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5. ACTIVITY VARIABLES POSSIBLY AFFECTING CUMULATIVE IMPACTS

As noted in the previous section, the workshop participants recognized that the activities carried out at visitor sites as well as the characteristics of the sites may affect the nature and severity of possible cumulative impacts. For example, they recognized that both the timing of visits relative to the life cycles or breeding chronologies of species present at sites, and the number, frequency, and length of visits can affect the nature and severity of impacts. That is, visits that occur during egg laying, incubation, formation of mother-pup bonds, or other critical times in the life cycles of wildlife present at visitor sites have a higher likelihood of impacting biologically important behaviors than do visits carried out at other times of the year. Similarly, long visits carried out multiple times a year over many years are more likely to have cumulative impacts than fewer, shorter visits.

Other activity-related variables likely to affect the nature and severity of possible cumulative impacts include the number of visitors ashore at any one time, how long they are at the site, where they go and what they do while ashore, and how well they are briefed before hand and obey the do's and don'ts for particular sites. As a general rule, the likelihood of cumulative impacts at sites with potentially vulnerable wildlife or other features can be expected to increase in proportion to the length and frequency of visits, and the number of visitors allowed ashore at any one time. The likelihood of many possible cumulative impacts can be substantially reduced by educating visitors before they go ashore as to what they should do to avoid impacting wildlife or other vulnerable features of the site, and by supervising visitors while ashore to ensure that they comply with the applicable guidelines.

Determining whether ship-based tourism may be responsible for observed changes in the characteristics of visitor sites will require reliable information on the activity variables noted above.

6. POSSIBLE IMPACT AVOIDANCE/ MITIGATION MEASURES

Given the preceding, the workshop participants noted that a range of measures could be taken to avoid, minimize, or mitigate the possible cumulative impacts of ship-based tour operations. They include the following:

- **Limit the Number of Visits and Visitors to Particular Sites.**

As noted above, the likelihood of cumulative impacts can be expected to increase in proportion to the number and frequency of visits to particular sites and what visitors do while at those

sites. Thus, in some cases, cumulative impacts may be avoided or minimized by limiting the number of visitors and visits to sites, by season, year, and time ashore.

- **Maximize, Minimize, or Alternate the Number of Sites Visited.** If cumulative impacts are determined by the number of visits and visitors over time and the number of visits and visitors are relatively constant, it follows that impacts can be avoided or minimized by maximizing the number of sites visited, thus reducing the number of times that any one site is visited in a given period of time. However, if interest in Antarctic tourism continues to increase, the number of visits to reasonably accessible sites may increase to the point that cumulative impacts are occurring or likely to occur, in which case the best way to minimize overall impacts may be to minimize the number of sites visited and/or to alternate visiting certain sites.
- **Categorize and Develop Site-Specific Visit Guidelines for Different Types of Sites.** As noted earlier, certain sites may be more resistant or more vulnerable to cumulative impacts depending on the characteristics of the site. For example, wildlife at sites near the margins of their distributional ranges may be more vulnerable to disturbance-related declines than wildlife at sites near the centers of their distributional ranges. It therefore follows that certain cumulative impacts can be avoided or minimized by categorizing sites according to their most vulnerable attributes, and developing and implementing visit guidelines accordingly.
- **Establish Qualification Standards for Ship Operations and Expedition Staff.** Perhaps the greatest human-related threat to the Antarctic environment is oil or fuel spills resulting from accidents, such as the grounding of the A.R.A. *Bahia Paraiso* in Arthur Harbor in January 1989. Such accidents also pose one of the greatest risks to human health and safety in the Antarctic. The best ways to minimize such risks are to develop minimum standards for ships operating in the Antarctic (a task currently under consideration by the Antarctic Treaty Consultative Parties), and to ensure that the deck officers responsible for ship operations have up-to-date navigation charts and the special qualifications necessary to ensure safe ship operations in ice-covered and poorly charted waters.

With regard to ship-based tours, the environmental risks and risks to human health and safety can be further minimized by establishing training standards and/or special qualifications for expedition leaders, naturalists, zodiac drivers, and observers and by ensuring that expedition leaders and other key personnel have

accurate maps of the sites being visited. Potential adverse impacts can also be avoided by ensuring thorough and effective education and supervision of site visitors.

- **Design and Conduct Comparative Studies and Perturbation Experiments.** Available information is insufficient to accurately predict whether, or at what threshold levels, repeated visits will affect different types of sites. The most effective ways to overcome this insufficiency would be to conduct comparative studies at similar sites with different types and levels of tourist activities, and/or to intentionally vary the types and levels of tourist activities at comparable sites while monitoring the variables of concern.
- **Site Modification.** What visitors do while on shore is one of the things that can affect possible impacts. One way to prevent or minimize possible impacts at frequently visited sites, with particularly vulnerable or sensitive features, would be to mark walking paths, or to construct boardwalks and observation platforms, where appropriate, and to ensure that visitors use them.
- **Encourage Self-Regulation and Self-Policing.** The companies conducting commercial, ship-based tours of the Antarctic Peninsula area have a great deal to lose if their activities affect the landscape, wildlife, or other features of the areas of interest to tourists. As noted earlier, the International Association of Antarctica Tour Operators (IAATO) was established as a forum to cooperatively promote safe and environmentally benign opportunities for tourists to visit Antarctica. Such mechanisms provide the most cost-effective means for identifying and avoiding possible cumulative environmental impacts.
- **Establish Guidelines or Codes of Conduct for Additional Activities.** Both the tour industry and the Antarctic Treaty Consultative Parties have established guidelines for governing and reporting tourist and other non-governmental activities in Antarctica. These guidelines do not provide codes of conduct for all tourist-related activities that could have environmental impacts. As examples, there currently are no generally agreed guidelines for scuba diving or whale watching in the Peninsula area, or for approaches to, and anchoring locations at, the various sites of tourist interest. Establishing guidelines or codes of conduct for these and other tourist-related activities not covered by existing protocols could help to avoid or minimize possible cumulative environmental impacts.
- **Periodic Review and Revision of Applicable Guidelines.** Available information is not sufficient to be sure that the afore-

mentioned types of measures will be successful in avoiding, minimizing, or mitigating the possible cumulative impacts of commercial, ship-based tourism in the Antarctic Peninsula area. Thus, periodic review and revision of the applicable guidelines and codes of conduct to take account of new information is a necessary and important part of the range of measures that can be taken to avoid, minimize, or mitigate possible cumulative adverse impacts.

7. ASSESSING THE PRACTICALITY OF POSSIBLE MANAGEMENT MEASURES

All possible measures for assessing and avoiding or minimizing the cumulative effects of commercial, ship-based tourism may not be practical to implement. As an example, it would be prohibitively costly to attempt to monitor every site in the Antarctic Peninsula area that might be subject to ship-based tourism, even if baseline information on those sites were already available. When assessing possible management measures, the decision makers must consider the practicality and cost of implementing the measures, as well as the need for management action. Variables that may need to be considered include 1) the likely acceptance of the measure(s) by the Antarctic Treaty Consultative Parties, by IAATO members, and by tour operators not members of IAATO; 2) the ease and economic consequences of implementation; 3) possible alternative measures; 4) the actual and perceived effectiveness of existing measures; 5) the uniqueness or novelty of the site to which the measure(s) would apply; 6) the evidence indicating that a cumulative impact is occurring or likely to occur and that the contemplated measure(s) would prevent, minimize, or mitigate the impact; and 7) the presence of a comparable, similarly accessible site or sites near the site that the management measure(s) would affect.

8. ONGOING RESEARCH AND MONITORING PROGRAMS OF POTENTIAL RELEVANCE

There are several long-term research and monitoring programs being conducted in the Peninsula area that are compiling information potentially useful for detecting the possible cumulative environmental effects of tourism and other activities in the area and changes due to natural factors such as change in climate. They include 1) the Antarctic Site Inventory being carried out by Oceanites, a non-governmental organization; 2) the Antarctic Marine Living Resources (AMLR) Research Program being carried out by the Southwest Fisheries Science Center of