare north of North Carolina, and south to Florida and the Gulf of Mexico (NOAA 2013f).

(2) Essential Fish Habitat

Essential fish habitat is defined as "those waters and substrate necessary to fish for spawning, breeding, feeding, or growth to maturity". "Waters" include aquatic areas and their associated physical, chemical, and biological properties that are used by fish. "Substrate" includes sediment, hard bottom, structures underlying the waters, and associated biological communities (NMFS 2013c). The entire eastern seaboard from the coast to the limits of the EEZ is EFH for one or more species or life stage for which EFH has been designated.

Two fishery management councils, created by the 1976 Magnuson Fisheries Conservation and Management Act (renamed Magnuson Stevens Fisheries Conservation and Management Act in 1996) are responsible for the management of fishery resources, including designation of EFH, in federal waters of the survey area: the Mid-Atlantic Fishery Management Council (MAFMC) and the South Atlantic Fishery Management Council (SAFMC). The Highly Migratory Division of the National Marine Fisheries Service in Silver Spring, MD, manages highly migratory species (sharks, swordfish, billfish, and tunas).

The life stages and associated habitats for those species with EFH in the survey area are described in Table 4.

Several EFH areas in or near the proposed survey area have prohibitions in place for various gear types and/or possession of specific species/species groups: (1) Restricted areas designated to minimize impacts on juvenile and adult tilefish EFH from bottom trawling activity (see further under next section), (2) Prohibitions on the use of several gear types to fish for and retain snapper-grouper species from state waters to the limit of the EEZ, including roller rig trawls, bottom longlines, and fish traps; and on the harvesting of *Sargassum* (an abundant brown algae that occurs on the surface in the warm waters of the western North Atlantic), soft corals, and gorgonians (SAFMC 2013), and (3) Prohibitions on the possession of coral species and the use of all bottom-damaging gear (including bottom longline, bottom and mid-water trawl, dredge, pot/trap, and anchor/anchor and chain/grapple and chain) by all fishing vessels in Deepwater Coral HAPC (see further under next section).

(3) Habitat Areas of Particular Concern

Habitat Areas of Particular Concern (HAPC) are subsets of EFH that provide important ecological functions and/or are especially vulnerable to degradation, and are designated by Fishery Management Councils. HAPC have been designated for seven species/species groups within the proposed survey area:

1. Juvenile and adult summer flounder: all native species of macroalgae, seagrasses, and freshwater and tidal macrophytes in any size bed, as well as loose aggregations, within adult and juvenile EFH, which is demersal waters over the continental shelf north of Cape Hatteras and demersal waters over the continental shelf south of Cape Hatteras to a depth of 152 m (NOAA 2012b);
2. Juvenile and adult tilefish: four canyons with clay outcroppings ("pueblo habitats"; complex of burrows in clay outcrops, walls of submarine canyons, or elsewhere on the outer continental shelf) in 100–300 m depths (MAFMC and NMFS 2008), of which the Norfolk Canyon (HAPC # 11 in Fig. 1) is just north of the survey area;

TABLE 4. Marine species with Essential Fish Habitat (EFH) overlapping the proposed survey area.

	Life stage[1] and habitat[2]				
Species	E	L/N	J	A	SA
Atlantic herring *Clupea harengus*			P/D	P/D	
Bluefish *Pomatomus saltatrix*	P	P	P	P	P
Butterfish *Peprilus triacanthus*	P	P	P	P	P
Black sea bass *Centropristis striata*	P	D	D	D	D
Atlantic mackerel *Scomber scombrus*	P	P	P	P	P
King mackerel *Scomberomorus cavalla*	P[3]	P[3]	P[3]	P[3]	P[3]
Spanish mackerel *Scomberomorus maculatus*	P[3]	P[3]	P[3]	P[3]	P[3]
Cobia *Rachycentron canadum*	P[3]	P[3]	P[3]	P[3]	P[3]
Snapper-Grouper[4]	P/D	P/D	P/D	P/D	P/D
Offshore hake *Merluccius albidus*	P	P	D	D	D
Red hake *Urophycis chuss*	P	P	D	D	D
Silver hake *Merluccius bilinearis*	P	P	D	D	D
White hake *Urophycis tenuis*	P	P	P/D	D	D
Scup *Stenotomus chrysops*	P[5]	P/D[5]	D	D	D
Dolphin *Coryphaena hippurus,* wahoo *Acanthocybium solanderi*	P[6]	P[6]	P[6]	P[6]	P[6]
Tilefish *Lopholatilus chamaeleonticeps*	P[7]	P[7]	B[7]	B[7]	B[7]
Monkfish *Lophius americanus*	P	P	B	B	B
Summer flounder *Paralichthys dentatus*	P	P	B	B	B
Window pane flounder *Scophthalmus aquosus*	P	P	B	B	B
Witch flounder *Glyptocephalus cynoglossus*	P	P	B	B	B
Yellowtail flounder *Limanda ferruginea*		P			
Albacore tuna *Thunnus alalunga*			P	P	
Bluefin tuna *Thunnus thynnus*		P	P	P	
Bigeye tuna *Thunnus obesus*			P	P	
Yellowfin tuna *Thunnus albacres*			P	P	
Skipjack tuna *Katsuwonus pelamis*			P	P	
Swordfish *Xiphias gladius*		P	P	P	
Blue marlin *Makaira nigricans*			P	P	
White marlin *Tetrapturus albidus*			P	P	
Sailfish *Istiophorus platypterus*	P	P	P	P	P
Longbill spearfish *Tetrapturus pfluegeri*			P	P	
Roundscale spearfish *Tetrapturus georgii*			P	P	
Clearnose skate *Raja eglanteria*			B[8]	B[8]	
Little skate *Leucoraja erinacea*			B[9]	B[9]	
Rosette skate *Leucoraja garmani*			B[10]	B[10]	
Winter skate *Leucoraja ocellata*			B[11]	B[11]	
Angel shark *Squatina dumeril*			B	B	
Atlantic sharpnose shark *Rhizoprionodon terraenovae*		B	B	B	
Basking shark *Cetorhinus maximus*			P	P	
Bigeye thresher shark *Alopias superciliosus*		P	P	P	
Common thresher shark *Alopias vulpinus*		P	P	P	
Blue shark *Prionace glauca*			P	P	
Porbeagle shark *Lamna nasus*		P	P	P	
Longfin mako shark *Isurus paucus*		P	P	P	
Shortfin mako shark *Isurus oxyrinchus*		P	P	P	
Smooth (spiny) dogfish *Squalus acanthias*		P	P	P	
Tiger shark *Galeocerdo cuvier*		P	P	P	
Sand tiger shark *Carcharias taurus*		P	P	P	
White shark *Carcharodon carcharias*		P	P	P	
Bonnethead shark *Sphyrna tiburo*				B	
Great hammerhead shark *Sphyrna mokarran*		P	P	P	
Scalloped hammerhead shark *Sphyrna lewini*		P	P	P	
Bignose shark *Carcharhinus altimus*			B	B	

TABLE 4. (Concluded).

Species	Life stage[1] and habitat[2]				
	E	L/N	J	A	SA
Blacknose shark *Carcharhinus acronotus*		B	B	B	
Blacktip shark *Carcharhinus limbatus*		P	P	P	
Dusky shark *Carcharhinus obscurus*		P	P	P	
Finetooth shark *Carcharhinus isodon*			P	P	
Night shark *Carcharhinus signatus*		P	P	P	
Oceanic whitetip shark *Carcharhinus longimanus*		P	P	P	
Sandbar shark *Carcharhinus plumbeus*		B	B	B	
Silky shark *Carcharhinus falciformis*		P	P	P	
Spinner shark *Carcharhinus brevipinna*		P	P	P	
Atlantic sea scallop *Placopecten magellanicus*	B	P	B	B	B
Atlantic surfclam *Spisula solidissima*	P[12]	P[12]	B[12]	B[12]	B[12]
Ocean quahog *Arctica islandica*	P[13]	P[13]	B[13]	B[13]	B[13]
Golden crab *Chaceon fenneri*	P[6]	P/B[6]	B[6]	B[6]	B[6]
Red crab *Chaceon quinquedens*	P[14]	P/B[14]	B[14]	B[14]	B[14]
Spiny lobster *Panulirus argus*		P[6]	B[6]	B[6]	
Shrimp	P/D[6]	P/D[6]	P/D[6]	P/D[6]	P/D[6]
Northern shortfin squid *Illex illecebrosus*	P[15]	P[15]	D/P[15]	D/P[15]	D/P[15]
Longfin inshore squid *Loligo pealeii*	B[16]	P[16]	D/P[16]	D/P[16]	D/P[16]
Coral, coral reefs and live/hard bottom[17]		D/B[6]	B[6]	B[6]	B[6]

Source: NOAA 2012b

[1] E = eggs; L/N = larvae for bony fish and invertebrates, neonate for sharks; J = juvenile; A = adult; SA = spawning adult

[2] P = pelagic; D = demersal; B = benthic

References: [3] ESS 2013; [4] May include up to 70 species (NOAA 2012b); [5] Steimle et al. 1999a; [6] SAFMC 1998; [7] Steimle et al. 1999b; [8] Packer et al. 2003a; [9] Packer at al. 2003b; [10] Packer et al. 2003c; [11] Packer et al. 2003d; [12] Cargnelli et al. 1999a; [13] Cargnelli et al. 1999b; [14] Steimle et al. 2001; [15] Hendrickson and Holmes 2004; [16] Jacobson 2005

[17] May include black corals (*Antipatharia*) and Octocorals (including sea pens and sea pansies)

3. Species in the snapper-grouper management group: medium- to high-profile offshore hard bottoms where spawning normally occurs; localities of known or likely periodic spawning aggregations; nearshore hard-bottom areas; The Point (HAPC # 1 in Fig. 1), The 10- Fathom Ledge (HAPC # 5 in Fig. 1), and Big Rock (HAPC # 10 in Fig. 1); The Charleston Bump Complex (HAPC # 4 in Fig. 1); mangrove habitat; seagrass habitat; oyster/shell habitat; all coastal inlets (in and near the survey area, HAPC # 2 in Fig. 1); all state-designated nursery habitats of particular importance to snapper/grouper (e.g., Primary and Secondary Nursery Areas designated in North Carolina); and pelagic and benthic *Sargassum* (SAFMC and NMFS 2011);
4. Coastal migratory pelagics (including sharks, swordfish, billfish, and tunas) and dolphin and wahoo fish: within the proposed survey area, The Point, the Charleston Bump Complex, 10-Fathom Ledge, Big Rock, and pelagic *Sargassum* (SAFMC and NMFS 2009);
5. Deepwater Coral: Within the survey area, The Point, 10-Fathom Ledge, Big Rock, Cape Lookout *Lophelia* Banks (HAPC # 7 in Fig. 1), and Cape Fear *Lophelia* Banks (HAPC # 8 in Fig. 1) (SAFMC 2013); the use of specified fishing gear/methods and the possession of corals are prohibited (SAFMC 2013);
6. Sandbar shark: in and near the survey area region, important nursery and pupping grounds near Outer Banks (North Carolina), in areas of Pamlico Sound and adjacent to Hatteras and Ocracoke Islands (North Carolina), and offshore those islands (HAPC # 6 in Fig. 1; NOAA 2012b); and

7. *Sargassum*: HAPC for various fish species because of mutually beneficial relationship between the fishes and algae, and commercial harvest; the top 10 m of the water column in the South Atlantic EEZ, bounded by the Gulf Stream (SAFMC and NMFS 2011; SAFMC 2013).

Fisheries

Commercial and recreational fisheries data are collected by NMFS, including species, gear type and landings mass and value, all of which are reported by state of landing (NOAA 2013g). Fisheries data from 2008 to 2012 (and 2013 where available) were used in the analysis of Virginia's and North Carolina's commercial and recreational fisheries. The latest year's available data are considered preliminary.

(1) Commercial Fisheries

Virginia

In the waters off Virginia, commercial fishery catches are dominated by menhaden, various finfish, and shellfish. Menhaden accounted for 84% of the catch weight, followed by blue crab (7%), sea scallop (2%), Atlantic croaker (2%), summer flounder (1%), unidentified finfish (1%), and northern quahog clam (1%). Numerous other fish and invertebrate species accounted for the remaining proportion of catch weight. Most fish and all shellfish and squid were captured within 5.6 km from shore, which would be outside of the proposed survey area. The average annual catch weights and values, fishing season, and gear types for major commercial species are summarized in Table 5. During 2002–2006 (the last year reported), commercial catch has only been landed by U.S. and Canadian vessels in the EEZ along the U.S east coast, with the vast majority of the catch (>99%) taken by U.S. vessels (Sea Around Us Project 2011). Typical commercial fishing vessels in the Virginia area include trawlers, gill netters, lobster/crab boats, dredgers, longliners, and purse seiners.

North Carolina

In North Carolina waters, commercial fishery catches are predominantly various shellfish and finfish. Blue crab accounted for 43% of the catch weight, followed by Atlantic croaker (8%), brown shrimp (6%), summer flounder (4%), bluefish (3%), southern flounder (3%), striped (liza) mullet (3%), spiny dogfish shark (3%), white shrimp (3%), menhaden (2%), smooth dogfish shark (2%), and Spanish mackerel (1%). Numerous other fish and invertebrate species accounted for the remaining proportion of catch weight. Fish were caught equally within 5.6 km from shore and between 5.6 and 370 km from shore, whereas the majority of shellfish were caught within 5.6 km from shore. The average annual catch weights and values, fishing season, and gear types for major commercial species are summarized in Table 6). Typical commercial fishing vessels in the North Carolina area include trawlers, gill netters, lobster/crab boats, dredgers, longliners, and purse seiners.

(2) Recreational Fisheries

Virginia

In 2012, marine recreational fishers in Virginia waters caught ~7.9 million fish for harvest or bait, and ~13.7 million fish in catch and release programs. These catches were taken by 684,022 recreational fishers during more than 2.5 million trips. The majority of the trips (99%) occurred within 5.6 km from

TABLE 5. Commercial fishery catches for major marine species for Virginia waters by weight, value, season, and gear type, averaged from 2008 to 2012.

Species	Average annual landings (mt)	% total	Average annual landings (1000$)	% total	Fishing season (peak season)	Gear Type	
						Fixed	Mobile
Menhaden	176,236	87	28,681	19	Year-round (May-Nov)	Gill nets, long lines, pots, traps, pound nets	Cast nets, seines, hand lines,
Blue crab	14,436	7	21,548	15	Year-round (Mar-Oct)	Gill nets, pots, traps, lines trot with bait, pound nets	Dip nets, dredge, fyke net, hand lines, picks, scrapes, tongs, grabs
Sea scallop	3,905	2	66,511	45	Year-round (Mar-Sept)	N/A	Dredge, trawls
Atlantic croaker	3,637	2	6,056	4	Year-round (Mar-Nov)	Gill nets, long lines, lines trot with bait, pots, traps, pound nets	Cast nets, dredge, fyke net, seines, hand lines, otter trawl
Summer flounder	1,306	1	4,705	3	Year-round (Mar; Dec)	Gill nets, long lines, lines trot with bait, pots, traps, pound nets	Dredge, fyke net, seines, hooks, hand lines, trawls, rakes
Unidentified finfish	1,297	1	737	<1	Year-round (May-Sept)	Gill nets, pots, traps, pound nets	Hand, cast nets, dip nets, fyke net, seines, hand lines, picks
Northern quahog clam	1,128	1	19,374	13	Year-round (spring-fall)	Pots, traps, pound nets	Hand, dredge, picks, scrapes, tongs, grabs
Total	201,945	100	147,612	100			

Source: NOAA 2013g

shore, outside of the survey area. The periods with the most boat-based trips (including charter, party, and private/rental boats) were July–August (430,733 trips or 29% of total), followed by May–June (407,783 or 28%), and September–October (344,787 or 23%). Similarly, most shore-based trips (from beaches, jetties, banks, marshes, docks, and/or piers; DoN 2008a), were in July–August (397,340 or 38%), and September–October (224,238 or 21%).

In 2007, there were two recreational fishing tournaments in Virginia, for tuna in July and for billfish in August, both based in Virginia Beach and within ~200 km from Virginia's shore (DoN 2008a). Of the "hotspots" (popular fishing sites commonly visited by recreational anglers) mapped by DoN (2008a), most are to the north of the proposed survey area; however, there is at least one hotspot ("Cigar") located in or very near the portion of the proposed survey area that is closest to the Virginia border.

In 2012, at least 77 species of fish were targeted by recreational fishers in Virginia waters. Species with 2012 recreational catch numbers exceeding one million include Atlantic croaker (40% of total catch), red drum (12%), spot (12%), striped mullet (6%), and summer flounder (5%). Other notable species or species groups representing at least 1% each of the total catch included black sea bass, white perch, spotted seatrout, blue catfish, oyster toadfish, northern kingfish, bluefish, Atlantic menhaden, striped bass, southern kingfish, pinfish, Atlantic spadefish, northern puffer, and weakfish. Virtually all (~99%) of these species/species groups were predominantly caught within 5.6 km from shore.

TABLE 6. Commercial fishery catches for major marine species for North Carolina waters by weight, value, season, and gear type, averaged from 2008 to 2012.

Species	Average annual landings (mt)	% total	Average annual landings (1000$)	% total	Fishing season (peak season)	Gear Type	
						Fixed	Mobile
Blue Crab	13,266	48	22,497	34	Year-round (May-Nov)	Gill nets, pots, traps, pound nets	Bag nets, hand, dredge, fyke nets, hoop nets, trawls
Atlantic Croaker	2,486	9	2,971	4	Year-round (Nov-Mar)	Gill nets, pots, traps, pound nets	Fyke nets, hoop nets, seines, hand lines, trawls, spears
Brown Shrimp	1,949	7	8,037	12	May-Dec (Jul-Aug)	Pots, traps	Bag nets, trawls, cast nets
Summer Flounder	1,136	4	5,414	8	Year-round (Winter)	Gill nets, pots, traps	Seines, hand lines, trawls, spears
Bluefish	922	3	764	1	Year-round (Jan-Apr)	Gill nets, long lines, pots, traps, pound nets	Seines, hand lines, troll lines, trawls, spears
Southern Flounder	869	3	4,232	6	Year-round (Apr-Nov)	Gill nets, pots, traps, pound nets	Bag nets, trawls, hand, cast nets, dredge, fyke nets, hoop nets, seines, hand lines, rakes, spears
Striped (Liza) Mullet	810	3	889	1	Year-round (Oct-Nov)	Gill nets, pots, traps, pound nets	Hand, cast nets, fyke nets, hoop nets, seines, hand lines, trawls, spears
Spiny Dogfish Shark	778	3	304	<1	Jan	Gill nets	N/A
White Shrimp	774	3	3,713	6	Year-round (Aug-Feb; May-Jun)	Gill nets	Bag nets, trawls, cast nets
Menhaden	738	3	166	<1	Year-round (Jan-Mar)	Gill nets, pots, traps, pound nets	Bag nets, cast nets, fyke nets, hoop nets, seines, hand lines, trawls, rakes
Smooth Dogfish Shark	534	2	386	1	Year-round (Mar-Apr)	Gill nets, long lines	Hand lines, trawls
Spanish Mackerel	370	1	1,013	2	Year-round (May-Oct)	Gill nets, pots, traps, pound nets	Bag nets, trawls, seines, hand lines, troll lines
Spot	340	1	527	1	Year-round (May-Nov)	Gill nets, pots, traps, pound nets	Bag nets, hand, seines, hand lines, trawls, spears
King Whiting	328	1	746	1	Year-round (Nov-Apr)	Gill nets, pots, traps, pound nets	Seines, hand lines, troll lines, trawls, spears
Eastern Oyster	301	1	3,427	5	Year-round (Oct-Mar)	Gill nets	Hand, dredge, trawls, rakes, tongs, grabs
Swordfish	298	1	1,995	3	Year-round (Dec-Jun)	Long lines	N/A
King and Cero Mackerel	258	1	1,134	2	Year-round (Oct-Apr)	Gill nets, long lines	Hand lines, troll lines
Yellowfin Tuna	254	1	1,100	2	Year-round (May-Oct)	Long lines	Hand lines, trawls, troll lines
Blue, Peeler Crab	216	1	1,098	2	Mar-Nov (Apr-Jun)	Gill nets, pots, traps, pound nets	Trawls
Catfishes and Bullheads	186	1	86	<1	Year-round (Feb-Apr)	Gill nets, lines trot with bait, pots, traps, pound nets	Fyke nets, hoop nets, hand lines
Back Sea Bass	184	1	964	1	Year-round (Dec-Feb; Jun-Aug)	Gill nets, long lines, pots, traps	Hand lines, troll lines, trawls
Pink Shrimp	173	1	685	1	Apr-Nov (May-Jul)	N/A	Bag nets, trawls

TABLE 6. (Concluded).

Species	Average annual landings (mt)	% total	Average annual landings (1000$)	% total	Fishing season (peak season)	Gear Type	
						Fixed	Mobile
Vermilion Snapper	170	1	1,123	2	Year-round (Jan; Jul-Sep)	Pots, traps	Hand lines
Blueline Tilefish	162	1	650	1	Year-round (May-Sep)	Gill nets, long lines, pots, traps	Hand lines, trawls
Quahog Clam	161	1	2,192	3	Year-round	Gill nets, pots, traps	Hand, dredge, trawls, rakes, tongs, grabs
Striped Bass	158	1	865	1	Oct-Apr (Jan-Apr)	Gill nets, pots, traps, pound nets	Fyke nets, hoop nets, seines, trawls
Total	27,820	100	27,820	100			

Source: NOAA 2013g

North Carolina

In 2012, marine recreational fishers in the waters of North Carolina caught ~8.5 million fish for harvest or bait, and over 18.5 million fish in catch and release programs. These catches were taken by over 1.6 million recreational fishers during more than 5.3 million trips. The majority of the trips (94%) occurred within 5.6 km from shore, outside of the survey area. The periods with the most boat-based trips (including charter, man-made, and private/rental boats) were July–August (949,950 trips or 26% of total), followed by September–October (923,650 or 25%), and May–June (857,356 or 23%). The majority of shore-based trips (from beaches, jetties, banks, marshes, docks, and/or piers; DoN 2008b) occurred in September–October (524,506 trips or 33%), then July–August (422,863 or 26%), and May–June (316,825 or 20%).

North Carolina also provides a recreational commercial gear license in addition to typical recreational fishing, which allows recreational anglers to use select amounts of commercial gear to harvest for personal, non-salable consumption (DoN 2008b).

In 2007, there were 35 recreational fishing tournaments around North Carolina, between May and November, all within ~200 km from shore (DoN 2008b). Eight tournaments were held in September or October. DoN (2008a,b) mapped numerous hotspots off North Carolina, many of which are located within or near the proposed survey area, mostly at or inshore of the shelf break. In 2014, 15 tournaments are currently (24 April 2014) scheduled for North Carolina ports of call (Table 7). No detailed information about locations is given in the sources cited.

In 2012, at least 190 species of fish were targeted by recreational fishers in the waters of North Carolina. Species with 2012 recreational catch numbers exceeding one million include pinfish (13% of total), black sea bass (8%), spotted seatrout (8%), bluefish (7%), red drum (6%), Atlantic croaker (6%), spot (6%), unidentified lefteye flounders (5%), unidentified kingfishes (5%), and unidentified mullets (5%). Other notable species or species groups representing at least 1% each of the total catch included pigfish, Spanish mackerel, Atlantic menhaden, northern puffer, unidentified sharks, southern kingfish, Florida pompano, dolphinfish, unidentified puffers, unidentified lizardfish, Gulf kingfish, black drum, weakfish, sheepshead, striped bass, and unidentified sea robins. Most of these species/species groups were predominantly caught within 5.6 km from shore (63% of total catch for black sea bass; ~98% for all others), with the exception of dolphinfish, which were almost entirely caught beyond 5.6 km.

Table 7. Fishing tournaments off North Carolina, mid September–mid October 2014.

Dates	Tournament name	Port	Marine species/groups targeted	Source
1 Jan–31 Dec	2014 North Carolina Saltwater Fishing Tournament	Statewide	False albacore tuna; amberjack; Atlantic bonito; barracuda; black sea/ striped bass; bluefish; cobia; croaker; dolphinfish; black/red drum; flatfish; grouper; crevalle jack; king/Spanish mackerel; blue/white marlin; sea mullet; Florida pompano; silver snapper (porgy); sailfish; shark; sheepshead; spearfish; spotfish; tarpon; gray tilefish; triggerfish; gray(weakfish)/speckled trout; bigeye/ blackfin/bluefin/yellowfin tuna; wahoo	1
20, 27 Sep; 4, 11 Oct	Kayak Wars	Statewide	Barred sand/calico/spotted bay/white sea bass; bonefish; bonito; cabezon; California barracuda; coho/king/pink salmon; corvina; dorado (mahi mahi); greenling; halibut; leopard/mako/ sevengill/thresher shark; lingcod; opaleye; rock sole; rockfish; saltwater perch; sanddab; sculpin; sheephead; spiny dogfish; starry flounder; sturgeon; cutthroat trout; whitefish; yellowtail	2
8 Aug–30 Nov	Onslow Bay Open King Mackerel Tournament	Swansboro	King mackerel	3
18–20 Sep	Atlantic Beach Saltwater Classic	Atlantic Beach	Unlisted	3
20 Sep	Military Appreciation Day	Morehead City	Wahoo; dolphinfish; triggerfish; grouper: snapper; sea bass; flounder; redfish; king/Spanish mackerel; bluefish; amberjack	4
20 Sep	Redfish Shootout Series #3	Surf City	Redfish	4
20 Sep	Carolina Fall Flatfish Tournament	Kure Beach	Flatfish	4
26–27 Sep	Newbridge Bank Spanish Mackerel Open	Wrightsville Beach	Spanish mackerel	4
27 Sep	Carolina Redfish Series	Atlantic Beach	Unlisted	3
27–28 Sep	Carolina Fall King Challenge	Kure Beach	King mackerel	4
2–4 Oct	U.S. Open King Mackerel Challenge	Southport	King mackerel	5
4–5 Oct	Ocean Crest Pier Fall Flounder Tournament	Oak Island	King/Spanish mackerel	4
10–12 Oct	Ocean Isle Fishing Centre Fall Brawl King Classic	Ocean Isle Beach	King/Spanish mackerel	3
11 Oct	Redfish Shootout Series Championship	Sneads Ferry	Redfish	4
11–12 Oct	Rumble on the Tee King Mackerel Tournament	Oak Island	King mackerel	4

Sources: 1: NCDMF (2014); 2: American Fishing Contests (2014); 3: SportFishermen (2014); 4: Fisherman's Post (2014); 5: U.S. OKMT (2014)

Recreational SCUBA Diving

Wreck diving is a popular recreation in the waters off North Carolina, an area nicknamed the "Graveyard of the Atlantic". A search for shipwrecks in and near the proposed survey area was made using NOAA's automated wreck and obstruction information system (NOAA 2014), and wreck use by divers and wreck locations were verified by searching various dive operators' web sites and other sources (especially DiveAdvisor [2014] and DiveBuddy [2014], and also NC [2014] and OBDC [2014]). Results of the searches in water depths <100 m, a depth considered to be the maximun for recreational diving, are plotted in Figure 6 together with the survey lines. Only dive sites within 25 km of the survey track lines are included in Table 8. The coordinates of any shipwrecks on survey track lines in water depths >100 m would be given to the crew conducting OBS deployment.

Terrestrial Species

A search for ESA-listed species was conducted using USFWS' Information, Planning, and Conservation System (IPAC) in 20 km x 20 km areas around the 14 nominal drill sites where explosives would be detonated. Three fish species (Roanoke logperch *Percina rex*, shortnose sturgeon *Acipenser brevirostrum*, and Cape Fear shiner *Notropis mekistocholas*) and one mussel (dwarf wedgemussel *Alasmidonta heterodon*) were identified in the search; these are not discussed further here, as drilling would not be conducted in or near water. Two bird species, one mammal, one insect, and eight species of vegetation found in the searches are described in the following sections. Marine species identified in the search (because the areas around the nominal drill sites included marine waters at coastal sites) are described in the appropriate sections above.

(1) Birds

Red-cockaded Woodpecker (*Picoides borealis*)

The red-cockaded woodpecker is listed as ***Endangered*** under the U.S. ESA, and as ***Near Threatened*** on the IUCN Red List of Threatened Species (IUCN 2013). It was found in the IPAC search of the 20 km x 20 km areas around most of the nominal drill sites. The red-cockaded woodpecker is endemic to the southeastern United States, where it inhabits fire-sustained open pine-forest, dominated in half of its range by longleaf pine elsewhere by shortleaf, slash, or loblolly pine. It is a cooperative breeder (i.e., family groups typically consist of a breeding pair with or without one or two male helpers), and each group requires at least 80 ha of habitat. Nests are in cavities of living old-growth (100+ years) trees, and eggs are laid from late April to early June. Both adults and nestlings apparently forage more in shortleaf and loblolly pine habitats than in longleaf pine forest (BirdLife International 2014).

The red-cockaded woodpecker likely would not be encountered because its habitat is forest, and land-based operational activities would not occur there.

Wood Stork (*Mycteria americana*)

The U.S. breeding population of the wood stork was listed in Florida, Georgia, South Carolina, and Alabama is listed as ***Endangered*** under the U.S. ESA and as ***Least Concern*** on the IUCN Red List of Threatened Species (IUCN 2013). It was found in the IPAC search of the areas around only 2 of the 14 nominal drill sites, two sites near the middle of the southern line. Historically, the core of the wood stork breeding population was located in the Everglades of southern Florida. Populations there diminished because of habitat deterioration, but the breeding range has now almost doubled in extent and shifted

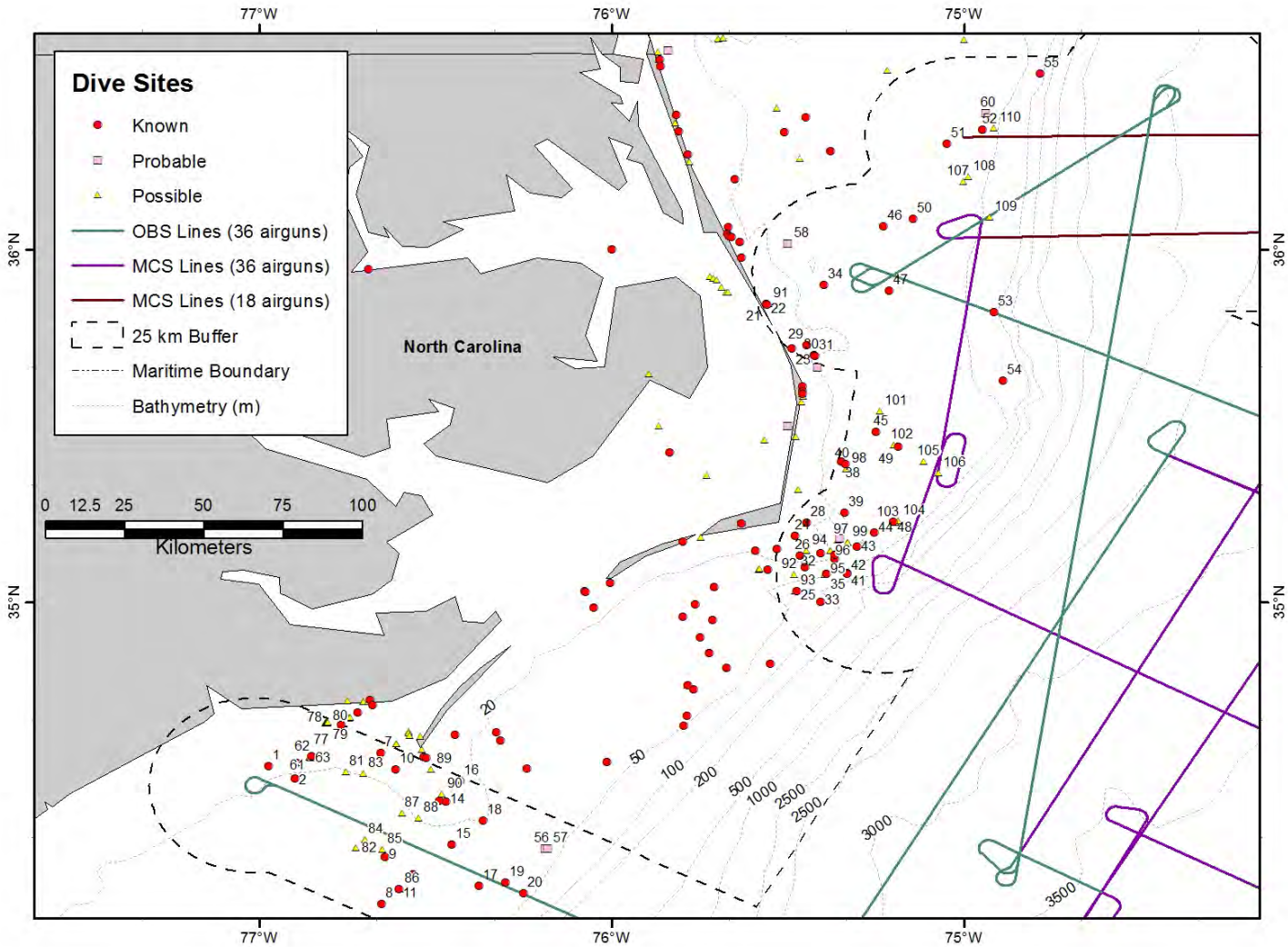


Figure 6. Recreational dive sites in water depths <100 m.

Table 8. North Carolina dive sites in <100 m depth and within 25 km of the proposed transect lines.

ID Number	Site ID	Latitude	Longitude	Source
Known Sites				
1	*Titan Tug (AR-345)* Shipwreck	34.535683	-76.97455	DiveBuddy 2014
2	*W.E. Hutton* Shipwreck	34.499833	-76.897983	DiveBuddy 2014
3	*Suloide* Shipwreck	34.544789	-76.895011	NOAA 2014
4	*Indra* Shipwreck	34.5623	-76.851517	DiveBuddy 2014
5	*Theodore Parker* Shipwreck	34.652189	-76.768341	DiveBuddy 2014
6	*Dorothy B* Shipwreck	34.3585	-76.677983	DiveAdvisor 2014; NOAA 2014
7	*Senateur Duhamel* Shipwreck	34.57149	-76.655045	DiveBuddy 2014
8	*Papoose* Shipwreck	34.143883	-76.652567	DiveBuddy 2014
9	*SCGC Spar (AR-305)* Shipwreck	34.277716	-76.64475	DiveBuddy 2014
10	*USS Aeolus* Shipwreck	34.52637	-76.613423	DiveBuddy 2014
11	*Schurz* Shipwreck	34.186167	-76.602833	DiveBuddy 2014
12	*U-352* Shipwreck	34.228033	-76.565117	DiveBuddy 2014
13	*Fenwick Island* Shipwreck	34.437111	-76.489919	DiveAdvisor 2014; NOAA 2014
14	*EA* Shipwreck	34.4335	-76.469639	DiveAdvisor 2014; NOAA 2014
15	*Ario (1)* Shipwreck	34.313503	-76.453139	DiveAdvisor 2014; NOAA 2014
16	*Portland* Shipwreck	34.492592	-76.429961	NOAA 2014
17	Box Wreck	34.194417	-76.376067	DiveBuddy 2014
18	*Ashkabad* Shipwreck	34.380669	-76.365467	DiveAdvisor 2014; NOAA 2014
19	*HMS Bedfordshire* Shipwreck	34.204534	-76.302795	DiveBuddy 2014
20	*Yancy* Shipwreck	34.175048	-76.250746	NOAA 2014
21	*Oriental* Shipwreck	35.847342	-75.561611	DiveAdvisor 2014; NOAA 2014
22	*Laura A. Barnes* Shipwreck	35.845175	-75.559944	DiveAdvisor 2014; NOAA 2014
23	*Oriental* Shipwreck	35.7189	-75.48905	NOAA 2014
24	*Kassandra Louloudis* Shipwreck	35.187678	-75.480148	DiveBuddy 2014
25	*Empire Gem* Shipwreck	35.030456	-75.475978	NOAA 2014
26	*Brewster* Shipwreck	35.131844	-75.466258	DiveAdvisor 2014; NOAA 2014
27	*Glanayron* Shipwreck	35.100178	-75.451256	DiveAdvisor 2014; NOAA 2014
28	*Central America* Shipwreck	35.226844	-75.447922	DiveAdvisor 2014; NOAA 2014
29	*Zane Grey* Shipwreck	35.730283	-75.446117	DiveBuddy 2014
30	*Mirlo* Shipwreck	35.700178	-75.424603	DiveAdvisor 2014; NOAA 2014
31	*Marlyn* Shipwreck	35.698789	-75.422658	DiveAdvisor 2014; NOAA 2014
32	*Veturia* Shipwreck	35.138917	-75.4075	DiveBuddy 2014
33	*Monitor* Shipwreck	35.001992	-75.406703	DiveAdvisor 2014; NOAA 2014
34	*Advance II* Shipwreck	35.900283	-75.397783	DiveBuddy 2014
35	*Tenas* Shipwreck	35.081289	-75.389864	DiveAdvisor 2014; NOAA 2014
36	*Australia* Shipwreck	35.121844	-75.367086	DiveAdvisor 2014; NOAA 2014
37	*Lancing* Shipwreck	35.133511	-75.366253	DiveAdvisor 2014; NOAA 2014
38	*Ciltvaira* Shipwreck	35.400178	-75.349592	DiveAdvisor 2014; NOAA 2014
39	*H.C. Drewer* Shipwreck	35.254622	-75.338753	DiveAdvisor 2014; NOAA 2014
40	*City of Atlanta* Shipwreck	35.391289	-75.336811	DiveAdvisor 2014; NOAA 2014
41	*Norlavore* Shipwreck	35.083511	-75.332919	DiveAdvisor 2014; NOAA 2014
42	*Diamond Shoal No. 71* Shipwreck	35.080178	-75.332917	DiveAdvisor 2014; NOAA 2014
43	*British Splendour* Shipwreck	35.156844	-75.303472	DiveAdvisor 2014; NOAA 2014
44	*Empire Thrush* Shipwreck	35.196847	-75.254583	DiveAdvisor 2014; NOAA 2014
45	*Bedloe* Shipwreck	35.483514	-75.249589	OBDC 2012; NOAA 2014
46	*York* Shipwreck	36.066839	-75.227936	DiveAdvisor 2014; NOAA 2014
47	*Jackson* Shipwreck	35.8846	-75.213089	DiveBuddy 2014
48	*Merak* Shipwreck	35.228792	-75.201247	DiveAdvisor 2014; NOAA 2014
49	*Moriana 200* Shipwreck	35.441847	-75.187919	DiveAdvisor 2014; NOAA 2014
50	*Byron D. Benson* Shipwreck	36.086841	-75.143738	NOAA 2014
51	*Baurque* Shipwreck	36.300167	-75.0496	DiveAdvisor 2014; NOAA 2014
52	*Snoopy* Shipwreck	36.340317	-74.947722	DiveAdvisor 2014; NOAA 2014
53	*U-85* Shipwreck	35.822267	-74.915771	DiveBuddy 2014

Table 8. (Continued).

54	*San Delfino* Shipwreck	35.628511	-74.889856	DiveAdvisor 2014; NOAA 2014
55	*Nordhav* Shipwreck	36.500161	-74.782925	DiveAdvisor 2014; NOAA 2014
Probable Sites				
56	*Irene* Shipwreck	34.299753	-76.188394	NOAA 2014
57	*Irene* Shipwreck	34.300172	-76.182958	NOAA 2014
58	*Olympic* Shipwreck	36.016836	-75.499611	NOAA 2014
59	*Virginia* Shipwreck	35.181844	-75.352919	NOAA 2014
60	*Sea Hawk* Shipwreck	36.387608	-74.937842	NOAA 2014
Possible Sites				
61	Unidentified Obstruction	34.560611	-76.856561	NOAA 2014
62	Unidentified Obstruction	34.560656	-76.856425	NOAA 2014
63	Unidentified Obstruction	34.558547	-76.854247	NOAA 2014
64	Unidentified Obstruction	34.657817	-76.811317	NOAA 2014
65	Unidentified Obstruction	34.662389	-76.810111	NOAA 2014
66	Unidentified Obstruction	34.656778	-76.81	NOAA 2014
67	Unidentified Obstruction	34.658306	-76.809806	NOAA 2014
68	Unidentified Obstruction	34.658972	-76.809472	NOAA 2014
69	Unidentified Obstruction	34.657861	-76.80925	NOAA 2014
70	Unidentified Obstruction	34.656722	-76.808889	NOAA 2014
71	Unidentified Obstruction	34.658194	-76.8085	NOAA 2014
72	Unidentified Obstruction	34.658833	-76.808194	NOAA 2014
73	Unidentified Obstruction	34.655861	-76.808194	NOAA 2014
74	Unidentified Obstruction	34.659361	-76.808056	NOAA 2014
75	Unidentified Obstruction	34.658444	-76.807861	NOAA 2014
76	Unidentified Obstruction	34.656778	-76.807528	NOAA 2014
77	Unidentified Obstruction	34.657194	-76.80725	NOAA 2014
78	Unidentified Obstruction	34.655561	-76.807056	NOAA 2014
79	Unidentified Obstruction	34.657556	-76.806417	NOAA 2014
80	Unidentified Obstruction	34.660056	-76.8055	NOAA 2014
81	Unidentified Obstruction	34.518544	-76.754314	NOAA 2014
82	Unidentified Shipwreck	34.301833	-76.72465	NOAA 2014
83	Unidentified Shipwreck	34.514856	-76.705392	NOAA 2014
84	Unidentified Shipwreck	34.326833	-76.69965	NOAA 2014
85	Unidentified Obstruction	34.2985	-76.651314	NOAA 2014
86	Unidentified Shipwreck	34.186836	-76.601311	NOAA 2014
87	Unidentified Obstruction	34.40085	-76.594725	NOAA 2014
88	Unidentified Obstruction	34.386667	-76.548333	NOAA 2014
89	Unidentified Obstruction	34.525164	-76.511586	NOAA 2014
90	Unidentified Shipwreck	34.455167	-76.481306	NOAA 2014
91	Unidentified Shipwreck	35.845675	-75.555444	NOAA 2014
92	Unidentified Shipwreck	35.077633	-75.480853	NOAA 2014
93	Unidentified Shipwreck	35.031708	-75.478703	NOAA 2014
94	Unidentified Shipwreck	35.146844	-75.446256	NOAA 2014
95	Unidentified Shipwreck	35.078511	-75.394586	NOAA 2014
96	Unidentified Shipwreck	35.146844	-75.379586	NOAA 2014
97	Unidentified Shipwreck	35.177219	-75.358017	NOAA 2014
98	Unidentified Shipwreck	35.379075	-75.333317	NOAA 2014
99	Unidentified Shipwreck	35.170178	-75.330142	NOAA 2014
100	Unidentified Shipwreck	35.170178	-75.328753	NOAA 2014
101	Unidentified Shipwreck	35.542672	-75.237867	NOAA 2014
102	Unidentified Shipwreck	35.444836	-75.19955	NOAA 2014
103	Unidentified Shipwreck	35.225181	-75.194581	NOAA 2014
104	Unidentified Shipwreck	35.230181	-75.186247	NOAA 2014
105	Unidentified Shipwreck	35.398236	-75.115136	NOAA 2014
106	Unidentified Shipwreck	35.365375	-75.0727	NOAA 2014

Table 8. (Concluded).

107	Unidentified Shipwreck	36.192947	-75.002372	NOAA 2014
108	Unidentified Shipwreck	36.206414	-74.987028	NOAA 2014
109	Unidentified Shipwreck	36.093519	-74.926639	NOAA 2014
110	Unidentified Shipwreck	36.344969	-74.914458	NOAA 2014

northward to wetland complexes along the Atlantic coast as far as southeastern North Carolina (USFWS 2007).

Throughout its range, the wood stork is dependent upon wetlands for breeding and foraging. It has a unique feeding method and requires higher prey concentrations than other wading birds. Optimal water regimes involve periods of flooding, during which prey (fish) populations increase, alternating with dryer periods, during which receding water levels concentrate fish at higher densities coinciding with the stork's nesting season (USFWS 2014). In north and central Florida, Georgia, and South Carolina, storks lay eggs during March–late May, with fledging occurring in July and August. Nests are frequently located in the upper branches of large cypress trees or in mangroves on islands (USFWS 2014).

The wood stork likely would not be encountered because its habitat is wetlands, and land-based operational activities would not occur there.

(2) Mammals

Northern Long-eared Bat (*Myotis septentrionalis*)

In October 2013, USFWS published a proposal to list the northern long-eared bat as ***Endangered***; it is listed as ***Least Concern*** on the IUCN Red List of Threatened Species (IUCN 2013). It was found in the IPAC search of the area around only 1 of the 14 nominal drill sites, near the middle of the northern line. The range of the northern long-eared bat includes much of the eastern and north central United States, and all Canadian provinces.

During winter, northern long-eared bats hibernate in caves and mines called hibernacula. During summer, they roost singly or in colonies underneath bark, in cavities, or in crevices of live or dead trees. Breeding begins in late summer or early fall, when males swarm near hibernacula. After copulation, females store sperm during hibernation; in spring, they emerge from their hibernacula, ovulate, and the stored sperm fertilizes an egg. After fertilization, pregnant females migrate to summer areas where they roost in small colonies and give birth to a single pup. Maternity colonies, with young, generally have 30–60 bats, although larger maternity colonies have been observed. Most females in a colony give birth from late May or early June to late July. Young bats start flying within 18–21 days of birth (USFWS 2013a).

The northern long-eared bat likely would not be encountered because its habitat is forest and hibernacula, and land-based operational activities would not occur there.

(3) Insects

Saint Francis' Satyr Butterfly (*Neonympha mitchellii francisci*)

Saint Francis' satyr (SFS) butterfly is listed as ***Endangered*** under the U.S. ESA, and it has not yet been assessed for the IUCN Red List of Threatened Species (IUCN 2013). It was found in the IPAC search of the areas around only 2 of the 14 nominal drill sites, the sites on the southern line that are farthest inshore. There is currently only one known population of SFS butterfly, found in a range that is

~10 km x 10 km at Ft. Bragg, NC. The population consists of a number of small inactive (formerly occupied) and active sites (subpopulations), 0.2–2.0 ha in size; most active sites are found in artillery impact areas that are restricted in access (USFWS 2013b).

The distribution of SFS butterfly at the local subpopulation level is most closely tied to grassy wetlands with numerous sedges that are created and maintained through a regular disturbance regime, especially by beavers or fire. The most influential disturbances are beaver impoundments, which create inundated regions highly favorable to sedge growth. Most subpopulations are found in abandoned beaver dams or along streams with active beaver complexes. SFS cannot survive in sites that either are inundated by flooding or succeed to riparian forest. Fire may also be a type of disturbance of importance; fire resets succession, where grassy wetlands naturally succeed to shrub lands and then hardwood forest. The host plant for SFS butterfly larvae is *Carex mitchelliana*, a sedge that grows in swampy woods and wet meadows. The butterfly's adult lifespan averages 3–4 days (USFWS 2013b).

Saint Francis' satyr butterfly likely would not be encountered because its habitat is wetlands, and land-based operational activities would not occur there.

(4) Plants

Seabeach Amaranth (*Amaranthus pumilus*)

Seabeach amaranth is listed as ***Threatened*** under the U.S. ESA, and it has not yet been assessed for the IUCN Red List of Threatened Species (IUCN 2013). It was found in the IPAC search of the areas around only 3 of the 14 nominal drill sites, areas on both lines that are closest to shore and include some coastline. It is native to the barrier island beaches of the Atlantic coast. An annual plant, to grow it appears to need extensive areas of barrier island beaches and inlets, functioning in a relatively natural and dynamic manner, allowing it to move around in the landscape, occupying suitable habitat as it becomes available. It often grows in the same areas selected for nesting by shorebirds such as plovers, terns, and skimmers (Weakley et al. 1996). Seabeach amaranth is a classic example of a fugitive species: "an inferior competitor which is always excluded locally under interspecific competition, but which persists in newly disturbed habitats by virtue of its high dispersal ability; a species of temporary habitats" (Lincoln et al. 1982 *in* Weakley et al. 1996).

Seabeach amaranth likely would not be encountered because its habitat is barrier island beaches, and land-based operational activities would not occur there.

Golden Sedge (*Carex lutea*)

Golden sedge is listed as ***Endangered*** under the U.S. ESA, and it has not yet been assessed for the IUCN Red List of Threatened Species (IUCN 2013). It was found in the IPAC search of the areas around only 2 of the 14 nominal drill sites, areas on the southern line that are closest to shore. It is a perennial member of the sedge family that is endemic to Onslow and Pender Counties, NC. Eight populations are recognized made up of 17 distinct locations or element occurrences all occurring within a 26 km x 8 km area, extending southwest from the community of Maple Hill. Golden sedge generally occurs on fine sandy loam, loamy fine sands, and fine sands that are moist to saturated to periodically inundated (USFWS 2011a). Critical habitat has been designated for the golden sedge (see maps in USFWS 2011); none of those areas is in the 20 km x 20 km areas around the nominal drill sites.

Golden sedge likely would not be encountered because its habitat is wetlands, and land-based operational activities would not occur there.

Pondberry *(Lindera melissifolia*)

Pondberry is listed as ***Endangered*** under the U.S. ESA, and it has not yet been assessed for the IUCN Red List of Threatened Species (IUCN 2013). It was found in the IPAC search of the areas around 5 of the 14 nominal drill sites, all on the southern line. As of 1993, there were 36 populations of pondberry distributed in Arkansas, Georgia, Mississippi, Missouri, North Carolina, and South Carolina (LeDay et al. 1993). There are two known populations in North Carolina, one in Cumberland County and one in Sampson County (USFWS 2011b). Pondberry occurs in seasonally flooded wetlands, sandy sinks, pond margins, and swampy depressions. In the coastal sites of North and South Carolina, pondberry is associated with the margins of sinks, ponds, and depressions in the pinelands (LeDay et al. 1993).

Pondberry likely would not be encountered because its habitat is wetlands, and land-based operational activities would not occur there.

Rough-leaved Loosestrife (*Lysimachia asperulaefolia*)

Rough-leaved loosestrife is listed as ***Endangered*** under the U.S. ESA, and it has not yet been assessed for the IUCN Red List of Threatened Species (IUCN 2013). It was found in the IPAC search of the areas around 5 of the 14 nominal drill sites, all on the southern line. Rough-leaved loosestrife is a rare perennial herb, endemic to the coastal plain and sandhills of North Carolina and South Carolina. North Carolina populations are known from the following counties: Bladen, Brunswick, Carteret, Cumberland, Harnett, Hoke, New Hanover, Onslow, Pamlico, Pender, Richmond and Scotland. Most of the populations are small, both in extent of area covered and in number of stems (USFWS 2011c). As of 1995 (Frantz 1995), nearly all sites were on publicly owned land, with the majority on federally owned land (e.g., 33 on military bases).

It is associated with sandy or peaty soils and moist open habitat that was more abundant prior to the development of the coastal region of the Carolinas (Frantz 1995). This species generally occurs in the ecotones or edges between longleaf pine uplands and pond pine pocosins (areas of dense shrub and vine growth usually on a wet, peaty, poorly drained soil) on moist to seasonally saturated sands and on shallow organic soils overlaying sand. Rough-leaf loosestrife has also been found on deep peat in the low shrub community of large Carolina bays (shallow, elliptical, poorly drained depressions of unknown origin). The grass-shrub ecotone, where rough-leaf loosestrife is found, is fire-maintained, as are the adjacent plant communities. Several populations are known from roadsides and power line rights of way where regular maintenance mimics fire and maintains vegetation so that herbaceous species are open to sunlight (USFWS 2011c).

Rough-leaved loosestrife could be encountered because its habitat includes roadsides, where land activities would occur.

Harperella (*Ptilimnium nodosum*)

Harperella is listed as ***Endangered*** under the U.S. ESA, and it has not yet been assessed for the IUCN Red List of Threatened Species (IUCN 2013). It was found in the IPAC search of the area around only 1 of the 14 nominal drill sites, the site on the southern line that is farthest inshore. Harperella is a perennial herb that typically occurs on rocky or gravel shoals and sandbars and along the margins of clear, swift-flowing stream sections. It is known from only two locations in North Carolina: one population in the Tar River in Granville County and another in the Deep River in Chatham County (USFWS 2011d).

Harperella likely would not be encountered because its habitat is riverine, and land-based operational activities would not occur in or near water.

Michaux's Sumac (*Rhus michauxii*)

Michaux's sumac is listed as ***Endangered*** under the U.S. ESA, and it has not yet been assessed for the IUCN Red List of Threatened Species (IUCN 2013). It was found in the IPAC search of the areas around 3 of the 14 nominal drill sites, sites on the southern line that are farthest inshore. Michaux's sumac is endemic to the coastal plain and piedmont (the plateau region located between the coastal plain and the main Appalachian Mountains) from Virginia to Florida. Most populations are located in the North Carolina piedmont and sandhills. Currently, the plant occurs in the following counties: Cumberland, Davie, Durham, Franklin, Hoke, Moore, Nash, Richmond, Robeson, Scotland, and Wake.

Michaux's sumac grows in sandy or rocky, open woods with basic soils, apparently surviving best in areas where some form of disturbance has provided an open area. Several populations in North Carolina are on highway rights-of way, roadsides, or on the edges of artificially maintained clearings. Others are in areas with periodic fires and on sites undergoing natural succession, and one is in a natural opening on the rim of a Carolina bay (USFWS 2011e).

Michaux's sumac could be encountered because its habitat includes roadsides and the edges of artificially maintained clearings, where land-based operational activities would occur.

American Chaffseed (*Schwalbea americana*)

American chaffseed is listed as ***Endangered*** under the U.S. ESA, and it has not yet been assessed for the IUCN Red List of Threatened Species (IUCN 2013). It was found in the IPAC search of the areas around 6 of the 14 nominal drill sites, sites on both northern and southern lines. American chaffseed occurs in New Jersey and from North Carolina to Florida. It is found in sandy, acidic, seasonally moist to dry soils, and "is generally found in habitats described as open, moist pine flatwoods, fire-maintained savannas, ecotonal areas between peaty wetlands and xeric sandy soils, and other open grass-sedge systems." (USFWS 2011f). Chaffseed is dependent on factors such as fire, mowing, or fluctuating water tables to maintain open to partly-open conditions. Most surviving populations are in areas that are subject to frequent fire, including plantations where burning is part of management for quail and other game, army base impact zones that burn regularly because of artillery shelling, forest management areas burned to maintain habitat for wildlife, and private lands burned to maintain open fields (USFWS 2011f).

American chaffseed could be encountered because its habitat includes private lands burned to maintain open fields, where land-based operational activities could occur.

Cooley's Meadowrue (*Thalictrum cooleyi*)

Cooley's meadowrue is listed as ***Endangered*** under the U.S. ESA, and it has not yet been assessed for the IUCN Red List of Threatened Species (IUCN 2013). It was found in the IPAC search of the areas around only 2 of the 14 nominal drill sites, areas on the southern line that are closest to shore. Currently, Cooley's meadowrue is known from North Carolina, Georgia, and Florida. In North Carolina, populations are located in Brunswick, Columbus, Onslow, and Pender counties, including several sites protected by The Nature Conservancy and NC Division of Parks and Recreation. It occurs in grass-sedge bogs and wet pine savannahs and savannah-like areas, and can also occur along fire plow lines, in roadside ditches, woodland clearings, and powerline rights-of-way, where some type of disturbance such as fire or mowing maintains an open habitat (USFWS 2011g).

Cooley's meadowrue could be encountered because its habitat includes roadsides, where land-based operational activities would occur.

IV. ENVIRONMENTAL CONSEQUENCES

Proposed Action

(1) Direct Effects on Marine Mammals and Sea Turtles and Their Significance

The material in this section includes a brief summary of the anticipated potential effects (or lack thereof) of airgun sounds on marine mammals and sea turtles, and reference to recent literature that has become available since the PEIS was released in 2011. . A more comprehensive review of the relevant background information, as well as information on the hearing abilities of marine mammals and sea turtles, appears in § 3.4.4.3, § 3.6.4.3, § 3.7.4.3, and Appendix E of the PEIS.

This section also includes estimates of the numbers of marine mammals that could be affected by the proposed seismic surveys scheduled to occur during September–October 2014. A description of the rationale for NSF's estimates of the numbers of individuals exposed to received sound levels ≥160 dB re 1 μPa_{rms} is also provided.

(a) Summary of Potential Effects of Airgun Sounds

The effects of sounds from airguns could include one or more of the following: tolerance, masking of natural sounds, behavioral disturbance, and at least in theory, temporary or permanent hearing impairment, or non-auditory physical or physiological effects (Richardson et al. 1995; Gordon et al. 2004; Nowacek et al. 2007; Southall et al. 2007). Permanent hearing impairment (PTS), in the unlikely event that it occurred, would constitute injury, but temporary threshold shift (TTS) is not considered an injury (Southall et al. 2007; Le Prell 2012). Rather, the onset of TTS has been considered an indicator that, if the animal is exposed to higher levels of that sound, physical damage is ultimately a possibility. Recent research has shown that sound exposure can cause cochlear neural degeneration, even when threshold shifts and hair cell damage are reversible (Liberman 2013). These findings have raised some doubts as to whether TTS should continue to be considered a non-injurious effect. Although the possibility cannot be entirely excluded, it is unlikely that the project would result in any cases of temporary or permanent hearing impairment, or any significant non-auditory physical or physiological effects. If marine mammals encounter the survey while it is underway, some behavioral disturbance could result, but this would be localized and short-term.

Tolerance.—Numerous studies have shown that pulsed sounds from airguns are often readily detectable in the water at distances of many kilometers (e.g., Nieukirk et al. 2012). Several studies have shown that marine mammals at distances more than a few kilometers from operating seismic vessels often show no apparent response. That is often true even in cases when the pulsed sounds must be readily audible to the animals based on measured received levels and the hearing sensitivity of that mammal group. Although various baleen whales and toothed whales, and (less frequently) pinnipeds have been shown to react behaviorally to airgun pulses under some conditions, at other times mammals of all three types have shown no overt reactions. The relative responsiveness of baleen and toothed whales are quite variable.

Masking.—Masking effects of pulsed sounds (even from large arrays of airguns) on marine mammal calls and other natural sounds are expected to be limited, although there are very few specific data on this. Because of the intermittent nature and low duty cycle of seismic pulses, animals can emit and receive

sounds in the relatively quiet intervals between pulses. However, in exceptional situations, reverberation occurs for much or all of the interval between pulses (e.g., Simard et al. 2005; Clark and Gagnon 2006), which could mask calls. Situations with prolonged strong reverberation are infrequent. However, it is common for reverberation to cause some lesser degree of elevation of the background level between airgun pulses (e.g., Gedamke 2011; Guerra et al. 2011, 2013), and this weaker reverberation presumably reduces the detection range of calls and other natural sounds to some degree. Guerra et al. (2013) reported that ambient noise levels between seismic pulses were elevated as a result of reverberation at ranges of 50 km from the seismic source. Based on measurements in deep water of the Southern Ocean, Gedamke (2011) estimated that the slight elevation of background levels during intervals between pulses reduced blue and fin whale communication space by as much as 36–51% when a seismic survey was operating 450–2800 km away. Based on preliminary modeling, Wittekind et al. (2013) reported that airgun sounds could reduce the communication range of blue and fin whales 2000 km from the seismic source. Klinck et al. (2012) also found reverberation effects between airgun pulses. Nieukirk et al. (2012) and Blackwell et al. (2013) noted the potential for masking effects from seismic surveys on large whales.

Some baleen and toothed whales are known to continue calling in the presence of seismic pulses, and their calls usually can be heard between the seismic pulses (e.g., Cerchio et al. 2010; Nieukirk et al. 2012). In addition, some cetaceans are known to change their calling rates, shift their peak frequencies, or otherwise modify their vocal behavior in response to airgun sounds (e.g., Di Iorio and Clark 2010; Castellote et al. 2012; Blackwell et al. 2013). The hearing systems of baleen whales are undoubtedly more sensitive to low-frequency sounds than are the ears of the small odontocetes that have been studied directly (e.g., MacGillivray et al. 2014). The sounds important to small odontocetes are predominantly at much higher frequencies than are the dominant components of airgun sounds, thus limiting the potential for masking. In general, masking effects of seismic pulses are expected to be minor, given the normally intermittent nature of seismic pulses. We are not aware of any information concerning masking of hearing in sea turtles.

Disturbance Reactions.—Disturbance includes a variety of effects, including subtle to conspicuous changes in behavior, movement, and displacement. Based on NMFS (2001, p. 9293), NRC (2005), and Southall et al. (2007), we believe that simple exposure to sound, or brief reactions that do not disrupt behavioral patterns in a potentially significant manner, do not constitute harassment or "taking". By potentially significant, we mean, 'in a manner that might have deleterious effects to the well-being of individual marine mammals or their populations'.

Reactions to sound, if any, depend on species, state of maturity, experience, current activity, reproductive state, time of day, and many other factors (Richardson et al. 1995; Wartzok et al. 2004; Southall et al. 2007; Weilgart 2007; Ellison et al. 2012). If a marine mammal does react briefly to an underwater sound by changing its behavior or moving a small distance, the impacts of the change are unlikely to be significant to the individual, let alone the stock or population (e.g., New et al. 2013). However, if a sound source displaces marine mammals from an important feeding or breeding area for a prolonged period, impacts on individuals and populations could be significant (e.g., Lusseau and Bejder 2007; Weilgart 2007). Given the many uncertainties in predicting the quantity and types of impacts of noise on marine mammals, it is common practice to estimate how many marine mammals would be present within a particular distance of industrial activities and/or exposed to a particular level of industrial sound. In most cases, this approach likely overestimates the numbers of marine mammals that would be affected in some biologically important manner.

The sound criteria used to estimate how many marine mammals could be disturbed to some biologically important degree by a seismic program are based primarily on behavioral observations of a few species. Detailed studies have been done on humpbacks, gray whales, bowheads, and sperm whales. Less detailed data are available for some other species of baleen whales and small toothed whales, but for many species, there are no data on responses to marine seismic surveys.

Baleen Whales

Baleen whales generally tend to avoid operating airguns, but avoidance radii are quite variable. Whales are often reported to show no overt reactions to pulses from large arrays of airguns at distances beyond a few kilometers, even though the airgun pulses remain well above ambient noise levels out to much longer distances. However, baleen whales exposed to strong noise pulses from airguns often react by deviating from their normal migration route and/or interrupting their feeding and moving away. In the cases of migrating gray and bowhead whales, the observed changes in behavior appeared to be of little or no biological consequence to the animals. They simply avoided the sound source by displacing their migration route to varying degrees, but within the natural boundaries of the migration corridors (Malme et al. 1984; Malme and Miles 1985; Richardson et al. 1995).

Responses of *humpback whales* to seismic surveys have been studied during migration, on summer feeding grounds, and on Angolan winter breeding grounds; there has also been discussion of effects on the Brazilian wintering grounds. Off Western Australia, avoidance reactions began at 5–8 km from the array, and that those reactions kept most pods ~3–4 km from the operating seismic boat; there was localized displacement during migration of 4–5 km by traveling pods and 7–12 km by more sensitive resting pods of cow-calf pairs (McCauley et al. 1998, 2000). However, some individual humpback whales, especially males, approached within distances of 100–400 m. Studies examining the behavioral responses of humpback whales to airguns are currently underway off eastern Australia (Cato et al. 2011, 2012, 2013).

In the northwest Atlantic, sighting rates were significantly greater during non-seismic periods compared with periods when a full array was operating, and humpback whales were more likely to swim away and less likely to swim towards a vessel during seismic vs. non-seismic periods (Moulton and Holst 2010). On their summer feeding grounds in southeast Alaska, there was no clear evidence of avoidance, despite the possibility of subtle effects, at received levels up to 172 re 1 μPa on an approximate rms basis (Malme et al. 1985). It has been suggested that South Atlantic humpback whales wintering off Brazil may be displaced or even strand upon exposure to seismic surveys (Engel et al. 2004), but data from subsequent years, indicated that there was no observable direct correlation between strandings and seismic surveys (IWC 2007).

There are no data on reactions of *right whales* to seismic surveys. However, Rolland et al. (2012) suggested that ship noise causes increased stress in right whales; they showed that baseline levels of stress-related faecal hormone metabolites decreased in North Atlantic right whales with a 6-dB decrease in underwater noise from vessels. Wright et al. (2011) also reported that sound could be a potential source of stress for marine mammals.

Results from *bowhead whales* show that their responsiveness can be quite variable depending on their activity (migrating vs. feeding). Bowhead whales migrating west across the Alaskan Beaufort Sea in autumn, in particular, are unusually responsive, with substantial avoidance occurring out to distances of 20–30 km from a medium-sized airgun source (Miller et al. 1999; Richardson et al. 1999). However, more recent research on bowhead whales corroborates earlier evidence that, during the summer feeding season, bowheads are not as sensitive to seismic sources (e.g., Miller et al. 2005). Nonetheless,

Robertson et al. (2013) showed that bowheads on their summer feeding grounds showed subtle but statistically significant changes in surfacing–respiration–dive cycles during exposure to seismic sounds, including shorter surfacing intervals, shorter dives, and decreased number of blows per surface interval.

Bowhead whale calls detected in the presence and absence of airgun sounds have been studied extensively in the Beaufort Sea. Bowheads continue to produce calls of the usual types when exposed to airgun sounds on their summering grounds, although numbers of calls detected are significantly lower in the presence than in the absence of airgun pulses; Blackwell et al. (2013) reported that calling rates in 2007 declined significantly where received SPLs from airgun sounds were 116–129 dB re 1 μPa. Thus, bowhead whales in the Beaufort Sea apparently decrease their calling rates in response to seismic operations, although movement out of the area could also contribute to the lower call detection rate (Blackwell et al. 2013).

A multivariate analysis of factors affecting the distribution of calling bowhead whales during their fall migration in 2009 noted that the southern edge of the distribution of calling whales was significantly closer to shore with increasing levels of airgun sound from a seismic survey a few hundred kilometers to the east of the study area (i.e., behind the westward-migrating whales; McDonald et al. 2010, 2011). It was not known whether this statistical effect represented a stronger tendency for quieting of the whales farther offshore in deeper water upon exposure to airgun sound, or an actual inshore displacement of whales.

Reactions of migrating and feeding (but not wintering) *gray whales* to seismic surveys have been studied. Off St. Lawrence Island in the northern Bering Sea, it was estimated, based on small sample sizes, that 50% of feeding gray whales stopped feeding at an average received pressure level of 173 dB re 1 μPa on an (approximate) rms basis, and that 10% of feeding whales interrupted feeding at received levels of 163 dB re 1 μPa_{rms} (Malme et al. 1986, 1988). Those findings were generally consistent with the results of experiments conducted on larger numbers of gray whales that were migrating along the California coast (Malme et al. 1984; Malme and Miles 1985), and western Pacific gray whales feeding off Sakhalin Island, Russia (e.g., Gailey et al. 2007; Johnson et al. 2007; Yazvenko et al. 2007a,b).

Various species of *Balaenoptera* (blue, sei, fin, and minke whales) have occasionally been seen in areas ensonified by airgun pulses; sightings by observers on seismic vessels off the U.K. from 1997 to 2000 suggest that, during times of good sightability, sighting rates for mysticetes (mainly fin and sei whales) were similar when large arrays of airguns were shooting vs. silent, although there was localized avoidance (Stone and Tasker 2006). Singing fin whales in the Mediterranean moved away from an operating airgun array, and their song notes had lower bandwidths during periods with versus without airgun sounds (Castellote et al. 2012).

During seismic surveys in the northwest Atlantic, baleen whales as a group showed localized avoidance of the operating array (Moulton and Holst 2010). Sighting rates were significantly lower during seismic operations compared with non-seismic periods. Baleen whales were seen on average 200 m farther from the vessel during airgun activities vs. non-seismic periods, and these whales more often swam away from the vessel when seismic operations were underway compared with periods when no airguns were operating (Moulton and Holst 2010). Blue whales were seen significantly farther from the vessel during single airgun operations, ramp up, and all other airgun operations compared with non-seismic periods (Moulton and Holst 2010). Similarly, fin whales were seen at significantly farther distances during ramp up than during periods without airgun operations; there was also a trend for fin whales to be sighted farther from the vessel during other airgun operations, but the difference was not significant (Moulton and Holst 2010). Minke whales were seen significantly farther from the vessel

during periods with than without seismic operations (Moulton and Holst 2010). Minke whales were also more likely to swim away and less likely to approach during seismic operations compared to periods when airguns were not operating (Moulton and Holst 2010).

Data on short-term reactions by cetaceans to impulsive noises are not necessarily indicative of long-term or biologically significant effects. It is not known whether impulsive sounds affect reproductive rate or distribution and habitat use in subsequent days or years. However, gray whales have continued to migrate annually along the west coast of North America with substantial increases in the population over recent years, despite intermittent seismic exploration (and much ship traffic) in that area for decades. The western Pacific gray whale population did not seem affected by a seismic survey in its feeding ground during a previous year, and bowhead whales have continued to travel to the eastern Beaufort Sea each summer, and their numbers have increased notably, despite seismic exploration in their summer and autumn range for many years.

Toothed Whales

Little systematic information is available about reactions of toothed whales to sound pulses. However, there are recent systematic studies on sperm whales, and there is an increasing amount of information about responses of various odontocetes to seismic surveys based on monitoring studies. Seismic operators and marine mammal observers on seismic vessels regularly see dolphins and other small toothed whales near operating airgun arrays, but in general there is a tendency for most delphinids to show some avoidance of operating seismic vessels (e.g., Stone and Tasker 2006; Moulton and Holst 2010; Barry et al. 2012). In most cases, the avoidance radii for delphinids appear to be small, on the order of 1 km or less, and some individuals show no apparent avoidance.

During seismic surveys in the northwest Atlantic, delphinids as a group showed some localized avoidance of the operating array (Moulton and Holst 2010). The mean initial detection distance was significantly farther (by ~200 m) during seismic operations compared with periods when the seismic source was not active; however, there was no significant difference between sighting rates (Moulton and Holst 2010). The same results were evident when only long-finned pilot whales were considered.

Preliminary findings of a monitoring study of *narwhals* (*Monodon monoceros*) in Melville Bay, Greenland (summer and fall 2012) showed no short-term effects of seismic survey activity on narwhal distribution, abundance, migration timing, and feeding habits (Heide-Jørgensen et al. 2013a). In addition, there were no reported effects on narwhal hunting. These findings do not seemingly support a suggestion by Heide-Jørgensen et al. (2013b) that seismic surveys in Baffin Bay may have delayed the migration timing of narwhals, thereby increasing the risk of narwhals to ice entrapment.

The beluga, however, is a species that (at least at times) shows long-distance (10s of km) avoidance of seismic vessels (e.g., Miller et al. 2005). Captive bottlenose dolphins and beluga whales exhibited changes in behavior when exposed to strong pulsed sounds similar in duration to those typically used in seismic surveys, but the animals tolerated high received levels of sound before exhibiting aversive behaviors (e.g., Finneran et al. 2000, 2002, 2005).

Most studies of *sperm whales* exposed to airgun sounds indicate that the sperm whale shows considerable tolerance of airgun pulses; in most cases the whales do not show strong avoidance (e.g., Stone and Tasker 2006; Moulton and Holst 2010), but foraging behavior can be altered upon exposure to airgun sound (e.g., Miller et al. 2009). There are almost no specific data on the behavioral reactions of *beaked whales* to seismic surveys. Most beaked whales tend to avoid approaching vessels of other types (e.g., Würsig et al. 1998) and/or change their behavior in response to sounds from vessels (e.g., Pirotta et

al. 2012). However, some northern bottlenose whales remained in the general area and continued to produce high-frequency clicks when exposed to sound pulses from distant seismic surveys (e.g., Simard et al. 2005). In any event, it is likely that most beaked whales would also show strong avoidance of an approaching seismic vessel, although this has not been documented explicitly.

The limited available data suggest that *harbor porpoises* show stronger avoidance of seismic operations than do Dall's porpoises. Thompson et al. (2013) reported decreased densities and reduced acoustic detections of harbor porpoise in response to a seismic survey in Moray Firth, Scotland, at ranges of 5–10 km (SPLs of 165–172 dB re 1 μPa, SELs of 145–151 dB $\mu Pa^2 \cdot s$); however, animals returned to the area within a few hours. The apparent tendency for greater responsiveness in the harbor porpoise is consistent with their relative responsiveness to boat traffic and some other acoustic sources (Richardson et al. 1995; Southall et al. 2007).

Odontocete reactions to large arrays of airguns are variable and, at least for delphinids, seem to be confined to a smaller radius than has been observed for the more responsive of the mysticetes and some other odontocetes. A ≥170 dB disturbance criterion (rather than ≥160 dB) is considered appropriate for delphinids, which tend to be less responsive than the more responsive cetaceans.

Sea Turtles

The limited available data indicate that sea turtles will hear airgun sounds and sometimes exhibit localized avoidance (see PEIS, § 3.4.4.3). Based on available data, it is likely that sea turtles will exhibit behavioral changes and/or avoidance within an area of unknown size near a seismic vessel. To the extent that there are any impacts on sea turtles, seismic operations in or near areas where turtles concentrate are likely to have the greatest impact. There are no specific data that demonstrate the consequences to sea turtles if seismic operations with large or small arrays of airguns occur in important areas at biologically important times of year.

Hearing Impairment and Other Physical Effects.—Temporary or permanent hearing impairment is a possibility when marine mammals are exposed to very strong sounds. TTS has been demonstrated and studied in certain captive odontocetes and pinnipeds exposed to strong sounds. However, there has been no specific documentation of TTS let alone permanent hearing damage, i.e., PTS, in free-ranging marine mammals exposed to sequences of airgun pulses during realistic field conditions.

Additional data are needed to determine the received sound levels at which small odontocetes would start to incur TTS upon exposure to repeated, low-frequency pulses of airgun sound with variable received levels. To determine how close an airgun array would need to approach in order to elicit TTS, one would (as a minimum) need to allow for the sequence of distances at which airgun pulses would occur, and for the dependence of received SEL on distance in the region of the seismic operation (e.g., Breitzke and Bohlen 2010; Laws 2012). At the present state of knowledge, it is also necessary to assume that the effect is directly related to total received energy, although there is recent evidence that auditory effects in a given animal are not a simple function of received acoustic energy. Frequency, duration of the exposure, and occurrence of gaps within the exposure can also influence the auditory effect (Finneran and Schlundt 2010, 2011; Finneran et al. 2010a,b; Finneran 2012; Ketten 2012; Finneran and Schlundt 2011, 2013; Kastelein et al. 2013a).

The assumption that, in marine mammals, the occurrence and magnitude of TTS is a function of cumulative acoustic energy (SEL) is probably an oversimplification (Finneran 2012). Popov et al. (2011) examined the effects of fatiguing noise on the hearing threshold of Yangtze finless porpoises when exposed to frequencies of 32–128 kHz at 140–160 dB re 1 μPa for 1–30 min. They found that an

exposure of higher level and shorter duration produced a higher TTS than an exposure of equal SEL but of lower level and longer duration. Kastelein et al. (2012a,b; 2013b) also reported that the equal-energy model is not valid for predicting TTS in harbor porpoises or harbor seals.

Recent data have shown that the SEL required for TTS onset to occur increases with intermittent exposures, with some auditory recovery during silent periods between signals (Finneran et al. 2010b; Finneran and Schlundt 2011). Schlundt et al. (2013) reported that the potential for seismic surveys using airguns to cause auditory effects on dolphins could be lower than previously thought. Based on behavioral tests, Finneran et al. (2011) and Schlundt et al. (2013) reported no measurable TTS in bottlenose dolphins after exposure to 10 impulses from a seismic airgun with a cumulative SEL of ~195 dB re 1 $\mu Pa^2 \cdot s$; results from auditory evoked potential measurements were more variable (Schlundt et al. 2013).

Recent studies have also shown that the SEL necessary to elicit TTS can depend substantially on frequency, with susceptibility to TTS increasing with increasing frequency above 3 kHz (Finneran and Schlundt 2010, 2011; Finneran 2012). When beluga whales were exposed to fatiguing noise with sound levels of 165 dB re 1 μPa for durations of 1–30 min at frequencies of 11.2–90 kHz, the highest TTS with the longest recovery time was produced by the lower frequencies (11.2 and 22.5 kHz); TTS effects also gradually increased with prolonged exposure time (Popov et al. 2013a). Popov et al. (2013b) also reported that TTS produced by exposure to a fatiguing noise was larger during the first session (or naïve subject state) with a beluga whale than TTS that resulted from the same sound in subsequent sessions (experienced subject state). Therefore, Supin et al. (2013) reported that SEL may not be a valid metric for examining fatiguing sounds on beluga whales. Similarly, Nachtigall and Supin (2013) reported that false killer whales are able to change their hearing sensation levels when exposed to loud sounds, such as warning signals or echolocation sounds.

It is inappropriate to assume that onset of TTS occurs at similar received levels in all cetaceans (*cf.* Southall et al. 2007). Some cetaceans could incur TTS at lower sound exposures than are necessary to elicit TTS in the beluga or bottlenose dolphin. Based on the best available information, Southall et al. (2007) recommended a TTS threshold for exposure to single or multiple pulses of 183 dB re 1 $\mu Pa^2 \cdot s$. Tougaard et al. (2013) proposed a TTS criterion of 165 dB re 1 $\mu Pa^2 \cdot s$ for porpoises based on data from two recent studies. Gedamke et al. (2011), based on preliminary simulation modeling that attempted to allow for various uncertainties in assumptions and variability around population means, suggested that some baleen whales whose closest point of approach to a seismic vessel is 1 km or more could experience TTS.

There is no specific evidence that exposure to pulses of airgun sound can cause PTS in any marine mammal, even with large arrays of airguns. However, given the likelihood that some mammals close to an airgun array might incur at least mild TTS, there has been further speculation about the possibility that some individuals occurring very close to airguns might incur PTS (e.g., Richardson et al. 1995, p. 372*ff*; Gedamke et al. 2011). In terrestrial animals, exposure to sounds sufficiently strong to elicit a large TTS induces physiological and structural changes in the inner ear, and at some high level of sound exposure, these phenomena become non-recoverable (Le Prell 2012). At this level of sound exposure, TTS grades into PTS. Single or occasional occurrences of mild TTS are not indicative of permanent auditory damage, but repeated or (in some cases) single exposures to a level well above that causing TTS onset might elicit PTS (e.g., Kastak and Reichmuth 2007; Kastak et al. 2008).

Current NMFS policy regarding exposure of marine mammals to high-level sounds is that cetaceans and pinnipeds should not be exposed to impulsive sounds with received levels ≥180 dB and 190 dB re

1 μPa_{rms}, respectively (NMFS 2000). These criteria have been used in establishing the exclusion (=shut-down) zones planned for the proposed seismic survey. However, those criteria were established before there was any information about minimum received levels of sounds necessary to cause auditory impairment in marine mammals.

Recommendations for science-based noise exposure criteria for marine mammals, frequency-weighting procedures, and related matters were published by Southall et al. (2007). Those recommendations were never formally adopted by NMFS for use in regulatory processes and during mitigation programs associated with seismic surveys, although some aspects of the recommendations have been taken into account in certain environmental impact statements and small-take authorizations. In December 2013, NOAA made available for public comment new draft guidance for assessing the effects of anthropogenic sound on marine mammals (NOAA 2013a), taking at least some of the Southall et al. recommendations into account. At the time of preparation of this Draft EA, the date of release of the final guidelines and how they would be implemented are unknown.

Nowacek et al. (2013) concluded that current scientific data indicate that seismic airguns have a low probability of directly harming marine life, except at close range. Several aspects of the planned monitoring and mitigation measures for this project are designed to detect marine mammals occurring near the airgun array, and to avoid exposing them to sound pulses that might, at least in theory, cause hearing impairment (see § II and § IV[2], below). Also, many marine mammals and (to a limited degree) sea turtles show some avoidance of the area where received levels of airgun sound are high enough such that hearing impairment could potentially occur. In those cases, the avoidance responses of the animals themselves would reduce or (most likely) avoid any possibility of hearing impairment.

Non-auditory physical effects may also occur in marine mammals exposed to strong underwater pulsed sound. Possible types of non-auditory physiological effects or injuries that might (in theory) occur in mammals close to a strong sound source include stress, neurological effects, bubble formation, and other types of organ or tissue damage. It is possible that some marine mammal species (i.e., beaked whales) may be especially susceptible to injury and/or stranding when exposed to strong transient sounds.

There is no definitive evidence that any of these effects occur even for marine mammals in close proximity to large arrays of airguns. However, Gray and Van Waerebeek (2011) have suggested a cause-effect relationship between a seismic survey off Liberia in 2009 and the erratic movement, postural instability, and akinesia in a pantropical spotted dolphin based on spatially and temporally close association with the airgun array. Additionally, a few cases of strandings in the general area where a seismic survey was ongoing have led to speculation concerning a possible link between seismic surveys and strandings (e.g., Castellote and Llorens 2013).

Non-auditory effects, if they occur at all, would presumably be limited to short distances and to activities that extend over a prolonged period. Marine mammals that show behavioral avoidance of seismic vessels, including most baleen whales, some odontocetes, and some pinnipeds, are especially unlikely to incur non-auditory physical effects. The brief duration of exposure of any given mammal, the deep water in the study area, and the planned monitoring and mitigation measures would further reduce the probability of exposure of marine mammals to sounds strong enough to induce non-auditory physical effects.

Sea Turtles

There is substantial overlap in the frequencies that sea turtles detect vs. the frequencies in airgun pulses. We are not aware of measurements of the absolute hearing thresholds of any sea turtle to waterborne sounds similar to airgun pulses. In the absence of relevant absolute threshold data, we cannot

estimate how far away an airgun array might be audible. Moein et al. (1994) and Lenhardt (2002) reported TTS for loggerhead turtles exposed to many airgun pulses (see PEIS). This suggests that sounds from an airgun array might cause temporary hearing impairment in sea turtles if they do not avoid the (unknown) radius where TTS occurs. However, exposure duration during the proposed survey would be much less than during the aforementioned studies. Also, recent monitoring studies show that some sea turtles do show localized movement away from approaching airguns. At short distances from the source, received sound level diminishes rapidly with increasing distance. In that situation, even a small-scale avoidance response could result in a significant reduction in sound exposure.

The PSVOs stationed on the *Langseth* would also watch for sea turtles, and airgun operations would be shut down if a turtle enters the designated EZ.

(b) Possible Effects of Other Acoustic Sources

The Kongsberg EM 122 MBES, Knudsen Chirp 3260 SBP, and Teledyne OS75 75-kHz ADCP would be operated from the source vessel during the proposed survey. Information about this equipment was provided in § 2.2.3.1 of the PEIS (MBES, SBP) or § II of this Draft EA (ADCP). A review of the anticipated potential effects (or lack thereof) of MBESs, SBPs, and pingers on marine mammals and sea turtles appears in § 3.4.4.3, § 3.6.4.3, § 3.7.4.3, and Appendix E of the PEIS.

There has been some recent attention given to the effects of MBES on marine mammals, as a result of a report issued in September 2013 by an IWC independent scientific review panel linking the operation of a MBES to a mass stranding of melon-headed whales (*Peponocephala electra*; Southall et al. 2013) off Madagascar. During May–June 2008, ~100 melon-headed whales entered and stranded in the Loza Lagoon system in northwest Madagascar at the same time that a 12-kHz MBES survey was being conducted ~65 km away off the coast. In conducting a retrospective review of available information on the event, an independent scientific review panel concluded that the Kongsberg EM 120 MBES was the most plausible behavioral trigger for the animals initially entering the lagoon system and eventually stranding. The independent scientific review panel, however, identified that an unequivocal conclusion on causality of the event was not possible because of the lack of information about the event and a number of potentially contributing factors. Additionally, the independent review panel report indicated that this incident was likely the result of a complicated confluence of environmental, social, and other factors that have a very low probability of occurring again in the future, but recommended that the potential be considered in environmental planning. It should be noted that this event is the first known marine mammal mass stranding closely associated with the operation of a MBES. Leading scientific experts knowledgeable about MBES have expressed concerns about the independent scientific review panel analyses and findings (Bernstein 2013).

There is no available information on marine mammal behavioral response to MBES sounds (Southall et al. 2013) or sea turtle responses to MBES systems. Much of the literature on marine mammal response to sonars relates to the types of sonars used in naval operations, including Low-Frequency Active (LFA) sonars (e.g., Miller et al. 2012; Sivle et al. 2012) and Mid-Frequency Active (MFA) sonars (e.g., Tyack et al. 2011; Melcón et al. 2012; Miller et al. 2012; DeRuiter et al. 2013a,b; Goldbogen et al. 2013). However, the MBES sounds are quite different than naval sonars. Ping duration of the MBES is very short relative to naval sonars. Also, at any given location, an individual marine mammal would be in the beam of the MBES for much less time given the generally downward orientation of the beam and its narrow fore-aft beamwidth; naval sonars often use near-horizontally-directed sound. In addition, naval sonars have higher duty cycles. These factors would all reduce the sound energy received from the MBES relative to that from naval sonars.

Risch et al. (2012) found a reduction in humpback whale song in the Stellwagen Bank National Marine Sanctuary during Ocean Acoustic Waveguide Remote Sensing (OAWRS) activities that were carried out approximately 200 km away. The OAWRS used three frequency-modulated (FM) pulses centered at frequencies of 415, 734, and 949 Hz with received levels in the sanctuary 88–110 dB re 1 µPa. Deng et al (2014) measured the spectral properties of pulses transmitted by three 200-kHz echo sounders, and found that they generated weaker sounds at frequencies below the center frequency (90–130 kHz). These sounds are within the hearing range of some marine mammals, and the authors suggested that they could be strong enough to elicit behavioural responses within close proximity to the sources, although they would be well below potentially harmful levels.

Despite the aforementioned information that has recently become available, this Draft EA is in agreement with the assessment presented in § 3.4.7, 3.6.7, and 3.7.7 of the PEIS that operation of MBESs, SBPs, and pingers is not likely to impact mysticetes or odontocetes and is not expected to affect sea turtles, (1) given the lower acoustic exposures relative to airguns and (2) because the intermittent and/or narrow downward-directed nature of these sounds would result in no more than one or two brief ping exposures of any individual marine mammal or sea turtle given the movement and speed of the vessel. Also, for sea turtles, the associated frequency ranges are above their known hearing range.

(c) Other Possible Effects of Seismic Surveys

Other possible effects of seismic surveys on marine mammals and/or sea turtles include masking by vessel noise, disturbance by vessel presence or noise, and injury or mortality from collisions with vessels or entanglement in seismic gear.

Vessel noise from the *Langseth* could affect marine animals in the proposed survey area. Sounds produced by large vessels generally dominate ambient noise at frequencies from 20 to 300 Hz (Richardson et al. 1995). Ship noise, through masking, can reduce the effective communication distance of a marine mammal if the frequency of the sound source is close to that used by the animal, and if the sound is present for a significant fraction of time (e.g., Richardson et al. 1995; Clark et al. 2009; Jensen et al. 2009; Hatch et al. 2012). In order to compensate for increased ambient noise, some cetaceans are known to increase the source levels of their calls in the presence of elevated noise levels from shipping, shift their peak frequencies, or otherwise change their vocal behavior (e.g., Parks et al. 2011; 2012; Castellote et al. 2012; Melcón et al. 2012: Tyack and Janik 2013).

Baleen whales are thought to be more sensitive to sound at these low frequencies than are toothed whales (e.g., MacGillivray et al. 2014), possibly causing localized avoidance of the proposed survey area during seismic operations. Reactions of gray and humpback whales to vessels have been studied, and there is limited information available about the reactions of right whales and rorquals (fin, blue, and minke whales). Reactions of humpback whales to boats are variable, ranging from approach to avoidance (Payne 1978; Salden 1993). Baker et al. (1982, 1983) and Baker and Herman (1989) found humpbacks often move away when vessels are within several kilometers. Humpbacks seem less likely to react overtly when actively feeding than when resting or engaged in other activities (Krieger and Wing 1984, 1986).

Many odontocetes show considerable tolerance of vessel traffic, although they sometimes react at long distances if confined by ice or shallow water, if previously harassed by vessels, or have had little or no recent exposure to ships (Richardson et al. 1995). Dolphins of many species tolerate and sometimes approach vessels. Some dolphin species approach moving vessels to ride the bow or stern waves (Williams et al. 1992). There are few data on the behavioral reactions of beaked whales to vessel noise, though they seem to avoid approaching vessels (e.g., Würsig et al. 1998) or dive for an extended period when

approached by a vessel (e.g., Kasuya 1986). Based on a single observation, Aguilar-Soto et al. (2006) suggest foraging efficiency of Cuvier's beaked whales may be reduced by close approach of vessels.

The PEIS concluded that project vessel sounds would not be at levels expected to cause anything more than possible localized and temporary behavioral changes in marine mammals or sea turtles, and would not be expected to result in significant negative effects on individuals or at the population level. In addition, in all oceans of the world, large vessel traffic is currently so prevalent that it is commonly considered a usual source of ambient sound.

Another concern with vessel traffic is the potential for striking marine mammals or sea turtles. Information on vessel strikes is reviewed in § 3.4.4.4 and § 3.6.4.4 of the PEIS. The PEIS concluded that the risk of collision of seismic vessels or towed/deployed equipment with marine mammals or sea turtles exists but is extremely unlikely, because of the relatively slow operating speed (typically 7–9 km/h) of the vessel during seismic operations, and the generally straight-line movement of the seismic vessel.

Entanglement of sea turtles in seismic gear is also a concern; whereas there have been reports of turtles being trapped and killed between the gaps in tail-buoys offshore from West Africa (Weir 2007); however, these tailbuoys are significantly different then those used on the *Langseth*. In April 2011, a dead olive ridley turtle was found in a deflector foil of the seismic gear on the *Langseth* during equipment recovery at the conclusion of a survey off Costa Rica, where sea turtles were numerous. Such incidents are possible, but that was the only case of sea turtle entanglement in seismic gear for the *Langseth*, which has been conducting seismic surveys since 2008, or for its predecessor, R/V *Maurice Ewing*, during 2003–2007. Towing the hydrophone streamer or other equipment during the proposed survey is not expected to significantly interfere with sea turtle movements, including migration.

(d) Mitigation Measures

Several mitigation measures are built into the proposed seismic survey as an integral part of the planned activities. These measures include the following: ramp ups; typically two, however a minimum of one dedicated observer maintaining a visual watch during all daytime airgun operations; two observers for 30 min before and during ramp ups during the day and at night; PAM during the day and night to complement visual monitoring (unless the system and back-up systems are damaged during operations); and power downs (or if necessary shut downs) when mammals or turtles are detected in or about to enter designated EZ. These mitigation measures are described in § 2.4.4.1 of the PEIS and summarized earlier in this document, in § II(3). The fact that the airgun array, because of its design, directs the majority of the energy downward, and less energy laterally, is also an inherent mitigation measure.

Previous and subsequent analysis of the potential impacts takes account of these planned mitigation measures. It would not be meaningful to analyze the effects of the planned activities without mitigation, as the mitigation (and associated monitoring) measures are a basic part of the activities, and would be implemented under the Proposed Action or Alternative Action.

(e) Potential Numbers of Cetaceans Exposed to Received Sound Levels ≥160 dB

All anticipated takes would be "takes by harassment" as described in § I, involving temporary changes in behavior. The mitigation measures to be applied would minimize the possibility of injurious takes. (However, as noted earlier and in the PEIS, there is no specific information demonstrating that injurious "takes" would occur even in the absence of the planned mitigation measures.) In the sections below, we describe methods to estimate the number of potential exposures to sound levels >160 dB re 1 μPa_{rms}, and present estimates of the numbers of marine mammals that could be affected during the

proposed seismic program. The estimates are based on consideration of the number of marine mammals that could be disturbed appreciably by ~6350 km of seismic surveys off Cape Hatteras. The main sources of distributional and numerical data used in deriving the estimates are described in the next subsection.

Basis for Estimating Exposure.—The estimates are based on a consideration of the number of marine mammals that could be within the area around the operating airgun array where the received levels (RLs) of sound >160 dB re 1 μPa_{rms} are predicted to occur (see Table 1). The estimated numbers are based on the densities (numbers per unit area) of marine mammals expected to occur in the area in the absence of a seismic survey. To the extent that marine mammals tend to move away from seismic sources before the sound level reaches the criterion level and tend not to approach an operating airgun array, these estimates are likely to overestimate the numbers actually exposed to the specified level of sounds. The overestimation is expected to be particularly large when dealing with the higher sound-level criteria, e.g., 180 dB re 1 μPa_{rms}, as animals are more likely to move away before RL reaches 180 dB than they are to move away before it reaches (for example) 160 dB re 1 μPa_{rms}. Likewise, they are less likely to approach within the ≥180-dB radius than they are to approach within the considerably larger ≥160-dB radius.

We used densities calculated from the U.S. Navy's "OPAREA Density Estimates" (NODE) database (DoN 2007). The cetacean density estimates are based on the NMFS-SEFSC and NMFS-NEFC vessel-based and aerial surveys conducted between 1998 and 2005; most (seven) surveys that included the proposed survey area were conducted in summer (between June and August), one vessel-based survey extended to the end of September, and one vessel-based and two aerial surveys were conducted in winter–spring (between January and April). Density estimates were derived using density surface modelling of the existing line-transect data, which uses sea surface temperature, chlorophyll *a*, depth, longitude, and latitude to allow extrapolation to areas/seasons where survey data were not collected. For some species, there were not enough sightings to be able to produce a density surface, so densities were estimated using traditional line-transect analysis. The models and analyses have been incorporated into a web-based Geographic Information System (GIS) developed by Duke University's Department of Defense Strategic Environmental Research and Development Program (SERDP) team in close collaboration with the NMFS SERDP team (Read et al. 2009). We used the GIS to obtain densities in polygons for the survey area separated into three depth strata (<100 m, 100–1000 m, and >1000 m) for the 20 cetacean species in the model. The GIS provides minimum, mean, and maximum estimates for four seasons, and we used the mean estimates for fall. Mean densities were used because the minimum and maximum estimates are for points within the polygons, whereas the mean estimate is for the entire polygons.

The estimated numbers of individuals potentially exposed presented below are based on the 160-dB re 1 μPa_{rms} criterion for all cetaceans. It is assumed that marine mammals exposed to airgun sounds that strong could change their behavior sufficiently to be considered "taken by harassment". Table 9 shows the density estimates calculated as described above and the estimates of the number of different individual marine mammals that potentially could be exposed to ≥160 dB re 1 μPa_{rms} during the seismic survey if no animals moved away from the survey vessel. The *Requested Take Authorization* is given in the far right column of Table 9.

It should be noted that the following estimates of exposures to various sound levels assume that the proposed survey would be completed; in fact, the ensonified areas calculated using the planned number of line-kilometers ***have been increased by 25%*** to accommodate lines that may need to be repeated, equipment testing, etc. As is typical during offshore ship surveys, inclement weather and equipment malfunctions are likely to cause delays and may limit the number of useful line-kilometers of seismic operations that can be undertaken. Also, any marine mammal sightings within or near the designated EZ would result in

TABLE 9. Densities and estimates of the possible numbers of individuals that could be exposed to ≥160 dB re 1 μPa_{rms} during L-DEO's proposed seismic survey in the Atlantic Ocean off Cape Hatteras during September–October 2014. The proposed sound source consists of a 36-airgun array with a total discharge volume of ~6600 in^3 or an 18-airgun array with a total discharge volume of ~3300 in^3. Species in italics are listed under the ESA as endangered. The column of numbers in boldface shows the numbers of Level B "takes" for which authorization is requested.

	Reported density[1] (#/1000 km^2) in depth range (m)			Ensonified area (1000 km^2) in depth range (m)			Calculated Take[2] in depth range (m)				% Regional pop'n[3]	Requested Level B Take Authorization
Species	<100	100-1000	>1000	<100	100-1000	>1000	<100	100-1000	>1000	All		
Mysticetes												
North Atlantic right whale	*0*	*0*	*0*	*15.17*	*6.65*	*42.90*	*0*	*0*	*0*	*0*	*0*	***0***
Humpback whale	*0.73*	*0.56*	*1.06*	*15.17*	*6.65*	*42.90*	*11*	*4*	*46*	*60*	*0.52*	***60***
Minke whale	0.03	0.02	0.04	*15.17*	*6.65*	*42.90*	0	0	2	2	0.01	**2**
Sei whale	*0*	*0*	*0*	*15.17*	*6.65*	*42.90*	*0*	*0*	*0*	*0*	*0*	***0***
Fin whale	*<0.01*	*0.01*	*0.01*	*15.17*	*6.65*	*42.90*	*0*	*0*	*0*	*0*	*<0.01*	***1***
Blue whale	*0*	*0*	*0*	*15.17*	*6.65*	*42.90*	*0*	*0*	*0*	*0*	*0*	***1***
Odontocetes												
Sperm whale	*0.03*	*0.68*	*3.23*	*15.17*	*6.65*	*42.90*	*1*	*4*	*139*	*144*	*1.09*	***144***
Pygmy/dwarf sperm whale	0.64	0.49	0.93	*15.17*	*6.65*	*42.90*	10	3	40	53	1.39	**53**
Beaked whales[4]	0.01	0.14	0.58	*15.17*	*6.65*	*42.90*	0	1	25	26	0.19	**26**
Rough-toothed dolphin	0.30	0.23	0.44	*15.17*	*6.65*	*42.90*	5	2	19	25	9.23	**25**
Bottlenose dolphin	70.4	331.0	49.4	*15.17*	*6.65*	*42.90*	1068	2200	2120	5388	6.21	**5388**
Pantropical spotted dolphin	14.0	10.7	20.4	*15.17*	*6.65*	*42.90*	213	71	874	1158	34.74	**1158**
Atlantic spotted dolphin	216.5	99.7	77.4	*15.17*	*6.65*	*42.90*	3285	663	3322	7270	16.26	**7270**
Spinner dolphin[5]	0	0	0	*15.17*	*6.65*	*42.90*	0	0	0	0	0	**0**
Striped dolphin	0	0.4	3.53	*15.17*	*6.65*	*42.90*	0	2	151	154	0.28	**154**
Clymene dolphin	6.70	5.12	9.73	*15.17*	*6.65*	*42.90*	102	34	418	553	N/A	**553**
Common dolphin	5.8	138.7	26.4	*15.17*	*6.65*	*42.90*	88	922	1132	2142	1.23	**2142**
Atlantic white-sided dolphin	0	0	0	*15.17*	*6.65*	*42.90*	0	0	0	0	0	**0**
Fraser's dolphin[5]	0	0	0	*15.17*	*6.65*	*42.90*	0	0	0	0	0	**0**
Risso's dolphin	1.18	4.28	2.15	*15.17*	*6.65*	*42.90*	18	28	92	139	0.76	**139**
Melon-headed whale[5]	0	0	0	*15.17*	*6.65*	*42.90*	0	0	0	0	0	**0**
Pygmy killer whale[5]	0	0	0	*15.17*	*6.65*	*42.90*	0	0	0	0	0	**0**
False killer whale[5]	0	0	0	*15.17*	*6.65*	*42.90*	0	0	0	0	0	**0**
Killer whale[5]	0	0	0	*15.17*	*6.65*	*42.90*	0	0	0	0	0	**0**
Pilot whale	3.74	58.9	19.1	*15.17*	*6.65*	*42.90*	57	392	820	1268	0.16	**1268**
Harbor porpoise	0	0	0	*15.17*	*6.65*	*42.90*	0	0	0	0	0	**0**

[1] Densities are the mean values for the depth stratum in the survey area, calculated from the SERDP model of Read et al. (2009)

[2] Calculated take is reported density multiplied by the 160-dB ensonified area (including the 25% contingency); calculated take for the fin whale was 0.49 so requested take is 1.

[3] Requested takes expressed as percentages of the larger regional populations, where available, for species that are at least partly pelagic; where not available (most odontocetes–see Table 3), SAR population estimates were used. This results in overestimates, particularly for the pantropical and Atlantic spotted dolphins, as SAR estimates are based on surveys only in U.S. waters rather than in their full ranges. N/A means not available

[4] May include Cuvier's, True's, Gervais', or Blainville's beaked whales

[5] Atlantic waters not included in the SERDP model of Read et al. (2009), only Gulf of Mexico

the shut down of seismic operations as a mitigation measure. Thus, the following estimates of the numbers of marine mammals potentially exposed to 160-dB re 1 μPa_{rms} sounds are precautionary and probably overestimate the actual numbers of marine mammals that could be involved. These estimates assume that there would be no weather, equipment, or mitigation delays, which is highly unlikely.

Consideration should be given to the hypothesis that delphinids are less responsive to airgun sounds than are mysticetes, as referenced in both the PEIS and "Summary of Potential Airgun Effects" of this document. The 160-dB (rms) criterion currently applied by NMFS, on which the following estimates are based, was developed based primarily on data from gray and bowhead whales. The estimates of "takes by harassment" of delphinids given below are thus considered precautionary. As noted previously,

in December 2013, NOAA made available for public comment new draft guidance for assessing the effects of anthropogenic sound on marine mammals (NOAA 2013a), although at the time of preparation of this Draft EA, the date of release of the final guidelines and how they would be implemented are unknown. Available data suggest that the current use of a 160-dB criterion may be improved upon, as behavioral response may not occur for some percentage of odontocetes and mysticetes exposed to received levels >160 dB, while other individuals or groups may respond in a manner considered as taken to sound levels <160 dB (NMFS 2013d). It has become evident that the context of an exposure of a marine mammal to sound can affect the animal's initial response to the sound (NMFS 2013d).

Potential Number of Marine Mammals Exposed.—The number of different individuals that could be exposed to airgun sounds with received levels ≥160 dB re 1 μPa_{rms} on one or more occasions can be estimated by considering the total marine area that would be within the 160-dB radius around the operating seismic source on at least one occasion, along with the expected density of animals in the area. The number of possible exposures (including repeated exposures of the same individuals) can be estimated by considering the total marine area that would be within the 160-dB radius around the operating airguns, including areas of overlap. During the proposed survey, the transect lines are widely spaced relative to the 160-dB distance. Thus, the area including overlap is 1.79 times the area excluding overlap, so a marine mammal that stayed in the survey area during the entire survey could be exposed slightly less than twice, on average. However, it is unlikely that a particular animal would stay in the area during the entire survey. The numbers of different individuals potentially exposed to ≥160 dB re 1 μPa_{rms} were calculated by multiplying the expected species density times the anticipated area to be ensonified to that level during airgun operations excluding overlap. The area expected to be ensonified was determined by entering the planned survey lines into a MapInfo GIS, using the GIS to identify the relevant areas by "drawing" the applicable 160-dB buffer (see Table 1) around each seismic line, and then calculating the total area within the buffers.

Applying the approach described above, ~51,775 km^2 (~64,720 km^2 including the 25% contingency) would be within the 160-dB isopleth on one or more occasions during the proposed survey. Because this approach does not allow for turnover in the mammal populations in the area during the course of the survey, the actual number of individuals exposed may be underestimated, although the conservative (i.e., probably overestimated) line-kilometer distances used to calculate the area may offset this. Also, the approach assumes that no cetaceans would move away or toward the trackline in response to increasing sound levels before the levels reach 160 dB as the *Langseth* approaches. Another way of interpreting the estimates that follow is that they represent the number of individuals that are expected (in the absence of a seismic program) to occur in the waters that would be exposed to ≥160 dB re 1 μPa_{rms}.

The estimate of the number of individual cetaceans that could be exposed to seismic sounds with received levels ≥160 dB re 1 μPa_{rms} during the proposed survey is 18,382 (Table 9). That total includes 204 cetaceans listed as ***Endangered*** under the ESA, including 60 humpback whales (0.52% of the regional

population) and 144 sperm whales (1.09%). It also includes 26 beaked whales (0.19%), probably mostly Cuvier's whale. Most (98.5%) of the cetaceans potentially exposed are delphinids; the Atlantic spotted dolphin, bottlenose dolphin, short-beaked common dolphin, short- and long-finned pilot whales, and pantropical spotted dolphin are estimated to be the most common delphinid species in the area, with estimates of 7270 (16.26% of the regional population), 5388 (6.21%), 2142 (1.23%), 1268 (0.16%), and 1158 (34.74%) exposed to ≥160 dB re 1 μPa_{rms}, respectively. All percentage estimates for delphinids except for the pilot whales are very likely overestimates, in some cases considerable overestimates, because the population sizes are very likely underestimates. This is because there are no truly regional population size estimates (e.g., for the northwest Atlantic) for most delphinids, most of which are at least partly pelagic; rather, the population sizes are based on surveys in U.S. waters, which represent only a small fraction of northwest Atlantic waters.

(f) Conclusions for Marine Mammals and Sea Turtles

The proposed seismic project would involve towing a 36-airgun array with a total discharge volume of 6600 in^3 or an 18-airgun array with a total discharge volume of 3300 in^3 that introduces pulsed sounds into the ocean. Routine vessel operations, other than the proposed seismic operations, are conventionally assumed not to affect marine mammals sufficiently to constitute "taking".

Cetaceans.—In § 3.6.7 and 3.7.7, the PEIS concluded that airgun operations with implementation of the proposed monitoring and mitigation measures could result in a small number of Level B behavioral effects in some mysticete and odontocete species, and that Level A effects were highly unlikely. The information from recent literature summarized in sections (a) to (c) above complements, and does not affect the outcome of the effects assessment as presented in the PEIS.

In this EA, estimates of the numbers of marine mammals that could be exposed to airgun sounds during the proposed program have been presented, together with the requested "take authorization". For most species predicted to be exposed to sound levels sufficient to cause appreciable disturbance, including all ESA listed species, the estimated numbers of animals potentially exposed are low percentages of the regional population sizes (Table 9). For some delphinid species, the estimated numbers potentially exposed are higher percentages of the populations in the NMFS SARs; as discussed above, we believe that those percentages are overestimates because the "regional" population sizes—in fact, the estimated population sizes in U.S. waters—underestimate true regional population sizes, in some cases considerably. The estimates of exposures are also likely overestimates of the actual number of animals that would be exposed to and would react to the seismic sounds. The reasons for that conclusion are outlined above. The relatively short-term exposures are unlikely to result in any long-term negative consequences for the individuals or their populations. Therefore, no significant impacts on cetaceans would be anticipated from the proposed activities.

Sea Turtles.—In § 3.4.7, the PEIS concluded that with implementation of the proposed monitoring and mitigation measures, no significant impacts of airgun operations are likely to sea turtle populations in any of the analysis areas, and that any effects are likely to be limited to short-term behavioral disturbance and short-term localized avoidance of an area of unknown size near the active airguns. Five species of sea turtle—the leatherback, loggerhead, green, hawksbill, and Kemp's ridley—could be encountered in the proposed survey area. Only foraging or migrating individuals would occur. Given the proposed monitoring and mitigation measures, no significant impacts on sea turtles would be anticipated.

(2) Direct Effects on Invertebrates, Fish, Fisheries, and EFH and Their Significance

Effects of seismic sound on marine invertebrates (crustaceans and cephalopods), marine fish, and their fisheries are discussed in § 3.2.4 and § 3.3.4 and Appendix D of the PEIS. Relevant new studies on the effects of sound on marine invertebrates, fish, and fisheries that have been published since the release of the PEIS are summarized below.

(a) Effects of Sound on Fish and Invertebrates

Morley et al. (2013) considered invertebrates important when examining the impacts of anthropogenic noise. Although their review focused on terrestrial invertebrates, they noted that invertebrates, because of their short life cycle, can provide model systems for evaluating the effects of noise on individual fitness and physiology, thereby providing data that can be used to draw stronger, ecologically valid conclusions.

Solé et al. (2013) exposed four cephalopod species to low-frequency sound (50–400 Hz sweeps) with received levels of 157 ± 5 dB re 1 μPa, and peak levels up to 175 dB re 1 μPa. Besides exhibiting startle responses, all four species examined received damage to the statocyst, which is the organ responsible for equilibrium and movement. The animals showed stressed behavior, decreased activity, and loss of muscle tone. When the shore crab *Carcinus maenas* was initially exposed to ship-noise playbacks, it consumed more oxygen, indicating a higher metabolic rate and potentially more stress; however, there were no changes in physiological responses to repeated exposure (Wale et al. 2013). Heavier crabs were more responsive than lighter crab (Wale et al. 2013). Celi et al. (2013) exposed red swamp crayfish (*Procambarus clarkia*) to linear sweeps with a frequency range of 0.1 to 25 kHz and a peak amplitude of 148 dB re 1 μPa rms at 12 kHz for 30 min. They found that the noise exposure caused changes in the haemato-immunological parameters (indicating stress) and reduced agonistic behaviors.

Fewtrell and McCauley (2012) exposed squid (*Sepioteuthis australis*), pink snapper (*Pagrus auratus*), and trevally (*Pseudocaranx dentex*) to pulses from a single airgun. The received sound levels ranged from 120 to 184 dB re 1 dB re 1 $\mu Pa^2 \cdot s$ SEL. Increases in alarm responses were seen in the squid and fish at SELs >147–151 dB re 1 $\mu Pa^2 \cdot s$; the fish swam faster and formed more cohesive groups in response to the airgun sounds, and squid were seen to discharge ink or change their swimming pattern or vertical position in the water column.

Bui et al. (2013) examined the behavioral responses of Atlantic salmon (*Salmo salar L.*) to light, sound, and surface disturbance events. They reported that the fish showed short-term avoidance responses to the three stimuli. Salmon that were exposed to 12 Hz sounds and/or surface disturbances increased their swimming speeds.

Peña et al. (2013) used an omnidirectional fisheries sonar to determine the effects of a 3D seismic survey off Vesterålen, northern Norway, on feeding herring (*Clupea harengus*). They reported that herring schools did not react to the seismic survey; no significant changes were detected in swimming speed, swim direction, or school size when the drifting seismic vessel approached the fish from a distance of 27 km to 2 km over a 6 h period. Peña et al. (2013) attributed the lack of response to strong motivation for feeding, the slow approach of the seismic vessel, and an increased tolerance to airgun sounds. This study contrasts the findings of Løkkeborg et al. (2012). Study results indicated that fishes reacted to airgun sound based on observed changes in catch rates during seismic shooting; gillnet catches increased during the seismic shooting, likely a result of increased fish activity, while longline catches decreased overall (Løkkeborg et al. 2012).

Miller and Cripps (2013) used underwater visual census to examine the effect of a seismic survey on a shallow-water coral reef fish community in Australia. The census took place at six sites on the reef prior to and after the survey. When the census data collected during the seismic program were combined with historical data, the analyses showed that the seismic survey had no significant effect on the overall abundance or species richness of reef fish. This was in part attributed to the design of the seismic survey, which reduced the impacts of seismic sounds on the fish communities by exposing them to relatively low SELs (<187 dB re 1 $\mu Pa^2 \cdot s$).

Hastings and Miksis-Olds (2012) measured the hearing sensitivity of caged reef fish following exposure to a seismic survey in Australia. When the auditory evoked potentials (AEP) were examined for fish that had been in cages as close as 45 m from the pass of the seismic vessel and at water depth of 5 m, there was no evidence of temporary threshold shift (TTS) in any of the fish examined, even though the cumulative SELs had reached 190 dB re 1 $\mu Pa^2 \cdot s$.

(b) Effects of Sound on Fisheries

Handegard et al. (2013) examined different exposure metrics to explain the disturbance of seismic surveys on fish. They applied metrics to two experiments in Norwegian waters, during which fish distribution and fisheries were affected by airguns. Even though the disturbance for one experiment was greater, the other appeared to have the stronger SEL, based on a relatively complex propagation model. Handegard et al. (2013) recommended that simple sound propagation models should be avoided and that the use of sound energy metrics like SEL to interpret disturbance effects should be done with caution. In this case, the simplest model (exposures per area) best explained the disturbance effect.

Hovem et al. (2012) used a model to predict the effects of airgun sounds on fish populations. Modeled SELs were compared with empirical data and were then compared with startle response levels for cod. Their preliminary analyses indicated that seismic surveys should occur at a distance of 5–10 km from fishing areas, in order to minimize potential effects on fishing.

(c) Conclusions for Invertebrates, Fish and Fisheries

This newly available information does not affect the outcome of the effects assessment as presented in the PEIS. The PEIS concluded that there could be changes in behavior and other non-lethal, short-term, temporary impacts, and injurious or mortal impacts on a small number of individuals within a few meters of a high-energy acoustic source, but that there would be no significant impacts of NSF-funded marine seismic research on populations and associated EFH. Most commercial and recreational fishing off Virginia and North Carolina occurs in State waters (within 5.6 km from shore), whereas the proposed survey is not in State waters, so interactions between the proposed survey and the fisheries would be relatively limited. Two possible conflicts are the *Langseth*'s streamer entangling with fixed fishing gear and displacement of fishers from the survey area. If fishing activities were occurring within the survey area, a safe distance would need to be kept from the *Langseth* and the towed seismic equipment. Conflicts would be avoided through communication with the fishing community during the survey and publication of a Notice to Mariners about operations in the area. A chase boat would also be employed to assist the *Langseth* by identifying, locating, and/or removing obstacles as required.

Ninety-four OBS instruments would be deployed during the 2-D survey. All OBSs would be recovered after the proposed survey. The OBS anchors either are 23-kg pieces of hot-rolled steel that have a footprint of 0.3×0.4 m or 36-kg iron grates with a footprint of 0.9×0.9 m. OBS anchors would be left behind upon equipment recovery. Although OBS placement would disrupt a very small area of

seafloor habitat and could disturb benthic invertebrates, the impacts are expected to be localized and transitory. Only three OBSs would be deployed in HAPC in the survey area (Fig. 1, HAPC #1 and possibly #5 and #10).

Given the proposed activities, no significant impacts on marine invertebrates, marine fish, their EFH or HAPC, and their fisheries would be anticipated.

(3) Direct Effects on Seabirds and Their Significance

Effects of seismic sound and other aspects of seismic operations (collisions, entanglement, and ingestion) on seabirds are discussed in § 3.5.4 of the PEIS. The PEIS concluded that there could be transitory disturbance, but that there would be no significant impacts of NSF-funded marine seismic research on seabirds or their populations. Given the proposed activities, no significant impacts on seabirds would be anticipated. Terrestrial activities would not affect seabirds because the only activities within 2 km of the coast would only involve burying passive seismometers.

(4) Indirect Effects on Marine Mammals, Sea Turtles, and Their Significance

The proposed seismic operations would not result in any permanent impact on habitats used by marine mammals or sea turtles, or to the food sources they use. The main impact issue associated with the proposed activities would be temporarily elevated noise levels and the associated direct effects on marine mammals and sea turtles, as discussed above.

During the proposed seismic survey, only a small fraction of the available habitat would be ensonified at any given time. Disturbance to fish species and invertebrates would be short-term, and fish would return to their pre-disturbance behavior once the seismic activity ceased. Thus, the proposed survey would have little impact on the abilities of marine mammals or sea turtles to feed in the area where seismic work is planned. No significant indirect impacts on marine mammals or seabirds would be anticipated.

(5) Direct Effects on Recreational SCUBA Divers and Dive Sites and Their Significance

No significant impacts on dive sites, including shipwrecks, would be anticipated. Airgun sounds would have no effects on solid structures, and the *Endeavor* would avoid deploying OBSs on any wrecks along the survey track lines. The only potential effects could be temporary displacement of fish and invertebrates from the structures.

Significant impacts on, or conflicts with, divers or diving activities would be avoided through communication with the diving community before and during the survey and publication of a Notice to Mariners about operations in the area. In particular, dive operators with dives scheduled during the survey within 25 km of the track lines would be contacted directly. Only a small percentage of the recreational dive sites (wrecks in water depths <100 m) are within 25 km of the survey track lines.

(6) Direct Effects on Terrestrial Species and Their Significance

Effects of the terrestrial component of the project would be very limited because of the nature of the activities. Small, passive Reftek seismometers would be placed at or just under the soil surface along two 200-km SE-NW transects, primarily beside state roads. Trillium sensors deployed at coastal sites would be buried in three coastal communities, well above the high-tide line and not on the beach. No impact to the environment would be expected from this activity. The active source component would be limited to 14 small detonations along the 200-km transects in pre-disturbed areas with easy access, such as along the edges of agricultural fields and along logging roads, buried ~25 m deep and sealed over the

upper 15 m. Because the holes would be sealed, negligible impact to the environment would be expected from the detonations.

No activities would occur in any protected lands, preserves, sanctuaries, or Critical Habitat for ESA-listed species. All required permits and licenses required for the activities would be obtained. Many of the ESA-listed species that were identified using IPAC in the general areas (20 km x 20 km) around the nominal drill sites would not be encountered because their habitat is not conducive to the methods required to do the work. For example, the large drill rig and water truck cannot operate in wetlands or forests; see further in § II(2)(f). Some of the ESA-listed plant species could occur at potential drill sites (e.g., along road sides), and they would be avoided by inspection, identification, and locating the actual (vs. nominal) drill sites away from them. Detailed information on the listed species given in § III is summarized below.

ESA-listed species that would not be encountered because of their habitat are as follows:

- The red-cockaded woodpecker, found in the IPAC search of the areas around most of the 14 nominal drill sites, inhabits fire-sustained open pine forest, nesting in cavities of living old-growth (100+ years) trees;
- The wood stork, found in the areas around only 2 of the 14 nominal drill sites, is dependent on wetlands for breeding and foraging, and nests are frequently located in the upper branches of large cypress trees or in mangroves on islands;
- The northern long-eared bat, found in the area around only 1 of the 14 nominal drill sites, roosts underneath bark, in cavities, or in crevices of live or dead trees in summer. Breeding begins in late summer or early fall near the caves and mines where they hibernate for the winter;
- Saint Francis' satyr butterfly, found in the areas around only 2 of the 14 nominal drill sites, is found only in a range that is ~10 km x 10 km at Ft. Bragg, NC. Its distribution is closely tied to grassy wetlands with numerous sedges that are created and maintained through a regular disturbance regime, especially by beavers or fire; most subpopulations are found in abandoned beaver dams or along streams with active beaver complexes;
- Seabeach amaranth, found in the areas around 3 of the 14 nominal drill sites (all near the coast), is native to the barrier island beaches of the Atlantic coast;
- Golden sedge, found in the areas around only 2 of the 14 nominal drill sites (both near the coast), found only within an area 26 km x 8 km, generally occurs on sandy ground that is moist to saturated to periodically inundated;
- Pondberry, found in the areas around 5 of the 14 nominal drill sites, occurs in seasonally flooded wetlands, sandy sinks, pond margins, and swampy depressions; and
- Harperella, found in the area around only 1 of the 14 nominal drill sites, typically occurs on rocky or gravel shoals and sandbars and along the margins of clear, swift-flowing stream sections.

ESA listed species that could be encountered are as follows:

- Rough-leaved loosestrife, found in the areas around 5 of the 14 nominal drill sites, is found in grass-shrub areas that are fire-maintained, and on roadsides and powerline rights-of-way where regular maintenance mimics fire and maintains vegetation so that herbaceous species are open to sunlight;

- Michaux's sumac, found in the areas around 3 of the 14 nominal drill sites, grows in sandy or rocky, open woods with basic soils, apparently surviving best in areas where some form of disturbance has provided an open area, including highway rights-of-way, roadsides, or on the edges of artificially maintained clearings;
- American chaffseed, found in the areas around 6 of the 14 nominal drill sites, is dependent on factors such as fire, mowing, or fluctuating water tables to maintain open to partly-open conditions; most surviving populations are in areas that are subject to frequent fire, including plantations, army base impact zones, forest management areas, and private lands burned to maintain open fields; and
- Cooley's meadowrue, found in the areas around only 2 of the 14 nominal drill sites, occurs in grass-sedge bogs and wet pine savannahs and savannah-like areas, and can also occur along fire plow lines, in roadside ditches, woodland clearings, and powerline rights-of-way.

As noted above, these four species of vegetation would be avoided during the site selection stage of the activities in the areas where they could be found by inspection and identification, and protected by locating the actual (vs. nominal) drill sites away from them.

No significant indirect impacts on terrestrial species would be anticipated.

(7) Cumulative Effects

The results of the cumulative impacts analysis in the PEIS indicated that there would not be any significant cumulative effects to marine resources from the proposed NSF-funded marine seismic research. However, the PEIS also stated that, "A more detailed, cruise-specific cumulative effects analysis would be conducted at the time of the preparation of the cruise-specific EAs, allowing for the identification of other potential activities in the area of the proposed seismic survey that may result in cumulative impacts to environmental resources." Here we focus on activities that could impact animals specifically in the proposed survey area (research activities, vessel traffic, and commercial fisheries).

(a) Past and future research activities in the area

There are many seismic data sets available for the continental shelf and slope of the eastern U.S. However, the quality of those data is not sufficient to meet the goals of the proposed project. The *Langseth* (or equivalent academic research vessel) has not acquired seismic data in this study area in the recent past.

In 2014, the *Langseth* may also support an NSF-proposed 3-D seismic survey off the coast of New Jersey to study the sea-level changes. That cruise would last ~36 days in June–July and cover ~4900 km of track lines. Additionally, the *Langseth* may conduct 2-D seismic surveys for ~3 weeks in August 2014, covering ~3175 km of track lines, and in a future year (3 weeks, ~3125 km of track lines) for the USGS in support of the delineation of the U.S. Extended Continental Shelf (ECS) along the east coast (Fig. 7). EAs are being prepared for both of those activities, and neither of those project survey tracklines are anticipated to overlap with the proposed survey tracklines.

Other scientific research activities may be conducted in this region in the future; however, aside from those noted here, no other marine geophysical surveys are currently proposed in the region using the *Langseth* in the foreseeable future. At the present time, the proponents of the survey are not aware of other similar marine research activities planned to occur in the proposed survey area during the September–October 2014 timeframe, but research activities planned by other entities are possible, although unlikely.

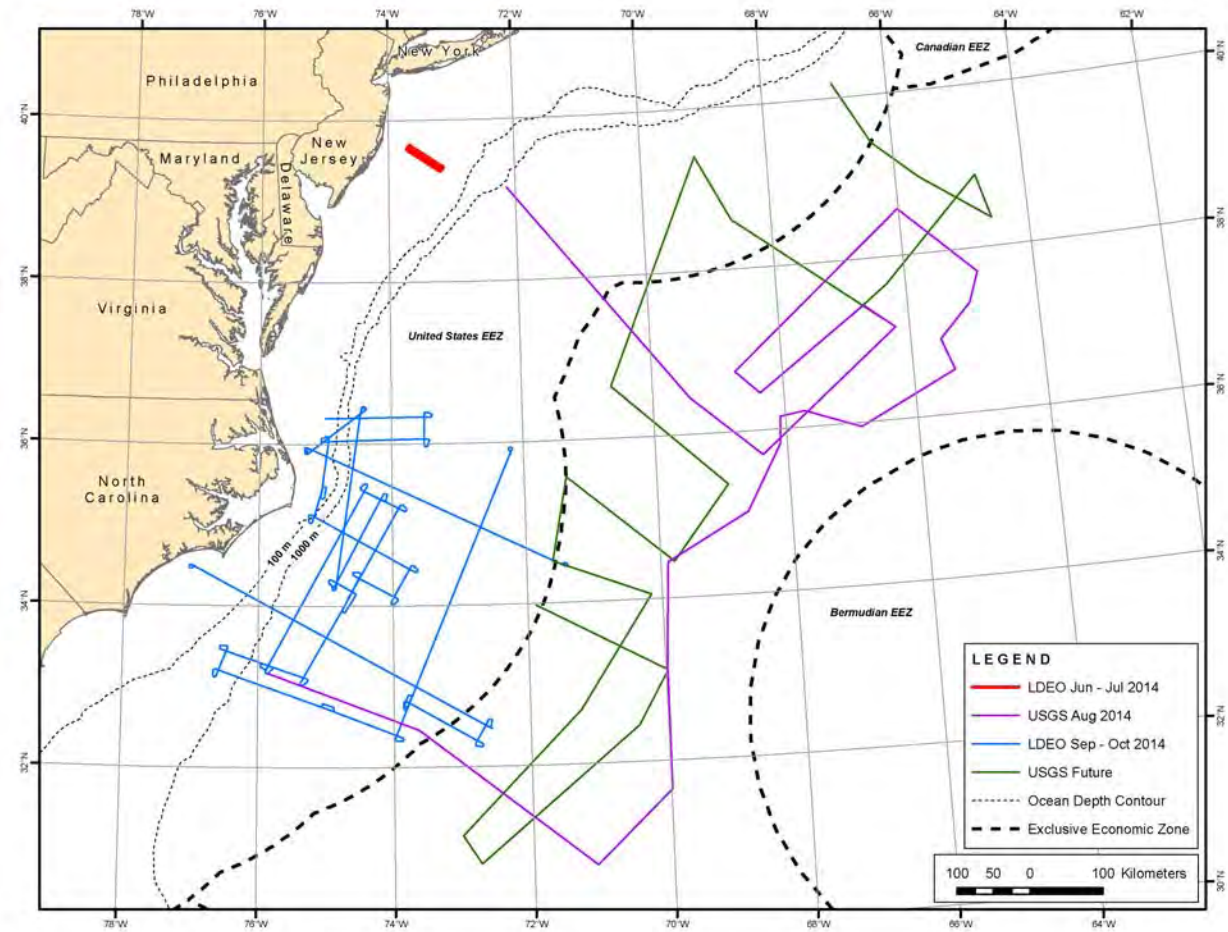


FIGURE 7. Locations of known proposed research activities off the U.S. east coast.

(b) Vessel traffic

Based on data available through the Automated Mutual-Assistance Vessel Rescue (AMVER) system managed by the U.S. Coast Guard, over 50 commercial vessels per month travelled through the proposed survey area during the months of September and October from 2008 to 2013, and for each month in 2012 and 2013 (2013 data are available for January–June) (USCG 2013).

Live vessel traffic information is available from MarineTraffic (2013), including vessel names, types, flags, positions, and destinations. Various types of vessels were in the general vicinity of the proposed survey area when MarineTraffic (2013) was accessed on 16 and 28 October 2013, including fishing vessels (2), pleasure craft/sailing vessels (78), tug/towing/pilot/port tender vessels (73), cargo vessels (41), chemical tanker (1), oil products tanker (1), tanker (1), research/survey vessel (1), military operations vessels (8), medical transport vessel (1), law enforcement vessel (1), coast guard vessel (1), search and rescue vessels (3), passenger vessels (5), survey/support vessels (4), and dredger vessels (4). With the exception of cargo vessels, the majority of vessels were U.S.A.-flagged.

The total transit distance (~10,000 km) by the *Langseth* and the *Endeavor* would be minimal relative to total transit length for vessels operating in the proposed survey area during September and October. Thus, the projected increases in vessel traffic attributable to implementation of the proposed

activities would constitute only a negligible portion of the total existing vessel traffic in the analysis area, and only a negligible increase in overall ship disturbance effects on marine mammals.

(c) Marine Mammal Disease

As discussed in § III, since July 2013, an unusually high number of dead or dying bottlenose dolphins have washed up on the mid-Atlantic coast from New York to Florida. NOAA noted that the triggers for disease outbreaks are unknown, but that contaminants and injuries may reduce the fitness of dolphin populations by stressing the immune system. Morbillivirus outbreaks can also be triggered by a drop in the immunity of bottlenose dolphin populations if they have not been exposed to the disease over time, and natural immunity wanes (NOAA 2013d). The last morbillivirus mortality event occurred in 1987–1988, when more than 740 bottlenose dolphins died along the mid-Atlantic coast from New Jersey to Florida (NOAA 2013d). During that mortality event, fungal, bacterial, and mixed bacterial and fungal pneumonias were common in the lungs of 79 dolphins that were examined, and the frequent occurrence the fungal and bacterial infections in dolphins that also were infected by morbillivirus was consistent with morbillivirus-induced immunosuppression resulting in secondary infections (Lipscomb et al. 1994). Dr. Teri Knowles of NOAA noted that if the current outbreak evolves like the one in 1987–1988, "we're looking at mortality being higher and morbillivirus traveling southwards and continuing until May 2014." She also speculated that environmental factors, such as heavy metal pollution and sea surface temperature changes, could also play a role in the current outbreak (National Geographic Daily News 2013). It seems unlikely that the short-term behavioral disturbance that could be caused by the proposed seismic survey, especially for dolphins, would contribute to the development or continuation of a morbillivirus outbreak.

(d) Fisheries

The commercial and recreational fisheries in the general area of the proposed survey are described in § III. The primary contributions of fishing to potential cumulative impacts on marine mammals and sea turtles involve direct removal of prey items, noise, potential entanglement (Reeves et al. 2003), and the direct and indirect removal of prey items. In U.S. waters, numerous cetaceans (mostly delphinids) and pinnipeds suffer serious injury or mortality each year from fisheries; for example, for the species assessed by Waring et al. (2013), average annual fishery-related mortality during 2006–2010 in U.S. Atlantic waters included 164 common dolphins, 212 Atlantic white-sided dolphins, 791 harbor porpoises, and 1466 harbor, gray, and harp seals. There may be some localized avoidance by marine mammals of fishing vessels near the proposed seismic survey area. L-DEO's operations in the proposed survey area are also limited (duration of ~1 month), and the combination of L-DEO's operations with the existing commercial and recreational fishing operations is expected to produce only a negligible increase in overall disturbance effects on marine mammals and sea turtles.

(e) Military Activity

The proposed survey is located within the U.S. Navy's Virginia Capes Operating Area (VACAPES OPAREA) and Cherry Point Operating Area (CHPT OPAREA). The Virginia Capes, Cherry Point, and Charleston/Jacksonville OPAREAs are collectively referred to as the Southeast OPAREA. The VACAPES OPAREA is located in the coastal and offshore waters off Delaware, Maryland, Virginia, and North Carolina, from the entrance to Chesapeake Bay south to just north of Cape Hatteras. The CHPT OPAREA is located in the coastal and offshore waters off North Carolina from just north of Cape Hatteras south to its southeast corner 210 southeast of Cape Fear at 32.1°N. The types of activities that could occur in the OPAREAs include aircraft carrier, ship and submarine operations; anti-air and surface gunnery, missile firing, anti-submarine warfare, mine warfare, and amphibious operations; all weather flight training, air warfare, refueling, UAV flights, rocket and missile firing, and bombing exercises; and

fleet training and independent unit training. L-DEO and NSF are coordinating, and would continue to coordinate, with the U.S. Navy to ensure there would be no conflicts.

(f) Oil and Gas Activities

The proposed survey site is within BOEM's Outer Continental Shelf (OCS) Mid-Atlantic and South Atlantic Planning Areas for proposed geological and geophysical (G&G) activities, for which a Draft PEIS was published in March 2012 (BOEM 2012). BOEM's intention is to authorize G&G activities in support of all three BOEM program areas: oil and gas exploration and development, renewable energy, and marine minerals. The Draft PEIS characterizes potential future G&G activities in Federal and State waters on the Atlantic OCS during 2012–2020. The activities include

- "various types of deep penetration seismic surveys used almost exclusively for oil and gas exploration and development;
- other types of surveys and sampling activities used only in support of oil and gas exploration and development, including electromagnetic surveys, deep stratigraphic and shallow test drilling, and various remote sensing methods;
- high-resolution geophysical (HRG) surveys used in all three program areas to detect geohazards, archaeological resources, and certain types of benthic communities; and
- geological and geotechnical bottom sampling used in all three program areas to assess the suitability of seafloor sediments for supporting structures (e.g., platforms, pipelines, cables, wind turbines) or to evaluate the quantity and quality of sand for beach nourishment projects."

BOEM activities were not anticipated to occur prior to 2017. Additionally, until the conclusion of the BOEM NEPA process and associated federal consultations, no oil and gas activities are anticipated in the survey region.

(8) Unavoidable Impacts

Unavoidable impacts to the species of marine mammals and turtles occurring in the proposed survey area would be limited to short-term, localized changes in behavior of individuals. For cetaceans, some of the changes in behavior may be sufficient to fall within the MMPA definition of "Level B Harassment" (behavioral disturbance; no serious injury or mortality). TTS, if it occurs, would be limited to a few individuals, is a temporary phenomenon that does not involve injury, and is unlikely to have long term consequences for the few individuals involved. No long-term or significant impacts would be expected on any of these individual marine mammals or turtles, or on the populations to which they belong. Effects on recruitment or survival would be expected to be (at most) negligible.

(9) Coordination with Other Agencies and Processes

This Draft EA was prepared by LGL on behalf of L-DEO and NSF pursuant to NEPA and EO 12114. Potential impacts to endangered species and critical habitat have also been assessed in the document; therefore, it will be used to support the ESA Section 7 consultation process with NMFS and USFWS. This document will also be used as supporting documentation for an IHA application submitted by L-DEO to NMFS, under the U.S. MMPA, for "taking by harassment" (disturbance) of small numbers of marine mammals, for this proposed seismic project. One land-based shotpoint site may be coordinated with the U.S. Marine Corps to occur within Marine Corps Base Camp Lejeune.

L-DEO and NSF have coordinated, and would continue to coordinate, with other applicable Federal agencies as required, and would comply with their requirements.

Alternative Action: Another Time

An alternative to issuing the IHA for the period requested, and to conducting the Project then, is to issue the IHA for another time, and to conduct the project at that alternative time. The proposed dates for the cruise (~38 days in September–October) are the dates when the personnel and equipment essential to meet the overall project objectives are available.

Marine mammals and sea turtles are expected to be found throughout the proposed survey area and throughout the time during which the project would occur. Some marine mammal species are expected to occur in the area year-round, so altering the timing of the proposed project likely would result in no net benefits for those species. Some migratory species, such as the North Atlantic right whale and other baleen whales, would be expected to be farther north at the time of the survey, so the survey timing would be beneficial for those species (see § III, above).

No Action Alternative

An alternative to conducting the proposed activities is the "No Action" alternative, i.e. do not issue an IHA and do not conduct the operations. If the research were not conducted, the "No Action" alternative would result in no disturbance to marine mammals or sea turtles attributable to the proposed activities, however valuable data about the marine environment would be lost. Research that would contribute to understanding how the continental crust stretched and separated during the opening of the Atlantic Ocean, and what the role of magmatism was during continental breakup, would also be lost and greater understanding of Earth processes would not be gained. The no Action Alternative would not meet the purpose and need for the proposed activities.

V. LIST OF PREPARERS

LGL Ltd., environmental research associates

William E. Cross, M.Sc., King City, Ont.*

Patrick Abgrall, Ph.D., King City, Ont.

Meike Holst, M.Sc., Sidney, B.C.*

Sarah Penney-Belbin, M.Sc., St. John's, Nfld.*

Mark Fitzgerald, B.Sc., King City, Ont.

William R. Koski, M.Sc., King City, Ont.

W. John Richardson, Ph.D., King City, Ont.

Lamont Doherty Earth Observatory

Helene Carton, Ph.D., Palisades, NY

National Science Foundation

Holly E. Smith, M.A., Arlington, VA

* Principal preparers of this specific document. Others listed above contributed to a lesser extent, or contributed substantially to previous related documents from which material has been excerpted.

VI. LITERATURE CITED

Aguilar, A. 1986. A review of old Basque whaling and its effect on the right whales of the North Atlantic. **Rep. Int. Whal. Comm. Spec. Iss**. 10:191-199.

Aguilar-Soto, N., M. Johnson, P.T. Madsen, P.L. Tyack, A. Bocconcelli, and J.F. Borsani. 2006. Does intense ship noise disrupt foraging in deep-diving Cuvier's beaked whales (*Ziphius cavirostris*)? **Mar. Mamm. Sci.** 22(3):690-699.

American Fishing Contests. 2014. American fishing contests. Accessed in April 2014 at http://www.americanfishingcontests.com/Contest/List.aspx?Rank=Month&Month=9&State=NC&Page=1.

Antochiw, D., A. Dubuque, S. Milne, D. Palacios, and M. Piercy. n.d. Marine mammal and sea turtle monitoring report for the Costa Rica 3D seismic survey (Bangs Crisp Project) in the Pacific Ocean offshore Costa Rica, 7 April 2011–12 May 2011, R/V *Marcus G. Langseth*. Rep. from RPS, Houston, TX, for Lamont-Doherty Earth Observatory of Columbia Univ., Palisades, NY, and Nat. Mar. Fish. Serv., Silver Spring, MD. 45 p. + app.

Baker, C.S. and L.M. Herman. 1989. Behavioral responses of summering humpback whales to vessel traffic: experimental and opportunistic observations. NPS-NR-TRS-89-01. Rep. from Kewalo Basin Mar. Mamm. Lab., Univ. Hawaii, Honolulu, HI, for U.S. Natl. Park Serv., Anchorage, AK. 50 p. NTIS PB90-198409.

Baker, C.S., L.M. Herman, B.G. Bays, and W.F. Stifel. 1982. The impact of vessel traffic on the behavior of humpback whales in southeast Alaska. Rep. from Kewalo Basin Mar. Mamm. Lab., Honolulu, HI, for U.S. Natl. Mar. Fish. Serv., Seattle, WA. 78 p.

Baker, C.S., L.M. Herman, B.G. Bays, and G.B. Bauer. 1983. The impact of vessel traffic on the behavior of humpback whales in southeast Alaska: 1982 season. Rep. from Kewalo Basin Mar. Mamm. Lab., Honolulu, HI, for U.S. Nat. Mar. Mamm. Lab., Seattle, WA. 30 p. + fig., tables.

Barry, S.B., A.C. Cucknell and N. Clark. 2012. A direct comparison of bottlenose dolphin and common dolphin behaviour during seismic surveys when airguns are and are not being utilised. p. 273-276 *In*: A.N. Popper and A. Hawkins (eds.), The effects of noise on aquatic life. Springer, New York, NY. 695 p.

Beaudin Ring, J. 2002. Right whale sightings and trackline data for the mid Atlantic by month, 1974–2002. Mid-Atlantic sightings archive. Accessed at http://www.nero.noaa.gov/shipstrike/doc/Historical%20sightings.htm on 3 September 2013.

Bernard, H.J. and S.B. Reilly. 1999. Pilot whales *Globicephala* Lesson, 1828. p. 245-279 *In*: S.H. Ridgway and R. Harrison (eds.), Handbook of marine mammals, Vol. 6: The second book of dolphins and the porpoises. Academic Press, San Diego, CA. 486 p.

Bernstein, L. 2013. The Washington Post: Health, Science, and Environment. Panel links underwater mapping sonar to whale stranding for first time. Published 6 October 2013. Accessed in April 2014 at http://www.washingtonpost.com/national/health-science/panel-links-underwater-mapping-sonar-to-whale-stranding-for-first-time/2013/10/06/52510204-2e8e-11e3-bbed-a8a60c601153_story.html.

BirdLife International. 2013a. Species factsheet: *Charadrius melodus*. Accessed on 5 September 2013 at http://www.birdlife.org/datazone/speciesfactsheet.php?id=3127.

BirdLife International. 2013b. Species factsheet: *Pterodroma cahow*. Accessed on 27 October 2012 at http://www.birdlife.org/datazone/speciesfactsheet.php?id=3910.

BirdLife International. 2014. Species factsheet: *Picoides borealis*. Accessed in March 2014 at http://www.birdlife.org/datazone/speciesfactsheet.php?id=653.

Blackwell, S.B., C.S. Nations, T.L. McDonald, C.R. Greene, Jr., A.M. Thode, M. Guerra, and A.M. Macrander. 2013. Effects of airgun sounds on bowhead whale calling rates in the Alaskan Beaufort Sea. **Mar. Mamm. Sci.** DOI: 10.1111/mms.12001.

BOEM (Bureau of Ocean Energy Management). 2012. Atlantic OCS proposed geological and geophysical activities: Mid-Atlantic and South Atlantic Planning Areas. Draft Programmatic Environmental Impact Statement. U.S. Department of the Interior. March 2012.

Breitzke, M. and T. Bohlen. 2010. Modelling sound propagation in the Southern Ocean to estimate the acoustic impact of seismic research surveys on marine mammals. **Geophys. J. Int.** 181(2):818-846.

Bui, S., F. Oppedal, Ø.J. Korsøen, D. Sonny, and T. Dempster. 2013. Group behavioural responses of Atlantic salmon (*Salmo salar* L.) to light, infrasound and sound stimuli. **PLoS ONE** 8(5):e63696. doi:10.1371/journal.pone.0063696.

Calambokidis, J., G.H. Steiger, J.M. Straley, L.M. Herman, S. Cerchio, D.R. Salden, J. Urbán R., J.K. Jacobsen, O. von Ziegesar, K.C. Balcomb, C.M. Gabrielle, M.E. Dahlheim, S. Uchida, G. Ellis, Y. Miyamura, P.L. de Guevara, M. Yamaguchi, F. Sato, S.A. Mizroch, L. Schlender, K. Rasmussen, J. Barlow, and T.J. Quinn II. 2001. Movements and population structure of humpback whales in the North Pacific. **Mar. Mamm. Sci.** 17(4):769-794.

Cargnelli, L.M., S.J. Griesbach, D.B. Packer, and E. Weissberger. 1999a. Essential fish habitat source document: Atlantic surfclam, *Spisula solidissima*, life history and habitat characteristics. NOAA Tech. Memo. NMFS-NE-142. Accessed in October 2013 at http://www.nefsc.noaa.gov/nefsc/publications/tm/tm142/tm142.pdf.

Cargnelli, L.M., S.J. Griesbach, D.B. Packer, and E. Weissberger. 1999b. Essential fish habitat source document: Ocean quahog, *Arctica islandica*, life history and habitat characteristics. NOAA Tech. Memo. NMFS-NE-148. Accessed in October 2013 at http://www.nefsc.noaa.gov/nefsc/publications/tm/tm148/tm148.pdf.

Carwardine, M. 1995. Whales, dolphins and porpoises. Dorling Kindersley Publishing, Inc., New York, NY. 256 p.

Castellote, M. and C. Llorens. 2013. Review of the effects of offshore seismic surveys in cetaceans: are mass strandings a possibility? Abstr. 3rd Int. Conf. Effects of Noise on Aquatic Life, Budapest, Hungary, August 2013.

Castellote, M., C.W. Clark, and M.O. Lammers. 2012. Acoustic and behavioural changes by fin whales (*Balaenoptera physalus*) in response to shipping and airgun noise. **Biol. Conserv**. 147(1):115-122.

Cato, D.H. M.J. Noad, R.A. Dunlop, R.D. McCauley, C.P. Salgado Kent, N.J. Gales, H. Kniest, J. Noad, and D. Paton. 2011. Behavioral response of Australian humpback whales to seismic surveys. **J. Acoust. Soc. Am.** 129(4):2396.

Cato, D.H., M.J. Noad, R.A. Dunlop, R.D. McCauley, N.J. Gales, C.P. Salgado Kent, H. Kniest, D. Paton, K.C.S. Jenner, J. Noad, A.L. Maggi, I.M. Parnum, and A.J. Duncan. 2012. Project BRAHSS: Behavioural response of Australian humpback whales to Seismic surveys. Proc. Austral. Acoust. Soc., 21–23 Nov. 2012, Fremantle, Australia. 7 p.

Cato, D.H., M. Noad, R. Dunlop, R.D. McCauley, H. Kniest, D. Paton, C.P. Salgado Ken and C.S. Jenner. 2013. Behavioral responses of humpback whales to seismic air guns. Proceedings of Meetings on Acoustics 19(010052).

Cattanach, K.L., J. Sigurjónsson, S.T. Buckland, and T. Gunnlaugsson. 1993. Sei whale abundance in the North Atlantic, estimated from NASS-87 and NASS-89 data. **Rep. Int. Whal. Comm.** 43:315-321.

Celi, M., F. Filiciotto, D. Parrinello, G. Buscaino, M.A. Damiano, A. Cuttitta, S. D'Angelo, S. Mazzola, and M. Vazzana. 2013. Physiological and agonistic behavioural response of Procambarus clarkii to an acoustic stimulus. **J. Exp. Biol.** 216:709-718.

Cerchio, S., T. Collins, S., Strindberg, C. Bennett, and H. Rosenbaum. 2010. Humpback whale singing activity off northern Angola: an indication of the migratory cycle, breeding habitat and impact of seismic surveys on singer number in Breeding Stock B1. Unpublished report submitted to the International Whaling Commission, Cambridge, U.K.

CetaceanHabitat. 2013. Directory of cetacean protected areas around the world. Accessed on 30 August 2013 at http://www.cetaceanhabitat.org/launch_intro.php.

CETAP (Cetacean and Turtle Assessment Program). 1982. A characterization of marine mammals and turtles in the mid- and north Atlantic areas of the USA outer continental shelf. Cetacean and Turtle Assessment Program, University of Rhode Island. Final Report #AA51-CT8-48 to the Bureau of Land Management, Washington, DC. 538 p.

Clapham, P.J., L.S. Baraff, C.A. Carlson, M.A. Christian, D.K. Mattila, C.A. Mayo, M.A. Murphy, and S. Pittman. 1993. Seasonal occurrence and annual return of humpback whales, *Megaptera novaeangliae*, in the southern Gulf of Maine. **Can. J. Zool.** 71:440-443.

Clark, C.W. 1995. Application of U.S. Navy underwater hydrophone arrays for scientific research on whales. **Rep. Int. Whal. Comm.** 45:210-212.

Clark, C.W. and G.C. Gagnon. 2006. Considering the temporal and spatial scales of noise exposures from seismic surveys on baleen whales. Working Pap. SC/58/E9. Int. Whal. Comm., Cambridge, U.K. 9 p.

Clark, C.W., W.T. Ellison, B.L. Southall, L. Hatch, S.M. Van Parijs, A. Frankel, and D. Ponirakis. 2009. Acoustic masking in marine ecosystems: intuitions, analysis, and implication. **Mar. Ecol. Prog. Ser.** 395:201-222.

Cole T., A. Glass, P.K. Hamilton, P. Duley, M. Niemeyer, C. Christman, R.M. Pace III, and T. Fraiser. 2009. Potential mating ground for North Atlantic right whales off the Northeast USA. Abstr. 18th Bienn. Conf. Biol. Mar. Mamm., Québec City, 12–16 Oct. 2009. 58 p.

Danton, C. and R. Prescott. 1988. Kemp's ridley in Cape Cod Bay, Massachusetts–1987 field research. p. 17-18 *In*: B.A. Schroeder (compiler), Proc. 8th Ann. Worksh. Sea Turtle Conserv. Biol. NOAA Tech. Memo. NMFS-SEFC-214. 123 p.

DeRuiter, S.L., I.L. Boyd, D.E. Claridge, C.W. Clark, C. Gagnon, B.L. Southall, and P.L. Tyack. 2013a. Delphinid whistle production and call matching during playback of simulated military sonar. **Mar. Mamm. Sci.** 29(2):E46-E59.

DeRuiter, S.L., B.L. Southall, J. Calambokidis, W.M.X. Zimmer, D. Sadykova, E.A. Falcone, A.S. Friedlaender, J.E. Joseph, D. Moretti, G.S. Schorr, L. Thomas, and P.L. Tyack. 2013b. First direct measurements of behavioural responses by Cuvier's beaked whales to mid-frequency active sonar. **Biol. Lett.** 9:20130223. http://dx.doi.org/10.1098/rsbl.2013.0223.

Deng, Z.D., B.L. Southall, T.J. Carlson, J. Xu, J.J. Martinez, M.A. Weiland, and J.M. Ingraham. 2014. 200 kHz commercial sonar systems generate lower frequency side lobes audible to some marine mammals. PLoS ONE 9(4): e95315. doi:10.1371/journal.pone.0095315.

Diebold, J.B., M. Tolstoy, L. Doermann, S.L. Nooner, S.C. Webb, and T.J. Crone. 2010. R/V Marcus G. Langseth seismic source: modeling and calibration. **Geochem. Geophys. Geosyst.** 11(12), Q12012, doi:10.1029/2010GC003126. 20 p.

Di Iorio, L. and C.W. Clark. 2010. Exposure to seismic survey alters blue whale acoustic communication. **Biol. Lett.** 6(1):51-54.

DiveAdvisor. 2014. United States dive sites. Accessed in April 2014 at http://diveadvisor.com/united-states/dive-sites.

DiveBuddy. 2014. Scuba Earth. Accessed in April 2014 at http://www.divebuddy.com/scubaearth.

Dolar, M.L.L. 2009. Fraser's dolphin–*Lagenodelphis hosei*. p. 469-474 *In*: W.F. Perrin, B. Würsig, and J.G.M. Thewissen (eds.), Encyclopedia of marine mammals, 2nd edit. Academic Press, San Diego, CA. 1316 p.

DoN (Department of the Navy). 2005. Marine resource assessment for the Northeast Operating Areas: Atlantic City, Narragansett Bay, and Boston. Rep. from GeoMarine Inc., Newport News, VA, for Naval Facilities Engineering Command, Atlantic; Norfolk, VA. Contract No. N62470-02-D-9997, Task Order No. 0018. 556 p.

DoN (Department of the Navy). 2008a. Marine resources assessment update for the Virginia Capes Operating Area. Department of the Navy, U.S. Fleet Forces Command, Norfolk, VA. Contract #N62470-02-D-9997, CTO 0056. Prepared by GeoMarine, Inc., Hampton, Virginia. 711 p.

DoN (Department of the Navy). 2008b. Marine resources assessment update for the Cherry Point Operating Area. Department of the Navy, U.S. Fleet Forces Command, Norfolk, VA. Contract #N62470-02-D-9997, CTO 0056. Prepared by GeoMarine, Inc., Hampton, Virginia. 643 p.

DoN (Department of the Navy). 2009a. Virginia Capes Range Complex Final Environmental Impact Statement/Overseas Environmental Impact Statement (EIS/OEIS). March 2009. NAVFAC Atlantic, Norfolk, VA. Accessed on 18 September 2013 at https://portal.navfac.navy.mil/portal/page/portal/navfac/navfac_ww_pp/navfac_hq_pp/navfac_environmental/documents/vacapes_feis_vol_1_full.pdf.

DoN (Department of the Navy). 2009b. Navy Cherry Point Range Complex Final Environmental Impact Statement/Overseas Environmental Impact Statement (EIS/OEIS). April 2009. NAVFAC Atlantic, Norfolk, VA. Accessed on 18 September 2013 at https://portal.navfac.navy.mil/portal/page/portal/navfac/navfac_ww_pp/navfac_hq_pp/navfac_environmental/documents/navy_cherry_point_feis_vol_1a_041509.pdf.

DoN (Department of Navy). 2007. Navy OPAREA density estimates (NODE) for the Southeast OPAREAs: VACAPES, CHPT, JAX/CHASN, and Southeastern Florida and AUTEC-Andros. Rep. from GeoMarine Inc., Hampton, VA, for Department of the Navy, Naval Facilities Engineering Command, Atlantic, Norfolk, VA. Contract N62470-02-D-9997, Task Order 0060. Accessed on 24 October 2013 at http://seamap.env.duke.edu/seamap2/downloads/resources/serdp/Southeast%20NODE%20Final%20Report.pdf.

Eckert, K.L. 1995a. Leatherback sea turtle, *Dermochelys coriacea*. p. 37-75 *In*: Plotkin, P.T. (ed.), National Marine Fisheries Service and U.S. Fish and Wildlife Service status reviews of sea turtles listed under the Endangered Species Act of 1973. Nat. Mar. Fish. Serv., Silver Spring, MD. 139 p.

Eckert, K.L. 1995b. Hawksbill sea turtle, *Eretmochelys imbricata*. p. 76-108 *In*: Plotkin, P.T. (ed.), National Marine Fisheries Service and U.S. Fish and Wildlife Service status reviews of sea turtles listed under the Endangered Species Act of 197. Nat. Mar. Fish. Serv., Silver Spring, MD. 139 p.

Ellison, W.T., B.L. Southall, C.W. Clark, and A.S. Frankel. 2012. A new context-based approach to assess marine mammal behavioral responses to anthropogenic sounds. **Conserv. Biol.** 26(1):21-28.

Engel, M.H., M.C.C. Marcondes, C.C.A. Martins, F.O. Luna, R.P. Lima, and A. Campos. 2004. Are seismic surveys responsible for cetacean strandings? An unusual mortality of adult humpback whales in Abrolhos Bank, northeastern coast of Brazil. Working Pap. SC/56/E28, Int. Whal. Comm., Cambridge, U.K.

Environment News Service. 2013. U.S. east coast dolphin die-off triggers investigation. Accessed on 17 September 2013 at http://ens-newswire.com/2013/08/08/u-s-east-coast-dolphin-die-off-triggers-investigation.

ESS (Group, Inc.). 2013. Essential fish habitat assessment: West Point in-river transmission cable project, Hudson River, New York. ESS Project No.W296-006. Rep. from ESS Group, Inc., Waltham, MA, for West Point Partners, LLC, Fairfield, CT. Accessed in October 2013 at http://documents.dps.ny.gov/public/Common/ViewDoc.aspx?DocRefId=%7B9A8C2628-6A7F-4EB6-A620-BFA9ECF9C3CE%7D.

Fertl, D., T.A. Jefferson, I.B. Moreno, A.N. Zerbini, and K.D. Mullin. 2003. Distribution of the Clymene dolphin *Stenella clymene*. **Mammal Rev.** 33(3):253-271.

Fewtrell, J.L. and R.D. McCauley. 2012. Impact of air gun noise on the behaviour of marine fish and squid. **Mar. Poll. Bull.** 64(5):984-993.

Fisherman's Post. 2014. Fisherman's Post: Tournament List. Accessed in April 2014 at http://www.fishermanspost.com/tournament-list.

Frantz, V. 1995. Recovery plan for rough-leaf loosestrife (*Lysimachia asperulaefolia*). Rep. for U.S. Fish Wildl. Serv., Southeast Region, Atlanta, GA. 32 p. Accessed in March 2013 at http://ecos.fws.gov/docs/recovery_plan/950419b.pdf.

Finneran, J.J. 2012. Auditory effects of underwater noise in odontocetes. p. 197-202 *In*: A.N. Popper and A. Hawkins (eds.), The effects of noise on aquatic life. Springer, New York, NY. 695 p.

Finneran, J.J. and C.E. Schlundt. 2010. Frequency-dependent and longitudinal changes in noise-induced hearing loss in a bottlenose dolphin (*Tursiops truncatus*) (L). **J. Acoust. Soc. Am.** 128(2):567-570.

Finneran, J.J. and C.E. Schlundt. 2011. Noise-induced temporary threshold shift in marine mammals. **J. Acoust. Soc. Am.** 129(4):2432. [supplemented by oral presentation at the ASA meeting, Seattle, WA, May 2011].

Finneran, J.J. and C.E. Schlundt. 2013. Effects of fatiguing tone frequency on temporary threshold shift in bottlenose dolphins (*Tursiops truncatus*). **J. Acoust. Soc. Am.** 133(3):1819-1826.

Finneran, J.J., C.E. Schlundt, D.A. Carder, J.A. Clark, J.A. Young, J.B. Gaspin, and S.H. Ridgway. 2000. Auditory and behavioral responses of bottlenose dolphins (*Tursiops truncatus*) and beluga whale (*Delphinapterus leucas*) to impulsive sounds resembling distant signatures of underwater explosions. **J. Acoust. Soc. Am.** 108(1):417-431.

Finneran, J.J., C.E. Schlundt, R. Dear, D.A. Carder, and S.H. Ridgway. 2002. Temporary shift in masked hearing thresholds in odontocetes after exposure to single underwater impulses from a seismic watergun. **J. Acoust. Soc. Am.** 111(6):2929-2940.

Finneran, J.J., D.A. Carder, C.E. Schlundt, and S.H. Ridgway. 2005. Temporary threshold shift in bottlenose dolphins (*Tursiops truncatus*) exposed to mid-frequency tones. **J. Acoust. Soc. Am.** 118(4):2696-2705.

Finneran, J.J., D.A. Carder, C.E. Schlundt and R.L. Dear. 2010a. Growth and recovery of temporary threshold shift (TTS) at 3 kHz in bottlenose dolphins (*Tursiops truncatus*). **J. Acoust. Soc. Am.** 127(5):3256-3266.

Finneran, J.J., D.A. Carder, C.E. Schlundt and R.L. Dear. 2010b. Temporary threshold shift in a bottlenose dolphin (*Tursiops truncatus*) exposed to intermittent tones. **J. Acoust. Soc. Am.** 127(5):3267-3272.

Finneran, J.J., J.S. Trickey, B.K. Branstetter, C.E. Schlundt, and K. Jenkins. 2011. Auditory effects of multiple underwater impulses on bottlenose dolphins (*Tursiops truncatus*). **J. Acoust. Soc. Am.** 130(4):2561.

Frazier, J., R. Arauz, J. Chevalier, A. Formia, J. Fretey, M.H. Godfrey, R. Márquez-M., B. Pandav, and K. Shanker. 2007. Human–turtle interactions at sea. p. 253-295 *In*: P.T. Plotkin (ed.), Biology and conservation of ridley sea turtles. The Johns Hopkins University Press, Baltimore, MD. 356 p.

Gailey, G., B. Würsig, and T.L. McDonald. 2007. Abundance, behavior, and movement patterns of western gray whales in relation to a 3-D seismic survey, northeast Sakhalin Island, Russia. **Environ. Monit. Assessm.** 134(1-3):75-91.

Gaskin, D.E. 1982. The ecology of whales and dolphins. Heineman Educational Books Ltd., London, U.K. 459 p.

Gaskin, D.E. 1984. The harbor porpoise *Phocoena phocoena* (L.): regional populations, status, and information on direct and indirect catches. **Rep. Int. Whal. Comm.** 34:569-586.

Gaskin, D.E. 1987. Updated status of the right whale, *Eubalaena glacialis*, in Canada. **Can Field-Nat** 101:295-309.

Gaskin, D.E. 1992. The status of the harbour porpoise. **Can. Field Nat.** 106(1):36-54.

Gedamke, J. 2011. Ocean basin scale loss of whale communication space: potential impacts of a distant seismic survey. p. 105-106 *In*: Abstr. 19th Bienn. Conf. Biol. Mar. Mamm., Tampa, FL, 27 Nov.–2 Dec. 2011. 344 p.

Gedamke, J., N. Gales, and S. Frydman. 2011. Assessing risk of baleen whale hearing loss from seismic surveys: the effects of uncertainty and individual variation. **J. Acoust. Soc. Am.** 129(1):496-506.

Goldbogen, J.A., B.L. Southall, S.L. DeRuiter, J. Calambokidis, A.S. Friedlaender, E.L. Hazen, E. Falcone, G. Schorr, A. Douglas, D.J. Moretti, C. Kyburg, M.F. McKenna, and P.L. Tyack. 2013. Blue whales respond to simulated mid-frequency military sonar. **Proc. R. Soc. B.** 280:20130657. http://dx.doi.org/10.1098/rspb.2013.0657.

Gordon, J., D. Gillespie, J. Potter, A. Frantzis, M.P. Simmonds, R. Swift, and D. Thompson. 2004. A review of the effects of seismic surveys on marine mammals. **Mar. Technol. Soc. J.** 37(4):16-34.

Götz, T. and V.M. Janik. 2013. Acoustic deterrent devices to prevent pinniped depredation: efficiency, conservation concerns and possible solutions. **Mar. Ecol. Prog. Ser.** 492:285-302.

Gray, H. and K. Van Waerebeek. 2011. Postural instability and akinesia in a pantropical spotted dolphin, *Stenella attenuata*, in proximity to operating airguns of a geophysical seismic vessel. **J. Nature Conserv.** 19(6):363-367.

Guerra, M., A.M. Thode, S.B. Blackwell, and M. Macrander. 2011. Quantifying seismic survey reverberation off the Alaskan North Slope. **J. Acoust. Soc. Am.** 130(5):3046-3058.

Guerra, M., P.J. Dugan, D.W. Ponirakis, M. Popescu, Y. Shiu, and C.W. Clark. 2013. High-resolution analysis of seismic airgun impulses and their reverberant field as contributors to an acoustic environment. Abstr. 3rd Int. Conf. Effects of Noise on Aquatic Life, Budapest, Hungary, August 2013.

Hamilton, P.K. and C.A. Mayo. 1990. Population characteristics of right whales (*Eubalaena glacialis*) observed in Cape Cod and Massachusetts Bays, 1978–86. **Rep. Int. Whal. Comm. Spec. Iss.** 12:203-208.

Handegard, N.O., T.V. Tronstad, and J.M. Hovem. 2013. Evaluating the effect of seismic surveys on fish—the efficacy of different exposure metrics to explain disturbance. **Can. J. Fish. Aquat. Sci.** 70:1271-1277.

Hastie, G.D., C. Donovan, T. Götz, and V.M. Janik. 2014. Behavioral responses of grey seals (*Halichoerus grypus*) to high frequency sonar. **Mar. Poll. Bull.** 79:205-210.

Hastings, M.C. and J. Miksis-Olds. 2012. Shipboard assessment of hearing sensitivity of tropical fishes immediately after exposure to seismic air gun emissions at Scott Reef. p. 239-243 *In*: A.N. Popper and A. Hawkins (eds.), The effects of noise on aquatic life. Springer, New York, NY. 695 p.

Hatch, L.T., C.W. Clark, S.M. Van Parijs, A.S. Frankel, and D.W. Ponirakis. 2012. **Conserv. Biol.** 26(6):983-994.

Hauser, D.D.W., M. Holst, and V.D. Moulton. 2008. Marine mammal and sea turtle monitoring during Lamont-Doherty Earth Observatory's marine seismic program in the Eastern Tropical Pacific, April–August 2008. LGL Rep. TA4656/7-1. Rep. from LGL Ltd., King City, Ont., and St. John's, Nfld., for Lamont-Doherty Earth Observatory of Columbia Univ., Palisades, NY, and Nat. Mar. Fish. Serv., Silver Spring, MD. 98 p.

Hawkes, L.A., A.C. Broderick, M.S. Coyne, M.H. Godfrey, and B.J. Godley. 2007. Only some like it hot–quantifying the environmental niche of the loggerhead sea turtle. **Divers. Distrib.** 13:447-457.

Heide-Jørgensen, M.P., R.G. Hansen, S. Fossette, N.J. Nielsen, M.V. Jensen, and P. Hegelund. 2013a. Monitoring abundance and hunting of narwhals in Melville Bay during seismic surveys. Preliminary report from the Greenland Institute of Natural Resources. 59 p.

Heide-Jørgensen, M.P., R.G. Hansen, K. Westdal, R.R. Reeves, and A. Mosbech. 2013b. Narwhals and seismic exploration: is seismic noise increasing the risk of ice entrapments? **Biol. Conserv.** 158:50-54.

Hendrickson, L.C. and E.M. Holmes. 2004. Essential fish habitat source document: Northern shortfin squid, *Illex illecebrosus*, life history and habitat characteristics, 2nd edit. NOAA Tech. Memo. NMFS-NE-191. Accessed in October 2013 at http://www.nefsc.noaa.gov/nefsc/publications/tm/tm191/tm191.pdf.

Holst, M. 2009. Marine mammal and sea turtle monitoring during Lamont-Doherty Earth Observatory's TAIGER marine seismic program near Taiwan, April–July 2009. LGL Rep. TA4553-4. Rep. from LGL Ltd., King City, Ont. for Lamont-Doherty Earth Observatory of Columbia Univ., Palisades, NY, and Nat. Mar. Fish. Serv., Silver Spring, MD. 103 p.

Holst, M. and J. Beland. 2008. Marine mammal and sea turtle monitoring during Lamont-Doherty Earth Observatory's seismic testing and calibration study in the northern Gulf of Mexico, November 2007–February 2008. LGL Rep. TA4295-2. Rep. from LGL Ltd., King City, Ont., for Lamont-Doherty Earth Observatory of Columbia Univ., Palisades, NY, and Nat. Mar. Fish. Serv., Silver Spring, MD. 77 p.

Holst, M. and M.A. Smultea. 2008. Marine mammal and sea turtle monitoring during Lamont-Doherty Earth Observatory's marine seismic program off Central America, February–April 2008. LGL Rep. TA4342-3. Rep. from LGL Ltd., King City, Ont., for Lamont-Doherty Earth Observatory of Columbia Univ., Palisades, NY, and Nat. Mar. Fish. Serv., Silver Spring, MD. 133 p.

Holst, M., M.A. Smultea, W.R. Koski, and B. Haley. 2005a. Marine mammal and sea turtle monitoring during Lamont-Doherty Earth Observatory's marine seismic program in the eastern tropical Pacific Ocean off Central America, November–December 2004. LGL Rep. TA2822-30. Rep. from LGL Ltd., King City, Ont., for Lamont-Doherty Earth Observatory of Columbia Univ., Palisades, NY, and Nat. Mar. Fish. Serv., Silver Spring, MD. 125 p.

Holst, M., M.A. Smultea, W.R. Koski, and B. Haley. 2005b. Marine mammal and sea turtle monitoring during Lamont-Doherty Earth Observatory's marine seismic program off the northern Yucatán Peninsula in the southern Gulf of Mexico, January–February 2005. LGL Rep. TA2822-31. Rep. from LGL Ltd., King City, Ont., for Lamont-Doherty Earth Observatory of Columbia Univ., Palisades, NY, and Nat. Mar. Fish. Serv., Silver Spring, MD. 96 p.

Hovem, J.M., T.V. Tronstad, H.E. Karlsen, and S. Løkkeborg. 2012. Modeling propagation of seismic airgun sounds and the effects on fish behaviour. **IEEE J. Oceanic Eng.** 37(4):576-588.

Hoyt, E. 2005. Marine protected areas for whales, dolphins and porpoises: a world handbook for cetacean habitat conservation. Earthscan, Sterling, VA. 492 p.

IOC (Intergovernmental Oceanographic Commission of UNESCO). 2013. The Ocean Biogeographic Information System. Accessed on 9 September 2013 at http://www.iobis.org.

IUCN. 2013. IUCN Red list of threatened species. Version 2013.1. Accessed on 5 September 2013 at http://www.iucnredlist.org.

IWC. 2013. Whale population estimates: population table. Last updated 09/01/09. Accessed on 9 September 2013 at http://iwc.int/estimate.htm.

IWC. 2007. Report of the standing working group on environmental concerns. Annex K to Report of the Scientific Committee. **J. Cetac. Res. Manage**. 9(Suppl.):227-260.

Jacobson, L.D. 2005. Essential fish habitat source document: Longfin inshore squid, *Loligo pealeii*, life history and habitat characteristics, 2nd edit. .NOAA Tech. Memo. NMFS-NE-193. Accessed in October 2013 at http://www.nefsc.noaa.gov/nefsc/publications/tm/tm193/tm193.pdf.

James, M.C., C.A. Ottensmeyer, and R.A. Myers. 2005. Identification of high-use habitat and threats to leatherback sea turtles in northern waters: new directions for conservation. **Ecol. Lett.** 8:195-201.

Jaquet, N. 1996. How spatial and temporal scales influence understanding of sperm whale distribution: a review. **Mamm. Rev.** 26:51-65.

Jefferson, T.A., M.A. Webber, and R.L. Pitman. 2008. Marine mammals of the world: a comprehensive guide to their identification. Elsevier, London, U.K. 573 p.

Jefferson, T.A., C.R. Weir, R.C. Anderson, L.T. Balance, R.D. Kenney, and J.J. Kiszka. 2013. Global distribution of Risso's dolphin *Grampus griseus*: a review and critical evaluation. **Mamm. Rev.** doi:10.1111/mam.12008.

Jensen, F.H., L. Bejder, M. Wahlberg, N. Aguilar Soto, M. Johnson, and P.T. Madsen. 2009. Vessel noise effects on delphinid communication. **Mar. Ecol. Prog. Ser.** 395:161-175.

Johnson, S.R., W.J. Richardson, S.B. Yazvenko, S.A. Blokhin, G. Gailey, M.R. Jenkerson, S.K. Meier, H.R. Melton, M.W. Newcomer, A.S. Perlov, S.A. Rutenko, B. Würsig, C.R. Martin, and D.E. Egging. 2007. A western gray whale mitigation and monitoring program for a 3-D seismic survey, Sakhalin Island, Russia. **Environ. Monit. Assessm.** 134(1-3):1-19.

Kastak, D. and C. Reichmuth. 2007. Onset, growth, and recovery of in-air temporary threshold shift in a California sea lion (*Zalophus californianus*). **J. Acoust. Soc. Am.** 122(5):2916-2924.

Kastak, D., J. Mulsow, A. Ghoul, and C. Reichmuth. 2008. Noise-induced permanent threshold shift in a harbor seal. **J. Acoust. Soc. Am.** 123(5):2986.

Kastelein, R., R. Gransier, L. Hoek, and J. Olthuis. 2012a. Temporary threshold shifts and recovery in a harbor porpoise (*Phocoena phocoena*) after octave-band noise at 4 kHz. **J. Acoust. Soc. Am.** 132(5):3525-3537.

Kastelein, R.A., R. Gransier, L. Hoek, A. Macleod, and J.M. Terhune. 2012b. Hearing threshold shifts and recovery in harbor seals (*Phoca vitulina*) after octave-band noise exposure at 4 kHz. **J. Acoust. Soc. Am.** 132(4):2745-2761.

Kastelein, R.A., R. Gransier, and L. Hoek, and M. Rambags. 2013a. Hearing frequency thresholds of a harbour porpoise (*Phocoena phocoena*) temporarily affected by a continuous 1.5-kHz tone. **J. Acoust. Soc. Am.** 134(3):2286-2292.

Kastelein, R., R. Gransier, and L. Hoek. 2013b. Comparative temporary threshold shifts in a harbour porpoise and harbour seal, and severe shift in a seal (L). **J. Acoust. Soc. Am.** 134(1):13-16.

Kasuya, T. 1986. Distribution and behavior of Baird's beaked whales off the Pacific coast of Japan. **Sci. Rep. Whales Res. Inst.** 37:61-83.

Katona, S.K., J.A. Beard, P.E. Girton, and F. Wenzel. 1988. Killer whales (*Orcinus orca*) from the Bay of Fundy to the Equator, including the Gulf of Mexico. **Rit Fiskideildar** 11:205-224.

Kenney, R.D., H.E. Winn, and M.C. Macaulay. 1995. Cetaceans in the Great South Channel, 1979–1989: right whale (*Eubalaena glacialis*). **Cont. Shelf Res.** 15:385-414.

Kenney, R.D., C.A. Mayo, and H.E. Winn. 2001. Migration and foraging strategies at varying spatial scales in western North Atlantic right whales: a review of hypotheses. **J. Cetac. Res. Manage**. **Spec. Iss.** 2:251-260.

Ketten, D.R. 2012. Marine mammal auditory system noise impacts: evidence and incidence. p. 207-212 *In*: A.N. Popper and A. Hawkins (eds.), The effects of noise on aquatic life. Springer, New York. 695 p.

Klinck, H., S.L. Nieukirk, D.K. Mellinger, K. Klinck, H. Matsumoto, and R.P. Dziak. 2012. Seasonal presence of cetaceans and ambient noise levels in polar waters of the North Atlantic. **J. Acoust. Soc. Am.** 132(3):EL176-EL181.

Knowlton, A.R., J. Sigurjónsson, J.N. Ciano, and S.D. Kraus. 1992. Long-distance movements of North Atlantic right whales (*Eubalaena glacialis*). **Mar. Mamm. Sci.** 8(4):397-405.

Knowlton, A.R., J.B. Ring, and B. Russell. 2002. Right whale sightings and survey effort in the mid Atlantic region: migratory corridor, time frame, and proximity to port entrances. Final Rep. to National Marine Fisheries Ship Strike Working Group. 25 p.

Kraus, S.D., J.H. Prescott, A.R. Knowlton, and G.S. Stone. 1986. Migration and calving of right whales (*Eubalaena glacialis*) in the western North Atlantic. **Rep. Int. Whal. Comm. Spec. Iss.** 10:139-144.

Krieger, K.J. and B.L. Wing. 1984. Hydroacoustic surveys and identification of humpback whale forage in Glacier Bay, Stephens Passage, and Frederick Sound, southeastern Alaska, summer 1983. NOAA Tech. Memo. NMFS F/NWC-66. U.S. Natl. Mar. Fish. Serv., Auke Bay, AK. 60 p. NTIS PB85-183887.

Krieger, K.J. and B.L. Wing. 1986. Hydroacoustic monitoring of prey to determine humpback whale movements. NOAA Tech. Memo. NMFS F/NWC-98. U.S. Natl. Mar. Fish. Serv., Auke Bay, AK. 63 p. NTIS PB86-204054.

Laws, R. 2012. Cetacean hearing-damage zones around a seismic source. p. 473-476 *In*: A.N. Popper and A. Hawkins (eds.), The effects of noise on aquatic life. Springer, New York, NY. 695 p.

Lazell, J.D. 1980. New England waters: critical habitat for marine turtles. **Copeia** 1980:290-295.

Leatherwood, S., D.K. Caldwell, and H.E. Winn. 1976. Whales, dolphins, and porpoises of the western North Atlantic. A guide to their identification. NOAA Tech. Rep. NMFS Circ. 396. U.S. Dep. Comm., Washington, DC. 176 p.

LeDay, L., R. O'Connor, J. Ryan, and R. Currie. 1993. Recovery plan for pondberry (*Lindera melissifolia* [Walt.] Blume). Rep. for U.S. Fish and Wildlife Service, Southeast Region, Atlanta, GA. 43 p. Accessed in March 2013 at http://ecos.fws.gov/docs/recovery_plan/930923a.pdf.

Lenhardt, M. 2002. Sea turtle auditory behavior. **J. Acoust. Soc. Amer**. 112(5, Pt. 2):2314 (Abstr.).

Le Prell, C.G. 2012. Noise-induced hearing loss: from animal models to human trials. p. 191-195 *In*: A.N. Popper and A. Hawkins (eds.), The effects of noise on aquatic life. Springer, New York, NY. 695 p.

Liberman, C. 2013. New perspectives on noise damage. Abstr. 3rd Int. Conf. Effects of Noise on Aquatic Life, Budapest, Hungary, August 2013.

Lien J., R. Sears, G.B. Stenson, P.W. Jones, and I-Hsun Ni. 1989. Right whale, (*Eubalaena glacialis*), sightings in waters off Newfoundland and Labrador and the Gulf of St. Lawrence, 1978–1987. **Can. Field-Nat.** 103:91-93.

Lipscomb, T.P, F.Y. Schulman, D. Moffett, and S. Kennedy. 1994. Morbilliviral disease in Atlantic bottlenose dolphins (*Tursiops truncatus*) from the 1987–1988 epizootic. **J. Wildl. Dis.** 30(4):567-571.

Løkkeborg, S., E. Ona, A. Vold, and A. Salthaug. 2012. Sounds from seismic air guns: Gear- and species-specific effects on catch rates and fish distribution. **Can. J. Fish. Aquat. Sci.** 69:1278-1291.

Lusseau, D. and L. Bejder. 2007. The long-term consequences of short-term responses to disturbance experience from whalewatching impact assessment. **Int. J. Comp. Psych.** 20(2-3):228-236.

MacGillivray, A.O., R. Racca, and Z. Li. 2014. Marine mammal audibility of selected shallow-water survey sources. **J. Acoust. Soc. Am.** 135(1):EL35-EL40.

MacLeod, C.D., W.F. Perrin, R. Pitman, J. Barlow, L.T. Ballance, A. D'Amico, T. Gerrodette, G. Joyce, K.D. Mullin, D. Palka, and G.T. Waring. 2006. Known and inferred distributions of beaked whale species (Cetacea: Ziphiidae). **J. Cetac. Res. Manage.** 7(3):271-286.

Maderios, J., N. Carlile, and D. Priddel. 2012. Breeding biology and population increase of the endangered Bermuda petrel *Pterodroma cahow*. **Bird Conserv. Int.** 22(1):35-45.

MAFMC (Mid-Atlantic Fishery Management Council) and NMFS (National Marine Fisheries Service). 2008. Amendment 1 to the tilefish fishery management plan, Vol. 1. Mid-Atlantic Fishery Management Council in cooperation with the National Marine Fisheries Service. A publication of the Mid-Atlantic Fishery Management Council pursuant to National Oceanic and Atmospheric Administration Award No. NA57FC0002. Accessed in October 2013 at https://googledrive.com/host/0B7aKVuJOPoZVYm90STFRTTZFLU0/Tilefish_Amend_1_Vol_1.pdf.

Malme, C.I. and P.R. Miles. 1985. Behavioral responses of marine mammals (gray whales) to seismic discharges. p. 253-280 *In:* G.D. Greene, F.R. Engelhard, and R.J. Paterson (eds.), Proc. Workshop on Effects of Explosives Use in the Marine Environment, Jan. 1985, Halifax, NS. Tech. Rep. 5. Can. Oil & Gas Lands Admin., Environ. Prot. Br., Ottawa, Ont. 398 p.

Malme, C.I., P.R. Miles, C.W. Clark, P. Tyack, and J.E. Bird. 1984. Investigations of the potential effects of underwater noise from petroleum industry activities on migrating gray whale behavior/Phase II: January 1984 migration. BBN Rep. 5586. Rep. from Bolt Beranek & Newman Inc., Cambridge, MA, for MMS, Alaska OCS Region, Anchorage, AK. NTIS PB86-218377.

Malme, C.I., P.R. Miles, P. Tyack, C.W. Clark, and J.E. Bird. 1985. Investigation of the potential effects of underwater noise from petroleum industry activities on feeding humpback whale behavior. BBN Rep. 5851; OCS Study MMS 85-0019. Rep. from BBN Labs Inc., Cambridge, MA, for MMS, Anchorage, AK. NTIS PB86-218385.

Malme, C.I., B. Würsig, J.E. Bird, and P. Tyack. 1986. Behavioral responses of gray whales to industrial noise: feeding observations and predictive modeling. BBN Rep. 6265. OCS Study MMS 88-0048. Outer Contin. Shelf Environ. Assess. Progr., Final Rep. Princ. Invest., NOAA, Anchorage 56(1988): 393-600. NTIS PB88-249008.

Malme, C.I., B. Würsig, B., J.E. Bird, and P. Tyack. 1988. Observations of feeding gray whale responses to controlled industrial noise exposure. p. 55-73 *In:* W.M. Sackinger, M.O. Jeffries, J.L. Imm, and S.D. Treacy (eds.), Port and Ocean Engineering Under Arctic Conditions. Vol. II. Symposium on Noise and Marine Mammals. Univ. Alaska Fairbanks, Fairbanks, AK. 111 p.

MarineTraffic. 2013. Life Ships Map–AIS–Vessel Traffic and Positions. MarineTraffic.com. Accessed in October 2013 at http://www.marinetraffic.com/ais/default.aspx?centerx=30&centery=25&zoom=2&level1=140.

McCauley, R.D., M.-N. Jenner, C. Jenner, K.A. McCabe, and J. Murdoch. 1998. The response of humpback whales (*Megaptera novaeangliae*) to offshore seismic survey noise: preliminary results of observations about a working seismic vessel and experimental exposures. **APPEA J.** 38:692-707.

McCauley, R.D., J. Fewtrell, A.J. Duncan, C. Jenner, M.-N. Jenner, J.D. Penrose, R.I.T. Prince, A. Adhitya, J. Murdoch, and K. McCabe. 2000. Marine seismic surveys: Analysis of airgun signals; and effects of air gun exposure on humpback whales, sea turtles, fishes and squid. Rep. from Centre for Marine Science and Technology, Curtin Univ., Perth, Western Australia, for Australian Petrol. Produc. & Explor. Association, Sydney, NSW. 188 p.

McDonald, T.L., W.J. Richardson, K.H. Kim, and S.B. Blackwell. 2010. Distribution of calling bowhead whales exposed to underwater sounds from Northstar and distant seismic surveys, 2009. p. 6-1 to 6-38 *In*: W.J. Richardson (ed.), Monitoring of industrial sounds, seals, and bowhead whales near BP's Northstar oil development, Alaskan Beaufort Sea: Comprehensive report for 2005–2009. LGL Rep. P1133-6. Rep. from LGL Alaska Res. Assoc. Inc. (Anchorage, AK), Greeneridge Sciences Inc. (Santa Barbara, CA), WEST Inc. (Cheyenne, WY) and Applied Sociocult. Res. (Anchorage, AK) for BP Explor. (Alaska) Inc., Anchorage, AK. 265 p.

McDonald, T.L., W.J. Richardson, K.H. Kim, S.B. Blackwell, and B. Streever. 2011. Distribution of calling bowhead whales exposed to multiple anthropogenic sound sources and comments on analytical methods. p. 199 *In*: Abstr. 19th Bienn. Conf. Biol. Mar. Mamm., Tampa, FL, 27 Nov.–2 Dec. 2011. 344 p.

Mead, J.G. 1986. Twentieth-century records of right whales (*Eubalaena glacialis*) in the northwest Atlantic Ocean. **Rep. Int. Whal. Comm. Spec. Iss.** 10:109-120.

Mead, J.G. 1989. Beaked whales of the genus *Mesoplodon*. p. 349-430 *In*: S.H. Ridgway and R.J. Harrison (eds.), Handbook of marine mammals, Vol. 4: River dolphins and the larger toothed whales. Academic Press, San Diego, CA. 442 p.

Melcón, M.L., A.J. Cummins, S.M. Kerosky, L.K. Roche, S.M. Wiggins, and J.A. Hildebrand. 2012. Blue whales response to anthropogenic noise. **PLoS ONE** 7(2):e32681. doi:10.1371/journal.pone.0032681.

Miller, G.W., R.E. Elliott, W.R. Koski, V.D. Moulton, and W.J. Richardson. 1999. Whales. p. 5-1 to 5-109 *In:* W.J. Richardson (ed.), Marine mammal and acoustical monitoring of Western Geophysical's open-water seismic program in the Alaskan Beaufort Sea, 1998. LGL Rep. TA2230-3. Rep. from LGL Ltd., King City, Ont., and Greeneridge Sciences Inc., Santa Barbara, CA, for Western Geophysical, Houston, TX, and Nat. Mar. Fish. Serv., Anchorage, AK, and Silver Spring, MD. 390 p.

Miller, G.W., V.D. Moulton, R.A. Davis, M. Holst, P. Millman, A. MacGillivray, and D. Hannay. 2005. Monitoring seismic effects on marine mammals—southeastern Beaufort Sea, 2001–2002. p. 511-542 *In:* S.L. Armsworthy, P.J. Cranford, and K. Lee (eds.), Offshore Oil and Gas Environmental Effects Monitoring/Approaches and Technologies. Battelle Press, Columbus, OH.

Miller, I. and E. Cripps. 2013. Three dimensional marine seismic survey has no measureable effect on species richness or abundance of a coral reef associated fish community. **Mar. Poll. Bull**. 77:63-70.

Miller, P.J.O., M.P. Johnson, P.T. Madsen, N. Biassoni, M. Quero, and P.L. Tyack. 2009. Using at-sea experiments to study the effects of airguns on the foraging behavior of sperm whales in the Gulf of Mexico. **Deep-Sea Res. I** 56(7):1168-1181.

Miller, P.J.O., P.H. Kvadsheim, F.P.A. Lam, P.J. Wensveen, R. Antunes, A.C. Alves, F. Visser, L. Kleivane, P.L. Tyack, and L.D. Sivle. 2012. The severity of behavioral changes observed during experimental exposures of killer (*Orcinus orca*), long-finned pilot (*Globicephala melas*), and sperm whales (*Physeter macrocephalus*) to naval sonar. **Aquat. Mamm.** 38:362-401.

Mitchell, E. and D.G. Chapman. 1977. Preliminary assessment of stocks of northwest Atlantic sei whales (*Balaenoptera borealis*). **Rep. Int. Whal. Comm. Spec. Iss.** 1:117-120.

Miyazaki, N. and W.F. Perrin. 1994. Rough-toothed dolphin *Steno bredanensis* (Lesson, 1828). p. 1-21 *In*: S.H. Ridgway and R.J. Harrison (eds.), Handbook of marine mammals, Vol. 5: The first book of dolphins. Academic Press, San Diego, CA. 416 p.

Mizroch, S.A., D.W. Rice, and J.M. Breiwick. 1984. The blue whale, *Balaenoptera musculus*. **Mar. Fish. Rev.** 46(4)15-19.

Moein, S.E., J.A. Musick, J.A. Keinath, D.E. Barnard, M. Lenhardt, and R. George. 1994. Evaluation of seismic sources for repelling sea turtles from hopper dredges. Rep. from Virginia Inst. Mar. Sci., Gloucester Point, VA, for U.S. Army Corps of Engineers. 33 p.

Moore, M.J., B. Rubinstein, S.A. Norman, and T. Lipscomb. 2004. A note on the most northerly record of Gervais' beaked whale from the western North Atlantic Ocean. **J. Cetac. Res. Manage.** 6(3):279-281.

Morano, J.L., A.N. Rice, J.T. Tielens, B.J. Estabrook, A. Murray, B.L. Roberts, and C.W. Clark. 2012. Acoustically detected year-round presence of right whales in an urbanized migration corridor. **Conserv. Biol.** 26(4):698-707.

Morley, E.L., G. Jones, and A.N. Radford. The importance of invertebrates when considering the impacts of anthropogenic noise. **Proc. R. Soc. B** 281, 20132683. http://dx.doi.org/10.1098/rspb.2013.2683.

Morreale, S., A. Meylan, and B. Baumann. 1989. Sea turtles in Long Island Sound, New York: an historical perspective. p. 121-122 *In*: S.A. Eckert, K.L. Eckert, and T.H. Richardson (compilers), Proc. 9th Ann. Worksh. Sea Turtle Conserv. Biol. NOAA Tech. Memo. NMFS-SEFC-232. 306 p.

Morreale, S.J., P.T. Plotkin, D.J. Shaver, and H.J. Kalb. 2007. Adult migration and habitat utilization: ridley turtles in their element. p. 213-229 *In*: P.T. Plotkin (ed.), Biology and conservation of ridley sea turtles. The Johns Hopkins University Press, Baltimore, MD. 356 p.

Moulton, V.D. and M. Holst. 2010. Effects of seismic survey sound on cetaceans in the Northwest Atlantic. Environ. Stud. Res. Funds Rep. 182. St. John's, Nfld. 28 p. Available at http://www.esrfunds.org/pdf/182.pdf.

Musick, J.A. and C.J. Limpus. 1997. Habitat utilization and migration in juvenile sea turtles. p. 137-163 *In*: P.L. Lutz and J.A. Musick (eds.), The biology of sea turtles. CRC Press, Boca Raton, FL. 432 p.

Musick, J.A., D.E. Barnard, and J.A. Keinath. 1994. Aerial estimates of seasonal distribution and abundance of sea turtles near the Cape Hatteras faunal barrier. p. 121-122 *In*: B.A. Schroeder and B.E. Witherington (compilers), Proc. 13th Ann. Symp. Sea Turtle Biol. Conserv. NOAA Tech. Mem. NMFS-SEFSC-341. 281 p.

Mussoline, S.E., D. Risch, L.T. Hatch, M.T. Weinrich, D.N. Wiley, M.A. Thompson, P.J. Corkeron, and S.M. Van Parijs. 2012. Seasonal and diel variation in North Atlantic right whale up-calls: implications for management and conservation in the northwestern Atlantic Ocean. **Endang. Species Res.** 17(1):17-26.

Nachtigall, P.E. and A.Y. Supin. 2013. Hearing sensation changes when a warning predicts a loud sound in the false killer whale. Abstr. 3rd Int. Conf. Effects of Noise on Aquatic Life, Budapest, Hungary, August 2013.

National Geographic Daily News. 2013. What's killing bottlenose dolphins? Experts discover cause. 13 August 2013. Accessed on 22 November 2013 at http://news.nationalgeographic.com/news/2013/08/130827-dolphin-deaths-virus-outbreak-ocean-animals-science/.

NC (North Carolina Department of Commerce, Division of Tourism, Film and Sports Development). 2014. Scuba diving in the graveyard of the Atlantic. Accessed in April 2014 at http://www.visitnc.com/story/scuba-diving-in-the-graveyard-of-the-atlantic.

NCDMF (North Carolina Division of Marine Fisheries). 2014. 2014 North Carolina saltwater fishing tournament managed by North Carolina Division of Marine Fisheries. Accessed at http://portal.ncdenr.org/web/mf/n.c.-saltwater-fishing-tournament in April 2014.

NEFSC (Northeast Fisheries Science Center). 2012. North Atlantic right whale sighting advisory system. Accessed on 11 September 2013 at http://www.nefsc.noaa.gov/psb/surveys/SAS.html.

NEFSC (Northeast Fisheries Science Center). 2013. Interactive North Atlantic right whale sightings map. Accessed on 22 August 2013 at http://www.nefsc.noaa.gov/psb/surveys.

New, L.F., J. Harwood, L. Thomas, C. Donovan, J.S. Clark, G. Hastie, P.M. Thompson, B. Cheney, L. Scott-Hayward, and D. Lusseau. 2013. Modelling the biological significance of behavioural change in coastal bottlenose dolphins in response to disturbance. **Function. Ecol.** 27:314-322.

Nieukirk, S.L., D.K. Mellinger, S.E. Moore, K. Klinck, R.P. Dziak and J. Goslin. 2012. Sounds from airguns and fin whales recorded in the mid-Atlantic Ocean, 1999–2009. **J. Acoust. Soc. Am.** 131(2):1102-1112.

NMFS (National Marine Fisheries Service). 1994. Designated critical habitat, northern right whale. **Fed. Regist.** (59, 3 June 1994): 28793.

NMFS (National Marine Fisheries Service). 2000. Small takes of marine mammals incidental to specified activities: marine seismic-reflection data collection in southern California/Notice of receipt of application. **Fed. Regist.** 65(60, 28 Mar.):16374-16379.

NMFS (National Marine Fisheries Service). 2001. Small takes of marine mammals incidental to specified activities: oil and gas exploration drilling activities in the Beaufort Sea/Notice of issuance of an incidental harassment authorization. **Fed. Regist.** 66(26, 7 Feb.):9291-9298.

NMFS (National Marine Fisheries Service). 2005. Recovery plan for the North Atlantic right whale (*Eubalaena glacialis*). Nat. Mar. Fish. Serv., Silver Spring, MD. 137 p.

NMFS (National Marine Fisheries Service). 2008. Endangered fish and wildlife; Final Rule to implement speed restrictions to reduce the threat of ship collisions with North Atlantic right whales. **Fed. Regist.** 73(198, 10 Oct.):60173-60191.

NMFS (National Marine Fisheries Service). 2010. Endangered fish and wildlife and designated Critical Habitat for the endangered North Atlantic right whale. **Fed. Regist.** 75:(193, 6 Oct.):61690-61691.

NMFS (National Marine Fisheries Service). 2013a. Endangered and threatened wildlife; designation of Critical Habitat for the Northwest Atlantic Ocean Loggerhead Sea Turtle Distinct Population Segment (DPS) and determination regarding critical habitat for the North Pacific Ocean Loggerhead DPS. **Fed. Regist.** 78 (138, 18 July):43006-43054.

NMFS (National Marine Fisheries Service). 2013b. Endangered and threatened wildlife; 90-Day finding on petitions to list the dusky shark as Threatened or Endangered under the Endangered Species Act. **Fed. Regist.** 78 (96, 17 May):29100-29110.

NMFS (National Marine Fisheries Service). 2013c. NOAA Fisheries Service, Southeast Regional Office. Habitat Conservation Division. Essential fish Habitat: frequently asked questions. Accessed on 24 September 2013 at http://sero.nmfs.noaa.gov/hcd/efh_faq.htm#Q2.

NMFS (National Marine Fisheries Service). 2013d. Effects of oil and gas activities in the Arctic Ocean: Supplemental draft environmental impact statement. U.S. Depart. Commerce, NOAA, NMFS, Office of Protected Resources. Accessed at http://www.nmfs.noaa.gov/pr/permits/eis/arctic.htm on 21 September 2013.

NMFS and USFWS (National Marine Fisheries Service and U.S. Fish and Wildlife Service). 2007. Green sea turtle (*Chelonia mydas*) 5-year review: summary and evaluation. NMFS Office of Protected Resources, Silver Spring, MD, and USFWS Southeast Region, Jacksonville Ecological Services Field Office, Jacksonville, FL. 105 p.

NMFS and USFWS (National Marine Fisheries Service and U.S. Fish and Wildlife Service). 2013a. Leatherback turtle (*Dermochelys coriacea*) 5-year review: summary and evaluation. NMFS Office of Protected Resources, Silver Spring, MD, and USFWS Southeast Region, Jacksonville Ecological Services Field Office, Jacksonville, FL. 89 p.

NMFS and USFWS (National Marine Fisheries Service and U.S. Fish and Wildlife Service). 2013b. Hawksbill turtle (*Eretmochelys imbricata*) 5-year review: summary and evaluation. NMFS Office of Protected Resources, Silver Spring, MD, and USFWS Southeast Region, Jacksonville Ecological Services Field Office, Jacksonville, FL. 91 p.

NOAA (National Oceanic and Atmospheric Administration). 2006. NOAA recommends new east coast ship traffic routes to reduce collisions with endangered whales. Press Release. Nat. Ocean. Atmos. Admin., Silver Spring, MD, 17 November.

NOAA (National Oceanic and Atmospheric Administration). 2007. NOAA & coast guard help shift Boston ship traffic lane to reduce risk of collisions with whales. Press Release. Nat. Ocean. Atmos. Admin., Silver Spring, MD, 28 June.

NOAA (National Oceanic and Atmospheric Administration). 2009. Fisheries of the northeastern United States: Magnuson-Stevens Fishery Conservation and Management Act Provisions; Tilefish; Amendment 1. **Fed. Regist.** 74(162, 24 Aug.):42580-42604.

NOAA (National Oceanic and Atmospheric Administration). 2010. Harbor porpoise take reduction plan: Mid-Atlantic. Accessed on 13 September 2013 at http://www.nero.noaa.gov/prot_res/porptrp/doc/HPTRPMidAtlanticGuide_Feb%202010.pdf

NOAA (National Oceanic and Atmospheric Administration). 2012a. Office of Protected Resources: Atlantic sturgeon (*Acipenser oxyrinchus oxyrinchus*). Accessed on 9 September 2013 at http://www.nmfs.noaa.gov/pr/species/fish/atlanticsturgeon.htm.

NOAA (National Oceanic and Atmospheric Administration). 2012b. NOAA Habitat Conservation, Habitat Protection. EFH text descriptions and GIS data inventory. Accessed in October 2013 at http://www.habitat.noaa.gov/protection/efh/newInv/index.html.

NOAA (National Oceanic & Atmospheric Administration). 2013a. Draft guidance for assessing the effects of anthropogenic sound on marine mammals/Acoustic threshold levels for onset of permanent and temporary threshold shifts. Draft: 23 Dec. 2013. 76 p. Accessed in January 2014 at http://www.nmfs.noaa.gov/pr/acoustics/draft_acoustic_guidance_2013.pdf.

NOAA (National Oceanic and Atmospheric Administration). 2013b. Final management plan and environmental assessment, Monitor National Marine Sanctuary. February 2013. 243 p. Accessed in August 2013 at http://monitor.noaa.gov/pdfs/final_mp0213.pdf.

NOAA (National Oceanic and Atmospheric Administration). 2013c. Reducing ship strikes to North Atlantic right whales. Accessed on 13 September 2013 at http://www.nmfs.noaa.gov/pr/shipstrike.

NOAA (National Oceanic and Atmospheric Administration). 2013d. 2013 bottlenose dolphin unusual mortality event in the mid-Atlantic. Accessed on 28 November 2013 at http://www.nmfs.noaa.gov/pr/health/mmume/midatldolphins2013.html.

NOAA (National Oceanic and Atmospheric Administration). 2013e. Office of Protected Resources: Shortnose sturgeon (*Acipenser brevirostrum*). Accessed on 9 September 2013 at http://www.nmfs.noaa.gov/pr/species/fish/shortnosesturgeon.htm.

NOAA (National Oceanic and Atmospheric Administration). 2013f. Office of Protected Resources: Great hammerhead shark (*Sphyrna mokarran*). Accessed on 9 September 2013 at http://www.nmfs.noaa.gov/pr/species/fish/greathammerheadshark.htm.

NOAA (National Oceanic and Atmospheric Administration). 2013g NOAA Office of Science and Technology, National Marine Fisheries Service, Fisheries Statistics and Economics Division. Accessed in October 2013 at http://www.st.nmfs.noaa.gov/index.

NOAA (National Oceanic and Atmospheric Administration). 2014. Automated wreck and obstruction information system. Accessed in April 2014 at http://www.nauticalcharts.noaa.gov/hsd/AWOIS_download.html.

Nowacek, D.P., L.H. Thorne, D.W. Johnston, and P.L. Tyack. 2007. Responses of cetaceans to anthropogenic noise. **Mamm. Rev.** 37(2):81-115.

Nowacek, D.P., K. Bröker, G. Donovan, G. Gailey, R. Racca, R.R. Reeves, A.I. Vedenev, D.W. Weller, and B.L. Southall. 2013. Responsible practices for minimizing and monitoring environmental impacts of marine seismic surveys with an emphasis on marine mammals. **Aquatic Mamm.** 39(4):356-377.

NRC (National Research Council). 2005. Marine mammal populations and ocean noise/Determining when noise causes biologically significant effects. U.S. Nat. Res. Counc., Ocean Studies Board, Committee on characterizing biologically significant marine mammal behavior (Wartzok, D.W., J. Altmann, W. Au, K. Ralls, A. Starfield, and P.L. Tyack). Nat. Acad. Press, Washington, DC. 126 p.

NSF (National Science Foundation). 2012. Record of Decision for marine seismic research funded by the National Science Foundation. June 2012. 41 p. Accessed at http://www.nsf.gov/geo/oce/envcomp/rod-marine-seismic-research-june2012.pdf on 23 September 2013.

NSF and USGS (National Science Foundation and U.S. Geological Survey). 2011. Final Programmatic Environmental Impact Statement/Overseas Environmental Impact Statement for Marine Seismic Research Funded by the National Science Foundation or Conducted by the U.S. Geological Survey. Accessed on 23 September 2013 at http://www.nsf.gov/geo/oce/envcomp/usgs-nsf-marine-seismic-research/nsf-usgs-final-eis-oeis-with-appendices.pdf.

OBDC (Outer Banks Dive Center). 2012. Shipwrecks. Accessed at http://www.obxdive.com/shipwrecks.html in April 2014.

Odell, D.K. and K.M. McClune. 1999. False killer whale *Pseudorca crassidens* (Owen, 1846). p. 213-243 *In*: S.H. Ridgway and R. Harrison (eds.), Handbook of marine mammals, Vol. 6: The second book of dolphins and the porpoises. Academic Press, San Diego, CA. 486 p.

Olson, P.A. 2009. Pilot whales. p. 847-852 *In*: W.F. Perrin, B. Würsig and J.G.M. Thewissen (eds.), Encyclopedia of marine mammals, 2nd edit. Academic Press, San Diego, CA. 1316 p.

Packer, D.B., C.A. Zetlin, and J.J. Vitaliano. 2003a. Essential fish habitat source document: Clearnose skate, *Raja eglanteria*, life history and habitat characteristics. NOAA Tech. Memo. NMFS-NE-174. Accessed in October 2013 at http://www.nefsc.noaa.gov/nefsc/publications/tm/tm174/tm174.pdf.

Packer, D.B., C.A. Zetlin, and J.J. Vitaliano. 2003b. Essential fish habitat source document: Little skate, *Leucoraja erinacea*, life history and habitat characteristics. NOAA Tech. Memo. NMFS-NE-175. Accessed in October 2013 at http://www.nefsc.noaa.gov/nefsc/publications/tm/tm175/tm175.pdf.

Packer, D.B., C.A. Zetlin, and J.J. Vitaliano. 2003c. Essential fish habitat source document: Rosette skate, *Leucoraja garmani virginica*, life history and habitat characteristics. NOAA Tech. Memo. NMFS-NE-176. Accessed in October 2013 at http://www.nefsc.noaa.gov/nefsc/publications/tm/tm176/tm176.pdf.

Packer, D.B., C.A. Zetlin, and J.J. Vitaliano. 2003d. Essential fish habitat source document: Winter skate, *Leucoraja ocellata*, life history and habitat characteristics. NOAA Tech. Memo. NMFS-NE-179. Accessed in October 2013 at http://www.nefsc.noaa.gov/nefsc/publications/tm/tm179/tm179.pdf.

Palka, D.L. 2006. Summer abundance estimates of cetaceans in U.S. North Atlantic Navy Operating Areas. Northeast Fish. Sci. Center Ref. Doc. 06-03. Northeast Fish. Sci. Center, Nat. Mar. Fish. Serv., Woods Hole, MA. 41 p.

Palka, D. 2012. Cetacean abundance estimates in U.S. northwestern Atlantic Ocean waters from summer 2011 line transect survey. Northeast Fish. Sci. Cent. Ref. Doc. 12-29. Northeast Fish. Sci. Center, Nat. Mar. Fish. Serv., Woods Hole, MA. 37 p.

Palsbøll, P.J., J. Allen, T.H. Anderson, M. Berube, P.J. Clapham, T.P. Feddersen, N.A. Friday, P.S. Hammond, H. Jorgensen, S.K. Katona, F. Larsen, J. Lien, D.K. Mattila, F.B. Nygaard, J. Robbins, R. Sponer, R. Sears, J. Sigurjonsson, T.G. Smith, P.T. Stevick, G.A. Vikingsson, and N. Oien. 2001. Stock structure and composition of the North Atlantic humpback whale, *Megaptera novaeangliae*. Working Pap. SC/53/NAH11. Int. Whal. Comm., Cambridge, U.K.

Parks, S.E. M. Johnson, D. Nowacek, and P.L. Tyack. 2011. Individual right whales call louder in increased environmental noise. **Biol. Lett.** 7(1):33-35.

Parks, S.E., M.P. Johnson, D.P. Nowacek, and P.L. Tyack. 2012. Changes in vocal behaviour of North Atlantic right whales in increased noise. p. 317-320 *In*: A.N. Popper and A. Hawkins (eds.), The effects of noise on aquatic life. Springer, New York, NY. 695 p.

Patrician, M.R., I.S. Biedron, H.C. Esch, F.W. Wenzel, L.A. Cooper, P.K. Hamilton, A.H. Glass, and M.F. Baumgartner. 2009. Evidence of a North Atlantic right whale calf (*Eubalaena glacialis*) born in northeastern U.S. waters. **Mar. Mamm. Sci.** 25(2):462-477.

Payne, R. 1978. Behavior and vocalizations of humpback whales (*Megaptera* sp.). *In*: K.S Norris and R.R. Reeves (eds.), Report on a workshop on problems related to humpback whales (*Megaptera novaeangliae*) in Hawaii. MCC-77/03. Rep. from Sea Life Inc., Makapuu Pt., HI, for U.S. Mar. Mamm. Comm., Washington, DC.

Payne, R. S. and S. McVay. 1971. Songs of humpback whales. **Science** 173(3997):585-597.

Peña, H., N.O. Handegard, and E. Ona. 2013. Feeding herring schools do not react to seismic air gun surveys. ICES J. Mar. Sci. doi:10.1093/icesjms/fst079.

Perrin, W.F., D.K. Caldwell, and M.C. Caldwell. 1994a. Atlantic spotted dolphin *Stenella frontalis* (G. Cuvier, 1829). p. 173-190 *In*: S.H. Ridgway and R.J. Harrison (eds.), Handbook of marine mammals, Vol. 5: The first book of dolphins. Academic Press, San Diego, CA. 416 p.

Perrin, W.F., S. Leatherwood, and A. Collet. 1994b. Fraser's dolphin *Lagenodelphis hosei* Fraser, 1956. p. 225-240 *In*: S.H. Ridgway and R. Harrison (eds.), Handbook of marine mammals, Vol. 5: The first book of dolphins. Academic Press, London, U.K. 416 p.

Perryman, W.L., D.W.K. Au, S. Leatherwood, and T.A. Jefferson. 1994. Melon-headed whale *Peponocephala electra* Gray, 1846. p. 363-386 *In*: S.H. Ridgway and R. Harrison (eds.), Handbook of marine mammals, Vol. 5: The first book of dolphins. Academic Press, London, U.K. 416 p.

Pierson, M.O., J.P. Wagner, V. Langford, P. Birnie, and M.L. Tasker. 1998. Protection from, and mitigation of, the potential effects of seismic exploration on marine mammals. Chapter 7 *In*: M.L. Tasker and C. Weir (eds.), Proc. Seismic Mar. Mamm. Worksh., London, U.K., 23–25 June 1998.

Pike, D.G., G.A. Víkingsson, T. Gunnlaugsson, and N. Øien. 2009. A note on the distribution and abundance of blue whales (*Balaenoptera musculus*) in the central and northeast North Atlantic. **NAMMCO Sci. Publ.** 7:19-29.

Pirotta, E., R. Milor, N. Quick, D. Moretti, N. Di Marzio, P. Tyack, I. Boyd, and G. Hastie. 2012. Vessel noise affects beaked whale behavior: results of a dedicated acoustic response study. **PLoS ONE** 7(8):e42535. doi:10.1371/journal.pone.0042535.

Plotkin, P. 2003. Adult migrations and habitat use. p. 225-241 *In*: P.L. Lutz, J.A. Musick, and J. Wyneken (eds.), The biology of sea turtles, Vol. II. CRC Press, New York, NY. 455 p.

Popov, V.V., A.Y. Supin, D. Wang, K. Wang, L. Dong, and S. Wang. 2011. Noise-induced temporary threshold shift and recovery in Yangtze finless porpoises *Neophocaena phocaenoides asiaeorientalis*. **J. Acoust. Soc. Am.** 130(1):574-584.

Popov, V.V., A.Y. Supin, V.V. Rozhnov, D.I. Nechaev, E.V. Sysuyeva, V.O. Klishin, M.G. Pletenko, and M.B. Tarakanov. 2013a. Hearing threshold shifts and recovery after noise exposure in beluga whales, *Delphinapterus leucas*. **J. Exper. Biol.** 216:1587-1596.

Popov, V., A. Supin, D. Nechaev, and E.V. Sysueva. 2013b. Temporary threshold shifts in naïve and experienced belugas: learning to dampen effects of fatiguing sounds? Abstr. 3rd Int. Conf. Effects of Noise on Aquatic Life, Budapest, Hungary, August 2013.

Read, A.J., P.N. Halpin, L.B. Crowder, B.D. Best, and E. Fujioka (eds.). 2009. OBIS-SEAMAP: Mapping marine mammals, birds and turtles. World Wide Web electronic publication. Accessed on 20 August 2013 at http://seamap.env.duke.edu/prod/serdp/serdp_map.php.

Reeves, R.R. 2001. Overview of catch history, historic abundance and distribution of right whales in the western North Atlantic and in Cintra Bay, West Africa**. J. Cetac. Res. Manage.** Spec. Iss. 2:187-192.

Reeves, R.R. and E. Mitchell. 1986. American pelagic whaling for right whales in the North Atlantic. **Rep. Int. Whal. Comm**. Spec. Iss. 10:221-254.

Reeves, R.R., C. Smeenk, R.L. Brownell, Jr., and C.C. Kinze. 1999. Atlantic white-sided dolphin *Lagenorhynchus acutus* (Gray, 1828). p. 31-58 *In*: S.H. Ridgeway and R. Harrison (eds.), Handbook of marine mammals, Vol. 6: The second handbook of dolphins and the porpoises. Academic Press, San Diego, CA. 486 p.

Rice, D.W. 1998. Marine mammals of the world, systematics and distribution. Spec. Publ. 4. Soc. Mar. Mammal., Allen Press, Lawrence, KS. 231 p.

Richardson, W.J., C.R. Greene, Jr., C.I. Malme, and D.H. Thomson. 1995. Marine mammals and noise. Academic Press, San Diego. 576 p.

Richardson, W.J., G.W. Miller, and C.R. Greene, Jr. 1999. Displacement of migrating bowhead whales by sounds from seismic surveys in shallow waters of the Beaufort Sea. **J. Acoust. Soc. Am.** 106(4, Pt. 2):2281 (Abstract).

Risch, D., P.J. Corkeron, W.T. Ellison, and S.M. Van Parijs. 2012. Changes in humpback whale song occurrence in response to an acoustic source 200 km away. **PLoS One** 7:e29741.

Robertson, F.C., W.R. Koski, T.A. Thomas, W.J. Richardson, B. Würsig, and A.W. Trites. 2013. Seismic operations have variable effects on dive-cycle behavior of bowhead whales in the Beaufort Sea. **Endang. Species Res.** 21:143-160.

Rolland, R.M., S.E. Parks, K.E. Hunt, M. Castellote, P.J. Corkeron, D.P. Nowacek, S.K. Water, and S.D. Kraus. 2012. Evidence that ship noise increases stress in right whales. **Proc. R. Soc. B** 279:2363-2368.

SAFMC (South Atlantic Fishery Management Council). 1998. Habitat plan for the south Atlantic region: Essential fish habitat requirements for fishery management plans of the South Atlantic Fishery Management Council (Final). Accessed in October 2013 at http://www.safmc.net/ecosystem-management/safmc-habitat-plan.

SAFMC (South Atlantic Fishery Management Council). 2013. South Atlantic Fishery Management Council: Conserving and managing America's fisheries from 3 to 200 miles off the coasts of North Carolina, South Carolina, Georgia and Florida. Accessed in October 2013 at http://www.safmc.net/.

SAFMC and NMFS (South Atlantic Fishery Management Council and National Marine Fisheries Service). 2009. Comprehensive ecosystem-based amendment 1 for the south Atlantic region. South Atlantic Fishery Management Council in cooperation with National Marine Fisheries Service. A publication of the South Atlantic Fishery Management Council Pursuant to National Oceanic and Atmospheric Administration Award No. NA05NMF4410004. Accessed in October 2013 at http://www.gulfcouncil.org/Beta/GMFMCWeb/downloads/BB%202009-01/L%20-%20SAFMC%20Comprehensive%20Ecosystem-Based%20Amendment.pdf.

SAFMC and NMFS (South Atlantic Fishery Management Council and National Marine Fisheries Service). 2011. Comprehensive ecosystem-based amendment 2 for the south Atlantic region. South Atlantic Fishery Management Council in cooperation with National Marine Fisheries Service. A publication of the South Atlantic Fishery Management Council Pursuant to National Ocean and Atmospheric Administration Award No. FNA05NMF4410004. Accessed in October 2013 at http://safmc.net/Library/pdf/CE-BA%202_July%2015,%202011_Final.pdf.

Salden, D.R. 1993. Effects of research boat approaches on humpback whale behavior off Maui, Hawaii, 1989–1993. p. 94 *In*: Abstr. 10th Bienn. Conf. Biol. Mar. Mamm., Galveston, TX, Nov. 1993. 130 p.

Schlundt, C.E., J.J. Finneran, B.K. Branstetter, J.S. Trickey, and K. Jenkins. 2013. Auditory effects of multiple impulses from a seismic air gun on bottlenose dolphins (*Tursiops truncatus*). Abstr. 3rd Int. Conf. Effects of Noise on Aquatic Life, Budapest, Hungary, August 2013.

Sea Around Us Project. 2011. Fisheries, ecosystems, and biodiversity. EEZ waters of United States, East Coast. Accessed on 17 September 2013 at http://www.seaaroundus.org/eez/851.aspx.

Sears, R. and W.F Perrin. 2000. Blue whale. p. 120-124 *In*: W.F. Perrin, B. Würsig, and J.G.M. Thewissen (eds.), Encyclopedia of marine mammals, 2nd edit. Academic Press, San Diego, CA. 1316 p.

Selzer, L.A. and P.M. Payne. 1988. The distribution of white-sided (*Lagenorhynchus acutus*) and common dolphins (*Delphinus delphis*) vs. environmental features of the continental shelf of the northeastern United States. **Mar. Mamm. Sci.** 4:141-153.

Simard, Y., F. Samaran, and N. Roy. 2005. Measurement of whale and seismic sounds in the Scotian Gully and adjacent canyons in July 2003. p. 97-115 *In*: K. Lee, H. Bain, and C.V. Hurley (eds.), Acoustic monitoring and marine mammal surveys in The Gully and outer Scotian Shelf before and during active seismic surveys. Environ. Stud. Res. Funds Rep. 151. 154 p. (Published 2007).

Sivle, L.D., P.H. Kvadsheim, A. Fahlman, F.P.A. Lam, P.L. Tyack, and P.J.O. Miller. 2012. Changes in dive behavior during naval sonar exposure in killer whales, long-finned pilot whales, and sperm whales. **Front. Physiol.** 3(400). doi:10.3389/fphys.2012.00400.

Smultea, M.A., M. Holst, W.R. Koski, and S. Stoltz. 2004. Marine mammal monitoring during Lamont-Doherty Earth Observatory's seismic program in the southeast Caribbean Sea and adjacent Atlantic Ocean, April–June 2004. LGL Rep. TA2822-26. Rep. from LGL Ltd., King City, Ont., for Lamont-Doherty Earth Observatory of Columbia Univ., Palisades, NY, and Nat. Mar. Fish. Serv., Silver Spring, MD. 106 p.

Solé, M., M. Lenoir, M. Durfort, M. López-Bejar, A. Lombarte, M. van der Schaaer, and M. André. 2013. Does exposure to noise from human activities compromise sensory information from cephalopod statocysts? **Deep-Sea Res. II** 95:160-181.

Southall, B.L., A.E. Bowles, W.T. Ellison, J.J. Finneran, R.L. Gentry, C.R. Greene Jr., D. Kastak, D.R. Ketten, J.H. Miller, P.E. Nachtigall, W.J. Richardson, J.A. Thomas, and P.L. Tyack. 2007. Marine mammal noise exposure criteria: initial scientific recommendations. **Aquat. Mamm.** 33(4):411-522.

Southall, B.L., T. Rowles, F. Gulland, R.W. Baird, and P.D. Jepson. 2013. Final report of the Independent Scientific Review Panel investigating potential contributing factors to a 2008 mass stranding of melon-headed whales (*Peponocephala electra*) in Antsohihy, Madagascar. Accessed in March 2014 at http://iwc.int/2008-mass-stranding-in-madagascar.

SportFishermen. 2014. North Carolina fishing tournaments—April 2014. SportFishermen.com: The ultimate fishing resource. Accessed in April 2014 at http://www.sportfishermen.com/tournaments/north-carolina/.

Spotila, J.R. 2004. Sea turtles: a complete guide to their biology, behavior, and conservation. The Johns Hopkins University Press, Baltimore, MD. 227 p.

Steimle, F.W., C.A. Zetlin, P.L. Berrien, D.L. Johnson, and S. Chang. 1999a. Essential fish habitat source document: Scup, *Stenotomus chrysops*, life history and habitat characteristics. NOAA Tech. Memo. NMFS-NE-149. Accessed in October 2013 at http://www.nefsc.noaa.gov/nefsc/publications/tm/tm149/tm149.pdf.

Steimle, F.W., C.A. Zetlin, P.L. Berrien, D.L. Johnson, and S. Chang. 1999b. Essential fish habitat source document: Tilefish, *Lopholatilus chamaeleonticeps*, life history and habitat characteristics. NOAA Tech. Memo. NMFS-NE-152. Accessed at http://www.nefsc.noaa.gov/publications/tm/tm152/tm152.pdf in October 2013.

Steimle, F.W., C.A. Zetlin, and S. Chang. 2001. Essential fish habitat source document: Red deepsea crab, *Chaceon* (*Geryon*) *quinquedens*, life history and habitat characteristics. NOAA Tech. Memo. NMFS-NE-163. Accessed in October 2013 at http://www.nefsc.noaa.gov/nefsc/publications/tm/tm163/tm163.pdf.

Stone, C.J. and M.L. Tasker. 2006. The effects of seismic airguns on cetaceans in U.K. waters. **J. Cetac. Res. Manage.** 8(3):255-263.

Supin, A., V. Popov, D. Nechaev, and E.V. Sysueva. 2013. Sound exposure level: is it a convenient metric to characterize fatiguing sounds? A study in beluga whales. Abstr. 3rd Int. Conf. Effects of Noise on Aquatic Life, Budapest, Hungary, August 2013.

Thompson, P.M., K.L. Brookes, I.M. Graham, T.R. Barton, K. Needham, G. Bradbury, and N.D. Merchant. 2013. Short-term disturbance by a commercial two-dimensional seismic survey does not lead to long-term displacement of harbour porpoises. **Proc. Royal Soc. B** 280: 20132001.

Tougaard, J., A.J. Wright, and P.T. Madsen. 2013. Noise exposure criteria for harbour porpoises. Abstr. 3rd Int. Conf. Effects of Noise on Aquatic Life, Budapest, Hungary, August 2013.

Tyack, P.L. and V.M. Janik. 2013. Effects of noise on acoustic signal production in marine mammals. p. 251-271 *In*: Animal communication and noise. Springer, Berlin, Heidelberg, Germany.

Tyack, P.L., W.M.X. Zimmer, D. Moretti, B.L. Southall, D.E. Claridge, J.W. Durban, C.W. Clark, A. D'Amico, N. DiMarzio, S. Jarvis, E. McCarthy, R. Morrissey, J. Ward, and I.L. Boyd. 2011. Beaked whales respond to simulated and actual navy sonar. **PLoS One**:6(e17009).

UNEP-WCMC (United Nations Environment Programme-World Conservation Monitoring Centre). 2012. Convention on International Trade in Endangered Species of Wild Flora and Fauna. Appendices I, II, and III. Valid from 12 June 2013. Accessed in August 2013 at http://www.cites.org/eng/app/2013/E-Appendices-2013-06-12.pdf.

USCG (U.S. Coast Guard). 1999. Mandatory ship reporting systems. **Fed. Regist.** 64(104, 1 June):29229-29235.

USCG (U.S. Coast Guard). 2001. Mandatory ship reporting systems–Final rule. **Fed. Regist.** 66(224, 20 Nov.):58066-58070.

USCG (U.S. Coast Guard). 2013. AMVER density plot display. USCG, U.S. Department of Homeland Security. Accessed in October 2013 at http://www.amver.com/density.asp.

USFWS (U.S. Fish and Wildlife Service). 1996. Piping plover *(Charadrius melodus)* Atlantic Coast Population revised recovery plan. Accessed on 5 September at http://ecos.fws.gov/docs/recovery_plan/960502.pdf.

USFWS (U.S. Fish and Wildlife Service). 1998. Roseate tern *Sterna dougallii*: Northeastern Population recovery plan, first update. Accessed on 5 September at http://ecos.fws.gov/docs/recovery_plan/981105.pdf.

USFWS (U.S. Fish and Wildlife Service). 2007. Wood stork (*Mycteria americana*) 5-year review: summary and evaluation. USFWS Southeast Region, Jacksonville Ecological Services Field Office, Jacksonville, FL. 32 p. Accessed in March 2013 at http://ecos.fws.gov/docs/five_year_review/doc1115.pdf.

USFWS (U.S. Fish and Wildlife Service). 2010. Caribbean roseate tern and North Atlantic roseate tern (*Sterna dougallii dougallii*) 5-year review: summary and evaluation. Accessed on 5 September at http://ecos.fws.gov/docs/five_year_review/doc3588.pdf.

USFWS (U.S. Fish and Wildlife Service). 2011a. Endangered and threatened wildlife and plants; designation of Critical Habitat for *Carex lutea* (golden sedge): Final Rule. Fed. Reg. 76(40, 1 Mar):11086-11111.

USFWS (U.S. Fish and Wildlife Service). 2011b. Raleigh Ecological Services Field Office: Pondberry (*Lindera melissifolia*). Species profile revised on 23 August 2011. Accessed in March 2013 at http://www.fws.gov/raleigh/species/es_pondberry.html.

USFWS (U.S. Fish and Wildlife Service). 2011c. Raleigh Ecological Services Field Office: Rough-leaf loosestrife (*Lysimachia asperulaefolia*). Species profile revised on 24 August 2011. Accessed in March 2013 at http://www.fws.gov/raleigh/species/es_rough-leaf_loosestrife.html.

USFWS (U.S. Fish and Wildlife Service). 2011d. Raleigh Ecological Services Field Office: Harperella (*Ptilimnium nodosum*). Species profile revised on 26 July 2011. Accessed in March 2013 at http://www.fws.gov/raleigh/species/es_harperella.html.

USFWS (U.S. Fish and Wildlife Service). 2011e. Raleigh Ecological Services Field Office: Michaux's sumac (*Rhus michauxii*). Species profile revised on 25 August 2011. Accessed in March 2013. at http://www.fws.gov/raleigh/species/es_michauxs_sumac.html.

USFWS (U.S. Fish and Wildlife Service). 2011f. Raleigh Ecological Services Field Office: American chaffseed (*Schwalbea americana*). Species profile revised on 26 July 2011. Accessed in March 2013 at http://www.fws.gov/raleigh/species/es_american_chaffseed.html.

USFWS (U.S. Fish and Wildlife Service). 2011g. Raleigh Ecological Services Field Office: Cooley's meadowrue (*Thalictrum cooleyi*). Species profile revised on 24 August 2011. Accessed in March 2013 at http://www.fws.gov/raleigh/species/es_cooleys_meadowrue.html.

USFWS (U.S. Fish and Wildlife Service). 2013a. U.S. Fish and Wildlife Service endangered species. Accessed in March 2013 at http://www.fws.gov/midwest/endangered/mammals/nlba/nlbaFactSheet.html

USFWS (U.S. Fish and Wildlife Service). 2013b. Saint Francis' satyr butterfly (*Neonympha mitchellii francisci*) 5-Year Review: summary and evaluation. USFWS Southeast Region, Raleigh Ecological Services Field Office, Raleigh, NC. 22 p. Accessed at http://ecos.fws.gov/docs/five_year_review/doc4330.pdf in March 2013.

USFWS (U.S. Fish and Wildlife Service). 2014. USFWS species profile: wood stork (*Mycteria americana*). Accessed in March 2013 at http://ecos.fws.gov/speciesProfile/profile/speciesProfile.action?spcode=B06O.

USOKMT (United States open king mackerel tournament). U.S. Open King Mackerel Tournament Facebook Page. Accessed in April 2014 at https://www.facebook.com/USOpenKingMackerelTournament.

Vigness-Raposa, K.J., R.D. Kenney, M.L. Gonzalez, and P.V. August. 2010. Spatial patterns of humpback whale (*Megaptera novaeangliae*) sightings and survey effort: insight into North Atlantic population structure. **Mar. Mamm. Sci.** 26(1):161-175.

Wale, M.A., S.D. Simpson, and A.N. Radford. 2013. Size-dependent physiological responses of shore crabs to single and repeated playback of ship noise. **Biol. Lett.** 9:20121194. http://dx.doi.org/10.1098/rsbl.2012.1194.

Ward-Geiger, L.I., G.K. Silber, R.D. Baumstark, and T.L. Pulfer. 2005. Characterization of ship traffic in right whale Critical Habitat. **Coast. Manage.** 33:263-278.

Waring, G.T., C.P. Fairfield, C.M. Ruhsam, and M. Sano. 1992. Cetaceans associated with Gulf Stream features off the Northeastern U.S.A. shelf. **ICES C.M.** 1992/N:12.

Waring, G.T., T. Hamazaki, D. Sheehan, G. Wood, and S. Baker. 2001. Characterization of beaked whale (Ziphiidae) and sperm whale (*Physeter macrocephalus*) summer habitat in shelf-edge and deeper waters off the northeast U.S. **Mar. Mamm. Sci.** 17(4):703-717.

Waring, G.T., E. Josephson, K. Maze-Foley, and P.E. Rosel (eds.) 2010. U.S. Atlantic and Gulf of Mexico marine mammal stock assessments–2010. NOAA Tech. Memo. NMFS-NE-219. 591 p.

Waring, G.T., E. Josephson, K. Maze-Foley, and P.E Rozel (eds.). 2013. U.S. Atlantic and Gulf of Mexico Marine Mammal Stock Assessments–2012. Vol. 1. 419 p. Accessed on 27 August 2013 at http://www.nmfs.noaa.gov/pr/sars/pdf/ao2012.pdf. Vol. 2. 79 p. Accessed on 27 August 2013 at http://www.nmfs.noaa.gov/pr/sars/pdf/ao2012_10stocks.pdf.

Wartzok, D., A.N. Popper, J. Gordon, and J. Merrill. 2004. Factors affecting the responses of marine mammals to acoustic disturbance. **Mar. Technol. Soc. J.** 37(4):6-15.

Weakley, A., M. Bucher, and N. Murdock. 1996. Recovery plan for seabeach amaranth *(Amaranthus pumilus)* Rafinesque. Rep. for U.S. Fish and Wildlife Service, Southeast Region, Atlanta, GA. 59 p. Accessed in March 2013 at http://ecos.fws.gov/docs/recovery_plan/961112b.pdf.

Weilgart, L.S. 2007. A brief review of known effects of noise on marine mammals. **Int. J. Comp. Psychol.** 20:159-168.

Weinrich, M.T., R.D. Kenney, and P.K. Hamilton. 2000. Right whales (*Eubalaena glacialis*) on Jeffreys Ledge: a habitat of unrecognized importance? **Mar. Mamm. Sci.** 16:326-337.

Weir, C.R. 2007. Observations of marine turtles in relation to seismic airgun sound off Angola. **Mar. Turtle Newsl.** 116:17-20.

Weir, C.R. and S.J. Dolman. 2007. Comparative review of the regional marine mammal mitigation guidelines implemented during industrial seismic surveys, and guidance towards a worldwide standard. **J. Int. Wildl. Law Policy** 10(1):1-27.

Wenzel, F., D.K. Mattila, and P.J. Clapham. 1988. *Balaenoptera musculus* in the Gulf of Maine. **Mar. Mamm. Sci.** 4(2):172-175.

Westgate, A.J., A.J. Read, T.M. Cox, T.D. Schofield, B.R. Whitaker, and K.E. Anderson. 1998. Monitoring a rehabilitated harbor porpoise using satellite telemetry. **Mar. Mamm. Sci.** 14(3):599-604.

Whitehead, H. 2002. Estimates of the current global population size and historical trajectory for sperm whales. **Mar. Ecol. Prog. Ser.** 242:295-304.

Whitt, A.D., K. Dudzinski, and J.R. Laliberté. 2013. North Atlantic right whale distribution and seasonal occurrence in nearshore waters off New Jersey, U.S.A., and implications for management. **Endang. Species Res.** 20:59-69.

Williams, T.M, W.A. Friedl, M.L. Fong, R.M. Yamada, P. Sideivy, and J.E. Haun. 1992. Travel at low energetic cost by swimming and wave-riding bottlenose dolphins. **Nature** 355(6363):821-823.

Winn, H.E., C.A. Price, and P.W. Sorensen. 1986. The distributional biology of the right whale (*Eubalaena glacialis*) in the western North Atlantic. **Rep. Int. Whal. Comm. Spec. Iss.** 10:129-138.

Wittekind, D., J. Tougaard, P. Stilz, M. Dähne, K. Lucke, C.W. Clark, S. von Benda-Beckmann, M. Ainslie, and U. Siebert. 2013. Development of a model to assess masking potential for marine mammals by the use of airguns in Antarctic waters. Abstr. 3rd Int. Conf. Effects of Noise on Aquatic Life, Budapest, Hungary, August 2013.

Wright, A.J., T. Deak, and E.C.M. Parsons. 2011. Size matters: management of stress responses and chronic stress in beaked whales and other marine mammals may require larger exclusion zones. **Mar. Poll. Bull.** 63(1-4):5-9.

Würsig, B., S.K. Lynn, T.A. Jefferson, and K.D. Mullin. 1998. Behaviour of cetaceans in the northern Gulf of Mexico relative to survey ships and aircraft. **Aquat. Mamm.** 24(1):41-50.

Würsig, B., T.A. Jefferson, and D.J. Schmidly. 2000. The marine mammals of the Gulf of Mexico. Texas A&M University Press, College Station, TX. 232 p.

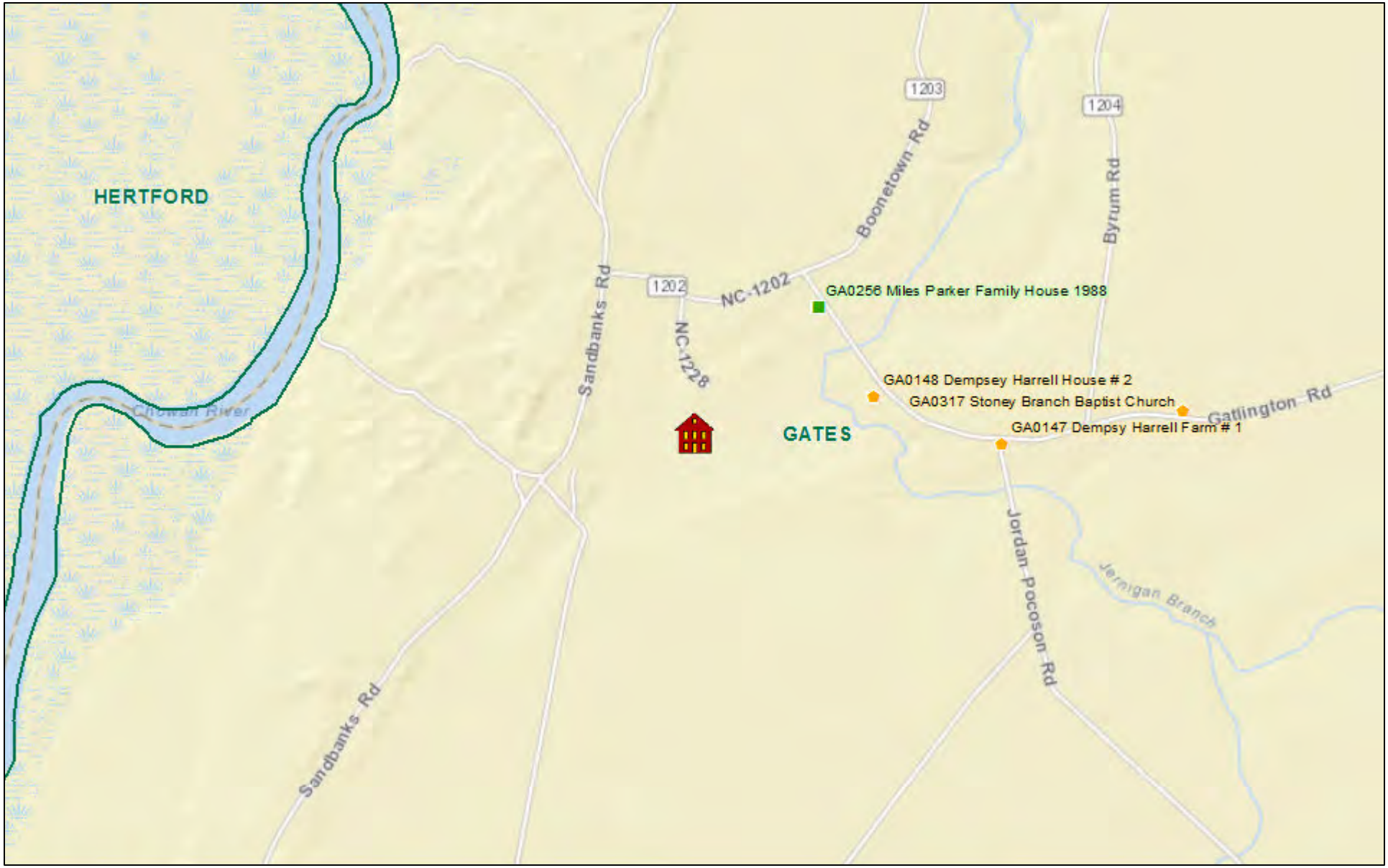
Yazvenko, S.B., T.L. McDonald, S.A. Blokhin, S.R. Johnson, S.K. Meier, H.R. Melton, M.W. Newcomer, R.M. Nielson, V.L. Vladimirov, and P.W. Wainwright. 2007a. Distribution and abundance of western gray whales during a seismic survey near Sakhalin Island, Russia. **Environ. Monit. Assessm.** 134(1-3):45-73.

Yazvenko, S. B., T.L. McDonald, S.A. Blokhin, S.R. Johnson, H.R. Melton, and M.W. Newcomer. 2007b. Feeding activity of western gray whales during a seismic survey near Sakhalin Island, Russia. **Environ. Monit. Assessm.** 134(1-3):93-106.

Active Land Shot Sites - Historic Resources

The NC State Historic Preservation Office (SHPO) HPOWEB GIS service was used to evaluate whether there would be any historic resources within the area of the proposed land shot sites. The proposed land shot sites are included in the following maps. Alternative siting options for some locations are also included in case individual proposed sites are determined to not be viable operationally.

Shot Point 14



June 18, 2014

1:31,598

0 0.25 0.5 1 mi

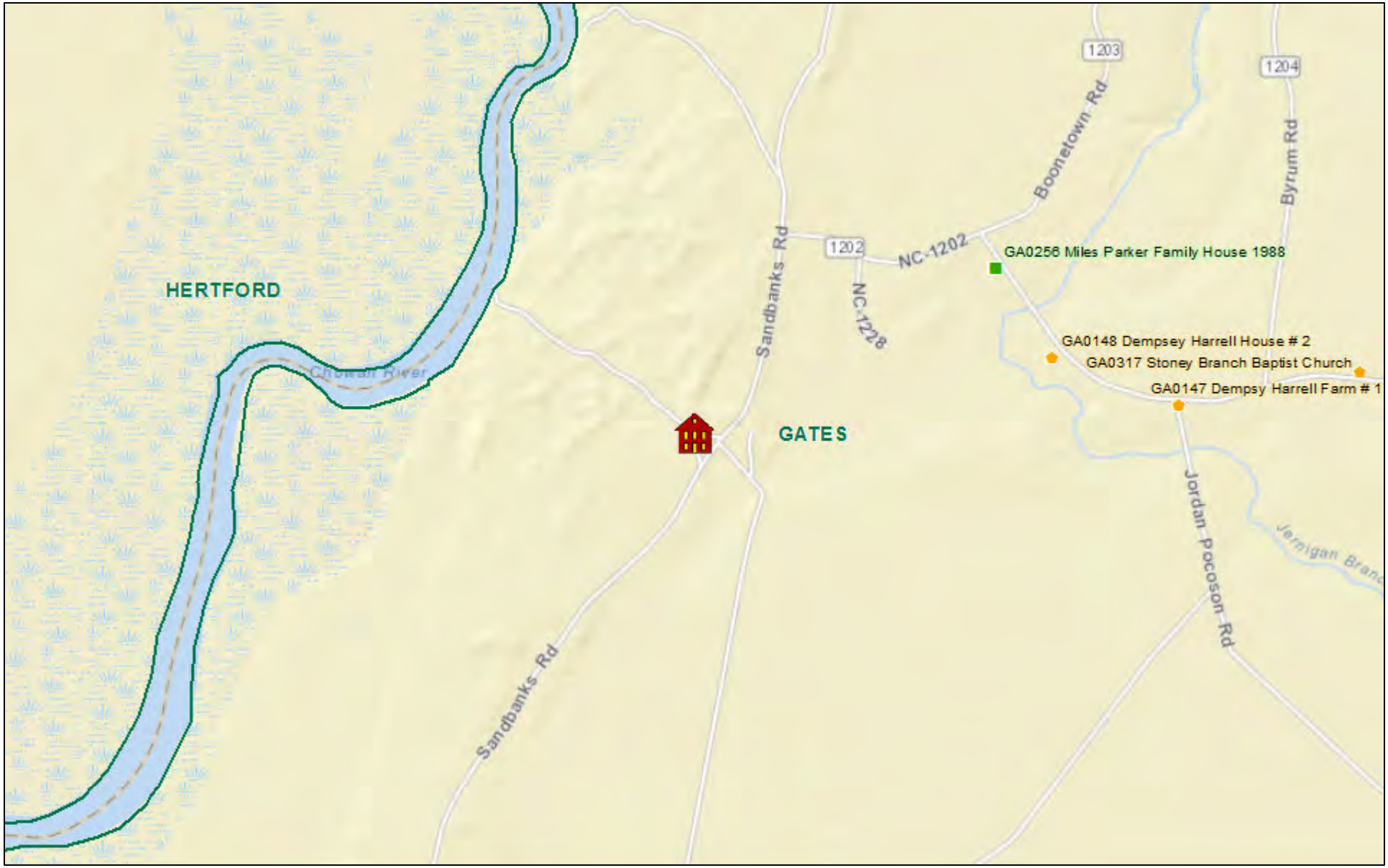
0 0.425 0.85 1.7 km

Sources: Esri, HERE, DeLorme, USGS, Intermap, increment P Corp., NRCAN, Esri Japan, METI, Esri China (Hong Kong), Esri (Thailand),

- NR Individual Listing
- NR Listing, Gone
- NRHD Center Point

Shot Point 14A

Attachment 2



June 18, 2014

1:31,598

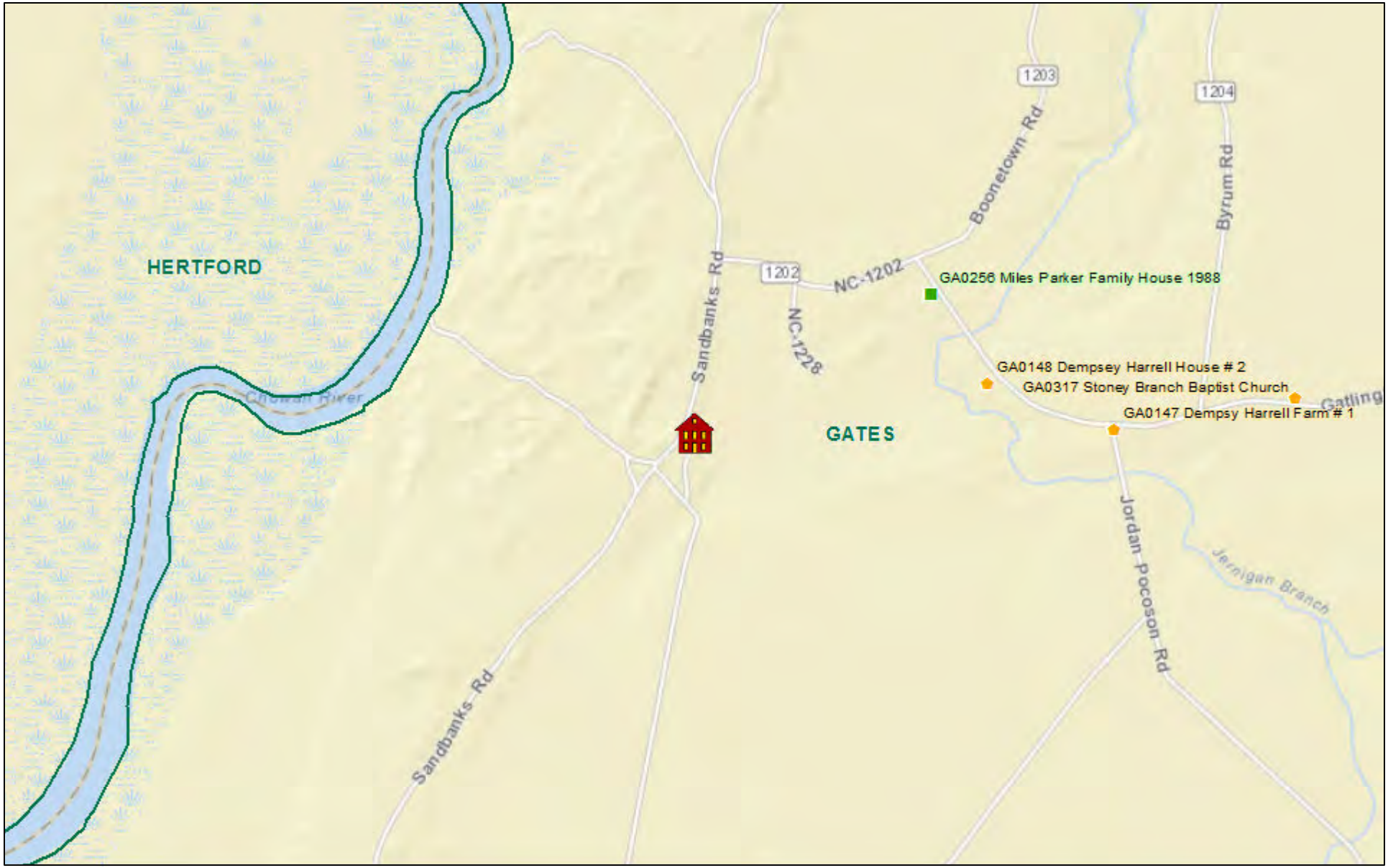
0 0.25 0.5 1 mi

0 0.425 0.85 1.7 km

Sources: Esri, HERE, DeLorme, USGS, Intermap, increment P Corp., NRCAN, Esri Japan, METI, Esri China (Hong Kong), Esri (Thailand),

- NR Individual Listing
- NR Listing, Gone
- NRHD Center Point

Shot Point 14B



June 18, 2014

1:31,598

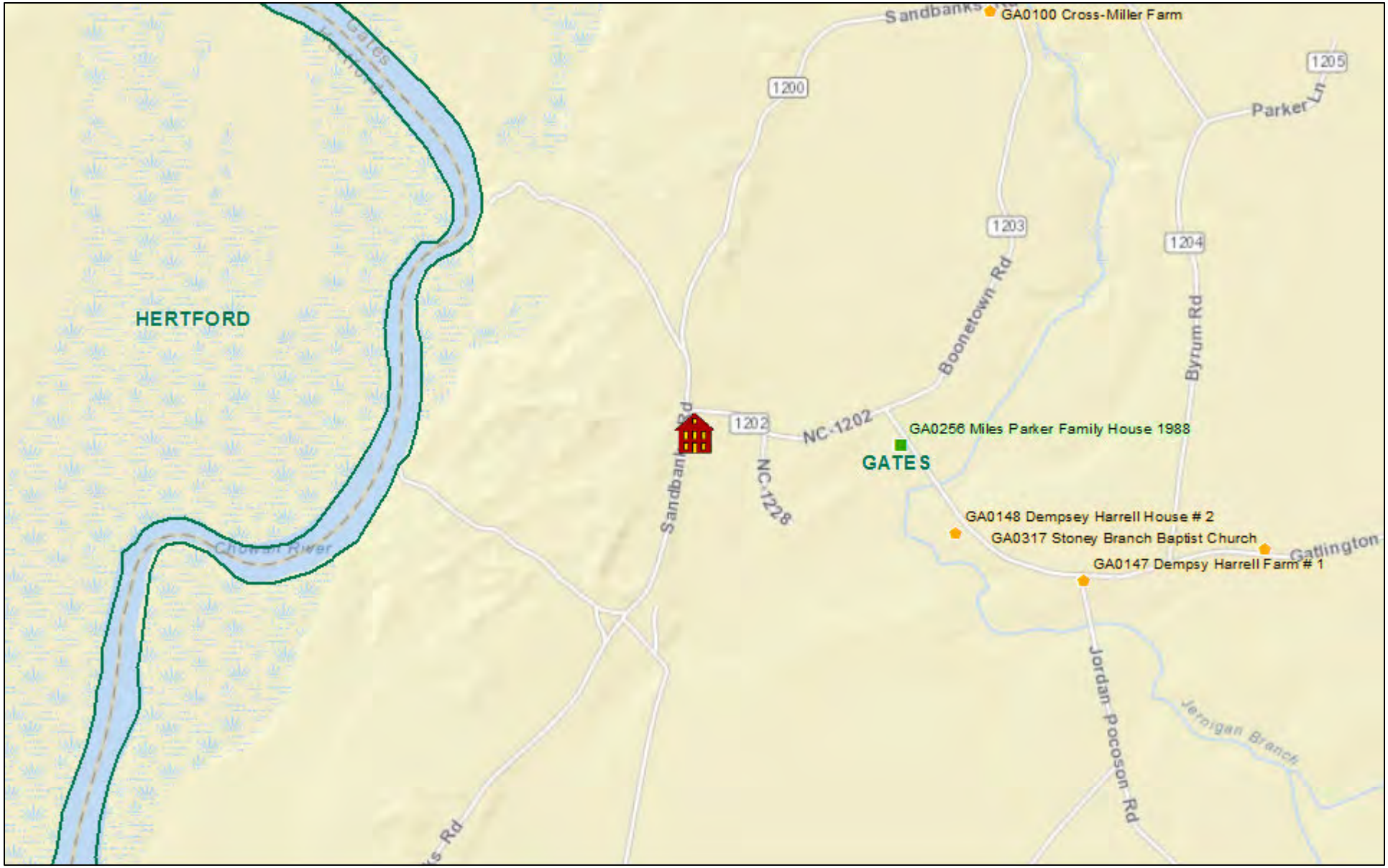
0 0.25 0.5 1 mi

0 0.425 0.85 1.7 km

Sources: Esri, HERE, DeLorme, USGS, Intermap, increment P Corp., NRCAN, Esri Japan, METI, Esri China (Hong Kong), Esri (Thailand),

- NR Individual Listing
- NR Listing, Gone
- NRHD Center Point

Shot Point 14C



June 18, 2014

1:31,598

0 0.25 0.5 1 mi

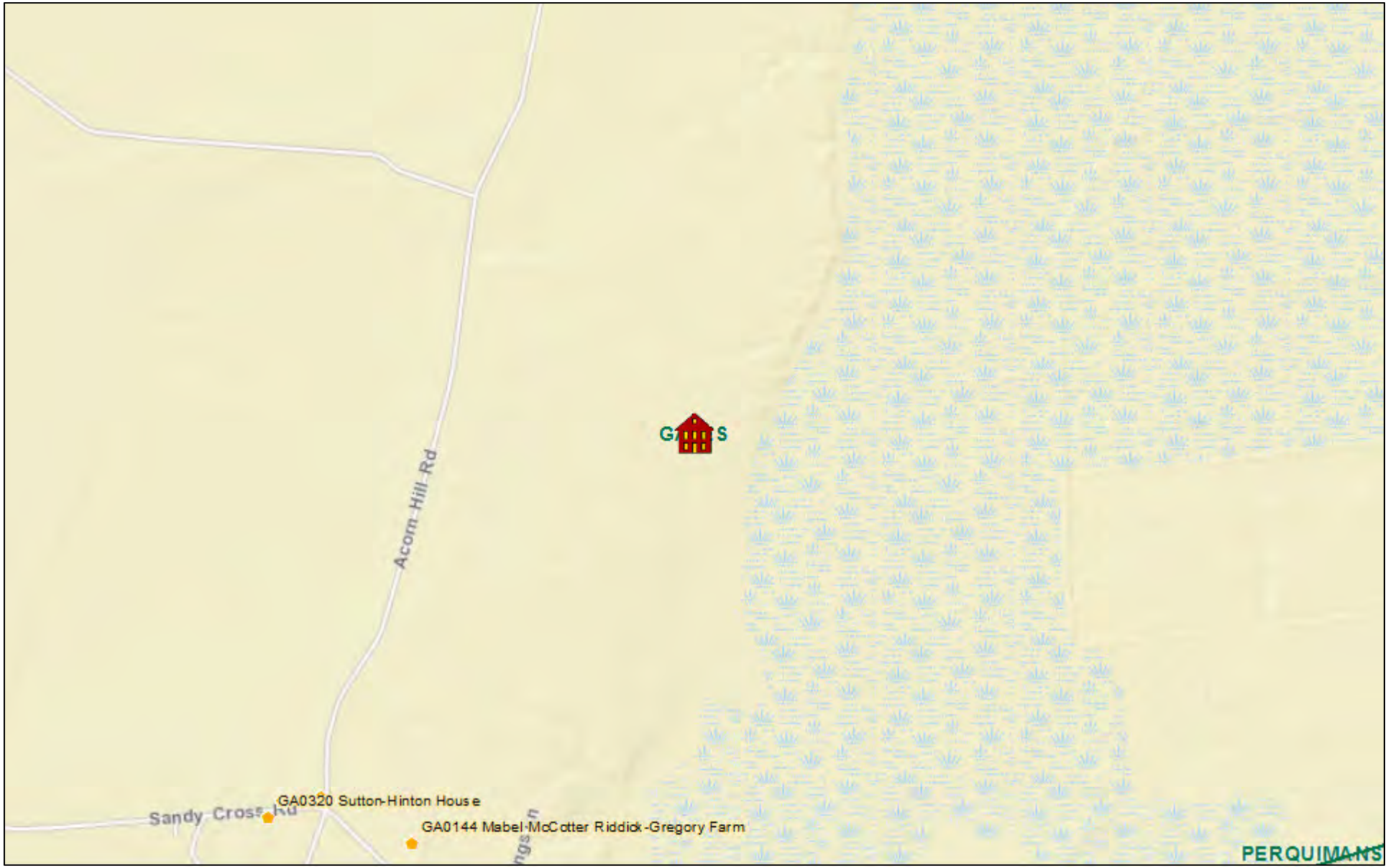
0 0.425 0.85 1.7 km

Sources: Esri, HERE, DeLorme, USGS, Intermap, increment P Corp., NRCAN, Esri Japan, METI, Esri China (Hong Kong), Esri (Thailand),

- NR Individual Listing
- NR Listing, Gone
- NRHD Center Point

Shot Point 15A

Attachment 2



June 18, 2014

1:31,598

0 0.25 0.5 1 mi

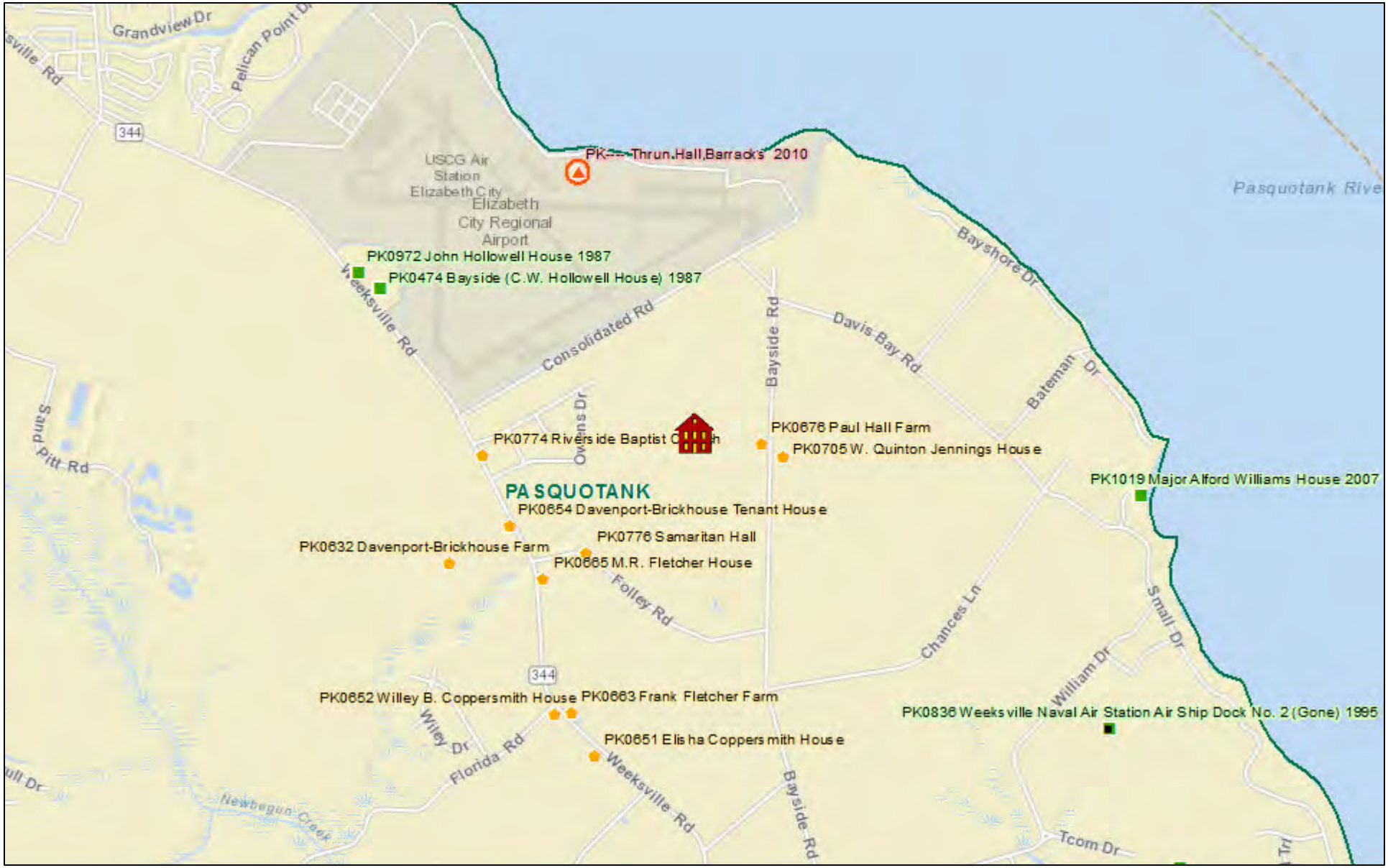
0 0.425 0.85 1.7 km

Sources: Esri, HERE, DeLorme, USGS, Intermap, increment P Corp., NRCAN, Esri Japan, METI, Esri China (Hong Kong), Esri (Thailand),

- NR Individual Listing
- NR Listing, Gone
- NRHD Center Point

Point 16

Attachment 2



June 12, 2014

1:36,112

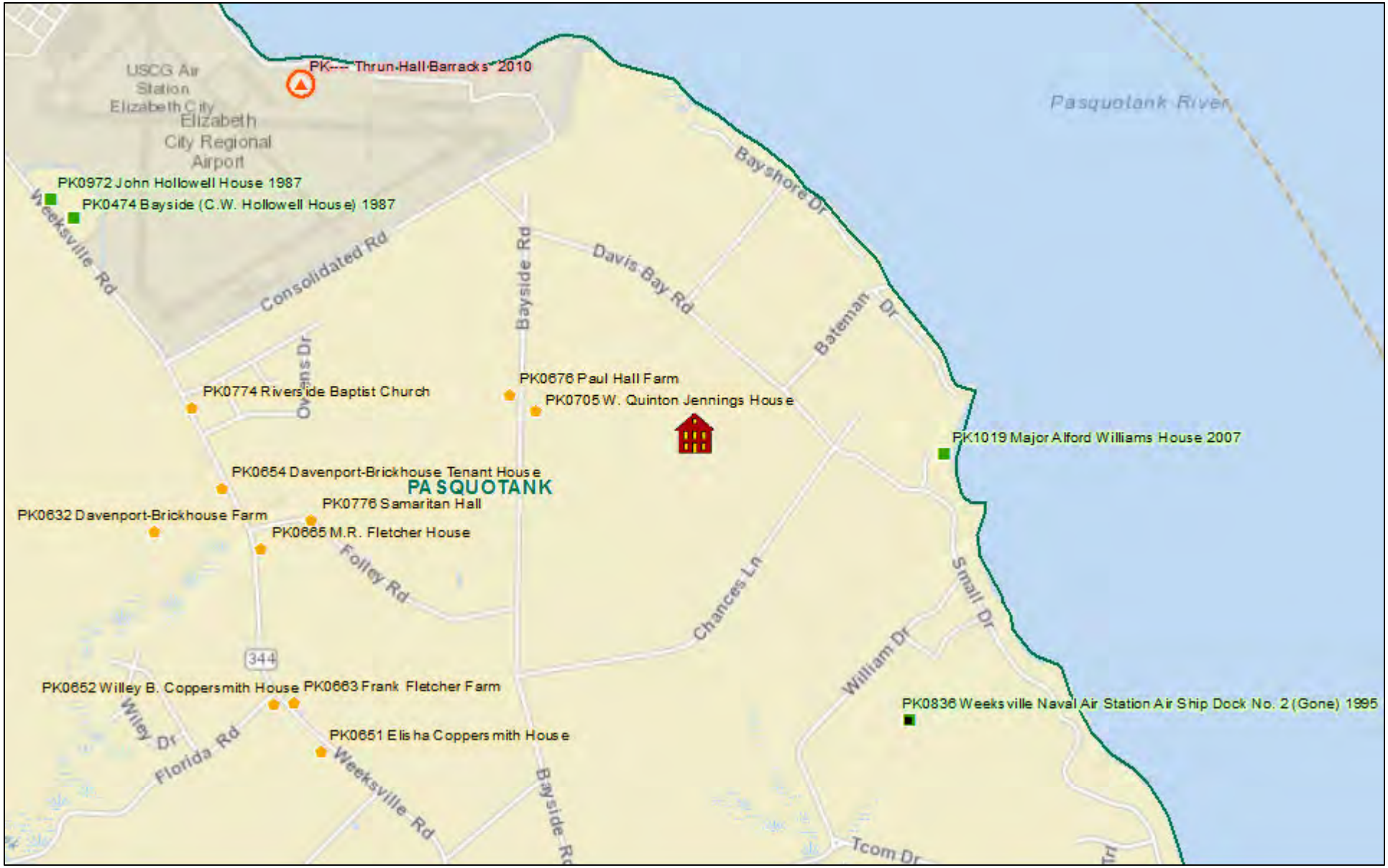
0 0.3 0.6 1.2 mi

0 0.5 1 2 km

Sources: Esri, HERE, DeLorme, USGS, Intermap, increment P Corp., NRCAN, Esri Japan, METI, Esri China (Hong Kong), Esri (Thailand),

- NR Individual Listing
- NR Listing, Gone
- NRHD Center Point

Shot Point 16A



June 18, 2014

1:31,598

0 0.25 0.5 1 mi

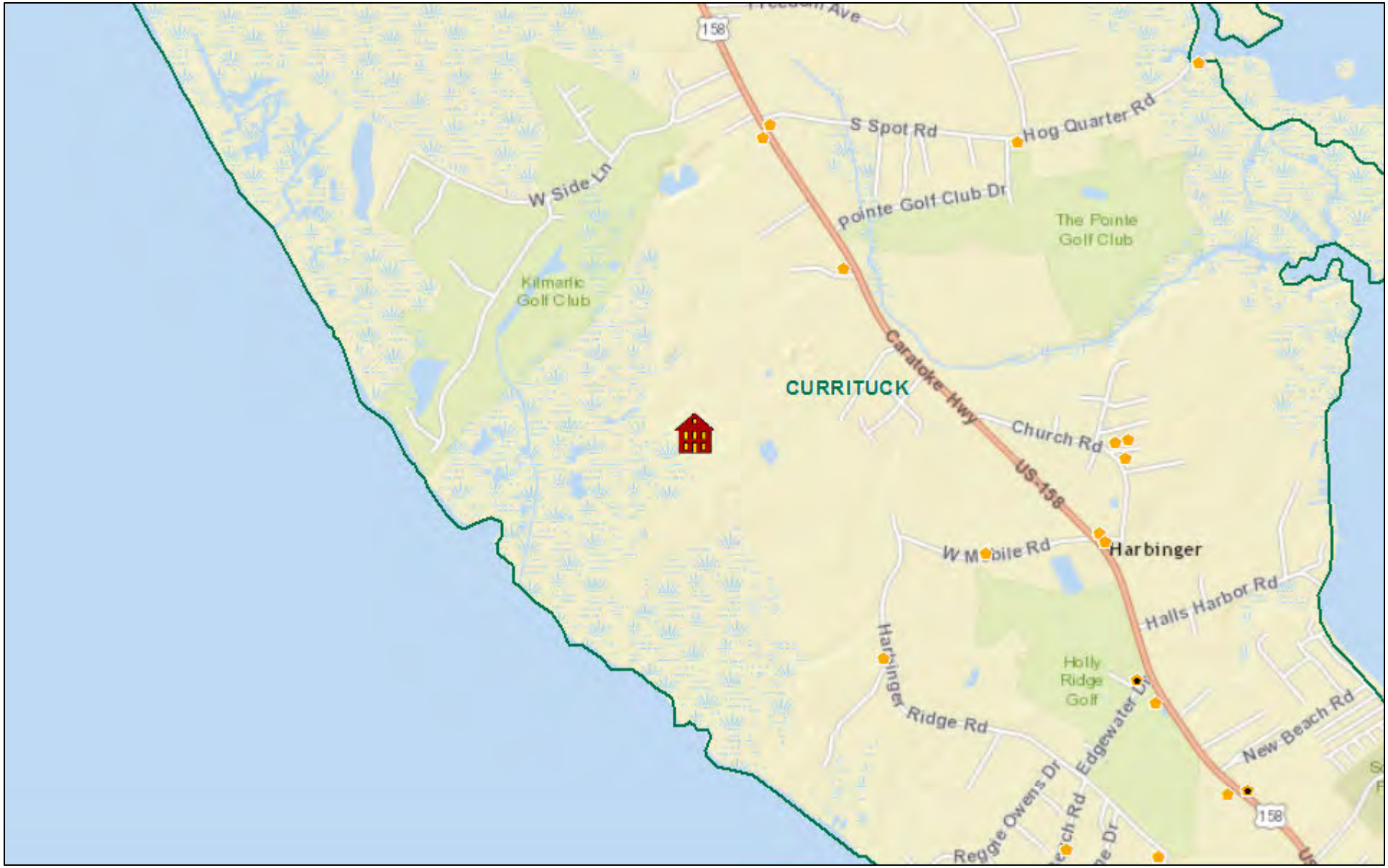
0 0.425 0.85 1.7 km

Sources: Esri, HERE, DeLorme, USGS, Intermap, increment P Corp., NRCAN, Esri Japan, METI, Esri China (Hong Kong), Esri (Thailand),

- NR Individual Listing
- NR Listing, Gone
- NRHD Center Point

Shot Point 17A

Attachment 2



June 18, 2014

1:31,598

0 0.25 0.5 1 mi

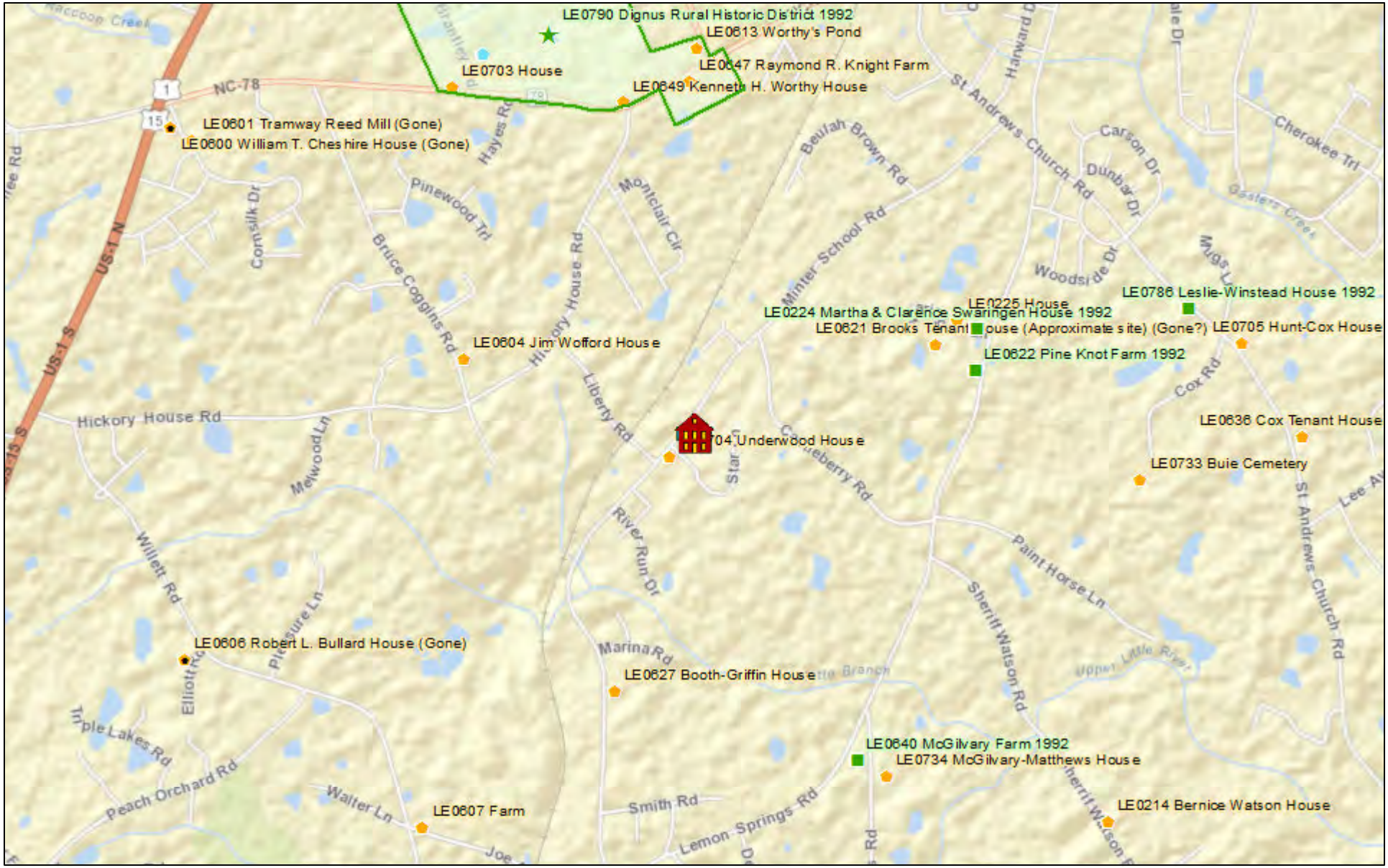
0 0.425 0.85 1.7 km

Sources: Esri, HERE, DeLorme, USGS, Intermap, increment P Corp., NRCAN, Esri Japan, METI, Esri China (Hong Kong), Esri (Thailand),

- NR Individual Listing
- NR Listing, Gone
- NRHD Center Point

Point 21

Attachment 2



June 12, 2014

1:36,112

0 0.3 0.6 1.2 mi

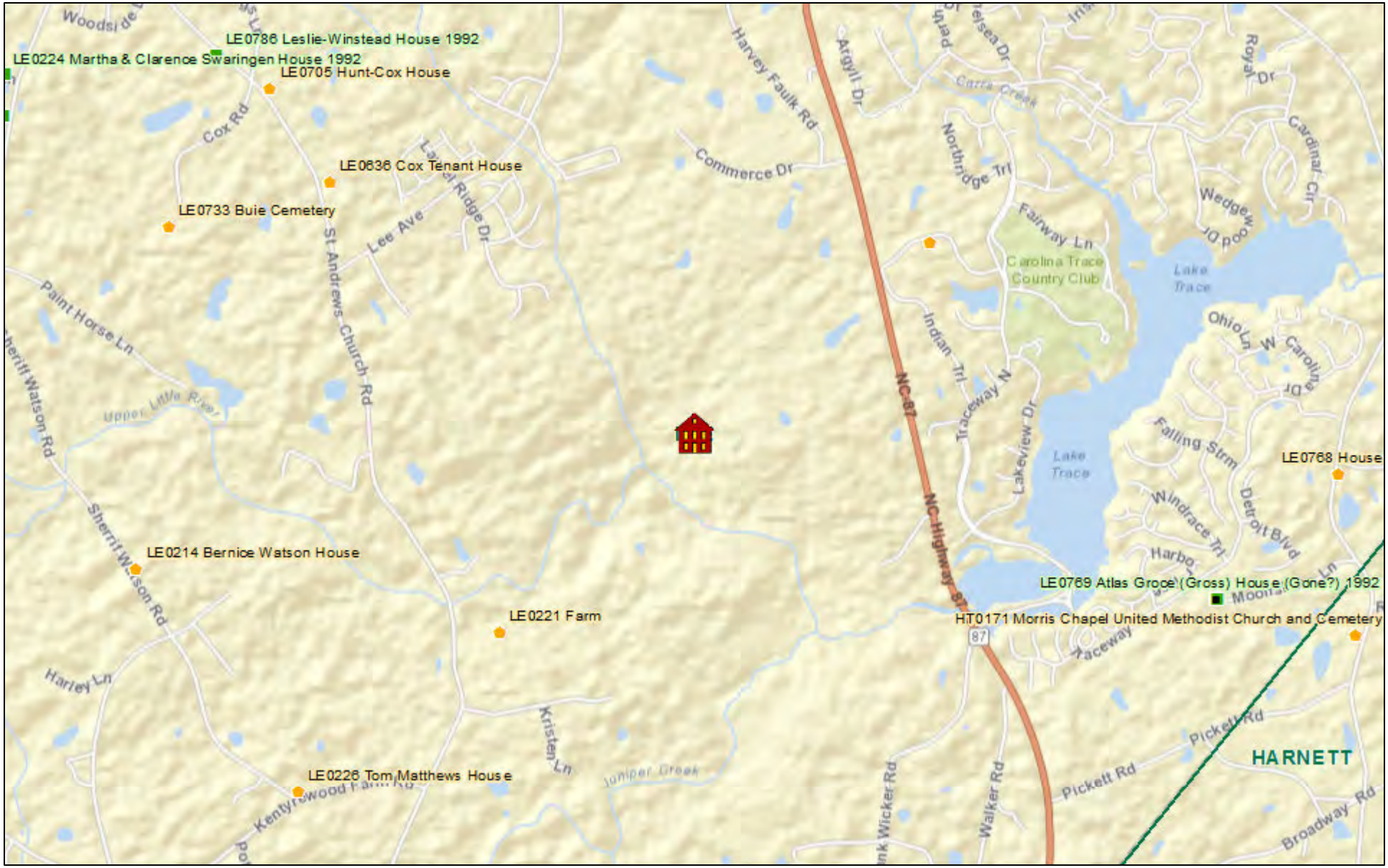
0 0.5 1 2 km

Sources: Esri, HERE, DeLorme, USGS, Intermap, increment P Corp., NRCAN, Esri Japan, METI, Esri China (Hong Kong), Esri (Thailand),

- NR Individual Listing
- NR Listing, Gone
- NRHD Center Point

Point 21A

Attachment 2



June 12, 2014

1:36,112

0 0.3 0.6 1.2 mi

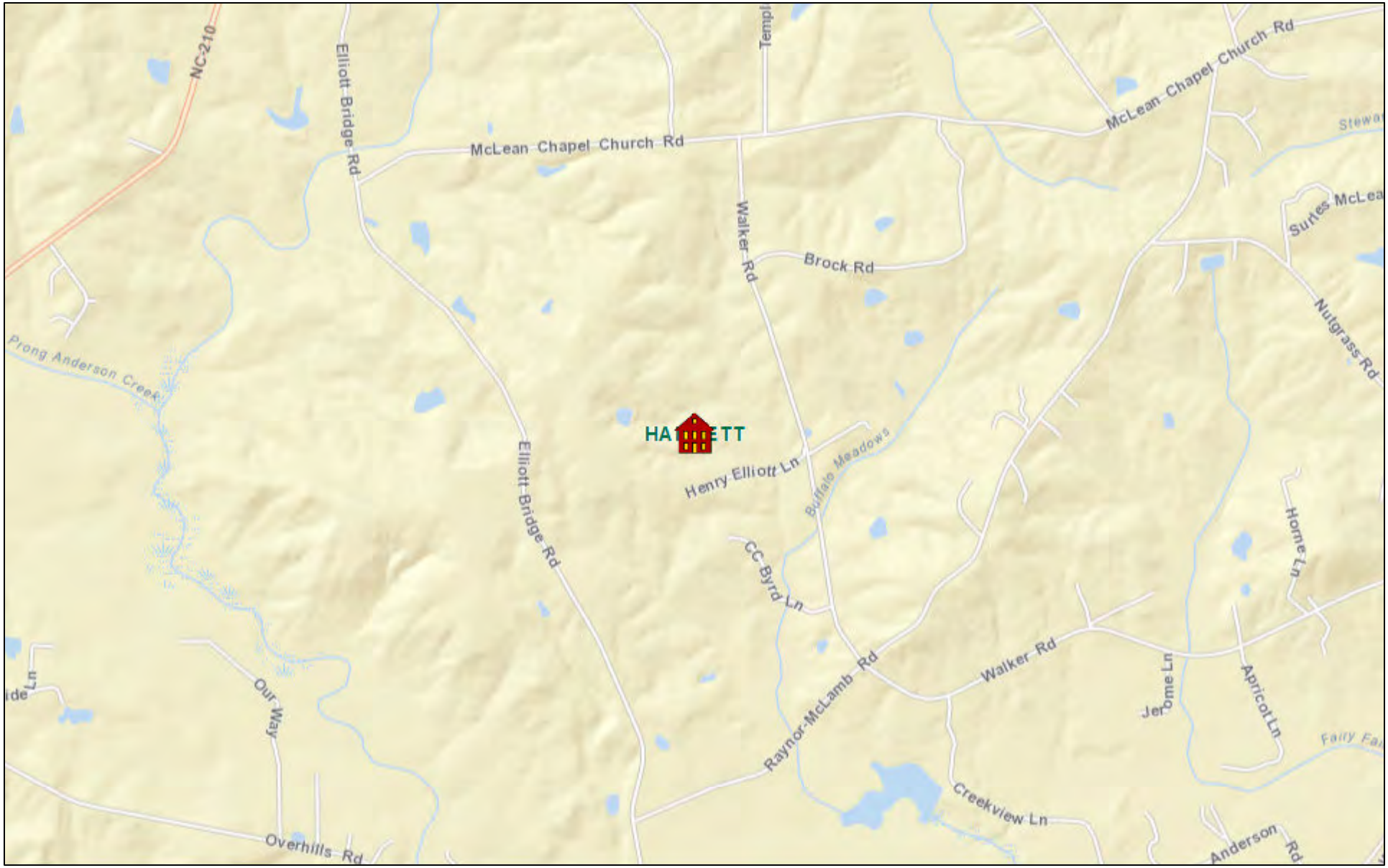
0 0.5 1 2 km

Sources: Esri, HERE, DeLorme, USGS, Intermap, increment P Corp., NRCAN, Esri Japan, METI, Esri China (Hong Kong), Esri (Thailand),

- NR Individual Listing
- NR Listing, Gone
- NRHD Center Point

Point 22

Attachment 2



June 12, 2014

1:36,112

0 0.3 0.6 1.2 mi

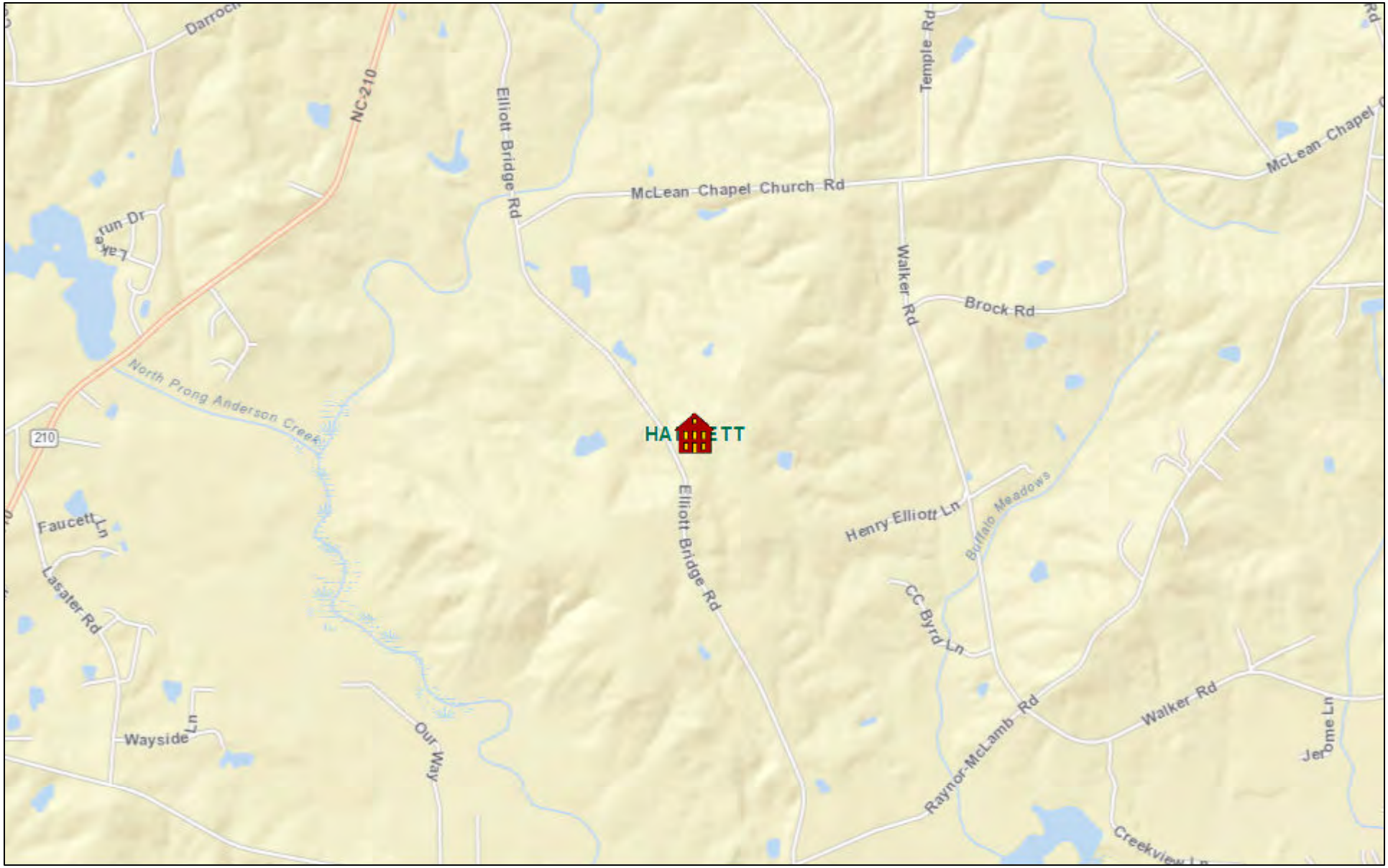
0 0.5 1 2 km

Sources: Esri, HERE, DeLorme, USGS, Intermap, increment P Corp., NRCAN, Esri Japan, METI, Esri China (Hong Kong), Esri (Thailand),

- NR Individual Listing
- NR Listing, Gone
- NRHD Center Point

Point 22A

Attachment 2



June 12, 2014

1:36,112

0 0.3 0.6 1.2 mi

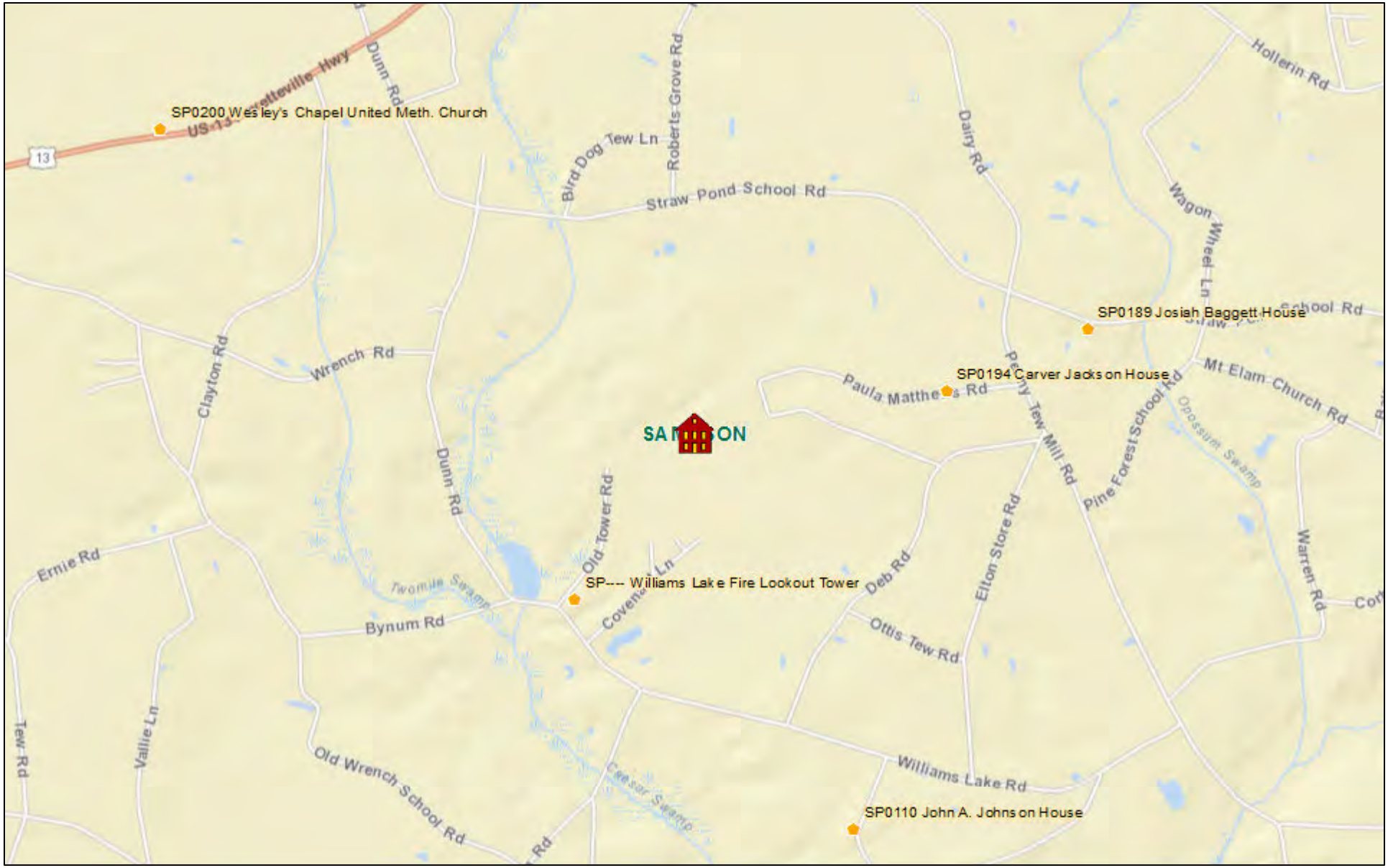
0 0.5 1 2 km

Sources: Esri, HERE, DeLorme, USGS, Intermap, increment P Corp., NRCAN, Esri Japan, METI, Esri China (Hong Kong), Esri (Thailand),

- NR Individual Listing
- NR Listing, Gone
- NRHD Center Point

Point 23

Attachment 2



June 12, 2014

1:36,112

0 0.3 0.6 1.2 mi

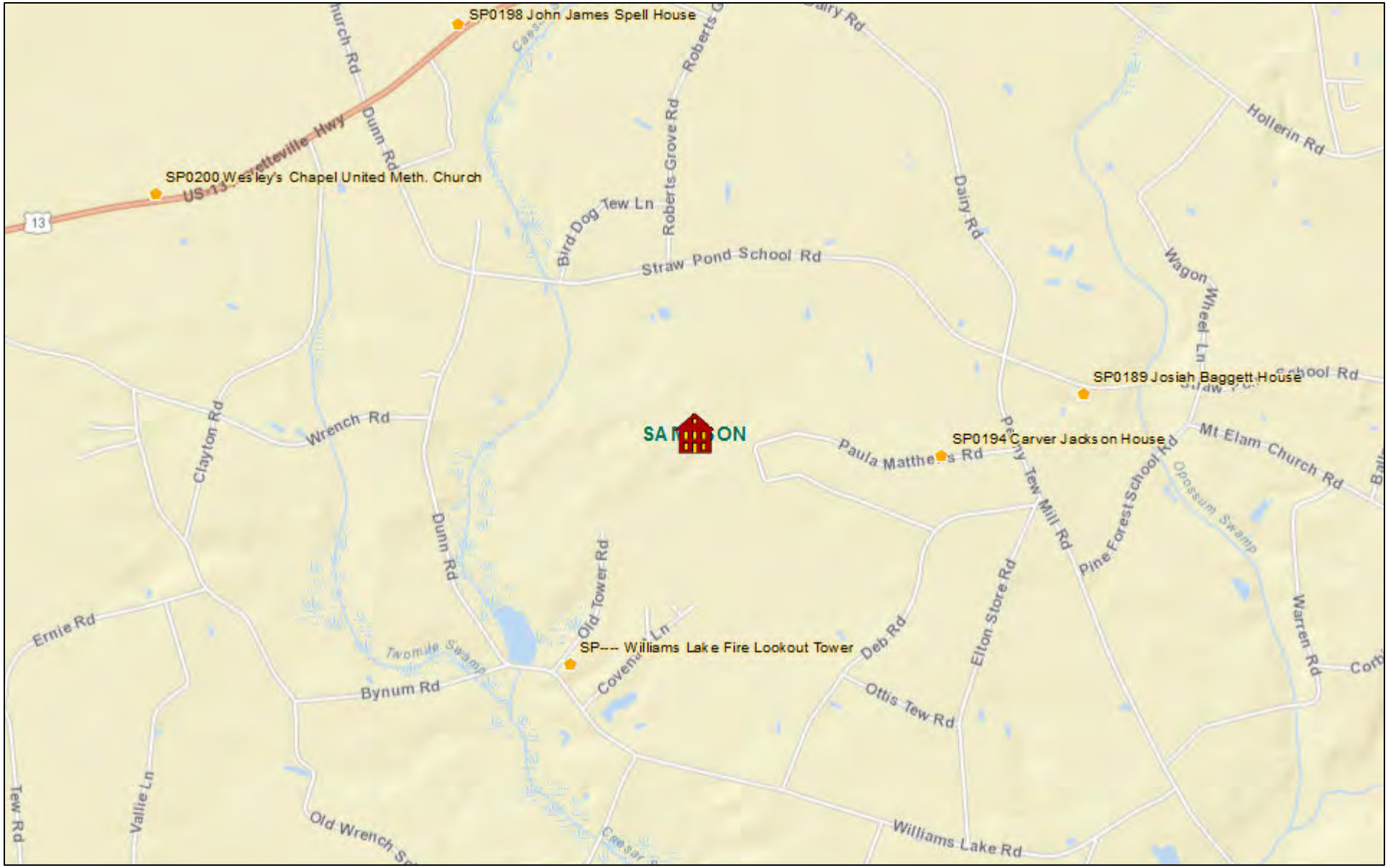
0 0.5 1 2 km

Sources: Esri, HERE, DeLorme, USGS, Intermap, increment P Corp., NRCAN, Esri Japan, METI, Esri China (Hong Kong), Esri (Thailand),

- NR Individual Listing
- NR Listing, Gone
- NRHD Center Point

Point 23C

Attachment 2



June 12, 2014

1:36,112

0 0.3 0.6 1.2 mi

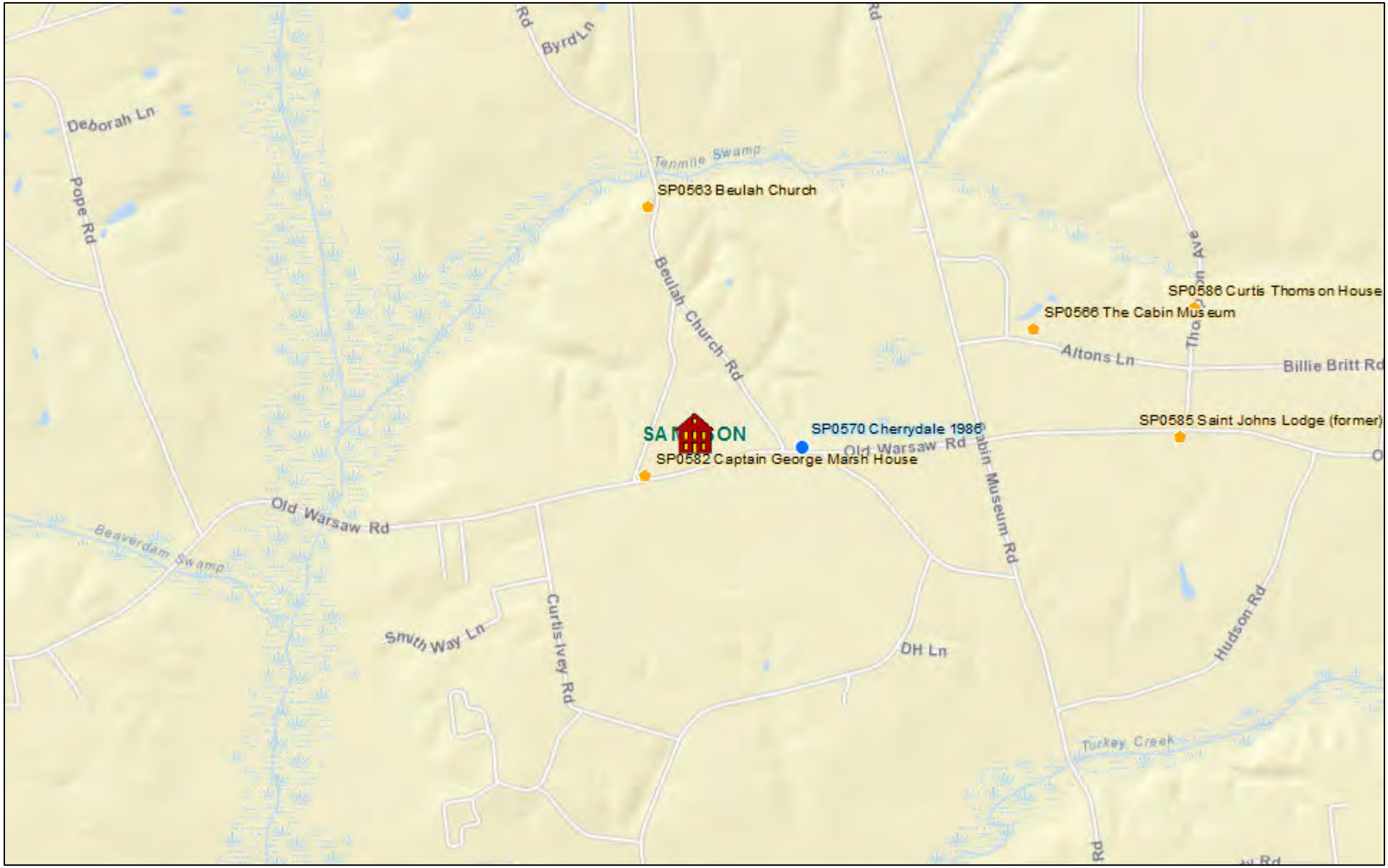
0 0.5 1 2 km

Sources: Esri, HERE, DeLorme, USGS, Intermap, increment P Corp., NRCAN, Esri Japan, METI, Esri China (Hong Kong), Esri (Thailand),

- NR Individual Listing
- NR Listing, Gone
- NRHD Center Point

Point 24

Attachment 2



June 12, 2014

1:36,112

0 0.3 0.6 1.2 mi

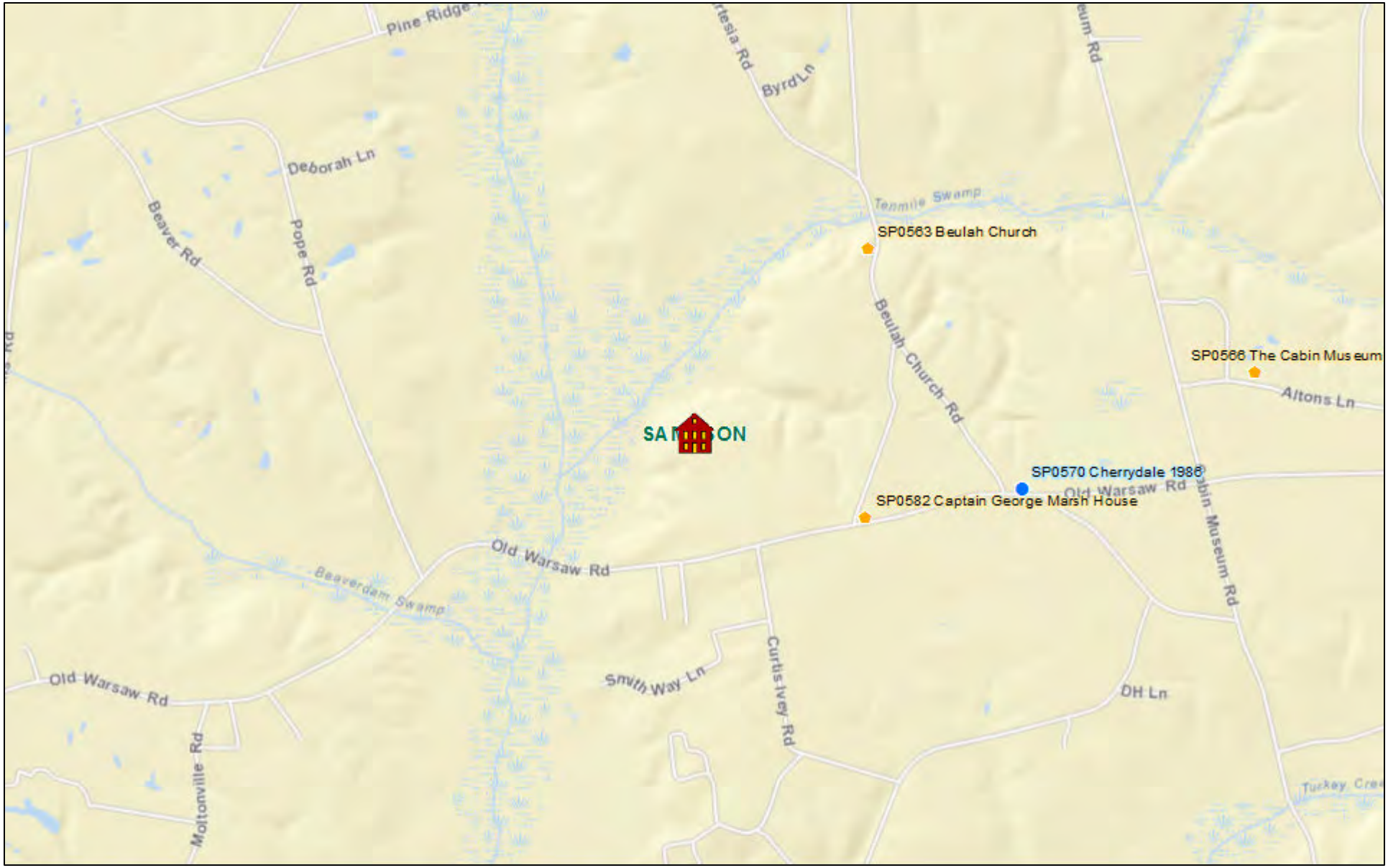
0 0.5 1 2 km

Sources: Esri, HERE, DeLorme, USGS, Intermap, increment P Corp., NRCAN, Esri Japan, METI, Esri China (Hong Kong), Esri (Thailand),

- NR Individual Listing
- NR Listing, Gone
- NRHD Center Point

Point 24A

Attachment 2



June 12, 2014

1:36,112

0 0.3 0.6 1.2 mi

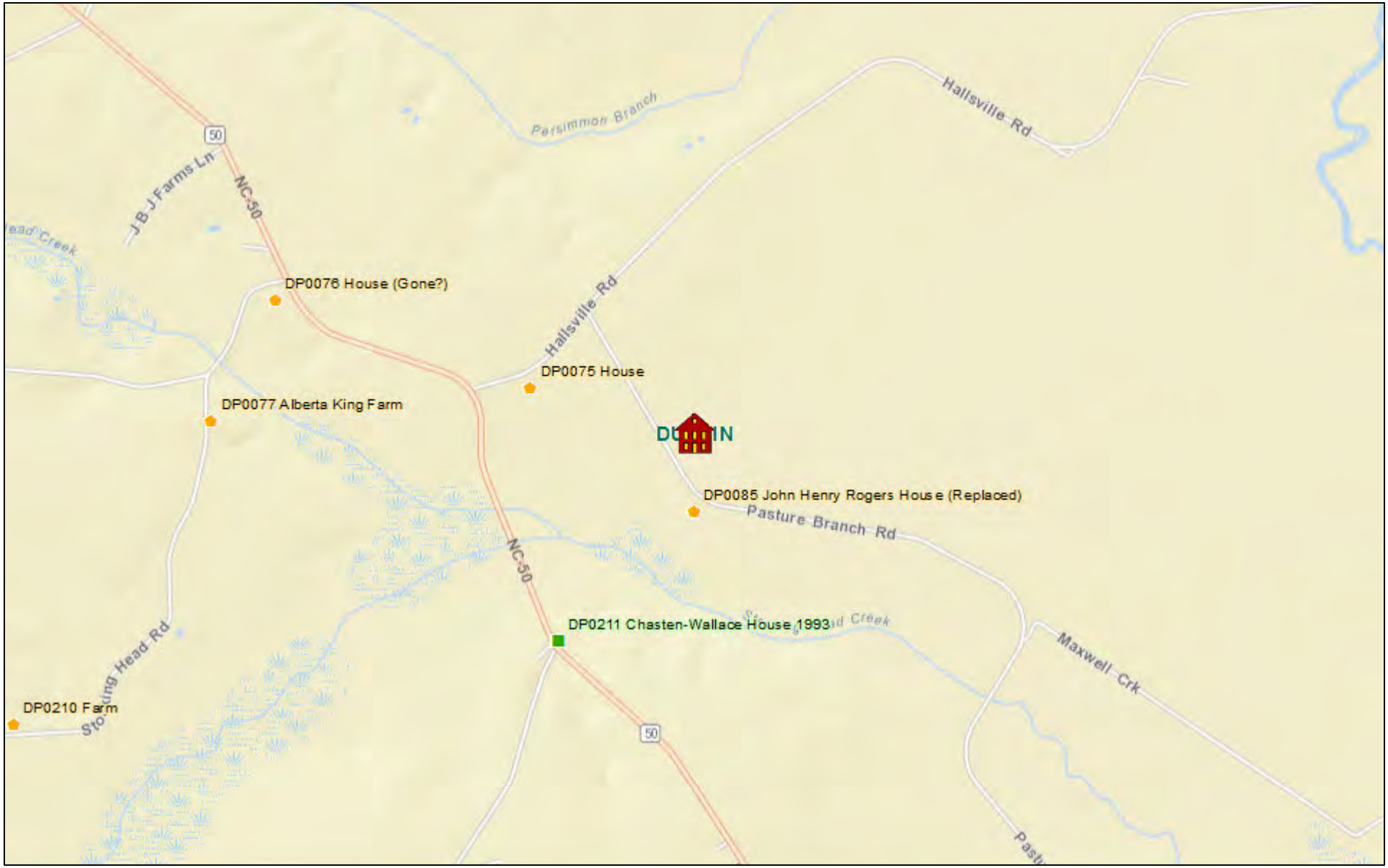
0 0.5 1 2 km

Sources: Esri, HERE, DeLorme, USGS, Intermap, increment P Corp., NRCAN, Esri Japan, METI, Esri China (Hong Kong), Esri (Thailand),

- NR Individual Listing
- NR Listing, Gone
- NRHD Center Point

Point 25

Attachment 2



June 12, 2014

1:36,112

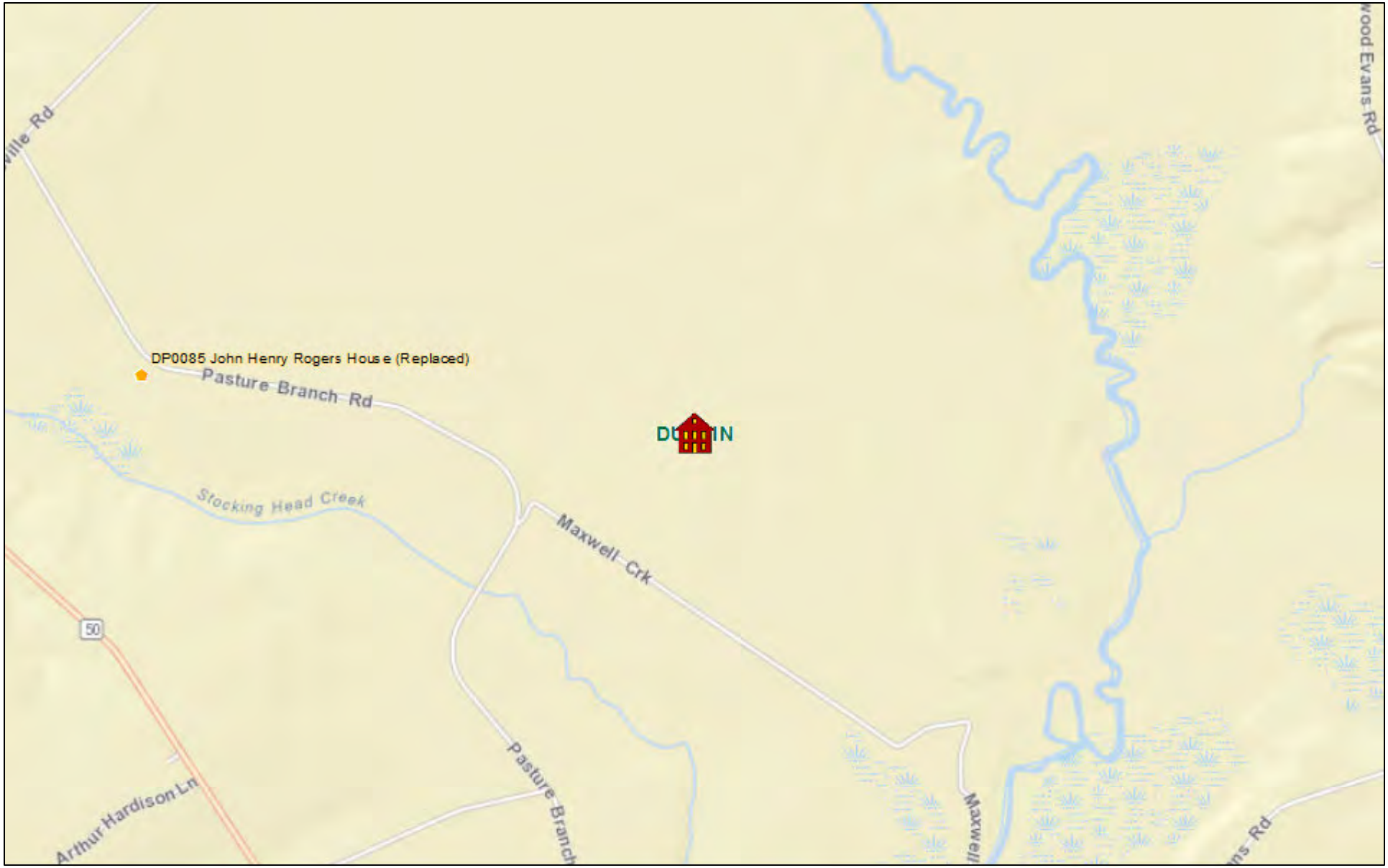
0 0.3 0.6 1.2 mi

0 0.5 1 2 km

Sources: Esri, HERE, DeLorme, USGS, Intermap, increment P Corp., NRCAN, Esri Japan, METI, Esri China (Hong Kong), Esri (Thailand),

- NR Individual Listing
- NR Listing, Gone
- NRHD Center Point

Shot Point 25A



June 18, 2014

1:31,598

0 0.25 0.5 1 mi

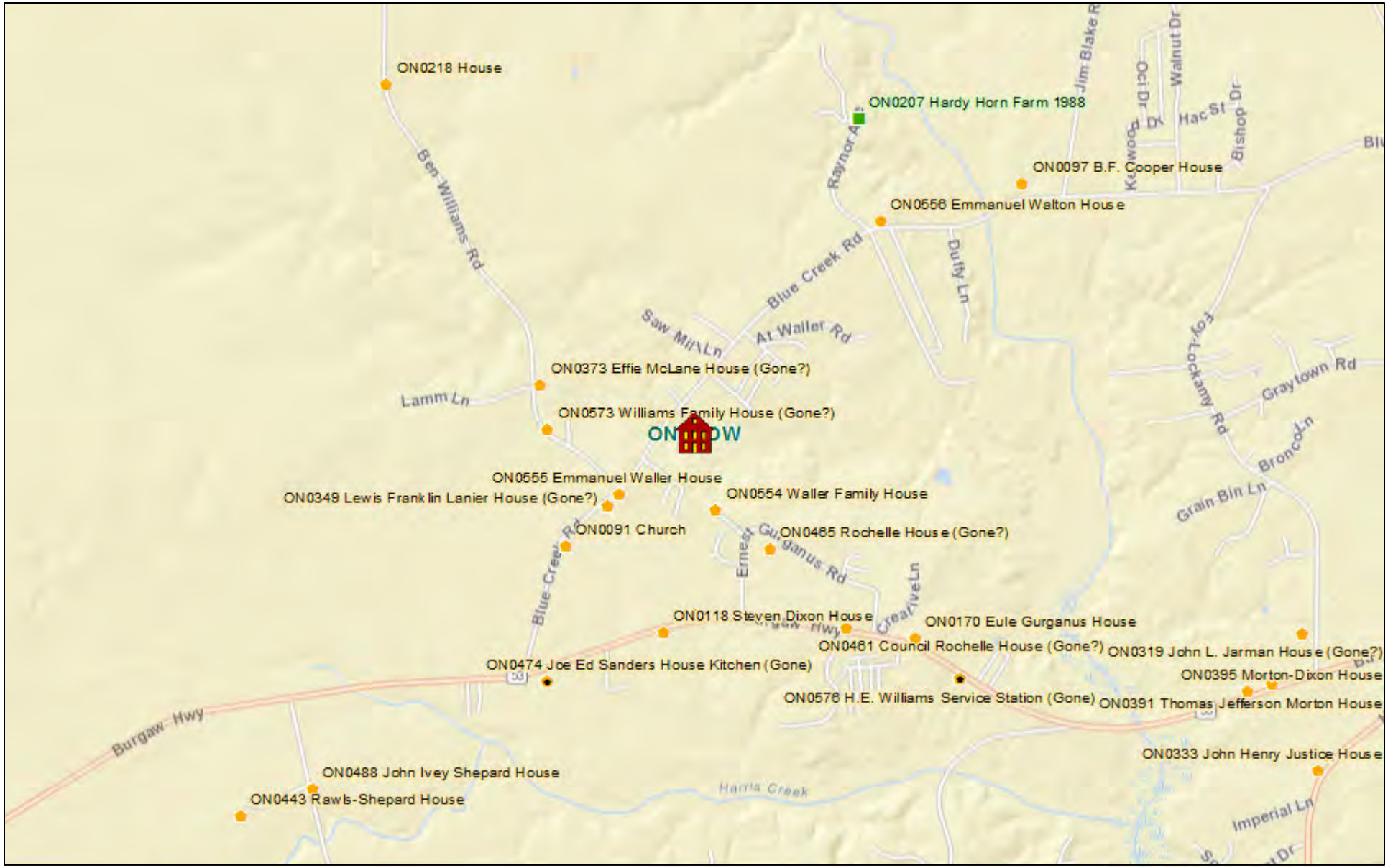
0 0.425 0.85 1.7 km

Sources: Esri, HERE, DeLorme, USGS, Intermap, increment P Corp., NRCAN, Esri Japan, METI, Esri China (Hong Kong), Esri (Thailand),

- NR Individual Listing
- NR Listing, Gone
- NRHD Center Point

Point 26

Attachment 2



June 12, 2014

1:36,112

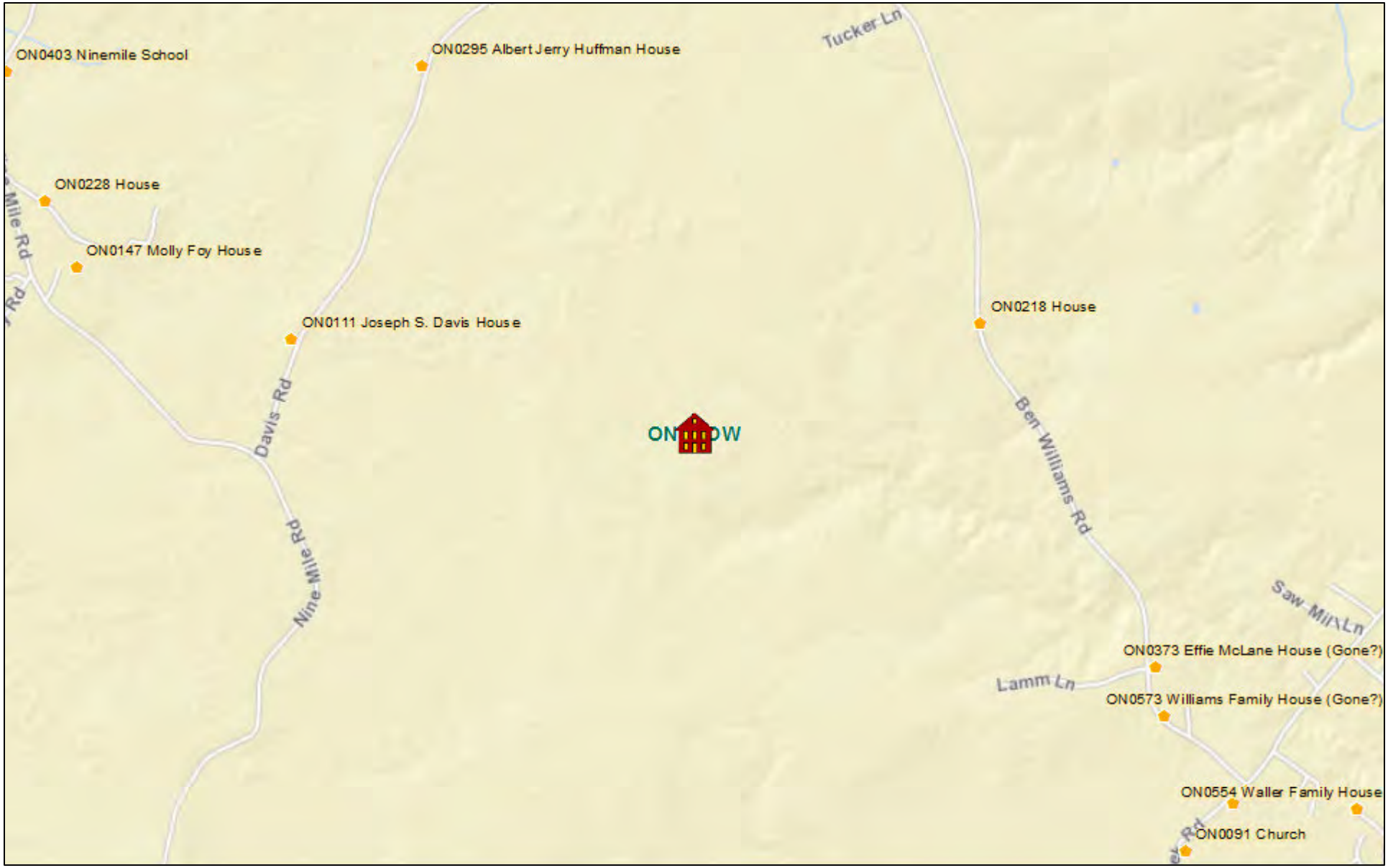
0 0.3 0.6 1.2 mi

0 0.5 1 2 km

Sources: Esri, HERE, DeLorme, USGS, Intermap, increment P Corp., NRCAN, Esri Japan, METI, Esri China (Hong Kong), Esri (Thailand),

- NR Individual Listing
- NR Listing, Gone
- NRHD Center Point

Shot Point 26B



June 18, 2014

1:31,598

0 0.25 0.5 1 mi

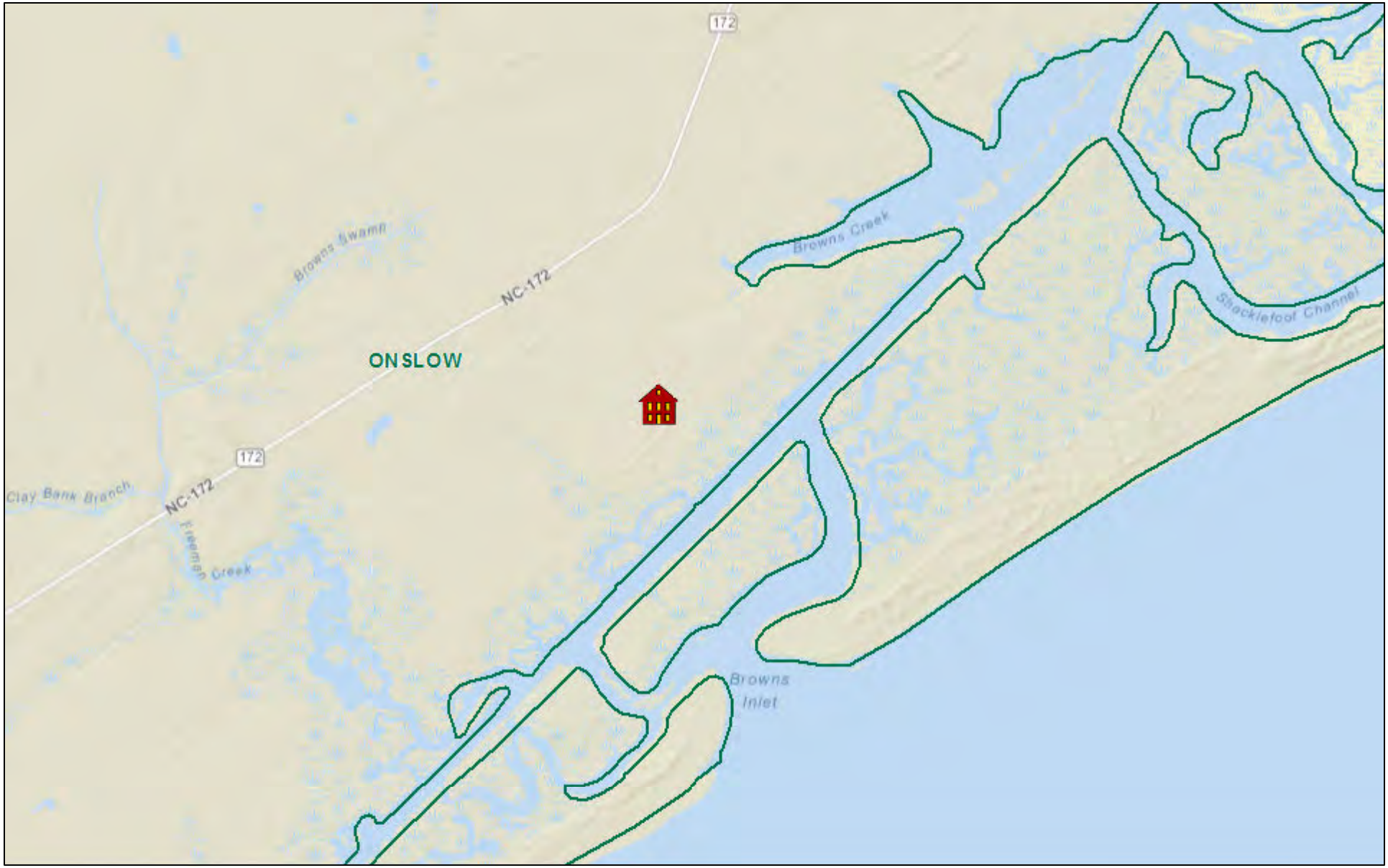
0 0.425 0.85 1.7 km

Sources: Esri, HERE, DeLorme, USGS, Intermap, increment P Corp., NRCAN, Esri Japan, METI, Esri China (Hong Kong), Esri (Thailand),

- NR Individual Listing
- NR Listing, Gone
- NRHD Center Point

Point 27

Attachment 2



June 12, 2014

1:36,112

0 0.3 0.6 1.2 mi

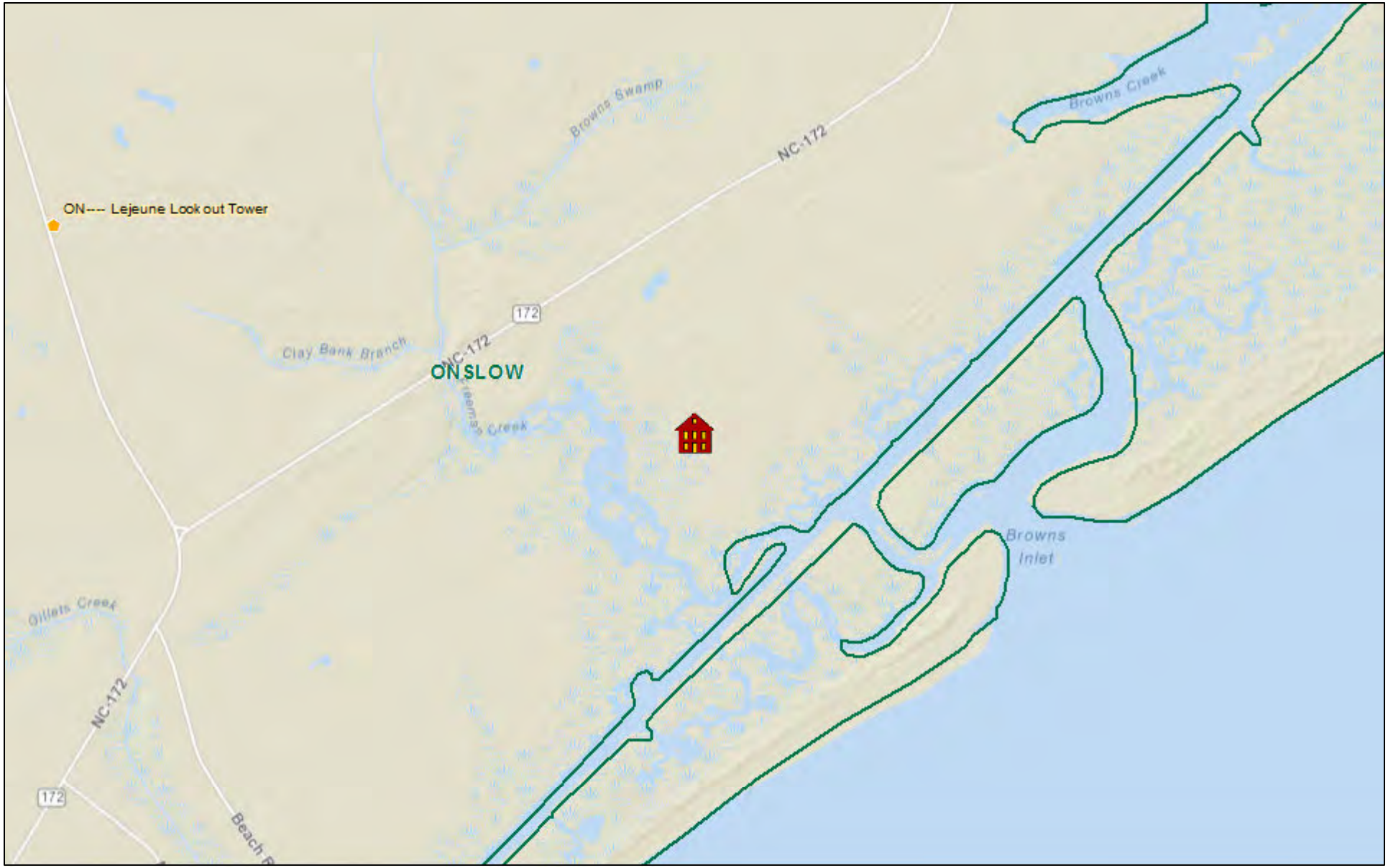
0 0.5 1 2 km

Sources: Esri, HERE, DeLorme, USGS, Intermap, increment P Corp., NRCAN, Esri Japan, METI, Esri China (Hong Kong), Esri (Thailand),

- NR Individual Listing
- NR Listing, Gone
- NRHD Center Point

Point 27A

Attachment 2



June 12, 2014

1:36,112

0 0.3 0.6 1.2 mi

0 0.5 1 2 km

Sources: Esri, HERE, DeLorme, USGS, Intermap, increment P Corp., NRCAN, Esri Japan, METI, Esri China (Hong Kong), Esri (Thailand),

- NR Individual Listing
- NR Listing, Gone
- NRHD Center Point