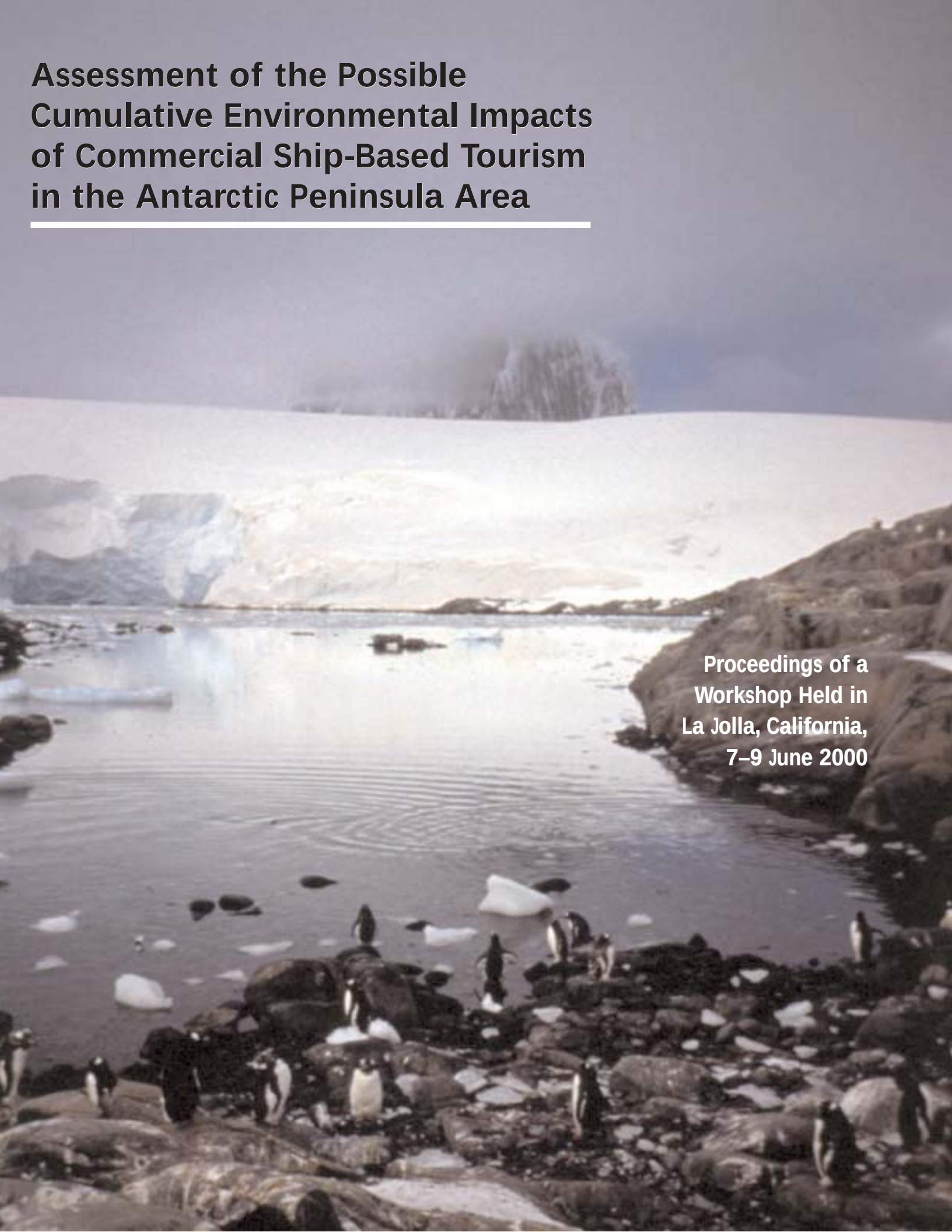
Assessment of the Possible Cumulative Environmental Impacts of Commercial Ship-Based Tourism in the Antarctic Peninsula Area



Proceedings of a Workshop Held in La Jolla, California, 7–9 June 2000

Cover photograph: Gentoo penguins at a rookery near the Antarctic Peninsula.
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Edited by
Robert J. Hofman (retired), Marine Mammal Commission
Joyce Jatko, Environmental Officer, Office of Polar Programs

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EXECUTIVE SUMMARY

Tourism in Antarctica, particularly ship-based tourism in the Antarctic Peninsula area, has increased steadily in the last decade. Currently available information is insufficient to accurately predict how or to what extent the physical features and biota at particular sites may be affected by repeat visits or to accurately predict the frequency and duration of visits likely to produce particular effects or how those effects might best be avoided.

A number of studies have been and are being done that provide the kinds of data needed. It is not clear, however, whether these studies are providing all of the needed information and, if not, what additional research and monitoring are necessary to resolve the uncertainties.

To help address these issues, a workshop was held in La Jolla, California, June 7–9, 2000, jointly sponsored by the U.S. National Science Foundation (NSF), the U.S. Environmental Protection Agency (EPA), and the International Association of Antarctica Tour Operators (IAATO). The principal objectives of this workshop were to: identify the types of cumulative environmental impacts that possibly could result from commercial, ship-based tourist operations in the Antarctic Peninsula area; review on-going research and monitoring programs in the Peninsula area to determine whether they likely will be able to detect the possible cumulative adverse effects of ship-based tourism before they reach significant levels, and; describe changes in existing research and monitoring programs or additional programs that would be required to detect cumulative adverse effects before they reach significant levels.

Participants included scientists from several countries with many years of research experience in Antarctica, representatives of companies engaged in Antarctic tour operations, and representatives of U.S. government agencies with responsibilities for implementing the provisions of the Environmental Protocol.

The first set of presentations focused on overview of commercial ship-based tour operations in the Peninsula area. Topics included an historical overview of tourism, how expeditions are planned, and how activities ashore are managed. Additional presentations and discussions considered examples of possible cumulative environmental impacts and the site variables and activity variables possibly affecting cumulative impacts. Presentations were also made by researchers involved in long-term research and monitoring programs being conducted in the Peninsula area and near McMurdo Station. Among other things, these study results indicated that long-term studies are likely to be necessary to detect any possible cumulative impacts of ship-based tourism.

Currently available information is insufficient to accurately predict how or to what extent the physical features and biota at particular sites may be affected by repeat visits.

In the discussions, the participants noted that a range of measures could be taken to avoid, minimize, or mitigate the possible cumulative impacts of ship-based tour operations. These measures included limiting the number of visits and visitors to particular sites; maximizing, minimizing, or alternating the number of sites visited; developing site-specific visit guidelines for different types of sites; establishing qualification standards for ship operations and expedition staff; conducting comparative studies and perturbation experiments; instituting site modifications such as marking walking paths; encouraging self-regulation and self-policing; and establishing and periodically reviewing guidelines or codes of conduct for activities not already covered by existing protocols.

Reliable information on both tourist and non-tourist activities at particular sites will be needed to do the kinds of analyses required to determine the likely cause or causes of any observed changes in the variables being monitored.

The presentations and discussions led the workshop participants to identify specific needs and opportunities for detecting, avoiding, or mitigating cumulative adverse impacts from ship-based tourism in the Antarctic Peninsula area. These needs and opportunities fall into four general categories:

1) Site Monitoring
2) Coordination with Related Research and Monitoring Programs
3) Tour Planning
4) Expediting Long-Term Program Planning and Evaluation.

Site Monitoring

1. For reasons of cost effectiveness and practicality, it would be desirable to identify and focus monitoring efforts on a series of sites believed to be representative of the types of sites of interest to, and being visited by, tourists in the Peninsula area.
2. The Antarctic Site Inventory project is providing the types of information needed to detect possible long-term cumulative impacts at typical sites. At present, however, the project lacks a stable, long-term funding base. It is not clear whether the sampling regime being used is adequate to detect any but major changes in the variables being monitored; whether all potentially relevant variables are being monitored; or whether variables being monitored will yield useful results.
3. Observations at a series of comparable sites along a gradient with different types and levels of tourist activities and/or observations at a series of comparable sites subjected intentionally to different types and levels of tourist activities likely will be necessary to distinguish any cumulative environmental impacts resulting from tourist activities from those caused by other factors.
4. Reliable information on both tourist and non-tourist activities at particular sites will be needed to do the kinds of analyses required

to determine the likely cause or causes of any observed changes in the variables being monitored. Procedures should be established to periodically review the data currently being collected to assure that it will enable meaningful retrospective analyses.

Coordination with Related Research and Monitoring Programs

5. Long-term observation will be necessary to detect possible cumulative environmental impacts of ship-based tourism in the Peninsula area.
6. If continued for the foreseeable future, the AMLR, LTER, and other research programs being carried out in the Peninsula area should detect region-wide changes in potentially affected penguin, sea bird, and seal populations and provide the kinds of information needed to determine whether any changes detected at tourist visitor sites are due to natural processes, fisheries, scientific research, or tourist activities.
7. Mechanisms should be established by the various organizations conducting or supporting related research in the Peninsula area to coordinate research planning, share data and logistic support, and cooperatively analyze and report data of mutual interest. Standard methods for collecting and formats for recording data of common interest should be established. Consideration should be given to establishing common base maps and geographic information systems for archiving and analyzing data with geographic attributes.
8. Efforts should be made to promote development of innovative research proposals and to seek funding from both government and private sources for short-term studies to document how disturbance affects the behavior and reproductive success of various species and for long-term monitoring to detect population level effects. Procedures should be developed to take advantage of the research opportunities afforded by accidents or by natural catastrophes.
9. Consideration should be given to long-term international programs to monitor the presence, level and effects of biological and chemical contaminants and disease organisms in indicator areas and species and to encouraging research coupling marine and terrestrial systems.

Tour Planning

10. It would be desirable to develop site-specific visit guidelines to manage tourist activities at sites which are visited frequently and which contain flora, fauna, geological features, or historic artifacts that may be particularly vulnerable to damage or destruction.
11. Codes of conduct or guidelines should be established for tourist-related activities for which appropriate guidelines do not currently exist (e.g., whale watching, scuba diving, camping).

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12. Basic qualification standards should be established for deck officers, expedition leaders, naturalists, zodiac drivers, and observers responsible for safe and environmentally benign tour operations in the Peninsula area.

Expediting Long-Term Program Planning and Evaluation

13. Recognizing the broad scope and complexity of these tasks, the most effective way to proceed might be to establish an independent steering group, made up of appropriate experts, to assist in scoping, implementing, and overviewing needed actions. Among other things, such a group might:

    - Develop or oversee development of a handbook of standard methods for characterizing tourist visitor sites and detecting the possible cumulative impacts of ship-based tourism;
    - Assist in the identification of representative "type" areas in which monitoring efforts should be focused;
    - Help identify and determine how best to access historic data and data from ongoing research and monitoring programs that could contribute to detecting and determining how best to avoid, minimize, or mitigate the possible adverse cumulative effects of ship-based tourist activities in the Peninsula area; and
    - Assist in the development of site-specific codes of conduct, visit guidelines, and monitoring plans for the most frequently visited areas.

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1. INTRODUCTION

Tourism in Antarctica, particularly ship-based tourism in the Antarctic Peninsula area, has increased steadily in the last decade. It is unlikely that any single visit by tourists to particular sites in the Peninsula area will have significant environmental effects if they are carried out in accordance with 1) the applicable provisions of the Protocol on Environmental Protection to the Antarctic Treaty (hereafter referred to as the "Protocol" or "Environmental Protocol"), 2) the Guidance for Visitors to the Antarctic and Guidance for Those Organizing and Conducting Tourism and Non-governmental Activities in the Antarctic provided in the 1994 Antarctic Treaty Consultative Meeting (ATCM) Recommendation XVIII-1 (Attachment 1), and 3) the post visit site report guidelines for tourism and non-governmental activities adopted at ATCM XIX (Attachment 2). However, it is possible that multiple visits to some areas, during the same year or over a series of years, could have cumulative adverse effects, even if the visits are carried out in accordance with the provisions of the Protocol and applicable guidelines.

Currently available information is insufficient to accurately predict how or to what extent the physical features and biota at particular sites may be affected by repeat visits. Similarly, available information is insufficient to accurately predict the frequency and duration of visits likely to produce particular effects, i.e., to predict likely cause-effect relationships. Available information also is insufficient to determine how best to avoid or mitigate possible cumulative adverse effects and whether effects are related linearly to the level of activity or occur only when disturbance reaches some threshold level.

A number of studies have been and are being done that provide the kinds of data necessary to assess and determine how best to prevent or mitigate the possible cumulative effects of tourist activities in the Peninsula area. However, it is not clear whether these studies are providing all of the needed information and, if not, what additional research and monitoring are necessary to resolve the uncertainties. Thus, the principal objectives of this workshop were to:

1. Identify, based upon available information and experience elsewhere, the types of cumulative environmental impacts that possibly could result from commercial, ship-based tourist operations in the Antarctic Peninsula area;
2. Review on-going research and monitoring programs in the Peninsula area to determine whether they likely will be able to detect the possible cumulative adverse effects of ship-based tourism before they reach significant levels (i.e., levels that would not be

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considered minor or transitory under the Environmental Protocol); and,

3. Describe changes in existing research and monitoring programs or additional programs that would be required to detect cumulative adverse effects before they reach significant levels.

The workshop was sponsored jointly by the U.S. National Science Foundation (NSF), the U.S. Environmental Protection Agency (EPA), and the International Association of Antarctica Tour Operators (IAATO). It was held in La Jolla, California, on 7–9 June 2000. The overall objectives are provided in Attachment 3. Participants shown in Attachment 4 included scientists from several countries with many years of experience conducting research in Antarctica, and representatives of companies engaged in Antarctic tour operations and U.S. government agencies with interests and responsibilities for implementing the provisions of the Environmental Protocol and related U.S. statutes and regulations. Attachment 5 is the meeting agenda.

Three discussion groups were established to facilitate consideration and identification of the range of views concerning the key issues on the agenda. The facilitators, rapporteurs, and members of the working groups are shown in Attachment 6.

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2. OVERVIEW OF COMMERCIAL SHIP-BASED TOUR OPERATIONS IN THE PENINSULA AREA

Attachment 7 is a time line indicating some of the important events in the history of Antarctica. The Antarctic tourism industry is generally considered to have begun in the late 1950s when Chile and Argentina took more than 500 fare-paying passengers to the South Shetland Islands aboard a naval transport ship.

The concept of "expedition cruising," with education a major theme, began when Lars-Eric Lindblad led the first tourist expedition to Antarctica in 1966. Lindblad once said, "You can't protect what you don't know." He believed that providing first-hand experience to tourists would alert them to the ecological sensitivity of the Antarctic environment and promote a greater understanding of the earth's resources and the important role of Antarctica in the global environment. The modern expedition cruise industry was born in 1969 when Lindblad built the world's first expedition ship — the *M/S Lindblad Explorer* — designed specifically for carrying tourists to the Antarctic. Before 1969, human activity in Antarctica had been limited to exploration, commercial hunting of seals and whales, commercial fishing, and scientific research. Antarctica's physical isolation, extreme climate, and remarkable scenery and wildlife are a great part of its attraction to tourists. Lindblad's model

of expedition cruising continues to be followed by the majority of companies operating ship-borne tours to Antarctica.

In 1991, seven tour operators active in Antarctica formed the International Association of Antarctica Tour Operators (IAATO) to advocate, promote, and practice environmentally responsible private-sector travel to Antarctica. By then, the Antarctic tour industry had expanded to include such activities as "flight-seeing" (flying passengers over scenic parts of the continent in jet aircraft without landing), and land-based adventure tours, including mountain climbing, skiing, and wildlife photography. During the 1991–1992 austral summer, tourists for the first time out numbered the scientists and support personnel working in the Antarctic Treaty area. During the 1999–2000 austral summer, an estimated 14,436 tourists were carried to the Antarctic by 14 IAATO-member companies operating 16 ships and one yacht, and by three non-IAATO member companies operating four ships (see Attachment 8). An estimated additional 139 tourists participated in land-based programs. Nine "flight-seeing" tours, carrying approximately 3,412 tourists and 193 crew members, were operated out of Australia to the Ross Sea region using Boeing 747 aircraft.

Both the National Science Foundation and IAATO compile statistics on tourist activities in Antarctica. Attachment 9 identifies the sites in the Antarctic Peninsula area visited from 1989 through 1999, and the number of passengers landed at the various sites each year. More than 150 different sites were visited during this period, some many times each year, others only infrequently. The five most visited sites during this period were Port Lockroy on Wiencke Island, Whalers Bay and Pendulum Cove at Deception Island, Cuverville Island, and Gonzalez Videla Station in Paradise Bay (see Attachment 10). Antarctic tourist trends from 1992–1993 through 1999–2000 are shown in Attachment 11.

Expedition Planning. Selecting sites to visit during ship-borne tourist expeditions to the Peninsula area generally occurs in two phases (see Attachment 12). Phase one involves developing and circulating tentative itineraries to other tour operators prior to commencement of the expedition. Phase two is the adjustment of the preliminary itinerary on a day-to-day basis to respond to environmental conditions and opportunities encountered in the course of the expedition.

Each tour has an Expedition Leader with first-hand knowledge of the points of interest in the Peninsula area. In most cases, both the preliminary itinerary planning and the day-to-day site selection are done by the Expedition Leader. In some cases, the company running the ship carries out the preliminary phase one planning, while the Expedition Leader makes the day-to-day decisions as to which sites are visited.

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expeditions, etc.) are considered during both preliminary planning and day-to-day site selection. Itineraries generally are planned and carried out to include sites with diverse wildlife (e.g., colonies of penguins, flying birds, and seals), sites of historic interests (e.g., old whaling and sealing stations), a visit to a scientific station, and areas with spectacular views of mountains, icebergs, and other natural features. For marketing purposes, special efforts may be made during certain cruises to cross the Antarctic Circle or to land passengers on the continent.

In the planning process, Expedition Leaders attempt to identify itineraries that will provide clients as exciting and diverse an experience as possible, within the constraints of time and, most importantly, of safety. Usually two or more site visits are planned each day, and nighttime hours are spent traveling. Surf, wind, and ice conditions often preclude safe landings at some sites. Communication is maintained between vessels throughout the season so that two passenger ships do not arrive at the same sites simultaneously. Decisions regarding environmental matters are made on a case-by-case basis as situations warrant. For example, if a ship carrying 100 passengers arrives at a penguin rookery on a very high tide with little exposed beach and little or no room for tourists to walk without disturbing the birds, passengers either will not be landed or will be landed only in small groups.

Managing Activities Ashore. IAATO has developed and adopted standard operating procedures (yearly instructions to Captains, Expedition Leaders, and expedition staff, Attachment 13) and guidelines prescribing 1) the maximum number of tourists (100) that can be ashore at any one time, 2) distances that tourists must stay from wildlife, and 3) the minimum ratio (1:20) of guides to tourists on shore (Attachment 14). Passengers are briefed before leaving the ship as to what can be seen at the site, where they should and should not go, the locations of any particular dangers or environmentally sensitive areas, and the locations of any Antarctic Specially Protected Areas (ASPAs). They are also briefed on the requirements of ATCM Recommendation XVIII-1, Guidance for Visitors to the Antarctic and given a copy for future reference. Staff go ashore before passengers to scout each landing and to assess any unique situations specific to the landing site. Upon arrival ashore, passengers are reminded of the salient points of the briefing, and both specific dangers and sensitive areas are pointed out.

Site visits typically are structured in one of two ways, depending upon the site. At some sites, staff are positioned at key points of interest and near potentially sensitive areas to provide directions, answer questions, and ensure that their charges act in accordance with the applicable guidelines. At other sites, passengers are divided into small groups that are led around the site by a guide. Hikes are accompanied by one or more guides, depending upon the number of passengers participating.

3. EXAMPLES OF POSSIBLE CUMULATIVE ENVIRONMENTAL IMPACTS

Repeated visits by ship-based tourists, coupled with other human activities, could have cumulative effects on the landscape, flora, fauna, historical artifacts, and science programs and support activities in the areas visited, and on nearby marine areas. As noted in the next section of this report, the nature and severity of the possible cumulative effects may differ from site to site depending on the characteristics of the sites and variables such as the frequency of visits. The following are examples of possible cumulative impacts identified by the workshop participants.

Landscape. The topography, geology, and other physical characteristics of the sites visited by tourists and others may be changed in a number of ways over time as a consequence of those visits. Repeated grounding of boats and off-loading and loading of passengers at access sites may disturb sand and gravel, and increase the rate of beach erosion. Visitors walking from landing beaches to points of interest at the sites may compact soil and wear footpaths, which in turn may cause increased wind and water erosion, alter the topography of the area, and affect where snow, ice, and rain water accumulate, and when and how snow and ice melt and run-off occur. If not well educated before going ashore, and supervised while on shore, visitors may discard and over time sites may accumulate litter such as food remnants, candy wrappers, cigarette butts, film boxes and containers, soda cans, sandwich wrappers, gloves, and other items of clothing. Litter can both affect the aesthetics of sites and, as noted below, harm wildlife in a variety of ways. Visitors also may unintentionally introduce non-indigenous flora and fauna, including microorganisms, which can affect soil formation and, as noted below, displace or harm indigenous flora and fauna. Further, particulates and chemicals in exhausts from ship engines and small boat motors can be transported to and accumulate on land, on snow and ice, and in melt pools.

Terrestrial Flora. Repeated visits of sites with assemblages of grasses, mosses, and lichens can have a variety of effects on the distribution, abundance, and productivity of the vegetation. For example, walking on mosses and lichens can crush and uproot them, and over time wear pathways and compact soil, which in turn can affect the retention and flow of water and cause soil erosion beyond the areas directly affected. Such damage may also affect the soil substrate and competitive ability of some species and lead to changes in species composition and increased vulnerability to invasion by non-native species. Damage and destruction of floral assemblages and related ecological processes (e.g., soil formation) also may be caused or enhanced by deposition of combustion products from ship and small-boat engines, and

The nature and severity of the possible cumulative impacts of ship-based tourism will depend in part on the characteristics of the sites visited.

by accidental introduction of non-indigenous species, including pathogenic microorganisms.

Terrestrial Fauna. As noted earlier, one of the principal reasons that tourists visit the Peninsula area is to see the various species of penguins, flying birds, and seals that are present on land there during the spring and summer reproductive seasons. If not done carefully and with adequate supervision, people visiting sites to see these species first-hand can accidentally trample cryptic eggs and nests, and disturb animals in ways that 1) cause them to abandon nesting and pupping sites; 2) interfere with incubation of eggs, formation of mother-pup bonds, and tending of young; 3) increase the vulnerability of bird eggs and chicks to skua predation and of penguins and young seals to leopard seal predation; and 4) cause stress that makes animals more susceptible to diseases and parasites. Over time, such mortality and disturbance can cause shifts in colony locations or boundaries, declines in the number and sizes of breeding colonies, and maladaptive changes in behavior that can escalate declines in productivity and abundance (e.g., increased intra-species aggression, and less time spent attending and feeding young).

As noted below, the nature and severity of impacts may vary depending upon when during the breeding cycle disturbance occurs.

Historic Sites and Monuments. Many tourists have read about the history of human activities in Antarctica and are interested in visiting old whaling and sealing stations, such as those on Deception Island, and the locations or remains of historic structures, such as those at Port Lockroy. The buildings and artifacts at such sites have been subject to decades of weathering and any disturbance can expedite further degradation. Also, while the visitor guidelines set forth in ATCM Recommendation XVIII-1 make specific reference to not defacing or vandalizing buildings, or taking parts or contents of buildings or other artifacts as souvenirs, many visitors understandably would like some memento of their trip and may see no harm in picking up rocks, bones, and other artifacts that may be present in and around the sites that are visited. Over time, such seemingly harmless activities can denude and destroy the historic value of such sites if passengers are not well educated before going ashore and not properly supervised on shore.

The Marine Environment. Operation of tour ships and related small-boat operations may have a number of cumulative effects on the marine environment and its component parts. Repeated anchoring of ships while passengers are transported to sites on shore can disturb bottom substrate and damage, destroy, or cause changes in the species composition of benthic communities. Fuel and oil leaks, and illegal dumping of sewage and waste likewise can have cumulative effects on benthic communities near terrestrial sites that are visited repeatedly. It also is possible that, in some areas, noise from ship and small-boat oper-

ations, and repeated attempts to approach whales, seals, and penguins for viewing could interfere with biologically important activities such as feeding and, over time, cause animals to abandon or avoid areas traditionally used for such purposes.

Science and Science Support Operations. Many tourists are interested in visiting and seeing first-hand the kinds of science being done at research stations operated by different countries in the Peninsula area. Such visits can interfere with the daily routine of station personnel and, if they occur frequently, may interfere with station operations if passengers are not well educated before going ashore and supervised while on shore. In some cases, repeated visits may interfere with or compromise on-going research. For example, visitors simply turning lights on or off in areas where experiments are being done to determine the effects of light on plankton, krill or other organisms can affect the study results.

Most national program managers have established restrictions on station visits, and procedures for structuring those visits to avoid or minimize possible impacts on station operations and personnel. Such actions are the responsibility of the individual program managers and were not considered by the workshop.

4. SITE VARIABLES AFFECTING POSSIBLE CUMULATIVE EFFECTS

The nature and severity of the possible cumulative impacts of ship-based tourism will depend in part on the characteristics of the sites visited. The following are ten site characteristics identified by the workshop participants.

1. Biological Diversity at the Site. As noted earlier, many tourists visit Antarctica to see wildlife. Thus, sites with large numbers of multiple species of penguins, flying birds, and seals are more likely to be visited than sites with smaller numbers of fewer species. As noted below, the frequency of visits and numbers of visitors are two of the principal factors determining the likelihood of cumulative impacts.

2. Location Relative to the Distributional Ranges of the Species Present. Sites with the greatest diversity of flora and fauna are likely to be in areas where the ranges of multiple species overlap. Species' distributions generally are determined by geographically variable environmental factors, such as the presence of ice-free areas at critical times in their breeding cycle and the absence of competing species. Thus, species at the margins of their distributional ranges may be more subject to stress and vulnerable to disturbance-related effects than species near the centers of their distributional ranges.

3. Robustness of the Species Present. Some species of flora and fauna will be more vulnerable or sensitive to repeated disturbance than others. As a general rule, mosses and lichens are more likely to be damaged or destroyed by trampling than are grasses. Conversely, penguins and flying birds that lay eggs and hatch chicks early in the austral spring before the beginning of the tourist season are less likely to have these vital processes interrupted than birds that lay eggs and hatch chicks later in the year.

4. Availability of Open Space. Some visitor sites have restricted access areas and little or no space for visitors to walk without disturbing wildlife or trampling vegetation. Other sites have more open, unoccupied areas permitting access to the sites and viewing of flora and fauna with less risk of disturbance. The risk of disturbance also will vary depending on the locations of access beaches, walking trails, and observation sites relative to the locations of penguin colonies, flying bird nesting sites, seal haul-outs and breeding colonies, and plant communities.

5. General Topography. The physical characteristics of sites subject to repeated visits also can play a role in determining the nature and severity of cumulative impacts. Sites with limited access and long or steep climbs to get to points of interest are less likely to be visited than sites with easier access. However, climbing steep hills can dislodge rocks and gravel, which in turn can alter the flow of rain- and melt-water and promote erosion. Likewise, if access to certain points of interest is easier through bird colonies or plant communities, visitors understandably may take the easier route through these areas if they have not been adequately briefed before coming ashore and are not well supervised while on shore.

6. Novelty of the Site. Some sites will be of interest to tourists because of some unique or novel feature. In the Antarctic Peninsula area, there are only a few accessible sites, for example, that have breeding colonies of crested penguins. Likewise, Deception Island is one of the few places in the world where ships can enter a water-filled caldera of a volcano. Such areas are likely to be visited more frequently than areas lacking such novelty.

7. Ice and Weather Conditions. Although several parts of the Antarctic Peninsula are accessible by air, most parts are accessible only by sea. Thus, the predictability of and variability in sea ice and weather conditions play a major role in determining when and how frequently certain sites can be visited. For example, sites where sea ice does not normally break-up until late in the austral summer, or where break-up may not occur at all in some years, are less likely to be visited than sites where access is more predictable. Likewise, sites where rain, fog, or wind are common, or where weather conditions can change rapidly, pose safety risks and are unlikely to be visited as often as sites

where weather conditions are generally better and less likely to deteriorate rapidly.

8. Availability of Safe Anchoring or Waiting Sites. One of the keys to successful ship-based tour operations is the ability to get passengers ashore, safely and quickly, at selected sites. Thus, sites with good, calm-water anchorages or waiting areas close to where passengers are put ashore are likely to be visited more frequently than areas where access is difficult or dangerous. Similarly, there is less risk of ships being blown on shore or being hit by icebergs in areas with protected anchorages.

9. Acoustic Characteristics. Sounds produced by ship and small-boat engines, fathometers, hull vibration, etc. can affect the behavior and, if loud or long-lasting, damage the hearing of animals both on land and in the water. Sound can be focused or dissipated depending upon the physical characteristics of the environment around the source. In embayments, for example, sound may be reflected off the bottom and shoreline, such that it converges or is focused in areas within or adjacent to the embayment. Sound similarly can be bounced off points of land and be focused in certain areas, depending upon the location of the source relative to the contour of the land. Thus, acoustic disturbance, like other forms of disturbance, may vary from site to site.

10. Location of Comparable Sites Nearby. One of the attractions of Antarctica to tourists is its largely unaffected wilderness quality. To maximize the "wilderness experience," tour operators generally endeavor to avoid taking passengers to areas where other ships are likely to be seen, particularly if they are embarking or disembarking passengers. Therefore, areas in which there are a number of sites with comparable wildlife or other points of interests beyond the sight of each other are likely to be visited more frequently than sites where other tours are likely to be encountered. On the other hand, each site in such areas may be visited less frequently than would a novel site if nothing comparable is nearby.

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.

The timing of visits… and the number, frequency, and length of visits can affect the nature and severity of impacts.

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

the U.S. National Marine Fisheries Service (NMFS); 3) the Palmer Station Long-Term Ecological Research (LTER) Program being supported by the NSF; and 4) penguin studies at Torgersen Island, and in the Palmer Station area, and at King George Island being supported by the NSF and NMFS. These programs were reviewed during the workshop, and are described below. There are additional programs being carried out or supported by other organizations and countries that likewise may be producing potentially useful information. Because of time and funding constraints, the workshop did not attempt to identify or review all potentially relevant programs.

The Antarctic Site Inventory. The Antarctic Site Inventory began fieldwork in the Peninsula in 1994. This project is operated and managed through Oceanites, Inc., a non-profit research and education organization that was established in 1987 by a former Antarctic expedition leader. The initial objectives of the Inventory were to:

- determine whether opportunistic visits can be used to effectively and economically to detect changes in the physical features, flora, and fauna of sites in the Antarctic Peninsula being visited repeatedly by ship-borne tourists; and
- begin compiling baseline data and activity information necessary to detect and determine the possible causes of changes in the physical or biological features of the sites.

Data used to characterize and monitor the key features of, and activities carried out at, the various sites are collected by researchers carried voluntarily by expedition tour ships at selected times each austral spring and summer. In 1999, further analysis of these data was also supported by a grant from the U.S. EPA. Site visits and aerial photodocumentation also have been conducted by project personnel placed, with the assistance of the United Kingdom's Foreign and Commonwealth Office, aboard the British Royal Navy ice patrol vessel HMS *Endurance*.

Three general categories of data and information are collected: 1) basic site information on latitude and longitude, topographic features, and locations of seal haul-outs, bird colonies, etc. used to describe the sites; 2) variable site information and data used to document seasonal and annual changes in environmental conditions (e.g., sea ice extent, cloud cover, snow cover, air temperature, wind direction and speed), biological variables (e.g., number of nesting birds, numbers of eggs and chicks per nest, and number of chicks surviving to fledging), and evidence of visitor presence (e.g., footprints or paths, cigarette butts, film canisters, and other litter); and 3) maps and photodocumentation used to establish visual records of the major features of each site, particularly the locations and extent (boundaries) of bird colonies, seal colonies, and plant assemblages. Biological/demographic are collected in accor-

dance with the *CEMP Standard Methods for Monitoring Studies* (Scientific Committee for the Conservation of Antarctic Marine Living Resources, 1997), which is the standard methodology used throughout the Peninsula.

From January 1994 to February 2000, project personnel made 287 trips to 59 sites in the Peninsula area visited by ship-borne tourists. Basic descriptions of more than 50 sites have been provided in a report, entitled "Compendium of Antarctic Peninsula Visitor Sites," submitted to the governments of the United States and the United Kingdom in November 1997.

The project has begun focusing its data collection effort at heavily visited and potentially sensitive sites, and has embarked on initiatives to ensure that these data are fully comparable with data/results collected elsewhere in the Peninsula. There are 16 sites Inventory researchers attempt to census each season, at key times for collecting relevant biological/demographic data: Hannah Point, Penguin Island, Baily Head, Aitcho Island, Turret Point, Yankee Harbor, Paulet Island, Brown Bluff, Waterboat Point, Point Lockroy, Orne Islands, Georges Point, Neko Harbor, Gourdin Island, Pléneau Island, and Petermann Island. More details on this program are provided in Attachments 15 and 16[1].

The AMLR Program. Fisheries began to develop in the seas around Antarctica in the 1960s. Concern that these fisheries, particularly the fishery for Antarctic krill (*Euphasia superba*), a key component in the diets in many whale, seal, bird, and fish species, could adversely affect these species as well as the target krill stocks led the Antarctic Treaty Consultative Parties to adopt the Convention on the Conservation of Antarctic Marine Living Resources (CCAMLR). The objectives of the Convention, which entered into force in 1982, are 1) to prevent harvested populations from being reduced or maintained below their maximum net productivity levels, 2) to maintain the ecological relationships among harvested, dependent, and related populations, and 3) to minimize the risk of changes in the Antarctic marine ecosystem that are not potentially reversible in two or three decades, i.e., to maintain the fullest possible range of management options for future generations.

The Antarctic Marine Living Resources Convention Act of 1984 provides the legislative authority necessary for the United States to implement the Convention. Among other things, the Act directs the Secretary of Commerce, in consultation with the Secretary of State, the Director of the National Science Foundation, and appropriate officials of other

[1] Details described in Attachment 15 were published, post-workshop, in two papers: "Censuses of penguin, blue-eyed shag, and southern giant petrel populations in the Antarctic Peninsula region, 1994–2000," *Polar Record* 36 (199): 323-334, 2000; and "Zodiac Landings by tourist ships in the Antarctic Peninsula, 1989–99," *Polar Record* 37 (201): 121-132, 2001.

federal agencies, such as the Marine Mammal Commission, to design and conduct a directed research program to support effective implementation of the Convention. The Secretary of Commerce delegated responsibility for designing and conducting the program to the National Marine Fisheries Service, which in turn has assigned responsibility to its Southwest Fisheries Science Center in La Jolla, California.

The principal elements of this program, known as the Antarctic Marine Living Resources (AMLR) Research Program, are 1) ship-board studies to document and monitor changes and trends in krill distribution, abundance, age structure, and related oceanographic conditions in the area around the South Shetland Islands, particularly the waters around Elephant, King George, and Livingston Islands; 2) trawl surveys to document and monitor the distribution, abundance, and trends of bottom fish in the waters around the South Shetland and South Orkney Islands; 3) compilation and assessment of catch and related data concerning crab and any other fisheries conducted in the Convention Area by vessels under U.S. jurisdiction; and 4) land-based studies of penguins and seals that could be affected indirectly by krill harvesting in the area around the South Shetland Islands. Additional land-based studies of penguins are carried out cooperatively with National Science Foundation grantees on Torgersen Island adjacent to Palmer Station on Anvers Island, and at Admiralty Bay on King George Island.

Since 1996, shipboard studies have been conducted during austral summers aboard the Russian research vessel, R/V *Yuzhmorzeologiya*, chartered by the National Marine Fisheries Service. The land-base studies initiated in 1988 at Seal Island, off the northwest coast of Elephant Island, were transferred in 1998 to Cape Shirreff on Livingston Island.

The study site at Cape Shirreff has been designated as a CCAMLR Ecosystem Monitoring Program (CEMP) site, and a Site of Special Scientific Interest. The studies being done there will provide data that can be used to help interpret the data being collected opportunistically from other sites as part of the Antarctic Site Inventory described above. The data being collected include that necessary to 1) estimate annually the size and productivity of the penguin and seal colonies at the site, 2) document seasonal and annual changes in the diets and at-sea foraging locations of the penguins and seals resident in the area during the summer breeding season, and 3) relate changes in the size and productivity of the penguin and seal colonies to the availability of key prey species in adjacent waters during the breeding season.

The Palmer LTER. The Long-Term Ecological Research Program at Palmer Station, initiated in 1991, is one of a series of Long-Term Ecological Research Programs being funded by the National Science Foundation. The central tenet of the program is that the annual advance and retreat of sea ice is a major determinant of temporal and spatial vari-

ability in the structure and function of the Antarctic marine ecosystem, from total annual primary production to breeding success in sea birds. Areas of research include documenting the interannual variability of annual sea ice and the corresponding variability in nutrient availability and in primary and secondary productivity; monitoring the distribution, abundance, and recruitment of krill and the breeding success and survival of sea birds in the study area; and construction and validation of models that relate ecosystem processes to environmental variability.

The study area is on the west side of the Antarctic Peninsula, and includes two sampling grids: a regional grid extending approximately 200 km offshore from Marguerite Bay in the south to the South Shetland Islands in the north, where it overlaps with the at-sea sampling grid for the AMLR Program; and a finer-scale sampling grid in the area immediately adjacent to Palmer Station.

Scientists from a broad range of scientific disciplines and academic institutions participate in the program. The institutions include the University of California at San Diego and Santa Barbara, Montana State University, SCRIPPS Institution of Oceanography, the University of Hawaii at Manoa, and the Lamont-Doherty Earth Observatory.

Additional information concerning the Palmer LTER can be found at http://www.icess.ucsb.edu// lter/lter.html. Among other things, the data and models being developed by the LTER Program should be useful for determining whether any changes detected in the sites in the Peninsula area being visited by ship-borne tourists are due to natural variability.

The Palmer Station Penguin Research. Adélie Penguins in the Palmer Station area occupy eight island rookeries that during the mid-1970s contained approximately 40,000 breeding pairs. Today fewer than 20,000 breeding pairs remain. A major focus of the research on Adélie Penguins in the area has been to understand the causal mechanisms associated with the decline of these populations, including the possible effects of tourism and scientific activities. The latter has been facilitated by the fact that some rookeries (Torgersen Island) have been visited by tourists and researchers for nearly three decades, while in others (Litchfield, Humble, Christine, Cormorant, Dream, Biscoe and Casey) exposure to human activity has been limited. This has provided a unique, long-term experimental setting to examine the relative effects of natural vs. human-induced variability on Adélie Penguin populations.

Recent findings, which incorporate long-term studies on breeding biology, foraging ecology and demography, suggest that most of the variability associated with the decline in Adélie Penguins can be explained by the effects of climate warming on two scales of processes. A change in the frequency of cold years with heavy winter sea ice, for example, is the factor most clearly correlated with these declines at regional scales. At local scales, however, additional processes take effect, and these can

be linked to interactions between breeding habitat geomorphology and changing patterns of snow deposition. A key implication of the latter observation in particular is that the availability and quality of the nesting habitat is an important additional source of local variability in penguin populations. This suggests that by understanding how variability in the landscape affects demography, it may be possible to tease apart the potential effects of human activity. Efforts to examine these interactions in the Palmer Station area have led to the following conclusions:

1. Studies that do not consider a potential landscape effect on Adélie Penguin demography are not likely to yield data useful for assessing the impacts of human activity associated with tourism, research or commercial fishing.
2. Tourism has not had a measurable impact on Adélie Penguin populations in the Palmer Station area.
3. Some types of research, and particularly research that requires repeated measurements based on invasive techniques such as serial blood sampling, conflict with efforts to minimize human impacts on Adélie Penguin populations.

9. LESSONS LEARNED FROM OTHER RESEARCH

Weddell Seal Research in the Ross Sea. The Weddell Seal population in the McMurdo Sound area of the Ross Sea has been studied since the early 1960s. Since 1973, all pups born in the area have been tagged. This has created a population of known-aged individuals that, aside from its value in documenting population demography, has assisted in designing and interpreting the results of physiological, genetics, and behavioral studies. The Weddell Seal's life history pattern is tailored for such studies, since the animals are philopatric, often returning to the same pupping and breeding colony each year. Thus, individual life histories can be recorded over time and a history of individual exposure to human disturbance can be documented in the database.

Over the years, individuals in this population have been handled for the attachment of tags and remote sensing devices, to take blood samples for physiology and genetic studies, and in the course of other investigations where manipulation of individuals for experimental purposes was necessary. In preparation for this workshop, the database was examined by Dr. Donald Siniff, University of Minnesota, to look for evidence of possible disturbance-related effects on the population, particularly possible effects of blood sampling which can be a very disruptive activity.

In the analysis, several possibilities were examined. The annual return rate to colonies of animals from which blood samples had been taken was contrasted with return rates for animals that had not been

sampled. No measurable difference between the groups was detected. Then only females that had given birth to a pup at a colony, and from which a blood sample had been taken, was contrasted with those pupping females that had not been handled for blood sampling. Again, no measurable difference was detected. Finally, the data were examined to see if any age-effect was apparent, hypothesizing that younger animals might react differently than older animals to the sampling procedure. Again, no measurable difference was found.

Although no attempt has been made to quantify or document the particular cause of the response, it appears that placement of a "fish house" or temporary living quarters near a seal colony can affect the distribution of seals at the colony. In particular, seals tend to move away from such structures as the season progresses. This behavior can, of course, be influenced by a number of variables, such as the distance of the structure from the colony and how cracks in the ice where the seals enter and leave the water change as the summer advances. Also, some animals, particularly those to which large packages of scientific instruments have been attached, visibly move away when approached, even after the instruments have been removed. However, continuation of such behavior the next year has not been observed.[2]

Among other things, these study results indicate that long-term studies are likely to be necessary to detect any possible cumulative impacts of ship-based tourism.

10. CONCLUSIONS

The information summarized above led the workshop participants to identification of specific needs and opportunities for detecting, avoiding, and mitigating cumulative adverse impacts from ship-based tourism in the Antarctic Peninsula area. The needs and opportunities fall into four general categories: 1) Site Monitoring; 2) Coordination with Related Research and Monitoring Programs; 3) Tour Planning; and 4) Expediting Long-Term Program Planning and Evaluation.

The information… led the workshop participants to identification of specific needs and opportunities for detecting, avoiding, and mitigating cumulative adverse impacts from ship-based tourism in the Antarctic Peninsula area.

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[2] Additional information on this research can be found in the following:

Testa, J.W. , D.B. Siniff, J.P. Croxall and H. Burton. 1990. Comparison of reproductive parameters among three populations of Weddell seals. *J. Anim. Ecol.* 59:1165-1175.

Siniff, D.B., T.S. Gelatt and M.F. Cameron. 1998. Long term patterns of philopatry in a Weddell seal population. 12th Biennial Conference on the Biology of Marine Mammals, Monaco.

Cameron,M.F., T.S. Gelatt, and D.B. Siniff. Investigations of a Weddell seal (Leptonychotes weddellii) population in McMurdo Sound, 1998-1999. *Antarctic Journal,* In Press.

Siniff, D.B. D.P. DeMaster, R.J. Hofman and L.L. Eberhardt. 1977. An analysis of the dynamics of a Weddell seal population. Ecological Monographs 47:319-335.

Site Monitoring

14. It would be impractical and prohibitively costly to attempt to characterize and monitor every site in the Peninsula area that is or may be subject to visits by ship-borne tourists. Therefore, it would be desirable to identify and focus monitoring efforts on a series of sites believed to be representative of the types of sites of interest to, and being visited by, tourists in the Peninsula area.

15. The Antarctic Site Inventory project is providing the types of information needed to detect possible long-term cumulative impacts at typical sites visited most frequently. At present, however, the project has been limited because it does not have a stable, long-term funding base. Further, it is not clear whether the sampling regime, dependent on opportunistic travel to and no more than a few hours at each site, is adequate to detect any but major changes in the variables being monitored; whether all potentially relevant variables are being monitored or monitored appropriately; whether variables being monitored will yield useful results.

16. Observations at a series of comparable sites along a gradient with different types and levels of tourist activities, and/or observations at a series of comparable sites subjected intentionally to different types and levels of tourist activities likely will be necessary to distinguish any cumulative environmental impacts possibly resulting from tourist activities from those caused by other factors.

17. Reliable information on both tourist and non-tourist activities at particular sites will be needed to do the kinds of retrospective analyses likely to be required to make reasoned judgements as to the cause(s) of any observed changes in the site variables being monitored. That is, reliable information on such things as the number of times that particular sites are visited by season and year, and what visitors do while at the various sites, will be required to make judgments as to the likely cause or causes of any observe changes in the variables being monitored. Such data concerning ship-based tour operations are being compiled and reported by tour operators to the NSF and IAATO. Procedures should be established to periodically review the data being collected to assure that it will enable meaningful retrospective analyses.

Coordination with Related Research and Monitoring Programs

18. Long-term observation will be necessary to detect possible cumulative environmental impacts of ship-based tourism in the Peninsula area.

19. Changes that may be observed in the variables being monitored could be due to natural variability, fishery-related effects, and, in

some cases, disturbance related to scientific research or related support activities, as well as tourist-related activities. If continued for the foreseeable future, the AMLR, LTER, and other research programs being carried out in the Peninsula area should detect region-wide changes in potentially affected penguin, sea bird, and seal populations, and provide the kinds of information needed to determine whether any changes detected at tourist visitor sites are due to natural processes, fisheries, scientific research, or tourist activities.

20. Mechanisms should be established by the various organizations conducting or supporting related research in the Peninsula area to coordinate research planning, share data and logistic support, and cooperatively analyze and report data of mutual interest. Standard methods for collecting and formats for recording data of common interest should be established. Consideration should be given to the establishment of common base maps and geographic information systems for archiving and analyzing data with geographic attributes.
21. Efforts should be made to promote development of innovative research proposals and to seek funding from both government and private sources for short-term studies to document how disturbance affects the behavior and reproductive success of various species and for long-term monitoring to detect population level effects. Procedures should be developed to take advantage of the research opportunities afforded by accidents such as the grounding of the *Bahia Paraiso* in Arthur Harbor in January 1989 or by natural catastrophes. Prompt publication of research and monitoring results in peer reviewed journals should be encouraged.
22. Consideration should be given to the need for long-term international programs to monitor the presence, level and effects of biological and chemical contaminants and disease organisms in indicator areas and species and to encouraging further holistic research coupling marine and terrestrial systems and exchange of information to assist in assessing human impacts.

Tour Planning

23. It would be desirable to develop site-specific visit guidelines to manage tourist activities at sites that are visited frequently and contain flora, fauna, geological features, or historic artifacts that may be particularly vulnerable to damage or destruction.
24. Codes of conduct or guidelines should be established for whale watching, scuba diving, camping, and other tourist-related activities for which appropriate guidelines do not currently exist.

25. Basic qualification standards should be established for deck officers, expedition leaders, naturalists, zodiac drivers, and observers responsible for safe and environmentally benign tour operations in the Peninsula area.

Expediting Long-Term Program Planning and Evaluation

26. Recognizing the broad scope and complexity of these tasks, the most effective way to proceed might be to establish an independent steering group, made up of appropriate experts, to assist in scoping, implementing, and overviewing the needed actions. Among other things, such a group might:

    - Develop or oversee development of a handbook of standard methods for characterizing tourist visitor sites and detecting the possible cumulative impacts of ship-based tourism;
    - Assist in the identification of representative "type" areas in which monitoring efforts should be focused;
    - Help identify and determine how best to access historic data and data from ongoing research and monitoring programs that could contribute to detecting and determining how best to avoid, minimize, or mitigate the possible adverse cumulative effects of ship-based tourist activities in the Peninsula area; and
    - Assist in the development of site specific codes of conduct, visit guidelines, and monitoring plans for the most frequently visited areas.

List of Attachments

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Attachment 1
Guidance for Visitors to the Antarctic and Guidance for Those Organizing and Conducting Tourism and Non-governmental Activities in the Antarctic (from Recommendation XVIII-1)

Guidance for Visitors to the Antarctic

Activities in the Antarctic are governed by the Antarctic Treaty of 1959 and associated agreements, referred to collectively as the Antarctic Treaty system. The Treaty established Antarctica as a zone of peace and science.

In 1991, the Antarctic Treaty Consultative Parties adopted the Protocol on Environmental Protection to the Antarctic Treaty, which designates the Antarctic as a natural reserve. The Protocol sets out environmental principles, procedures and obligations for the comprehensive protection of the Antarctic environment, and its dependent and associated ecosystems. The Consultative Parties have agreed that, pending its entry into force, as far as possible and in accordance with their legal system, the provisions of the Protocol should be applied as appropriate.

The Environmental Protocol applies to tourism and non-governmental activities as well as governmental activities in the Antarctic Treaty Area. It is intended to ensure that these activities do not have adverse impacts on the Antarctic environment, or on its scientific and aesthetic values.

This **Guidance for Visitors to the Antarctic** is intended to ensure that all visitors are aware of, and are therefore able to comply with, the Treaty and the Protocol. Visitors are, of course, bound by national laws and regulations applicable to activities in the Antarctic.

A) PROTECT ANTARCTIC WILDLIFE

1) Taking or harmful interference with Antarctic wildlife is prohibited except in accordance with a permit issued by a national authority.
2) Do not use aircraft, vessels, small boats, or other means of transport in ways that disturb wildlife, either at sea or on land.
3) Do not feed, touch, or handle birds or seals, or approach or photograph them in ways that cause them to alter their behavior. Special care is needed when animals are breeding or moulting.
4) Do not damage plants, for example by walking, driving, or landing on extensive moss beds or lichen-covered scree slopes.
5) Do not use guns or explosives. Keep noise to the minimum to avoid frightening wildlife.

6) Do not bring non-native plants or animals into the Antarctic (e.g. live poultry, pet dogs and cats, house plants).

B) RESPECT PROTECTED AREAS

A variety of areas in the Antarctic have been afforded special protection because of their particular ecological, scientific, historic or other values. Entry into certain areas may be prohibited except in accordance with a permit issued by an appropriate national authority. Activities in and near designated Historic Sites and Monuments and certain other areas may be subject to special restrictions.

1) Know the locations of areas that have been afforded special protection and any restrictions regarding entry and activities that can be carried out in and near them.
2) Observe applicable restrictions.
3) Do not damage, remove or destroy Historic Sites or Monuments, or any artifacts associated with them.

C) RESPECT SCIENTIFIC RESEARCH

Do not interfere with scientific research, facilities or equipment.

1) Obtain permission before visiting Antarctic science and logistic support facilities; reconfirm arrangements 24–72 hours before arriving; and comply strictly with the rules regarding such visits.
2) Do not interfere with, or remove, scientific equipment or marker posts, and do not disturb experimental study sites, field camps, or supplies.

D) BE SAFE

Be prepared for severe and changeable weather. Ensure that your equipment and clothing meet Antarctic standards. Remember that the Antarctic environment is inhospitable, unpredictable and potentially dangerous.

1) Know your capabilities, the dangers posed by the Antarctic, environment, and act accordingly. Plan activities with safety in mind at all times.
2) Keep a safe distance from all wildlife, both on land and at sea.
3) Take note of, and act on, the advice and instructions from your leaders; do not stray from your group.
4) Do not walk onto glaciers, or large snow fields without proper equipment and experience; there is a real danger of falling into hidden crevasses.

5) Do not expect a rescue service; self-sufficiency is increased and risks reduced by sound planning, quality equipment, and trained personnel.

6) Do not enter emergency refuges (except in emergencies). If you use equipment or food from a refuge, inform the nearest research station or national authority once the emergency is over.

7) Respect any smoking restrictions, particularly around buildings, and take great care to safeguard against the danger of fire. This is a real hazard in the dry environment of Antarctica.

E) KEEP ANTARCTICA PRISTINE

Antarctica remains relatively pristine, and has not yet been subjected to large scale human perturbations. It is the largest wilderness area on earth. Please keep it that way.

1) Do not dispose of litter or garbage on land. Open burning is prohibited.

2) Do not disturb or pollute lakes or streams. Any materials discarded at sea must be disposed of properly.

3) Do not paint or engrave names or graffiti on rocks or buildings.

4) Do not collect or take away biological or geological specimens or man-made artefacts as a souvenir, including rocks, bones, eggs, fossils, and parts or contents of buildings.

5) Do not deface or vandalize buildings, whether abandoned, or unoccupied, or emergency refuges.

Guidance for those Organising and Conducting Tourism and Non-governmental Activities in the Antarctic

Antarctica is the largest wilderness area on earth, unaffected by large scale human activities. Accordingly, this unique and pristine environment has been afforded special protection. Furthermore, it is physically remote, inhospitable, unpredictable and potentially dangerous. All activities in the Antarctic Treaty Area, therefore, should be planned and conducted with both environmental protection and safety in mind.

Activities in the Antarctic are subject to the Antarctic Treaty of 1959 and associated legal instruments, referred to collectively as the Antarctic Treaty system. These include the Convention for the Conservation of Antarctic Seals (CCAS 1972), the Convention on the Conservation of Antarctic Marine Living Resources (CCAMLR 1980) and the Recommendations and other measures adopted by the Antarctic Treaty Consultative Parties under the Antarctic Treaty.

In 1991, the Consultative Parties to the Antarctic Treaty adopted the Protocol on Environmental Protection to the Antarctic Treaty. This

Protocol sets out environmental principles, procedures and obligations for the comprehensive protection of the Antarctic environment, and its dependent and associated ecosystems. The Consultative Parties have agreed that, pending its entry into force, as far as possible and in accordance with their legal systems, that the provisions of the Protocol should be applied as appropriate.

The Environmental Protocol designates Antarctica as a natural reserve devoted to peace and science, and applies to both governmental and non-governmental activities in the Antarctic Treaty Area. The Protocol seeks to ensure that human activities, including tourism, do not have adverse impacts on the Antarctic environment, nor on its scientific and aesthetic values.

The Protocol states, as a matter of principle, that all activities are to be planned and conducted on the basis of information sufficient to evaluate their possible impact on the Antarctic environment and its associated ecosystems, and on the value of Antarctica for the conduct of scientific research. Organisers should be aware that the Environmental Protocol requires that "activities shall be modified, suspended or cancelled if they result in or threaten to result in impacts upon the Antarctic environment or dependent or associated ecosystems."

Those responsible for organising and conducting tourism and non-governmental activities must comply fully with national laws and regulations which implement the Antarctic Treaty system, as well as other national laws and regulations implementing international agreements on environmental protection, pollution and safety that relate to the Antarctic Treaty Area. They should also abide by the requirements imposed on organisers and operators under the Protocol on Environmental Protection and its Annexes, in so far as they have not yet been implemented in national law.

KEY OBLIGATIONS ON ORGANISERS AND OPERATORS

1) Provide prior notification of, and reports on, their activities to the competent authorities of the appropriate Party or Parties.
2) Conduct an assessment of the potential environmental impacts of their planned activities.
3) Provide for effective response to environmental emergencies, especially with regard to marine pollution.
4) Ensure self-sufficiency and safe operations.
5) Respect scientific research and the Antarctic environment, including restrictions regarding protected areas, and the protection of flora and fauna.
6) Prevent the disposal and discharge of prohibited waste.

PROCEDURES TO BE FOLLOWED BY ORGANISERS AND OPERATORS

A) When planning to go to the Antarctic

Organisers and operators should:

1) Notify the competent national authorities of the appropriate Party or Parties of details of their planned activities with sufficient time to enable the Party(ies) to comply with their information exchange obligations under Article VII(5) of the Antarctic Treaty. The information to be provided is listed in Attachment A.

2) Conduct an environmental assessment in accordance with such procedures as may have been established in national law to give effect to Annex I of the Protocol, including, if appropriate, how potential impacts will be monitored.

3) Obtain timely permission from the national authorities responsible for any stations they propose to visit.

4) Provide information to assist in the preparation of contingency response plans in accordance with Article 15 of the Protocol; waste management plans in accordance with Annex III of the Protocol; and marine pollution contingency plans in accordance with Annex IV of the Protocol.

5) Ensure that expedition leaders and passengers are aware of the location and special regimes which apply to Specially Protected Areas and Sites of Special Scientific Interest (and on entry into force of the Protocol, Antarctic Specially Protected Areas and Antarctic Specially Managed Areas) and of Historic Sites and Monuments and, in particular, relevant management plans.

6) Obtain a permit, where required by national law, from the competent national authority of the appropriate Party or Parties, should they have a reason to enter such areas, or a monitoring site (CEMP Site) designated under CCAMLR.

7) Ensure that activities are fully self-sufficient and do not require assistance from Parties unless arrangements for it have been agreed in advance.

8) Ensure that they employ experienced and trained personnel, including a sufficient number of guides.

9) Arrange to use equipment, vehicles, vessels, and aircraft appropriate to Antarctic operations.

10) Be fully conversant with applicable communications, navigation, air traffic control and emergency procedures.

11) Obtain the best available maps and hydrographic charts, recognising that many areas are not fully or accurately surveyed.

12) Consider the question of insurance (subject to requirements of national law).

13) Design and conduct information and education programmes to ensure that all personnel and visitors are aware of relevant provisions of the Antarctic Treaty system.

14) Provide visitors with a copy of the **Guidance for Visitors to the Antarctic.**

B) When in the Antarctic Treaty Area

Organisers and operators should:

1) Comply with all requirements of the Antarctic Treaty system and relevant national laws, and ensure that visitors are aware of requirements that are relevant to them.

2) Reconfirm arrangements to visit stations 24-72 hours before their arrival and ensure that visitors are aware of any conditions or restrictions established by the station.

3) Ensure that visitors are supervised by a sufficient number of guides who have adequate experience and training in Antarctic conditions and knowledge of the Antarctic Treaty system requirements.

4) Monitor environmental impacts of their activities, if appropriate, and advise the competent national authorities of the appropriate Party or Parties of any adverse or cumulative impacts resulting from an activity, but which were not foreseen by their environmental impact assessment.

5) Operate ships, yachts, small boats, aircraft, hovercraft, and all other means of transport safely and according to appropriate procedures, including those set out in the Antarctic Flight Information Manual (AFIM).

6) Dispose of waste materials in accordance with Annex III and IV of the Protocol. These annexes prohibit, among other things, the discharge of plastics, oil and noxious substances into the Antarctic Treaty Area; regulate the discharge of sewage and food waste; and, require the removal of most wastes from the area.

7) Co-operate fully with observers designated by Consultative Parties to conduct inspections of stations, ships, aircraft and equipment under Article VII of the Antarctic Treaty, and those to be designated under Article 14 of the Environmental Protocol.

8) Co-operate in monitoring programmes undertaken in accordance with Article 3(2)(d) of the Protocol.

9) Maintain a careful and complete record of their activities conducted.

C) On completion of the activities

Within three months of the end of the activity, organisers and operators should report on the conduct of it to the appropriate national authority in accordance with national laws and procedures. Reports should include the name, details and state of registration of each vessel or aircraft used and the name of their captain or commander; actual itinerary; the number of visitors engaged in the activity; places, dates and purposes of landings and the number of visitors landed on each occasion; any meteorological observations made, including those made as part of the World Meteorological Organization (WMO) Voluntary Observing Ships Scheme; any significant changes in activities and their impacts from those predicted before the visit was conducted; and action taken in case of emergency.

D) Antarctic Treaty System Documents and Information

Most Antarctic Treaty Parties can provide, through their national contact points, copies of relevant provisions of the Antarctic Treaty system and information about national laws and procedures, including:

- The Antarctic Treaty (1959)
- Convention for the Conservation of Antarctic Seals (1972)
- Convention on the Conservation of Antarctic Marine Living Resources (1980)
- Protocol on Environmental Protection to the Antarctic Treaty (1991)
- Recommendations and other measures adopted under the Antarctic Treaty
- Final Reports of Consultative Meetings
- Handbook of the Antarctic Treaty System (1994)
- Handbook of the Antarctic Treaty System (in Spanish, 1991 edition)

ATTACHMENT A
INFORMATION TO BE PROVIDED IN ADVANCE NOTICE

Organisers should provide the following information to the appropriate national authorities in the format requested.

1. name, nationality, and contact details of the organiser;
2. where relevant, registered name and national registration and type of any vessel or aircraft to be used (including name of the captain or commander, call-sign, radio frequency, INMARSAT number);
3. intended itinerary including the date of departure and places to be visited in the Antarctic Treaty Area;

4. activities to be undertaken and purpose;
5. number and qualifications of crew and accompanying guides and expedition staff;
6. estimated number of visitors to be carried;
7. carrying capacity of vessel;
8. intended use of vessel;
9. intended use and type of aircraft;
10. number and type of other vessels, including small boats, to be used in the Antarctic Treaty Area;
11. information about insurance coverage;
12. details of equipment to be used, including for safety purposes, and arrangements for self-sufficiency;
13. and other matters required by national laws.

Attachment 2

POST-VISIT REPORT: PART 1 - Expedition Record

The Expedition Record is completed for every Expedition. This information is requested in compliance with Antarctic Treaty Recommendation XVIII-1 and Resolution XIX-3. Please submit both Part 1 and Part 2 to an appropriate national authority within three months of the activity having taken place.

A: Expedition Details

Company name:	Voyage/Flight number: Voyage Name:
Expedition Leaders(s) name:	Vessel / aircraft name:
Ship Yacht Aircraft (check)	Captain's/commander's name:
Port of Embarkation: Date of Embarkation:	Port of Disembarkation: Date of Disembarkation

Actual itinerary traveled: please provide description of route, giving dates:

(Note: If you consider that the Site Visit Record (SVR) provides an adequate description of itinerary, simply write "See SVR")

B: Observers

Name:	Name:	Name:
Affiliation:	Affiliation:	Affiliation:

C: Record of Expedition numbers by nationality (in alphabetical order)

Nationality	Pax[1]	Staff[2]	Crew[3]	Nationality	Pax[1]	Staff[2]	Crew[3]
				TOTAL			

[1] **Passengers**: Members of the Expedition that are not Staff or Crew (exclude Observers/National representatives).
[2] **Staff:** Expedition personnel, guides, lecturers and small boat drivers (exclude crew serving these functions).
[3] **Crew**: Vessels captain and officers, helicopter pilots, crew and hotel / catering staff (excluding above)

D: Report on Expedition by Expedition Leader (please be brief, but use additional sheets if necessary)

1. Has an expedition meteorological report been submitted to the World Meteorological Organization?
   Yes No Don't Know
2. List any unusual incidents affecting people or the environment:
3. If there were any unusual events, has or will an incident report be prepared:
   Yes No Don't Know
4. To whom has or will the incident report be provided?
5. Any other comments or information
   (e.g. observations of disturbance to wildlife or the physical environment, changes from expedition Advance Notification, etc.

Signature: _____ Date: _____
Expedition Leader or Vessel Captain

POST VISIT REPORT: PART 2 – Site Visit Record

Instructions: Complete one line of the Site Visit Record wherever Expedition members disembark or journey beyond base or camp.

Voyage Number:
Embarkation Date:

Tour Company or Name: **Vessel Name:** **Voyage Name:**

Date(s)	Site visited	Site Latitude/Longitude	1st pax arrive shore/site (in GMT)	Last pax depart shore/site (in GMT)	Number of people making site visit				Activities at site (Use codes)
					Pax[1]	Staff[2]	Crew[3]	Obs*	

[1] **Pax** (Passengers): Members of the Expedition that are not Staff, Crew, Observers or National Representatives.
[2] **Staff:** Expedition personnel, guides, lecturers and boat drivers (exclude crew serving these functions).
[3] **Crew:** Vessels Captain and officers, helicopter pilots, and crew and hotel / catering staff (excluding above).
* **Obs:** Observers or National Representatives.

Activity codes:

Small boat landing:	**BL**	**Aircraft landing:**	**AL**	**Helicopter landing:**	**HL**	**Station visit:**	**SV**
Small boat cruising:	**ZC**	**Aircraft flight:**	**AF**	**Helicopter flight:**	**HF**	**Camping:**	**CP**

Attachment 3
Workshop on Means for Detecting the Cumulative Environmental Impacts of Tourism in the Antarctic Peninsula

The objectives of this workshop are to:

1. Identify, based upon available information and experience elsewhere, the types of cumulative adverse impacts on the physical environment and biota that could result from multiple visits, within a season and over a series of years, at the types of sites in the Antarctic Peninsula presently being visited by organized ship-based tours. The emphasis will be on typical tourist activities as opposed to visits by scientists or other field personnel;
2. Identify the variables concerning the sites and the tourist activities likely to determine the nature and severity of possible cumulative effects;
3. Consider the range of measures that possibly could be taken to avoid or minimize possible adverse cumulative effects and the questions that would have to be answered to decide which measures would be most practicable and cost-effective;
4. Identify the difficulties likely to be encountered in assessing cumulative adverse impacts to the physical environment and biota;
5. Identify the variables that would be most appropriate to assess and monitor in order to detect a) cumulative impacts; b) effectiveness of mitigation measures; c) anthropogenic vs. natural variability.
6. Review on-going research and monitoring programs in the Antarctic Peninsula to determine whether they likely will be able to detect the possible cumulative adverse effects of ship-based tourism before they reach significant levels – i.e., levels that would not be considered minor or transitory under the Protocol on Environmental Protection to the Antarctic Treaty;
7. If ongoing research and monitoring programs are judged inadequate to detect possible cumulative impacts or to determine how they might be best avoided or mitigated,
    a) describe the changes in the existing programs or additional programs that would be required to detect cumulative adverse effects, taking into account locations, timeframe, and methodology; and
    b) describe actions that would be required to identify and evaluate the effectiveness of measures necessary to avoid or mitigate cumulative adverse effects, taking into account locations, timeframes and other relevant variables.

Attachment 4
Workshop Participants

Mr. Scott Altmann
Campaign Associate
The Antarctica Project
1630 Connecticut Avenue
3rd Floor
Washington, DC 20009

Mr. Martin Betts
Australian Antarctic Division
Channel Hwy, Kingston
Tasmania, 7054 Australia

Dr. Maj DePoorter
School of Environment and Marine Sciences
University of Auckland
Private Bag 92019
Auckland, New Zealand

Mr. Matt Drennan
Antarctic Expedition Leader
Lindblad Expeditions
P.O. Box 162
Hulls Cove, ME 04644

Dr. William Fraser
Biology Department
University of Montana
Bozeman, MT 59717

Ms. Louise Hampson
Marine Expeditions
890 Yonge St. 3rd floor
Toronto, Ontario
Canada M4W 3P4

Dr. Robert Hofman
Scientific Program Director
Marine Mammal Commission
4340 East-West Highway
Bethesda, MD 20814

Dr. Rennie Holt
Chief, Antarctic Ecosystem Research Group
National Marine Fisheries Science Center
P.O. Box 271
La Jolla, CA 92038-0271

Dr. Joyce Jatko
Environmental Officer
Office of Polar Programs
National Science Foundation
4201 Wilson Boulevard
Arlington, VA 22230

Dr. Mahlon Kennicutt, II
Director
Geochemical Environmental Research Group
833 Graham Rd.
College Station, TX 77845

Ms. Lisa King-Wurzrainer
Ship Staff Coordinator
Zeagrahm Expedition

Ms. Denise Landau
Executive Secretary
IAATO
P.O. Box 2178
Basalt, CO 81621

Mr. Joseph Montgomery
Office of Federal Activities
US Environmental Protection Agency
1200 Pennsylvania Avenue, NW
Washington, DC 20460

Mr. Ron Naveen
President
Oceanites Inc.
P.O. Box 15259
Chevy Chase, MD 20825

Dr. Polly Penhale
Manager, Antarctic Biology and Medicine
Office of Polar Programs
National Science Foundation
4201 Wilson Boulevard
Arlington, VA 22230

Ms. Sally Poncet
Beaves Island
Falkland Islands, FI
C/o P.O. Stanley
South Atlantic

Dr. Martin Riddle
Australian Antarctic Division
Channel Hwy, Kingston
Tasmania, 7054 Australia

Dr. Donald Siniff
University of Minnesota
Department of Ecology, Evolution and Behavioral Biology
100 Ecology Building, Room 302
1987 Upper Buford Circle
St. Paul, MN 55108

Capt. P.R. (Dick) Taylor, USCG (retired)
Orient Lines Representative
4733 SE Constitution Ct.
Port Orchard, WA 98367-9000

Dr. Wayne Trivelpiece
Seabird Biologist
8604 La Jolla Shores Drive
SWFSC-AEROA
La Jolla, CA 92037

Ms. Victoria Underwood-Wheatley
Antarctic Environmental Officer
Explorer Shipping Corp.
10601 Tierra Santa Boulevard, #316
San Diego, CA 92124

Dr. Jose Valencia
Institute Antartico Chileno
Avenida V. L. Theyer Ojede 814
Santiago, Chile

Dr. Maria Vernet
Associate Research Oceanographer
Marine Research Division
Scripps Institue of Oceanography
La Jolla, CA 92093-0218

Dr. David W. Walton
British Antarctic Survey
Madingley Road
Cambridge B3 OET
United Kingdom

Dr. Pamela Yochem
Senior Research Biologist
Hubbs-Sea World Research. Institute
2595 Ingraham Street
San Diego, CA 92109

Attachment 5
WORKSHOP AGENDA

Detecting the Cumulative Environmental Impacts of Tourism in the Antarctic Peninsula

Radisson Hotel, La Jolla, San Diego, California
June 7–9, 2000

Day One

0830 Welcome, introductions, and review of objectives (Dr. Joyce Jatko)

0900 Review of the history, current status, and anticipated future of ship-based tourism in the Antarctic Peninsula and compilation of site visit statistics (Ms. Victoria Underwood/Ms. Denise Landau)

0930 Review of variables considered in selecting sites to be visited and review of the different types of sites commonly visited in the Antarctic Peninsula area (Mr. Matt Drennan)

1000 Coffee break

1030 Review of typical activities carried out at sites and procedures used to manage and supervise activities at those sites (Mr. Matt Drennan)

1100 Discussion Groups – Identify the range of measures that possibly could be taken to avoid or minimize possible adverse cumulative effects and the variables that would have to be considered to decide which measures would be most cost-effective

1215 Lunch

1330 Review of site characteristics likely to affect the nature and severity of possible cumulative impacts (Mr. Ron Naveen)

1400 Discussion Groups – Identify the kinds of cumulative impacts at the different types of sites commonly visited that could result from multiple visits. List and rank, if feasible, the relative importance the site characteristics most likely to determine the nature and severity of cumulative effects

1530 Coffee break

1600 Review of the objectives, methods, and results of research/monitoring programs

1600 Overview of AMLR/CEMP program (Dr. Rennie Holt)

1630 Torgersen Island study (Dr. William Fraser)

1700 Adjourn

Day Two

0830 Continue review of on-going research and monitoring programs

0830 Palmer LTER program (Dr. Maria Vernet)

0900 Lessons learned from long term seal research (Dr. Donald Siniff)

0930 Lessons learned from long term penguin research (Dr. Wayne Trivelpiece)

1000 Coffee break

1030 Discussion Groups—Identify the variables that would be most appropriate to assess and monitor in order to detect a) cumulative impacts; b) effectiveness of mitigation measures; c) anthropogenic versus natural variability

1200 Lunch

1330 Discussion Groups—Identify limitations of on-going research and monitoring programs in detecting cumulative impacts

1500 Break

1530 Discussion Groups—Identify changes in on-going programs and/or additional programs that would be required to detect cumulative adverse environmental impacts or evaluate the effectiveness of measures intended to avoid or mitigate adverse cumulative impacts.

1700 Summary of findings and conclusions

1715 Adjourn

Day Three

0830 Facilitators and rapporteurs meet to develop summaries of discussion group findings and recommendations.

1000 Entire group reconvenes for reporting out of preliminary findings and recommendations followed by discussion and adoption by workshop.

1130 Adjourn

Attachment 6
Discussion Group Members, Facilitators and Rapporteurs

Group 1	Group 2	Group 3
Robert Hofman[1]	David Walton[1]	Denise Landau[1]
Victoria Underwood-Wheatley[2]	Polly Penhale[2]	Chuck Kennicutt[2]
Martin Betts	Scott Altmann	Joseph Montgomery
Sally Poncet	Louise Hampson	Ron Naveen
Richard Taylor	Matt Drennan	Rennie Holt
Maj DePoorter	Martin Riddle	Donald Siniff
Pamela Yochem	William Fraser	Wayne Trivelpiece
Jose Valencia	Maria Vernet	
Lisa King		

[1] Denotes group facilitator
[2] Denotes group rapporteur

Attachment 7
A Timeline of Human Activity in Antarctica: Some Selected Highlights

1820s	Existence of Antarctica as a continent was established.
Early 1800s	Exploitation of fur seals and elephant seals begins (and continues until the 1960s).
1899	Humans first wintered on Antarctic shores. Just prior to 1900, Antarctic whaling becomes a very large, worldwide industry and, excepting the years of World War II, continued into the mid-1980s.
1911	Amundsen reaches the South Pole (and, shortly, thereafter, Scott in 1912). Humans did not reach the South Pole again until 1956.
1930s	Scientific exploration begins with expeditions such as Byrd and Ellsworth.
1956	The 1st recorded "tourists" fly over the Antarctic continent on a flight organized by a Chilean national airline on December 23rd; 66 tourists made the trip on a Douglas DC-6B.
1957	Pan American Airways operated the 1st commercial Stratoscruiser flight to land at McMurdo Sound in October, 1957.
1957–58	International governance in Antarctica originated during the International Geophysical Year—a science-oriented, international cooperative effort whose principal objective was the comprehensive and coordinated accumulation of knowledge about the region. The 12 participating countries established more than 60 stations on or near the continent with more than 5,000 scientific and supporting personnel.
1958	Chile and Argentina took more than 500 fare-paying passengers to the South Shetland Islands by ship (aboard the *Les Eclaireurs*, an Argentine naval transport ship) in January and February.
1959	The Antarctic Treaty was signed by 12 nations on December 1st.
1961	The Antarctic Treaty enters into force on June 23rd.
1966	The concept of 'expedition cruising,' coupled with education as a major theme began when Lars-Eric Lindblad leads the 1st traveler's expedition to Antarctica.
1969	The modern expedition cruise industry is born with the emergence of the m/s *Lindblad Explorer*—the 1st passen-

	ger cruise ship designed by Lars-Eric Lindblad specifically for carrying tourists to Antarctica.
1970s	"Flight-seeing," over-flying without landing, became popular. Planeloads of tourists were flown over the continent at low altitude by both Qantas Airways and Air New Zealand. Between 1977 and 1980, 44 flights, involving more than 11,000 passengers, were operated.
1979	"Flight-seeing," for all practical purposes, came to an end following the crash of Air New Zealand DC-10 on Mt. Erebus in November, 1979. All 257 passengers and crew were killed.
1983–84	Chileans begin operating C-130 flights, carrying 40 passengers, from Punta Arenas to Teniente Rodolfo Marsh Station on King George Island. Hotel accommodations are available at Estrella Polar, the 1st hotel in Antarctica. Small ski-equipped aircraft are also being used to fly passengers to the Antarctic. Since 1984 the dominant company has been Adventure Network International.
1989	Three major ship tour operators develop two sets of guidelines to manage the growing tourism industry: *Guidelines of Conduct for Antarctica Visitors and Guidelines of Conduct for Antarctica Tour Operators.* Guidelines, based upon these voluntary codes of conduct are adopted (in part) in 1994 by the ATCPs as Recommendation XVIII-1.
1989–90	Adventure Network International operates land-based operations from July to April (9 months). Russian research vessels enter the Antarctic tourism market following the collapse of the Soviet Union, changing the face of Antarctic ship-based tourism.
1991	The Protocol on Environmental Protection to the Antarctic Treaty was signed in Madrid, Spain. The Madrid Protocol extends and improves the Antarctic Treaty's effectiveness in ensuring the protection of the Antarctic environment. The Protocol's comprehensive regime is applicable to all human activity, including tourism. The International Association of Antarctica Tour Operators (IAATO) is formed by the seven tour operators active in Antarctica to act as a single organization to advocate, promote and practice environmentally responsible private-sector travel to Antarctica. IAATO has since been invited to attend meetings of the Antarctic Treaty Parties (ATCMs), as observers.

1991–92	Tourists, for the 1st time, are estimated to outnumber the personnel involved in national science and logistic programs in the area covered by the Antarctic Treaty System.
1992-93	More than 50 tourist voyages by seven U.S.-based companies and three foreign companies, carrying an estimated 6,166 fare-paying passengers visited the Antarctic. Ship-based tourists off of the *Kapitan Khlebnikov* visit the Dry Valleys by helicopter.
1994	Antarctic Treaty Recommendation XVIII-1 was adopted, laying out Guidance for Visitors and Operators to the Antarctic Treaty Area (based on IAATO's voluntary guidelines).
1994–95	"Flight-seeing" is resumed by Croydon Travel of Australia using Qantas's Boeing 747 aircraft.
1996–97	*Kapitan Khlebnikov* circumnavigates the Antarctic continent on a 66-day voyage, carrying 66 passengers. Nearly 90,000 tourists have now visited the continent by tour ship.
1997–98	Approximately 9,400 passengers are carried during the 1997–1998 summer aboard tour ships.
1998–99	Destination Management and Avant, a Chilean airline, begin operating over-flights of the Antarctic Peninsula from Punta Arenas, Chile. During the 1998-98 summer 22 flights aboard a Boeing 737 are conducted, carrying between 40-60 passengers on each flight.
1999–00	Approximately 14,762 tourists were carried to the Antarctic by 14 IAATO member companies operating 16 ships and 1 yacht and 3 non-IAATO member companies operating 4 ships. 139 tourists visited Antarctica on land-based programs organized by Adventure Network International. Croyden Travel operated 9 flight-seeing tours out of Australia, carrying 3,412 tourists and 193 crew.

Attachment 8
IAATO Overview of Ship- and Land-based Antarctic Tourism, 1999–00

(Based on information provided by Antarctic tour operators to the IAATO Secretariat)

Vessel	Operator/ Charterer	Number of Voyages	Number of Passengers	Member Affiliates
Explorer	Explorer Shipping	10	764	One voyage in conjunction with Victor Emanuel Nature Tours
Kapitan Khlebnikov	Quark Expeditions	2	198	Including one charter in conjunction with Zegrahm Expeditions
Professor Molchanov	Aurora Expeditions	9	453	
Professor Molchanov	Oceanwide Expeditions	1	32	
Akademik S. Vavilov	Quark Expeditions	8	565	
Professor Multanovskiy	Quark Expeditions	9	390	Including one charter in conjunction with Heritage Expeditions and Asteria
Akademik Shokalskiy	Heritage Expeditions	2	89	
Clipper Adventurer	New World Ship Management Clipper Cruise Line	7	662	
Clipper Adventurer	Zegrahm Expeditions	1	88	
World Discoverer	Society Expeditions	7	828	Including one voyage in conjunction with Zegrahm Expeditions
Bremen	Hapag-Lloyd	7	791	
Hanseatic	Hapag-Lloyd	7	1,008	
Caledonian Star	Lindblad Expeditions	6	523	
Akademik Ioffe	Marine Expeditions	10	873	
Akademik Shuleykin	Mountain Travel-Sobek	5	206	
Akademik Shuleykin	Marine Expeditions	4	144	
Lyubov Orlova	Marine Expeditions	9	933	
Akademik Boris Petrov	Peregrine Adventures	9	366	
Grigoriy Mikheev	Oceanwide Expeditions	4	122	
Grigoriy Mikheev	Aurora Expeditions	1	31	
S/Y Pelagic	Pelagic Expeditions	2	16	
Non IAATO Members				
Marco Polo	Orient Lines	5	2,583	Has been operating since 1993
Aegean I	World Cruise Company	2	912	Assisted by Marine Expeditions
Ocean Explorer I	World Cruise Company	2	889	Assisted by Marine Expeditions
Yachts (~17)	Various	23	221	Based on Port Lockroy and Palmer Station visits and In.Fue.Tur
Rotterdam VI	Holland America Line	1	936	Cruise only no landing
Land-based programs	Adventure Network Int'l	139		
TOTALS		**153**	**14,762**	

*Note: Full, Provisional and Associate Members will sell into the above mentioned vessels. Only the primary operator or charterers are listed here.

Attachment 9
Eleven Season (1989–2000) Overview of Sites Visited in the Antarctic Peninsula
Compiled by NSF from data provided by U.S. tour companies in response to treaty reporting requirements

Part 1: 1989 to 1994

Sites Visited	1989–1990 Total Visits	1989–1990 Total Pax Landed	1990–1991 Total Visits	1990–1991 Total Pax Landed	1991–1992 Total Visits	1991–1992 Total Pax Landed	1992–1993 Total Visits	1992–1993 Total Pax Landed	1993–1994 Total Visits	1993–1994 Total Pax Landed
Port Lockroy, Wiencke Is.	7	796	7	1067	19	2615	1* 22	57* 2139	4* 30	409* 4274
Whalers Bay, Deception Is.	17	1682	13	1496	23	2899	22	1711	37	3480
Pendulum Cove, Deception Is.	7	587	10	1215	19	2011	23	1936	33	3159
Cuverville Island	8	883	8	936	21	2565	25	1589	2* 27	226* 2174
Neko Harbor, Andvord Bay							8	357	6	275
Paulet Island	7	772	4	240	14	2239	16	1498	2* 18	266* 1664
Petermann Islands	6	761	11	1084	14	1376	14	1376	4* 30	518* 2828
Aitcho Islands	2	271	0	0	3	285	7	601	3	271
Almirante Brown (station), Paradise Bay	10	1191	16	1471	26	2889	19	1659	2* 31	78* 3513
Gonz. Videla/waterboat Pt., Paradise Bay	9	1038	10	1965	15	2398	19	1671	3* 17	330* 3248
Baily Head, Deception Is.	5	455	6	584	4* 14	315* 1182	1* 10	30* 657	1* 9	18* 990
Grytviken (station), S. Georgia	4	501	5	420	6	743	4	161	6	746
Goudier Island (small rock in harbor at Port Lockroy)										
Brown Bluff, Tabarin Penin. (Antarctic Peninsula)										
Arctowski (station), KGI	8	930	6	601	14	1509	10	598	30	3031
Paradise Bay (should specify)									1*	142*
Hannah Point, Livingston Is.	3	419	2	192	17	1632	23	1542	29	2740
Vernadsky Station, Argentine Island										
Jougla Point, Port Lockroy										
Penguin Island, KGI	3	256	0	0	1	65	7	506	1* 13	62* 1166
Gold Harbor, S. Georgia	3	274	3	282	2	203	0	0	4	504
Half Moon Island (moon Bay)	10	1191	9	1011	25	2984	14	1585	17	2961
Salisbury Plain, S. Georgia	4	412	4	307	4	390	3	128	2	164
Orcadas/scotia Bay/laurie Is., S. Orkney			1	36	2	148	1	127	2	152
Devil Island, Ne End Of Antarctic Peninsula										
Palmer Station, Anvers Is.	11	1252	9	923	11	1265	9	1014	10	1185
Esperanza Station, Hope Bay										
Cape Lookout, Elephant Is.	5	541	2	124	1* 5	50* 579	1* 4	118* 271	2* 6	133* 1131
Yankee Harbor, Greenwich Is.					2	763	2	474	1* 3	169* 233
Carcass Island										
Danco Island (off west coast Graham Land)									3	73
New Island, Falklands										
St. Andrews Bay, S. Georgia			1	45	0	0	1	46	1	49
Cooper Bay (north end), S. Georgia							1	46	0	0
Fortuna Bay, S. Georgia			1	90	0	0	0	0	0	0
Damoy Point, Wiencke Is.										
Albatross Island, South Georgia										
West Point Island, Falkland Is.										
Pleneau Island							10	447	6	370
Torgersen Island			8	788	8	872	8	890	2	126
Stromness Bay, S. Georgia			1	36	2	199	1	5	2	126
Telefon Bay, Deception Is.	6	492	4	452	6	606	1	72	12	819
Sea Lion Island, Falkland Islands										
Mikkelsen Harbor, Trinity Island	1	85	0	0	1	72	7	258	0	0
Crystal Hill, South-side Trinity Peninsula										
Hydrurga Rocks							1*	54*	3	165
Yalour Islands			1	87	1* 2	75* 177	1*	117*	1* 5	142* 378
Portal Point, Charlotte Bay			1	93	0	0	8	592	10	781
Dorian Bay, NW side Wiencke Island										
SNOW HILL ISLAND	2	125	0	0	1	90	1*	50*	0	0
Ferraz (station), Visca Anchorage, KGI	3	305	1	95	6	660	2	187	12	1135
Prion Island, S. Georgia	3	260	3	280	2	198	1*	60*	3	156
Arturo Prat (station), Greenwhich Is.					2	181	0	0	0	0
Bald Head, Trinity Peninsula										
Presidente Frei (station), KGI (Marsh Base)	6	621	4	596	8	1162	2	333	1	90
Astrolabe Island							1	34	3	93
Jubany (station), Potter's Cove, KGI	1	120	1	107	3	307	4	305	6	869
Suarez Glacier (not Petzval), Paradise Bay										
Royal Bay, S. Georgia							1	5	0	0
Bellingshausen (station), KGI					9	966	1	62	1	88
Gourdin Island										
Bleaker Island, Falkland Islands										
Shingle Cove, Iceberg Bay, Coronation Is.	4	436	1	38	2	240	0	0	5	991
Elsehul Bay, S. Georgia	1	84	1	52	2* 1	182* 77	1*	65*	2*	110*
Rothera (station), Adelaide Island	1	99	0	0	0	0	0	0	0	0
Useful Island										
Enterprise Islands										
Skontorp Cove, Paradise Bay							1* 7	27* 257	0	0
Saunders Island, S. Sandwich Islands										
Cierva Cove							1	38	3*	85*
Rum Cove, James Ross Island										
Godthul Bay, S. Georgia										
Hercules Bay, South Georgia										
Mikkelsen Island										
Right Whale Bay, S. Georgia					1	97	0	0	0	0

% = snorkeling/scuba; # = helo landing; @ = helo overflight ONLY; + = ice walking

Attachment 9
Eleven Season (1989–2000) Overview of Sites Visited in the Antarctic Peninsula
Compiled by NSF from data provided by U.S. tour companies in response to treaty reporting requirements

Part 1: 1989 to 1994 (continued)

Sites Visited	1989–1990		1990–1991		1991–1992		1992–1993		1993–1994	
	Total Visits	Total Pax Landed	Total Visits	Total Pax Landed	Total Visits	Total Pax Landed	Total Visits	Total Pax Landed	Total Visits	Total Pax Landed
Orne Harbor (west coast Graham Land) Ronge' Island Artigas [Station-Uruguay], KGI View Point, Duse Bay, Trinity Peninsula Fort Point, S. Greenwich Island							5	186	6	267
Pleneau Bay Crystal Sound, Pendleton Strait (Biscoe Is.) Deception Island (need to be more specific) Horseshoe Island Lagarrigue Cove (Selvick Cove), Orne Harbor										
Cooper Bay (south end), S. Georgia Curtiss Bay, (west coast Graham Land) Adelaide Island Beak Island, Prince Gustav Channel Cape Dundas, Laurie Is., S. Orkney	2	183	0	0	0	0	1 0	44 0	0 0	0 0
Moltke Harbor, Royal Bay, S. Georgia King Haakon Bay (outer), S. Georgia Leith Cove, Paradise Bay, Graham Land Great Wall (Station), KGI INTERCURRENCE ISLAND, CHRISTIANIA ISLANDS	1	97	1	45	2 1 1	240 81 84	0 0 1	0 0 62	0 1* 1 0	0 180* 152 0
Turret Point , King George Bay, KGI Spigot Peak, Orne Island Alcock Island Heroina Island, Danger Islands Pitt Point (Victory Glacier)					1	78	1*	36*	1 1 1	99 33 14
Biscoe Point, Anvers Island (ASPA) off limits Turnbull Point, D'urville Island Blazett Island Robert Point, Robert Is., South Shetlands Cape Rosa, South Georgia										
Pitt Islands Hercules Point, South Georgia Prince Olaf Harbor, S. Georgia Peggotty Bluff, South Georgia Booth Island	2	171	1	105	0	0	0	0	1	89
Larsen Harbor, S. Georgia Mt. Mill, Waddinton Bay (w. coast Graham Land) Volunteer Point, Falklands Possession Bay, South Georgia Cumberland East Bay, South Georgia			2	191	0	0	0	0	0 1	0 16
Laws Beach Dundee Island Charlotte Bay Patagonia Bay, Anvers Island Ezcurra Inlet, Admiralty Bay, KGI					2*	100*	1*	96*	0 1	0 36
Leith Harbor, S. Georgia Seymour Island Leige Island Laurie Is. , S. Orkneys (specify) Inverleith Harbor, Anvers Island	1	142	0	0	1	160	0	0	0	0
Perch Island, Fish Islands Cape Renard, Flandres Bay Nordenskjold Glacier, South Georgia Detaille Island Orne Islands (off west coast Graham Land)	1	94	2	195	0	0	3 2	278 201	0 1	0 54
Point Wild, Elephant Is. Melchior Islands Ardley Island Hovgaard Island Christiania Islands	2 1 4	265 100 418	2 7* 2	151 832 705	2 3 0 1	268 249 0 328	4* 1 3* 1 1 1	175* 95 305* 17 113 391	3* 1 2 1 1	207* 108 203 175 475
Wilhelmina Bay (w. Coast of Graham Land) Drygalski Fjord, S. Georgia Dion Islands (SPA#8) Prospect Point, Graham Land Dallmann Bay (b/t Brabant & Anvers Islands)							1 3	30 305	0 0 1*	0 0 84*
Fish Islands (west coast Graham Land) Cape Valentine, Elephant Is;. Gibbon Bay, Coronation Island Barcroft Islands (S. of Watkins and Biscoe Is.) Rosita Harbor, S. Georgia			1	98	0	0	1 0	28 0	2 1 1*	229 118 51*
Port Charcot, Booth Island Errera Channel (b/t Ronge Is. & Graham Land) Andersen Island Admiralty Bay, King George Island Admiralty Sound, b/t Seymour & Snow Hill Is.									1@	109@

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Eleven Season (1989–2000) Overview of Sites Visited in the Antarctic Peninsula
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Part 1: 1989 to 1994 (continued)

Sites Visited	1989–1990		1990–1991		1991–1992		1992–1993		1993–1994	
	Total Visits	Total Pax Landed	Total Visits	Total Pax Landed	Total Visits	Total Pax Landed	Total Visits	Total Pax Landed	Total Visits	Total Pax Landed
Ample Bay, S. Georgia			1	88	0	0	0	0	0	0
Andvord Bay (west coast Graham Land)										
Antarctic Sound										
Arago Glacier, Andvord Bay							6	251	0	0
Argentine Is. (not same as Faraday)										
Atka Iceport, Queen Maud Land									1	115
Auguste Island, Gerlache Strait										
Bay Of Isles, Albatross Is., S. Georgia	1	142	2	88	2	158	1	46	1* 1	106* 100
Bayard Islands (off west coast Graham Land)										
Bennett Islands, Hanusse Bay										
Bernardo O'Higgins Base										
Berthelot Islands										
Bismarck Strait										
Blaiklock Island (off west coast Graham Land)										
Bone Bay, Trinity Peninsula										
Bongrain Point, Pourqoi Pas Island										
Bradbrooke Island, Aitcho Is.										
Bransfield Strait										
Brunonia Glacier										
Bryde Island (SW of Lemaire Island)										
Buls Bay, Brabant IslanD										
Camara Station (Arg.), Half Moon Island										
Camp Point, West Coast Graham Land										
Cape Dubouzet										
Cape Evenson (west coast Graham Land)									1*	83*
Cape Gage, James Ross Island										
Cape Kjellman, Charcot BaY, Trinity Penin.										
Cape Lachman, James Ross Island										
Cape Melville, KGI							1	58	0	0
Cape Norvegia, Queen Maud Land									1	122
Cape Saunders, Hercules Bay, S. Georgia										
Cape Tuxen, Mt. Demaria (w. coast Graham Land)									1	16
Challenger Island (off west coast Graham Land)									1	27
Cobbler's Cove, S. Georgia										
Comb Ridge, James Ross Island										
Cooper Island, S. Georgia										
Cormorant Island					1	125	0	0	0	0
Coronation Island, S. Orkneys (specify)			2	185	2	370	0	0	1	176
Crescent Island, South Georgia										
Danger Islands					1*	91*	0	0	0	0
Durville Mount, Joinville Island									1	33
Duthoit Point, Maxwell Bay, Nelson Island										
Elephant Island [should specify]									1*	135*
Emperor Rookery (no name - on Riser-Larsen Iceshelf)										
False Bay, Livingston Is.	1	127	0	0	0	0	0	0	0	0
Faraday (Station)/akademic Vernodsky	2	252	5	432	4	422	3	274	2	178
Fildes Peninsula										
Flanders Bay (btwn Capes Renard & Willens, Grahamland										
Foyn Harbor					1*	70*	3* 1	227* 66	3* 3	194* 133
Fridtjof Sound (Tabarin Peninsula)										
Fumarole Bay, Deception Is.					1	8	0	0	0	0
Gabriel De Dastilla Station (Deception Island)										
Gaston Islands (near tip Reclus Peninsula)									1*	69*
Gennady Cove, Intercurrence Island										
George's Point, Ronge' Island										
Gerlache Strait										
Gibbs Island, South Shetland Is.										
Gin Cove, James Ross Island										
Gosling Islands									1* 1	49* 139
Grandidier Channel										
Gunnel Channel, Hanusse Bay										
Hanusse Bay			2	148	0	0	0	0	0	0
Heim Glacier, Arrowsmith Pen. (Graham Land)										
Heywood Island							1	102	0	0
Holluschickie Bay, James Ross Island										
Hope Bay (Esperanza)	1	145	3	1130	9	1278	3	209	17	1801
Huemul Island (Megaptera Is.)										
Husvik Harbor, S. Georgia			1	19	1	99	0	0	0	0
Inner Lee Island, Bay Of Isles, S. Georgia										
James Ross Island										
Joinville Island "Molchanov Beach"									2	65
Jonassen Island, NE tip Antarctic Peninsula										
Kelsey Bay										
King George Island (need to be specific)										
King Sejong (Station), KGI					2	191	0	0	1	180
Kinnes Cove, Joinville Island									1	71

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Part 1: 1989 to 1994 (continued)

Sites Visited	1989–1990		1990–1991		1991–1992		1992–1993		1993–1994	
	Total Visits	Total Pax Landed	Total Visits	Total Pax Landed	Total Visits	Total Pax Landed	Total Visits	Total Pax Landed	Total Visits	Total Pax Landed
Lallemand Fjord (b/twn Arrowsmith Pen./W. Grahamland) Lapeyrere Bay, Gourdin Peninsula Lemaire Channel Lindblad Cove Lion Island, East Side Anvers Island					1*	42*	0	0	1*	46*
Lion's Rump, KGI Macaroni Point, Deception Is. Madder Cliffs, Joinville Island Marian Cove, KGI Martel Inlet, Admiralty Bay, KGI	6	625	7	772	4	382	0	0	0 1	0 78
Maxwell Bay, KGI (specify) Metchnikoff Point, Brabant Island Mount Scott, Girard Bay, Lemaire Channel Moureaux Islands, Flandres Bay Murray Harbor, Murray Is. (w. coast Graham Land					1 1*	78 12*	0 0	0 0	2 0	166 0
Murray Island (off west coast Graham Land) Neumayer Station No Name Penguin Rookery (70deg31'S;80deg42'W) Palaver Point, Two Hummock Is. Penguin Point, Seymour Island Penguin Rookery (no name - on Riser-Larsen Iceshelf)					1	86	1* 1	61* 85	1 0 2	27 0 129
Peon Peak Peter Ist Island Petrel Station, Petrel Cove, Dundee Is. Point Martin, S. Orkney Islands Point Thomas, Ezcurra Inlet, Admiralty Bay, KGI					1	144	0	0	1 1* 3	51 90* 98
Primavera BasE (Arg.), Cierva Cove Prince Gustav Channel (b/t James Ross & Vega Isls.) Rancho Point, Deception Island Riser-larsen Ice Shelf, Queen Maud Land Rookery Bay, S. Georgia							4	152	6 1	159 123
Rosamel Island San Martin 68 deg 08'S; 67 deg 05'W Sanae Base Schollaert Channel (btwn Anver/Brabant Islands) Seal Islands, South Shetland Islands			1	82	0	0	0	0	1	154
Shag Rocks, S. Georgia Signy Base (U.K.), S. Orkneys Signy Island, S. Orkneys Small Island, Christiania Islands Small Peak, Errera Channel	1	145	0	0	1* 0	93* 0	0 2	0 130	0 0	0 0
South Bay, Livingston Island Southwind Pass Spring Point, Brailmont Cove (w. Graham Land) Steeple Jason Island, Falkland Is. Stonington Island (East Base)	1	97	0	0	0	0	0	0	1 1#	125 108#
Takai Peninsula Triangle Point Trinity Island (need to specify) Undine South Harbor, S. Georgia Uruguayan Hut, Hope Bay					1*	60*	1	2	0	0
Wauwermans Islands Welcome Islands, S. Georgia Wiggins Glacier Will Point, S. Georgia Willis Islands, S. Georgia			1	89	0	0	0	0	0	0
Winter Island, Argentine Islands Wordie Point, Visokoi Is., S. Sandwich Ils.										

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Eleven Season (1989–2000) Overview of Sites Visited in the Antarctic Peninsula
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Part 2: 1994 to 1999

Sites Visited	1994–1995 Total Visits	1994–1995 Total Pax Landed	1995–1996 Total Visits	1995–1996 Total Pax Landed	1996–1997 Total Visits	1996–1997 Total Pax Landed	1997–1998 Total Visits	1997–1998 Total Pax Landed	1998–1999 Total Visits	1998–1999 Total Pax Landed
Port Lockroy, Wiencke Is.	27	1769	3* 42	216* 3851	1*, (2~) 56	22*, (90~) 3,110	58	6,429	1% 59	22% 6473
Whalers Bay, Deception Is.	66	5241	67	5033	51	3,012	1* 60	49* 5,344	69	5427
Pendulum Cove, Deception Is.	41	2803	42	3492	44	2,725	31	3,426	50	4676
Cuverville Island	2* 47	144* 3367	3* 59	259* 4343	3* 56	169* 3,714	2* 53	525* 4,143	1% 55	10% 4087
Neko Harbor, Andvord Bay	12	560	21	963	1*, (1~) 36	46*, (21~) 2,348	27	1,737	1* 42	97* 3613
Paulet Island	30	2819	31	2315	31	2,808	8	732	1* 37	115* 3722
Petermann Islands	42	3406	47	3504	1* 34	75* 2,576	42	3,866	1* 38	67* 3305
Aitcho Islands	10	667	23	1759	37	2,341	31	2,499	31	2525
Almirante Brown (Station), Paradise Bay	5* 43	286* 1307	1* 25	17* 2244	38	2,504	1* 34	149* 3,991	17	1612
Gonz. Videla/waterboat Pt., Paradise Bay	5* 20	528* 1559	14	2384	12	1,095	12	2,998	20	3379
Baily Head, Deception Is.	2* 32	132* 2576	4* 19	311* 1094	2* 14	114* 1,133	19	1,395	1% 20	19% 2012
Grytviken (Station), S. GEORGIA	5	449	7	473	7	510	7	708	15	1357
Goudier Island (small rock in harbor at Port Lockroy)			1	44	3	262	6	467	1* 15	96* 1302
Brown Bluff, Tabarin Penin. (Antarctic Peninsula)	2	77	4	223	9	553	1* 17	135* 1,293	14	996
Arctowski (Station), KGI	1* 31	47* 2445	21	1724	22	1,789	11	1,014	13	1109
Paradise Bay (should specify)			4*,1@ 36	218*,92@ 2772	10* 22	857* 1,739	10* 15	952* 941	11* 15	827* 1529
Hannah Point, Livingston Is.	46	4010	37	3048	46	3,480	39	3,399	48	3982
Vernadsky Station, Argentine Island					6	369	19	1,094	22	1626
Jougla Point, Port Lockroy					1* 2	18* 102	5	450	16	1114
Penguin Island, KGI	24	1692	23	1449	2* 12	65* 1,090	15	1,394	20	1744
Gold Harbor, S. Georgia	3	398	4	308	6	438	5	365	10	752
Half Moon Island (Moon Bay)	38	3017	49	5221	35	2,258	33	4,382	33	3931
Salisbury Plain, S. Georgia	6	582	3	215	5	307	2	199	8	595
Orcadas/scotia Bay/laurie Is., S. Orkney	3	198	3	203	4	491			4	462
Devil Island, NE end of Antarctic Peninsula			4	352	9	657	1	2	3	285
Palmer Station, Anvers Is.	9	1030	8	724	11	979	14	1,417	12	1001
Esperanza Station, Hope Bay										
Cape Lookout, Elephant Is.	1* 9	103* 951	1* 4	134* 442	3* 8	431* 818	1* 7	159* 749	3* 9	270* 983
Yankee Harbor, Greenwich Is.	8	544	1* 19	43* 1893	7	473	7	589	12	1045
Carcass Island			2	110	2	174	3	152	7	635
Danco Island (off west coast Graham Land)	4	276	1* 13	34* 560	5	314	6	380	1% 6	20% 343
New Island, Falklands	1	51	1	73	2	179			6	494
St. Andrews Bay, S. Georgia	3	275	3	182	4	261	1* 2	58* 99	8	566
Cooper Bay (north end), S. Georgia	4	344	2	134	3	235	1* 1	48* 58		
Fortuna Bay, S. Georgia					3	224			5	348
Damoy Point, Wiencke Is.	2	188	5	503			1^ 1	40^ 24	4	360
Albatross Island, South Georgia			1* 3	38* 145	1* 2	68* 136	1* 3	148* 159	8	384
West Point Island, Falkland Is.					3	273	2	92	8	729
Pleneau Island	7* 6	445* 374	8* 20	613* 1333	10*, (3~) 24	306*, (55~) 1,803	3*, 2^ 8	198*, 101^ 548	8* 15	573* 682
Torgersen Island	6	545	4	325	3	192	9	890	9	671
Stromness Bay, S. Georgia	1	125			1	72			6	380
Telefon Bay, Deception Is.	5	403	7	543	4	282	7	566	13	1039
Sea Lion Island, Falkland Islands									2	119
Mikkelsen Harbor, Trinity Island	1* 3	41* 160	2	76	1	72	5	341	3	152
Crystal Hill, South-side Trinity Peninsula			4	352	2	165			1	94
Hydrurga Rocks	2	72	1	83	1* 7	31* 461	4	199	1% 8	27% 553
Yalour Islands	2* 2	226* 117	3* 3	268* 104	3	118	3	167	3	158
Portal Point, Charlotte Bay	8	641	14	890	(1~) 5	(15~) 370	4	118	6	328
Dorian Bay, NW side Wiencke Island	1	133	1* 1	82 94	1	92	6	453	4	193
Snow Hill Island	4	304	2	187	1* 1	84* 35			5	482
Ferraz (Station), Visca Anchorage, KGI	10	930	4	321	3	183	5	693	4	381
Prion Island, S. Georgia	4	490	1	125	1	43			4	485
Arturo Prat (Station), Greenwhich Is.	1	112	1	66	3	224	3	267		
Bald Head, Trinity Peninsula										
Presidente Frei (Station), KGI (Marsh Base)	9	766	6	542	5	335	2	165		
Astrolabe Island	2* 4	83* 211	3* 2	147* 69	2	105	1* 1	135* 53		
Jubany (station), Potter's Cove, KGI	3	403					3	333	1% 6	19% 232
Suarez Glacier (not Petzval), Paradise Bay					1* 1	42* 32	1	49	2*	83*
Royal Bay, S. Georgia	1	40	3	142	1	40			6	149
Bellingshausen (Station), KGI	8	573	10	530	6	138	11	146	5	305
Gourdin Island							2	207	4	321
Bleaker Island, Falkland Islands									2	90
Shingle Cove, Iceberg Bay, Coronation Is.	4	368	2	153	4	295			1* 5	175* 342
Elsehul Bay, S. Georgia	1	79	1*	48*			1*	64*	2* 2	139* 163
Rothera (Station), Adelaide Island	2	243	1	160						
Useful Island	1	47								
Enterprise Islands	1*	88*			1*	85*	2*	184*	3*	245*
Skontorp Cove, Paradise Bay							1	90	1	98
Saunders Island, S. Sandwich Islands									1	58
Cierva Cove			3*	107*	2* 3	200* 272	2* 2	103* 176	3* 2	98* 124
Rum Cove, James Ross Island					1	80				
Godthul Bay, S. Georgia									2	82
Hercules Bay, South Georgia							1*	51*	3	191
Mikkelsen Island										
Right Whale Bay, S. Georgia	1	117	1*	38*			1*	127*	1*	109*

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Sites Visited	1994–1995 Total Visits	1994–1995 Total Pax Landed	1995–1996 Total Visits	1995–1996 Total Pax Landed	1996–1997 Total Visits	1996–1997 Total Pax Landed	1997–1998 Total Visits	1997–1998 Total Pax Landed	1998–1999 Total Visits	1998–1999 Total Pax Landed
Orne Harbor (west coast Graham Land)			1 30		1* 3	70* 266	1* 1	31* 57	1	72
Ronge' Island	1* 9	47* 664	9	546	10	534	2	215	2	135
Artigas [Station-Uruguay], KGI	3	212					1	7	2	181
View Point, Duse Bay, Trinity Peninsula			1	99	3	207			1	88
Fort Point, S. Greenwich Island									2	185
Pleneau Bay					1*	27*	1*	49*	3*	172*
Crystal Sound, Pendleton Strait (Biscoe Is.)					1* 2	153* 290				
Deception Island (need to be more specific)			1* 9	17* 557	9	634	4	236	11	801
Horseshoe Island							1	55		
Lagarrigue Cove (Selvick Cove), Orne Harbor	1	99					1	77	2	144
Cooper Bay (south end), S. Georgia									1* 5	42* 340
Curtiss Bay, (west coast Graham Land)			2* 2	159* 72	1* 2	114* 65	1	57	1	56
Adelaide Island							1	57		
Beak Island, Prince Gustav Channel									1	51
Cape Dundas, Laurie Is., S. Orkney	1	138								
Moltke Harbor, Royal Bay, S. Georgia							2	99	1	76
King Haakon Bay (Outer), S. Georgia									1	24
Leith Cove, Paradise Bay, Graham Land										
Great Wall (Station), KGI			1	60			1	2	1	44
Intercurrence Island, Christiania Islands							1*	55*	1*	49*
Turret Point , King George Bay, KGI	1	146	4	180	3	185	9	858	2	138
Spigot Peak, Orne Island							1	97	1	97
Alcock Island										
Heroina Island, Danger Islands					1	90			1	37
Pitt Point (Victory Glacier)					1	88				
Biscoe Point, Anvers Island (ASPA) off limits										
Turnbull Point, D'urville Island										
Blazett Island										
Robert Point, Robert Is., South Shetlands			2	118	1	45	6	383		
Cape Rosa, South Georgia										
Pitt Islands	1	87								
Hercules Point, South Georgia										
Prince Olaf Harbor, S. Georgia									1	52
Peggotty Bluff, South Georgia										
Booth Island										
Larsen Harbor, S. Georgia	1	27			3	185	1*	45*	3* 4	169* 170
Mt. Mill, Waddinton Bay (w. coast Graham Land)										
Volunteer Point, Falklands			1	68			1	42		
Possession Bay, South Georgia							1	139		
Cumberland East Bay, South Georgia										
Laws Beach										
Dundee Island										
Charlotte Bay			4	349	1	92			2+ 1	164
Patagonia Bay, Anvers Island										
Ezcurra Inlet, Admiralty Bay, KGI										
Leith Harbor, S. Georgia									1	54
Seymour Island			2	99	1	59			1	119
Leige Island										
Laurie Is. , S. Orkneys (specify)	1	96	1* 2	53* 201	1	98			3	314
Inverleith Harbor, Anvers Island										
Perch Island, Fish Islands										
Cape Renard, Flandres Bay									1	70
Nordenskjold Glacier, South Georgia										
Detaille Island	2	236			1	108	4	413	1* 3	99* 244
Orne Islands (off west coast Graham Land)	1* 7	34* 368	1	42						
Point Wild, Elephant Is.	4* 3	361* 185	6* 1	484* 26	7*	547*	4* 2	321* 267	5* 1	528* 59
Melchior Islands	2* 1	177* 14	4*	324*	6* 3	411* 118	4* 1	203* 257	5* 3	410* 30
Ardley Island	2	149			1	55			1	8
Hovgaard Island	2	172	2	138	1*, (1~) 2	109*, (35~) 203	1* 1	54* 439	1* 1	447* 7
Christiania Islands							1* 1	59* 54	1	51
Wilhelmina Bay (w. Coast of Graham Land)			1*	41*					1	51
Drygalski Fjord, S. Georgia	1*	84*	1	105			2*	201*	1*	54*
Dion Islands (SPA#8)										
Prospect Point, Graham Land	4	291	1* 2	69* 122			1	91	4	294
Dallmann Bay (b/t Brabant & Anvers Islands)			2*	104*	1*	70*				
Fish Islands (west coast Graham Land)			1	113					1	95
Cape Valentine, Elephant Is;.										
Gibbon Bay, Coronation Island							1* 1	48 115		
Barcroft Islands (S. of Watkins and Biscoe Is.)	1* 1	97* 83			1*	134*			1	95
Rosita Harbor, S. Georgia	1*	30*								
Port Charcot, Booth Island			1	74					2	20
Errera ChanneL (b/t Ronge Is. & Graham Land)			2*	61*					1*	23*
Andersen Island			1*	41*						
Admiralty Bay, King George Island			1*	48*						
Admiralty Sound, b/t Seymour & Snow Hill Islands			1*	85*	3	185				
Ample Bay, S. Georgia										

% = snorkeling/scuba; # = helo landing; @ = helo overflight ONLY; + = ice walking

Attachment 9
Eleven Season (1989–2000) Overview of Sites Visited in the Antarctic Peninsula
Compiled by NSF from data provided by U.S. tour companies in response to treaty reporting requirements

Part 2: 1994 to 1999 (continued)

Sites Visited	1994–1995 Total Visits	1994–1995 Total Pax Landed	1995–1996 Total Visits	1995–1996 Total Pax Landed	1996–1997 Total Visits	1996–1997 Total Pax Landed	1997–1998 Total Visits	1997–1998 Total Pax Landed	1998–1999 Total Visits	1998–1999 Total Pax Landed
Andvord Bay (west coast Graham Land)	1*	34*			2*	168*	1*	32*	1*	34*
Antarctic Sound			1*	100*			2*	167*		
Arago Glacier, Andvord Bay										
Argentine Is. (not same as Faraday)					1	112			1	59
Atka Iceport, Queen Maud Land	2	239	2# 1	129# 113	2#	164				
Auguste Island, Gerlache Strait							1	55		
Bay Of Isles, Albatross Is., S. Georgia	3	111							1	53
Bayard Islands (off west coast Graham Land)									1	57
Bennett Islands, Hanusse Bay							1	56		
Bernardo O'higgins Base					1	95				
Berthelot Islands	1*	93*								
Bismarck Strait					1*	50*				
Blaiklock Island (off west coast Graham Land)	1	9								
Bone Bay, Trinity Peninsula			1*	33*						
Bongrain Point, Pourqoi Pas Island							1	80		
Bradbrooke Island, Aitcho Is.	1	136								
Bransfield Strait										
Brunonia Glacier							1	47		
Bryde Island (SW of Lemaire Island)									1	17
Buls Bay, Brabant Island							1	56		
Camara Station (Arg.), Half Moon Island	1	96			5	672	2	395		
Camp Point, West Coast Graham Land					1	78				
Cape Dubouzet										
Cape Evenson (west coast Graham Land)										
Cape Gage, James Ross Island	1	86	1	72						
Cape Kjellman, Charcot Bay, Trinity Penin.			1*	41*						
Cape Lachman, James Ross Island									1	95
Cape Melville, KGI										
Cape Norvegia, Queen Maud Land	1	97								
Cape Saunders, Hercules Bay, S. Georgia	2* 3	210* 344			1	50				
Cape Tuxen, Mt. Demaria (w. coast Graham Land)	1	30								
Challenger Island (off west coast Graham Land)										
Cobbler's Cove, S. Georgia									2	72
Comb Ridge, James Ross Island					1	31				
Cooper Island, S. Georgia										
Cormorant Island										
Coronation Island, S. Orkneys (specify)	1	108							3	199
Crescent Island, South Georgia			1	38						
Danger Islands					7	240				
Durville Mount, Joinville Island							1	74		
Duthoit Point, Maxwell Bay, Nelson Island	1	135	1	109						
Elephant Island [should specify]	3	259			1	50	1* 1	46* 81		
Emperor Rookery (no name - on Riser-Larsen Iceshelf)										
False Bay, Livingston Is.										
Faraday (Station)/akademic Vernodsky	4	267	5	209						
Fildes Peninsula					1	85				
Flanders Bay (btwn Capes Renard & Willens, Grahamland							1*	64*		
Foyn Harbor	1*	96*			3*	213*	1*	106*	2*	179*
Fridtjof Sound (Tabarin Peninsula)									1*	51*
Fumarole Bay, Deception Is.										
Gabriel De Dastilla Station (Deception Island)			1	42					1	80
Gaston Islands (near tip Reclus Peninsula)					1	40				
Gennady Cove, Intercurrence Island	1	34								
George's Point, Ronge' Island	1	47			2	139	4	440		
Gerlache Strait	1*	89*							2*	140*
Gibbs Island, South Shetland Is.	2*	229*	1*	107*	2*	247*	1* 1	96* 131	2* 2	337* 270
Gin Cove, James Ross Island			1	67	1	94				
Gosling Islands					1	96				
Grandidier Channel							1*	67*		
Gunnel Channel, Hanusse Bay							1*	75*		
Hanusse Bay										
Heim Glacier, Arrowsmith Pen. (Graham Land)	1	19								
Heywood Island										
Holluschickie Bay, James Ross Island					1	91				
Hope Bay (Esperanza)	1* 11	59* 907	17	1476	7	710	10	1,210	9	1031
Huemul Island (Megaptera Is.)	1*	45*								
Husvik Harbor, S. Georgia									2	210
Inner Lee Island, Bay Of Isles, S. Georgia	1	57								
James Ross Island									2	181
Joinville Island "Molchanov Beach"	1	24	3	134						
Jonassen Island, NE tip Antarctic Peninsula										
Kelsey Bay										
King George Island (need to be specific)			2	179	1	55				
King Sejong (Station), KGI									1	85
Kinnes Cove, Joinville Island	1*	82*					3	372	1	54

% = snorkeling/scuba; # = helo landing; @ = helo overflight ONLY; + = ice walking

Attachment 9
Eleven Season (1989–2000) Overview of Sites Visited in the Antarctic Peninsula
Compiled by NSF from data provided by U.S. tour companies in response to treaty reporting requirements

Part 2: 1994 to 1999 (continued)

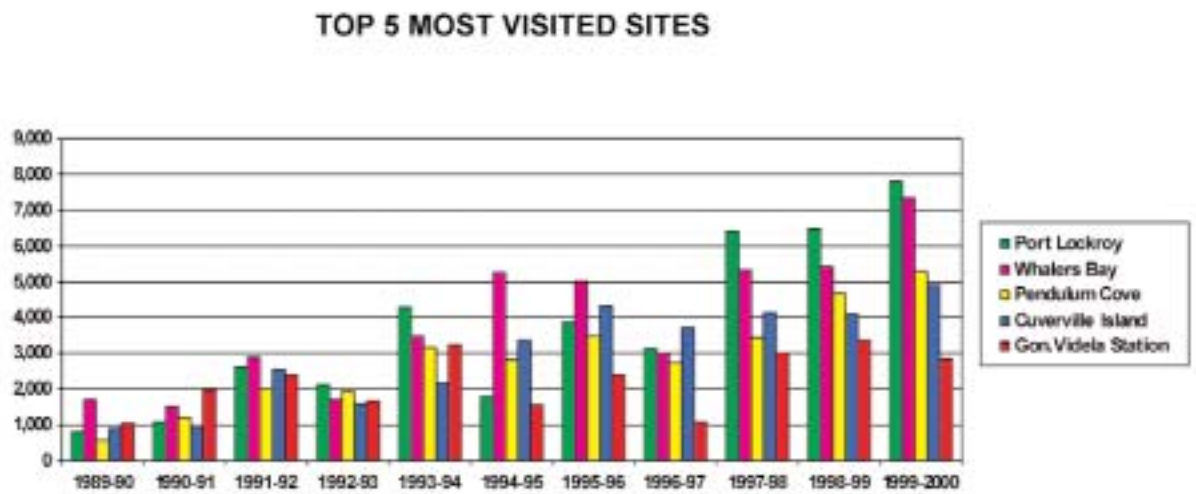
Sites Visited	1994–1995 Total Visits	1994–1995 Total Pax Landed	1995–1996 Total Visits	1995–1996 Total Pax Landed	1996–1997 Total Visits	1996–1997 Total Pax Landed	1997–1998 Total Visits	1997–1998 Total Pax Landed	1998–1999 Total Visits	1998–1999 Total Pax Landed
Lallemand Fjord (b/twn Arrowsmith Pen./W. Grahamland)									1	59
Lapeyrere Bay, Gourdin Peninsula							1*	76*		
Lemaire Channel			1*	86*	6*	455*	2*	131*	3*	184*
Lindblad Cove									1*	87*
Lion Island, East Side Anvers Island									1%	28%
Lion's Rump, KGI									1	15
Macaroni Point, Deception Is.	1	36			1*	33*				
Madder Cliffs, Joinville Island							1*	142*		
Marian Cove, KGI										
Martel Inlet, Admiralty Bay, KGI										
Maxwell Bay, KGI (specify)			3	148			1	70		
Metchnikoff Point, Brabant Island							1	55	1	2
Mount Scott, Girard Bay, Lemaire Channel			1	14						
Moureaux Islands, Flandres Bay									1	70
Murray Harbor, Murray Is. (w. coast Graham Land	1*	34*								
Murray Island (off west coast Graham Land)										
Neumayer Station	1	49	1	63	2#	140				
No Name Penguin Rookery (70deg31'S;80deg42'W)					3	328				
Palaver Point, Two Hummock Is.										
Penguin Point, Seymour Island	1	41								
Penguin Rookery (no name - on Riser-Larsen Iceshelf)										
Peon Peak							1	33		
Peter Ist Island					1	74				
Petrel Station, Petrel Cove, Dundee Is.										
Point Martin, S. Orkney Islands					1	80				
Point Thomas, Ezcurra Inlet, Admiralty Bay, KGI	1	38								
Primavera Base (Arg.), Cierva Cove	1* 2	38* 63			2	103				
Prince Gustav Channel (b/t James Ross & Vega Isls.)					1	105				
Rancho Point, Deception Island							1	98		
Riser-larsen Ice Shelf, Queen Maud Land	3	347								
Rookery Bay, S. Georgia									1*	35*
Rosamel Island										
San Martin 68 deg 08'S; 67 deg 05'W	1	95								
Sanae Base					1#	91				
Schollaert Channel (btwn Anver/Brabant Islands)					1*	25*				
Seal Islands, South Shetland Islands									1	6
Shag Rocks, S. Georgia										
Signy Base (u.k.), S. Orkneys					1	42				
Signy Island, S. Orkneys	1	4								
Small Island, Christiania Islands			1	38						
Small Peak, Errera Channel			1	15						
South Bay, Livingston Island										
Southwind Pass			1@	101@						
Spring Point, Brailmont Cove (w. Graham Land)			1	48						
Steeple Jason Island, Falkland Is.					1	113	1	56	1	97
Stonington Island (East Base)	2	197								
Takai Peninsula					1	52				
Triangle Point										
Trinity Island (need to specify)	2	135							1	69
Undine South Harbor, S. Georgia										
Uruguayan Hut, Hope Bay							1	105		
Wauwermans Islands			1*	96*						
Welcome Islands, S. Georgia										
Wiggins Glacier			1#	95#						
Will Point, S. Georgia										
Willis Islands, S. Georgia			1*	38*						
Winter Island, Argentine Islands									2	169
Wordie Point, Visokoi Is., S. Sandwich Ils.							1	50	2	139

% = snorkeling/scuba; # = helo landing; @ = helo overflight ONLY; + = ice walking

Attachment 10
Peninsula Sites Ranking in the Top 5 Most Visited Sites for 3 or More of the Last 11 Seasons

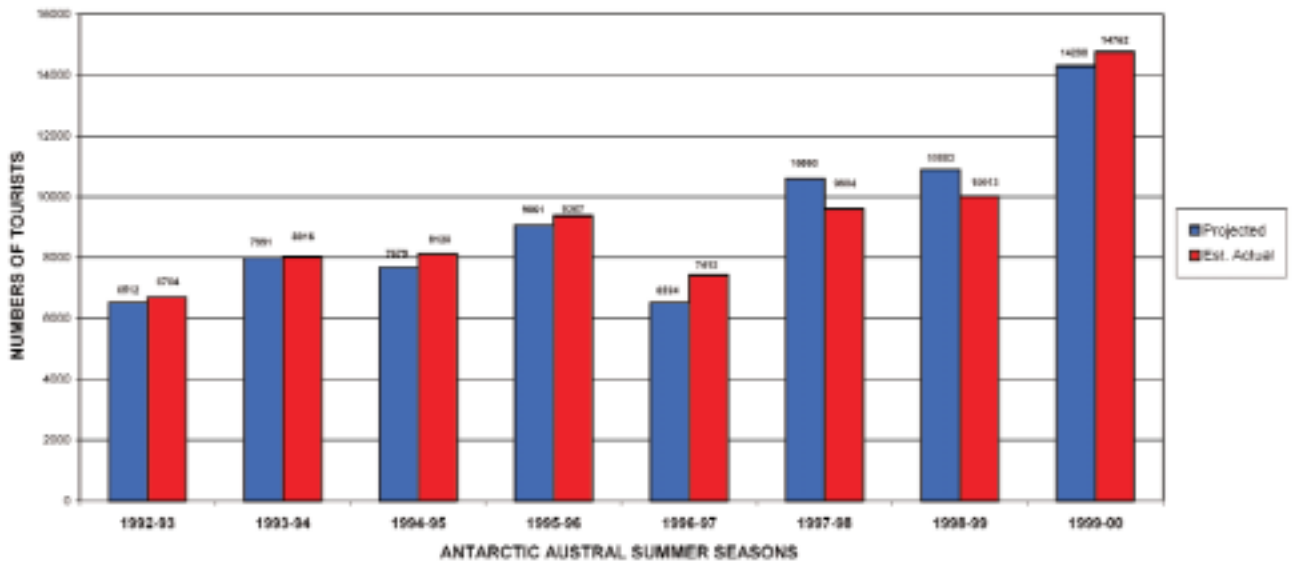
	1989–90	1990–91	1991–-92	1992–93	1993–94	1994–95	1995–96	1996–97	1997–98	1998–99	1999–2000
Port Lockroy	796	1,067	2,615	**2,139**	**4,274**	1,769	3,851	3,110	**6,429**	**6,473**	**7,804**
Whalers Bay	**1,682**	1,496	2,899	1,711	3,480	**5,241**	5,033	3,012	5,344	5,427	7,333
Pendulum Cove	587	1,215	**2,011**	1,936	3,159	2,803	**3,492**	2,725	3,426	4,676	5,300
Cuverville Island	883	936	2,565	1,589	2,174	3,367	4,343	**3,714**	4,143	4,087	4,908
Gon. Videla Station	1,038	**1,965**	2,398	1,671	3,248	1,559	2,384	1,095	2,998	3,379	2,871

Bold = Most visited site for that season.



Attachment 11
Antarctic Tourist Trends

[Includes Ship and Land-Based passenger numbers. 1997-98 onwards includes commercial yacht activity]



Attachment 12
Criteria Used by Expedition Leaders in Itinerary Planning and Site Selection for Expedition Cruising in the Antarctic Peninsula

A. Introduction

1. Selecting sites to visit during each shipborne tourist expedition to the Antarctic Peninsula occurs in two phases. Phase one involves initial itineraries being planned and circulated to other tour ships prior to the commencement of the expedition. The second phase involves adjustments to the initial itinerary on a day to day basis as a result of conditions and opportunities encountered en route.
2. With the majority of the companies, both phases of the detailed itinerary planning and site selection are implemented by the Expedition Leader. Though in some cases the company running the ship carries out the phase on planning, the Expedition Leader being responsible only for phase two, the criteria used in the decision making process does not vary significantly.
3. This report details the criteria considered in the decision making process for both phases. Section B deals with phase one. It concentrates on the decision making process involved in selecting sites in the context of the voyage as a whole. Section C assesses phase two, detailing criteria used when considering landing passengers as a specific site.

B. Phase One: Planning

1. Phase one, the initial itinerary, is concerned with site selection in the context of a voyage as a whole. The aim is to achieve an expedition that gives passengers an overview of the area being visited.
2. Certain parameters, such as number of days in the Antarctic region and the marketing emphasis, e.g., ice cruises, historical expeditions, etc., are set in site selection. Other factors which dictate itinerary planning are vessel speeds and the number of passengers involved.
3. There are a number of requisite sites or features to be incorporated into an itinerary (though these may be influenced by the marketing emphasis). These features are:
   - visits to renowned sites, e.g., Deception Island, Paradise Bay and Lemaire Channel;
   - 'key' components of the natural history, e.g., specific bird and marine mammal spp., geologic features, etc.;
   - a landing on the Antarctic continent;

- sites of historic interest, both exploration and sealing and whaling;
- a visit to a scientific station.

The extent to which each of these aspects are emphasized varies according to the personnel involved and time constraints.

4. Often several sites meet the criteria listed above. The decision of which site to visit and at what stage in the expedition depends on several factors. Two key principles are:

   a) to start with landings which are 'simple.' In this instance, simple can be defined as sites which: are usually sheltered, both at the vessel's gangway and at the landing point; have ample space near the landing point for passengers to adjust to the environmental and operation procedures (adjustments to clothing and equipment, etc.) without disrupting wildlife; and are safe and easy to move around.

   b) to manage expectations, i.e., to try to ensure that each day is 'better' than the day before. Often area which have a high species diversity, spectacular scenery, or unusual occurrences are perceived as 'more exciting'. Equally, such areas often require better understanding of the codes of conduct because of : increased awareness of the biota and potential for disturbance; safety reasons; or proximity to protected areas.

5. Final decisions in selecting routes and sites are based on local knowledge of the areas involved, taking into account the site's attractions and how they fit in with what has been experienced and will be experienced.

6. The overall route plan, including planned landings, is then circulated to other vessels operating in the area, to avoid two vessels trying to land at the same site at the same time. It is based on the assumption that conditions will not be prohibitive to landing passengers.

Phase Two: Adjustments in Itineraries

1. Adjustments often have to be made to daily itineraries. This is due to bad weather and ice conditions, other ships schedules, and opportunities which may become apparent during the voyage. If adjustments are made 24 + hours in advance, notification is usually sent to other vessels to avoid conflict.

2. The criteria considered by an expedition leader when making the decision of whether to go to a site, assessing if the landing is feasible, and if so, how it should be organized, fall into 3 categories:

   - **Attraction of the site:** i.e., why choose to land at this site? Is there a more suitable alternative site within reasonable steaming

distance? What activities are possible here? e.g., the factors mentioned in B 3, i.e., renowned, natural history, continent landing, historical, scientific, etc.

- **Shore operation:** do the characteristics of the site require particular visitor control methods to be used to minimise potential disturbance of the environment and ensure safety? If so, what? e.g., zodiac cruise only, guided walks, specific conduct reminders, etc.
- **Marine operation:** Are the conditions good enough and stable enough to allow a landing? If so, how should the zodiac operations be organized, e.g., consider: ship to shore distance; conditions at landing site and gangway; selection of best landing point; potential hazards; tide and current influences; number of shoremen required; number of zodiacs, etc.

3. Based on these criteria the expedition leader is able to decide whether or not to land at a particular site, conditions permitting. The expedition leader is also able to control the use of the site to ensure that: the landing is safe; it does not encroach areas into protected areas; and that the visit causes minimal disturbance to the local environment.

Kim Crosbie
Scott Polar Research Institute
University of Cambridge

Attachment 13
Sample Annual Instruction

October 11, 1999

MEMORANDUM

TO All Antarctic Captains, Expedition Leaders and Radio Officers

FM IAATO

RE 1999/00 Season

We developed the following notice at the IAATO annual meeting to help guide the exchange of information among vessels, co-ordination of itineraries and reporting for the season.

Exchange of Itineraries

- IAATO members agree to exchange itineraries and coordinate schedules. This is a key factor in self-regulation, monitoring of activities and also in effective emergency response.
- Consult the IAATO preliminary schedule (and updates circulated by In.Fue.Tur) to determine which vessels will be in your cruising area.
- Circulate your proposed final itinerary via telex by broadcast mode or radio (preferred) or fax or e-mail. (Please note that few tour vessels have regular real-time exchange of e-mail.) Since all ships are supposed to be equipped with the new GMDSS radio station, they should be able to scan a frequency in the 6310 KZ band (24 hrs). By using broadcast mode (one way) ships can send itineraries, ice information and other information as needed. These transmissions will be picked up by all vessels and should be able to printout.
- Itineraries may also be circulated via In.Fue.Tur but this is a method of last resort. Not all ships call at Ushuaia and the responsibility to circulate information is on individual vessels.
- Be sure to also exchange environmental information and management recommendations for individual landing sites or other notices with your colleagues as the season progresses.

Itinerary Changes

- To avoid conflicts, notify vessels in the region of any changes in planned itinerary as soon as practical.
- Notification can be by fax, telex, VHF or HF (see below)

Landing Priority

- In general, priority is given to the first vessel that has made its intentions known.

- In the event of conflict, expedition leaders should coordinate between themselves to determine priority, which is best accomplished through negotiation via HF or VHF.
- Please resolve any conflicts equitably. It is assumed that vessels visiting a site with some regularity will give way to a vessel that is not but any number of factors may come into play.
- Two vessels are not to land at the same place at the same time and, to avoid any potential environmental impacts, efforts should be made to spread out visits over time.

Station Visits

- Tour operators have agreed to provide 72 hour-notice of any planned station visit.
- Follow individual procedures determined by national programs/station leaders.
- Provide timely notice of cancellation, generally 48 hours in advance.
- Please include any additional station contact information, standard procedures or incidents involving stations in your voyage report to the home office.
- Remember no visits to Palmer Station are allowed on Sunday's and preferably not on Saturdays. All Palmer visits have been prearranged. Any changes, please advise Palmer as soon as possible.

Channel 16

- Channel 16 is used for hailing purposes only, NOT general communication.
- After making contact, immediately switch to another channel to continue conversation.
- Expedition Leaders should periodically review radio etiquette with staff. The airwaves during the height of the season in the Peninsula have been crowded, an issue with IAATO members and potentially with research stations. Take care to follow standard international procedures.

IAATO Radio Schedule

- IAATO members have agreed to implement a twice daily radio schedule.
- All ships should report in with their position/destination at 1230 and 1930 daily (Ushuaia local time). Each radio officer should record this information.

- Suggested HF hailing frequencies are: 4146 (1°), 6224 (2°)–SSB, 8294 (3°), to be finalized by radio officers during the season based on experience. Use 6224 whenever possible.
- Expedition leaders should make use of this schedule whenever VHF communication is impossible for exchange information. This will reduce communication costs.
- Please switch to another frequency for any extended conversation.

EMER (Emergency and Medical Evacuation Response)

- Review the IAATO Emergency Contingency Plan included in your briefing package.
- The reporting scheme indicated above is an integral part of emergency response. Please insure that it is followed and report any difficulties to your home office.

Post-Visit Reporting

- Following Antarctic Treaty recommendations, complete Part 1 and Part 2 of the standard Post-Visit report for every expedition. This should be the ONLY form completed and it should be completed carefully and returned to the office. This information is tabulated and circulated internationally.
- Please note guests of the company, guest lecturers, other "non-revenue passengers" should be reported as passengers *for the purposes of this report* unless they have a specific role ashore. In general, those responsible for supervising passenger operations ashore who report to the expedition leader are considered staff. Your office will provide additional guidance.
- Please use the standard list of "Antarctic Peninsula Region Landing Sites" for Part 2, in which case you need not complete the Latitude/Longitude. Please correct duplications or inconsistencies. In general, the most specific place name is used.
- Make additions to the list of landing sites as necessary — taking note of the standard procedures included in your briefing packet for assessing new or rarely visited sites.
- EL's, please note that this information is used for statistics that are tabled worldwide. Please do not hastily fill this out. If you have questions, consult your home office.

Have a safe and successful Antarctic season.

Attachment 14
Guidelines of Conduct for Antarctica Visitors

Antarctica, the world's last pristine wilderness, is particularly vulnerable to human presence. Life in Antarctica must contend with one of the harshest environments on earth, and we must take care that our presence does not add more stress to this fragile and unique ecosystem.

The following Guidelines of Conduct have been adopted by all members of the International Association of Antarctic Tour Operators (IATTO) and will be made available to all visitors traveling with them to Antarctica. With your cooperation we will be able to operate environmentally-conscious expeditions that protect and preserve Antarctica, leaving the continent unimpaired for future generations.

Please thoroughly study and follow these guidelines. By doing so, you will make an important contribution toward the conservation of the Antarctic ecosystem and minimize visitor impact. It will also help to ensure that you will have a safe and fulfilling experience in visiting one of the most exciting and fascinating places on earth.

1. DO NOT DISTURB, HARASS, OR INTERFERE WITH THE WILDLIFE

- never touch the animals.
- maintain a distance of at least 15 feet (4.5 meters) from penguins, all nesting birds and true seals (crawling seals), and 50 feet (15 meters) from fur seals.
- give animals the right-of-way.
- do not position yourself between a marine animal and its path to the water, nor between a parent and its young.
- always be aware of your surroundings; stay outside the periphery of bird rookeries and seal colonies.
- keep noise to a minimum.
- do not feed the animals, either ashore or from the ship.

Most of the Antarctic species exhibit a lack of fear which allows you to approach relatively close; however, please remember that the austral summer is a time for courting, mating, nesting, rearing young and molting. If any animal changes or stops its activities upon your approach, you are too close! Be especially careful while taking photographs, since it is easy to not notice adverse reactions of animals when concentrating through the lens of a camera. Disturbing nesting birds may cause them to expose their eggs/offspring to predators or cold. Maintain a low profile since animals can be intimidated by people standing over them. The disturbance of some animals, most notably fur seals and nesting skuas, may elicit an aggressive, and even dangerous, response.

2. DO NOT WALK ON OR OTHERWISE DAMAGE THE FRAGILE PLANTS, i.e., LICHENS, MOSSES AND GRASSES.

Poor soil and harsh living conditions mean growth and regeneration of these plants is extremely slow. Most of the lichens, which grow only on rocks, hard-packed sand and gravel, and bones, are extremely fragile. Damage from human activity among the moss beds can last for decades.

(continued on next page)

3. LEAVE NOTHING BEHIND, AND TAKE ONLY MEMORIES AND PHOTOGRAPHS.

- leave no litter ashore (and remove any litter you may find while ashore); dispose of all litter properly.
- do not take souvenirs, including whale and seal bones, live or dead animals, rocks, fossils, plants, other organic material, or anything which may be of historical or scientific value.

4. DO NOT INTERFERE WITH PROTECTED AREAS OR SCIENTIFIC RESEARCH.

- do not enter buildings at the research stations unless invited to do so.
- avoid entering all officially protected areas, and do not disturb any ongoing scientific studies.

Areas of special scientific concern are clearly delineated by markers and/or described in official records (the expedition staff know these sites). Scientific research in Antarctica is in the interest of everyone—visitors, scientists, and laymen.

5. HISTORIC HUTS MAY ONLY BE ENTERED WHEN ACCOMPANIED BY A PROPERLY AUTHORIZED ESCORT.

- nothing may be removed from or disurbed within historical huts.

Historic huts are essentially museums, and they are all officially maintained and monitored by various governments.

6. DO NOT SMOKE DURING SHORE EXCURSIONS.

Fire is a very serious hazard in the dry climate of Antarctica. Great care must be taken to safeguard against this danger, particularly around wildlife areas, historic huts, research buildings, and storage facilities.

7. STAY WITH YOUR GROUP OR WITH ONE OF THE SHIP'S LEADERS WHEN ASHORE.

- follow the directions of the expedition staff.
- never wander off alone or out of sight of others.
- do not hike onto glaciers or large snow fields, as there is a real danger of falling into hidden crevasses.

1992/93

In addition to the Guidelines of Conduct for Antarctic Visitors adopted by IAATO, all visitors should be aware of the Agreed Measures for the Conservation of Antarctic Fauna and Flora. This annex to the Antarctic Treaty of 1959 addresses the protection of the environment and conservation of wildlife. Citizens of any government that has ratified the Antarctic Treaty are legally bound by the following guidelines of conduct in the region south of Latitude 60° South:

Conservation of Wildlife

Animals and plants native to Antarctica are protected under the following five instruments outlined in the Agreed Measures:

1. Protection of Native Fauna

Within the Treaty Area it is prohibited to kill, wound, capture or molest any native mammal or bird, or any attempt at such an act, except in accordance with a permit.

2. Harmful Interference

Appropriate efforts will be taken to ensure that harmful interference is minimized in order that normal living conditions of any native mammal or bird are protected. Harmful interference includes any disturbance of bird and seal colonies during the breeding period by persistent attention from persons on foot.

3. Specially Protected Species

Special protection is accorded to Fur and Ross Seals.

4. Specially Protected Areas (SPAs)

Areas of outstanding scientific interest are preserved in order to protect their unique natural ecological system. Entry to these areas is allowed by permit only.

5. Introduction of Non-Indigenous Species, Parasites and Diseases

No species of animal or plant not indigenous to the Antarctic Treaty Area may be brought into the Area, except in accordance with a permit. All reasonable precautions have to be taken to prevent the accidental introduction of parasites and diseases into the Treaty Area.

Additionally, the Marine Mammal Protection Act of 1972 prohibits U.S. citizens from taking or importing marine mammals, or parts of marine mammals, into the U.S. Both accidental or deliberate disturbance of seals or whales may constitute harassment under the Act.

(continued on following page)

1992/93

Further, the Antarctic Conservation Act of 1978 (U.S. Public Law 95-541) was adopted by the United States Congress to protect and preserve the ecosystem, flora and fauna of the continent, and to implement the Agreed Measures for the Conservation of Antarctic Fauna and Flora. The Act sets forth regulations which are legally binding for U.S. citizens and residents visiting Antarctica.

Briefly, the Act provides the following:

> In Antarctica the Act makes it unlawful, unless authorized by regulation or permit issued under this Act, to take native animals or birds, to collect any special native plant, to introduce species, to enter certain special areas (SPAs), or to discharge or dispose of any pollutants. To "take" means to remove, harass, molest, harm, pursue, hunt, shoot, wound, kill, trap, capture, restrain, or tag any native mammal or native bird, or to attempt to engage in such conduct.

Under the Act, violations are subject to civil penalties, including a fine of up to $25,000 and one year imprisonment for each violation. The complete text of the Antarctic Conservation Act of 1978 can be found in the ship's library.

Our ship's staff will make certain that the Antarctic Conservation Act and the above guidelines are adhered to.

By encouraging your fellow expeditioners to follow your environmentally-conscious efforts you will help us to ensure that Antarctica will remain pristine for the enjoyment of future generations. Thank you in advance for your cooperation.

1992/93

Attachment 15
Review of Site Characteristics Likely to Affect the Nature and Severity of Possible Cumulative Impacts

Ron Naveen, Oceanites, Inc.
NSF/OPP Workshop on Cumulative Environmental Impacts of Tourism
June 7–9, 2000
San Diego, CA

ABSTRACT: In six seasons of fieldwork, 1994–2000, the Antarctic Site Inventory has begun compiling baseline data and information necessary to assess and determine how best to minimize, or potentially avoid, environmental impacts at Antarctic Peninsula visitor sites. This presentation describes site characteristics and biological and physical variables the Inventory has examined and suggests recommendations for improving the assessment and monitoring of possible environmental impacts at these sites.

Introduction

Following a year of examining methodologies and logistics, the Antarctic Site Inventory began fieldwork in November 1994. The Inventory's objectives are to:

- determine whether opportunistic visits can be used to effectively and economically detect possible changes in the physical features, flora, and fauna of sites in the Antarctic Peninsula being visited repeatedly by ship-based tourists; and
- begin compiling baseline data and information necessary to be able to detect possible changes in the physical and biological variables being monitored, and determine how best to minimize or avoid possible environmental impacts of tourism and non-governmental activities in the Antarctic Peninsula area.

Site visits are achieved by placing Antarctic Site Inventory researchers aboard expedition tour ships at key census times each austral spring and summer, coinciding with the peak of penguin egg-laying (for appropriate nest censuses) and the peak of penguin chick-crèching (for appropriate chick censuses). Site visits and aerial photodocumentation also are undertaken in cooperation with the British Royal Navy ice patrol vessel *HMS Endurance.* (Naveen: 1996, 1997a, 1999)

The project intends to assist the implementation of the 1991 Protocol on Environmental Protection to the Antarctic Treaty, which among other things requires:

- *a priori* environmental impact assessments for all human activities in Antarctica, including tourism, and
- for monitoring to be done, as and when necessary, to ensure that activities do not have unacceptable environmental impacts.

The Protocol intends to ensure that human activities do not have adverse impacts on the Antarctic environment. In assessing potential impacts, the Protocol focuses on the *initial environmental reference state* of particular locations, which in the case of tourism translates to sites shipboard passengers are visiting. While tourism sites are the locations specifically being examined by the Inventory, the project's broader concern is with possible environmental impacts from *any and all* activities. The Inventory is not constituted as a tourism study *per se,* nor does it specifically examine responses of fauna to various levels of human visitation. (Naveen: 1996, 1997a, 1999)

Approaches to assessment and monitoring

In this context, established authorities state that the environmental assessment and monitoring should identify changes to the baseline reference state at these sites and, if possible, determine whether any detected changes are naturally occurring, produced perhaps by human activities, or result from other direct, consequential, synergistic, and cumulative effects. Potential impacts may be short-term or long-term, immediate or cumulative. In the case of biological populations, the focus should be detecting and understanding changes that may occur to these populations as a whole. (Benninghoff and Bonner, 1985; Abbott and Benninghoff, 1990; SCAR, 1996; Trivelpiece, 1991; Emslie, 1997) These authorities suggest that assessment and monitoring efforts should:

- Identify the *types of activities* that could possibly have unacceptable effects on Antarctic ecosystems and the likely nature of those effects;
- Determine those *components* of Antarctic ecosystems that are most likely to be affected in unacceptable ways by human activities;
- Select possible *indicator variables and areas* to monitor; and, ultimately
- Ensure that activity causes *no unacceptable deterioration* of values or resources

With respect to examining potential impacts from tourism, such an approach suggests the importance of identifying the kinds of cumulative impacts potentially resulting from multiple visits and, if feasible, listing and ranking the relative importance site characteristics most likely to determine the nature and severity of cumulative effects. (Benninghoff and Bonner, 1985; Abbott and Benninghoff, 1990; SCAR, 1996)

Types of activities: Zodiac landing sites

With respect to Antarctic tourism, zodiac landings are the dominant activity and appear to be the activity that possibly could have unacceptable environmental effects, particularly regarding resident fauna and flora. Zodiac tours without shore landings, helicopter landings and overflights, scuba and snorkeling, ice walking, and camping do not appear to involve the same intensity or frequency of visitor contact with Peninsula fauna and flora. (Naveen: 1997a, 1999)

With the 1989–90 Antarctic tour season, the U.S. National Science Foundation Office of Polar Programs (NSF/OPP) began assembling data on Antarctic tourism, based entirely on site visit reports submitted by Antarctic tour operators (NSF/OPP, 1990–1999). The NSF/OPP compilations list more than 250 sites visited by tourists in the Antarctic Peninsula-Queen Maud Land-South Georgia-Falklands Islands region. The compilations indicate sites where visitor activity takes place, the types of activity taking place, the frequency of such activities, and the number of visiting passengers who are involved.

With regard to examining potential environmental impacts of zodiac landings at these sites, the Inventory considers overall numbers of visitors, tour ships, and departures to be less important than:

- *where* visitors make landings
- *how many* visitors go ashore during zodiac landings (i.e. the intensity of use of these landing sites); and
- *how frequently* zodiac landings occur. (Naveen, 1999)

The NSF/OPP data indicate that zodiac visitor landings occurred at 165 locations in the Peninsula in the 1989–99 period. In this period, the number of Peninsula zodiac landings per season increased more than 400%, from 164 to 858, concentrating in the South Shetland Islands (43.2% of all zodiac landings) and the northwestern part of the Peninsula (35.9% of all zodiac landings). The 10–20 Peninsula sites with the most zodiac landings per season consistently account for 54–75% of each season's landings and visitors. (Naveen, 1999)

However, in any given season, all available sites are not visited and many sites are visited only once (Naveen, 2000b):

Season	Available Zodiac landing sites, cumulative total	Available sites with Zodiac landings during the season	Percentage of available sites visited	Sites visited only once	Percentage of sites visited only once
1989–90	35	35	100.0%	9	25.7%
1990–91	42	32	76.2%	7	21.9%
1991–92	54	44	81.5%	12	27.3%
1992–93	68	50	73.5%	16	32.0%
1993–94	84	64	76.2%	23	35.9%
1994–95	105	5	71.4%	24	32.0%
1995–96	124	71	57.3%	20	28.2%
1996–97	142	81	57.0%	28	34.6%
1997–98	153	71	46.4%	26	36.6%
1998–99	165	85	51.5%	30	35.3%

Ecosystem components and indicators

The Inventory considers the following fauna and flora, found variously at these 165 sites, to be potential indicators of environmental change:

SEALS

Southern elephant seal	*Mirounga leonina*

PENGUINS

Adélie penguin	*Pygoscelis adeliae*
Chinstrap penguin	*Pygoscelis antarctica*
Gentoo penguin	*Pygoscelis papua*
Macaroni penguin	*Eudyptes chrysolophus*

FLYING BIRDS

Southern giant petrel	*Macronectes giganteus*
Antarctic fulmar	*Fulmarus glaciodes*
Pintado petrel	*Daption capense*
Snow petrel	*Pagodroma nivea*
Blue-eyed shag	*Phalacrocorax atriceps*
Snowy sheathbill	*Chionis alba*
Skua, spp.	*Catharacta lonnbergi*
	Catharacta maccormicki
Kelp gull	*Larus dominicanus*
Antarctic tern	*Sterna vittata*

FLORA

Antarctic hair grass	*Deschampsia antarctica*
Antarctic pearlwort	*Colobanthus quitensis*
Moss, spp.	*Bryum,* spp.
	Brachythecium, spp.
	Drepanocladus, spp.
	Polytrichum, spp.
Crustose lichens, spp.	*Xanthoria,* spp.
Fruticose and foliose lichens, spp., foliose alga	*Caloplaca,* spp.
	Verrucaria, spp.
	Haematomma, spp.
	Usnea, spp.
	Umbilicaria, spp.
	Ramalina, spp.
	Physcia, spp.
	Prasiola crispa (and its lichenized form, *Mastodia tesselata*)
Snow Algae	

Methods and geographical area

The Inventory's methodology (fully described in Naveen: 1996, 1997a) involves the collection of three categories of data and information:

- *Basic Site Information,* which includes descriptions of key physical and topographical characteristics; latitude and longitude; distribution of flora, seal haul-out and wallow locations, and discrete groups of breeding penguins and flying birds;
- *Variable Site Information and Data,* which includes weather and other environmental conditions (sea ice extent, cloud cover, snow cover, temperature, wind direction and speed), biological variables (number of breeding birds, nest counts, numbers and ages of chicks), and the nature and extent of visitor impacts (footprints or paths, cigarette butts, film canisters, and litter); and
- *Maps and Photodocumentation,* which portray the major features of each site, particularly the locations of colonies and assemblages of resident fauna and flora.

With respect to key biological variables — in particular, nest and chick censuses of penguins and seabirds — data are collected in accordance with the *CEMP Standard Methods for Monitoring Studies* (Scientific Committee for the Conservation of Antarctic Marine Living Resources, 1997). The *CEMP Standard Methods* delineate key census periods in each breeding season; specifically, during the peak of penguin egg-laying for penguin nest counts and during the peak of penguin chick-crèching for penguin chick counts.

The Inventory divides the Antarctic Peninsula into six subareas:

SO	South Orkneys	includes Laurie, Coronation, and Signy Islands
EI	Elephant Island	includes nearby islands
NE	Northeast Antarctic Peninsula	from Cape Dubouzet (63˚16'S 64˚00'W) to James Ross Island
SH	South Shetland Islands	including Deception, Low, and Smith Islands
NW	Northwest Antarctic Peninsula	from Cape Dubouzet (63˚16'S 64˚00'W) to north end of the Lemaire Channel
SW	Southwest Antarctic Peninsula	from the north end of the Lemaire Channel to the northern part of Marguerite Bay (68˚18'S 67˚11'W)

The project intends to reach as many visitor sites as possible during each austral spring and summer season, and during the key census times noted above. Expedition ships are selected carefully to meet this aim, particularly those with the longest Peninsula itineraries and with expedition leaders who strive to make as many landings as possible.

Census strategies

Regarding penguins, differences in breeding biology led to different Inventory census strategies. Chinstrap and Adélie penguins are highly faithful to specific nest sites, and do not tend to abandon regular nest sites and rookeries if there is a breeding failure in a single season. Because of the strong site fidelity of chinstrap and Adélie penguins, nest and chick censuses of discrete colonies and subgroups at a particular site may have long-term relevance, even if all colonies and subgroups at that site cannot be censused. Gentoo penguins do not exhibit the same nest site fidelity and regularly change nesting locations if there are disturbances. This means that gentoo penguin nest and chick censuses only may have long-term relevance if *all* gentoo colonies and subgroups at a particular site are censused. (Naveen: 1997a, 1999)

At a number of Peninsula sites with breeding chinstrap an/or Adélie penguins, the Inventory has begun to identify and census *control* colonies (i.e. those which are seldom disturbed) and *experimental* colonies (i.e. those which are frequently visited), which may be visited and censused regularly. Potentially, this will allow comparisons over time between areas where there is more and less human activity.

With respect to flying birds, the Inventory thus far has concentrated on nest/chick censuses of southern giant petrels, blue-eyed shags, kelp gulls, skuas (spp.), and snowy sheathbills, whose nests are reasonably discoverable and accessible.

Antarctic Site Inventory: Results and findings

1. Number of visits. From January 1994 to February 2000, with logistics assistance from various expedition ships and *HMS Endurance*, Inventory researchers made 287 survey visits to 59 Peninsula locations. (Naveen: 1997a, 1999; Naveen, et. al, 2000a)

2. Feasibility of reaching key sites. Regarding the project's goal of visiting key tourism sites repeatedly and cost-effectively, careful selection of vessels and expedition leaders has enabled the Inventory to reach all heavily visited tourism sites. (Naveen: 1997a, 1999)
The most visited Antarctic Peninsula sites over ten seasons, 1989–99, by number of zodiac landings, are:

Site	Subarea	1989–99 Landings	Rank
Whalers Bay, Deception Island	SH	425	1
Cuverville Island	NW	359	2
Port Lockroy	NW	350	3
Pendulum Cove, Deception Island	SH	300	4
Hannah Point, Livingston Island	SH	290	5
Petermann Island	SW	278	6
Half Moon Island	SH	263	7
Almirante Brown Station	NW	259	8
Paulet Island	NE	196	9
Arctowski Station, King George Is.	SH	166	10
Neko Harbor, Andvord Bay	NW	152	11
Baily Head (incl. Rancho Point)	SH	149	12
Waterboat Pt. (G. Videla Station)	NW	148	13
Aitcho Islands	SH	147	14
Penguin Island	SH	118	15

3. Basic site descriptions. Basic descriptions of more than 50 Antarctic Peninsula visitor sites have been published and made available. (Naveen: 1997a, 1997b, 1999)

4. Orientation maps. There are 16 sites at which Inventory researchers attempt to census each season, at the key census times suggested by the *CEMP Standard Methods*. These sites are: Hannah Point (SH); Penguin Island (SH); Baily Head (SH); Aitcho Islands (SH);

Turret Point (SH); Yankee Harbor (SH); Paulet Island (NE); Brown Bluff (NE); Waterboat Point (NW); Port Lockroy (NW); Orne Islands (NW); Georges Point (NW); Neko Harbor (NW); Gourdin Island (NW); Pléneau Island (SW); and Petermann Island (SW). To assist this effort, the Inventory has produced and regularly updates orientation maps for all 16 sites.

5. Aerial photodocumentation. The Inventory's collaboration with *HMS Endurance* has generated oblique aerial photodocumentation of 34 Antarctic Peninsula visitor sites.

6. Census refinements. A power analysis was undertaken to examine possibilities for improving Inventory census methods (Naveen, 1997a). As per procedures delineated in the *CEMP Standard Methods* (Scientific Committee for the Conservation of Antarctic Marine Living Resources, 1997), the Inventory methodology initially required that:

> counts of adults, active nests, and chicks should be repeated until three counts are obtained that are within 5–10% range of each other.

The power analysis suggested a slight refinement, requiring that:

> counts of adults, active nests, and chicks should be repeated until three counts are obtained, with the highest count being no more than 8% higher than the lowest count.

This refinement avoids a constant recalculation of mean values, which may be a particular difficulty when researchers are censusing a large colony.

7. Site diversity and sensitivity to potential disturbances. From its inception, the Inventory has collected data regarding the presence or absence of nesting species of penguins and flying birds, wallows of southern elephant seals, and large patches or beds of lichens and mosses at all sites visited (Naveen: 1996, 1997a, 1999; Naveen, et. al, 2000b). These presence/absence data have been used to rank zodiac landing sites according to the number of faunal species and major floral groups recorded, irrespective of whether nests, wallows, and floral groups may be easily accessed by tour ship visitors during a regular zodiac landing.

As a result, the five Peninsula sites considered to have a "high" species diversity are: Hannah Point (SH), Penguin Island (SH), the Aitcho Islands (SH), Cuverville Island (NW), and Fort Point (SH). The 15 sites considered to have a "medium" species diversity are: Arctowski Station (SH), Astrolabe Island (NW), Baily Head (SH), Brown Bluff (NE), Half Moon Island (SH), Heroína Island (NE), Port Lockroy (NW), Point Lookout (EI), Orne Island (NW), Paulet Island (NE), Petermann Island (SW), Pléneau Island (SW), Turret Point (SH), Whaler's Bay (SH), and Yankee Harbor (SH). The other 39 sites visited by the Inventory are considered to have "low" species diversity.

Because of the physical variation in landing sites, species diversity does not equate necessarily to visitors' attaining relatively close views of resident fauna and flora. Using these presence/absence data as a base, the Inventory also ranked sites in terms of visitors' accessibility to nests, wallows, and floral groups. In this respect, it is assumed, in the course of a regular tourist landing, that sites are more or less sensitive to potential disturbance according to the number of penguin and flying bird species whose nests visitors may access easily, whether or not visitors may access southern elephant seal wallows easily, and whether or not visitors may access easily and possibly trample large patches or beds of lichens and mosses.

In this analysis, sites with five or more of these proximity tallies were considered to be "highly" sensitive to potential disturbances by visitors, and four were identified: Hannah Point (SH), Penguin Island (SH), the Aitcho Islands (SH), and Turret Point (SH). Sites with 3–4 proximity tallies were considered to be "moderately" sensitive to potential disturbances, and nine were identified: Brown Bluff (NE), Fort Point (SH), Gourdin Island (NW), Orne Island (NW), Paulet Island (NE), Petermann Island (SW), Pléneau Island (SW), Georges Point, Rongé Island (NW), and Waterboat Point (NW).

Focusing solely on the 1998–99 season, 85 Antarctic Peninsula sites experienced zodiac visitor landings. The five "high" diversity sites comprised only 5.9% of sites visited that season, but attracted 18.2% of all zodiac landings and 14.3% of all visitors. The fifteen "medium" diversity sites comprised 17.7% of the 85 sites visited, but attracted 39.4% of all zodiac landings and 35.5% of all visitors. Sites with high/medium species diversity thus accounted for more than 50% of all Peninsula zodiac landings and visitors, an attraction that is highly significant ($\chi^2 = 581$, $p < .001$ with respect to landings; $\chi^2 = 50{,}698$, $p < .001$ with respect to visitors) and supports the conventional wisdom that visitors come to the Peninsula to see a diversity of wildlife. (Naveen, et. al, 2000b)

Also, in the 1998–99 season, the four Peninsula sites identified as "highly" sensitive to potential disturbances by visitors comprised 4.7% of the 85 sites visited that season, but attracted 11.8% of all zodiac landings and 9.6% of all visitors. The nine sites identified as "moderately" sensitive to potential disturbances by visitors comprised 10.6% of the 85 sites visited that season, but attracted 15.4% of landings and 14.6% of all visitors. Sites with high/moderate sensitivity to potential visitor disturbances by visitors thus accounted for more than 24% of all Peninsula zodiac landings and visitors, an attraction that is highly significant ($\chi^2 = 124$, $p < .001$ with respect to landings; $\chi^2 = 11{,}140$, $p < .001$ with respect to visitors). This also suggests that visitors either come to the Peninsula to see wildlife that is easily accessed, or that the modus

operandii of zodiac landing procedures and expedition staff guidance make wildlife easily accessible to visitors. (Naveen, et. al, 2000b)

When the 1998–99 season is analyzed in terms of the 55 Peninsula sites experiencing two or more zodiac visitor landings, the highly significant attraction to diverse and sensitive sites is maintained. Seventeen sites with high/medium species diversity were visited, representing 30.9% of these 55 sites, account for 59.5% of the zodiac landings (χ^2 = 320, $p < .001$) and 59.7% of the visitors (χ^2 = 28,271, $p < .001$). Twelve sites with high/moderate sensitivity to potential disturbances by visitors, representing 21.8% of these 55 sites, accounted for 28.1% of the zodiac landings (χ^2 = 33, $p < .001$) and 29.0% of the visitors (χ^2 = 2,721, $p < .001$). (Naveen, et. al, 2000b)

In the *Compendium of Antarctic Peninsula Visitor Sites* (Naveen, 1997a), site sensitivity was analyzed in another fashion. Recalling the guidance from Abbott and Benninghoff (1990) to identify unacceptable effects that are likely to occur and components of the ecosystem likely to be affected in unacceptable ways by human activities, the *Compendium* listed nine factors that would suggest a site's sensitivity to potential environmental damage:

- unusually high science values, which have the potential of being easily disturbed (e.g. the possibility of disturbing a major project being conducted on site, or disturbing a site like the Dry Valleys, which has clearly "recognized" science value);
- presence of an unusually high species diversity (for this purpose, reference may be made to the sites scoring in the "high" category, as explained on the previous page);
- presence of geological or physical features that may be easily disturbed (e.g. rare penguin fossils on Seymour Island; potentially serious erosion);
- close proximity to a boundary of a Site Of Special Scientific Interest (SSSI) or Specially Protected area (SPA), which boundary is poorly defined or easily encroached;
- presence of environmental elements that focus visitor attention and may be disrupted, (e.g. a species with very limited distribution or rare occurrence in the area, like macaroni penguins at Hannah Point);
- close proximity to any southern giant petrel nests, this being one species of flying bird that is very easily disturbed (Emslie, 1996; Trivelpiece, 1991);
- situations where nests of regularly encountered flying birds like blue-eyed shags, kelp gulls, or Antarctic terns may be easily disturbed;

- restricted visitor space at a particular site, where there are only very narrow (or perhaps, non-existent) pathways between visitors and penguins; and
- presence of large beds or patches of moss or foliose-fruticose lichens, which may be easily accessed and trampled.

On this basis, Hannah Point (SH) and Penguin Island (SH) were considered the two most environmentally sensitive sites, presenting five or more factors that would suggest a sensitivity to potential environmental damage. Nine sites presented two or more of these factors: Half Moon Island (SH); the Aitcho Island (SH); the vicinity of Arctowski Station (SH); the vicinity of Ferraz Station (SH); Turret Point (SH); Whalers Bay (SH); Paulet Island (NE); Astrolabe Island (NW); and Port Lockroy (NW).

8. Trends: Blue-eyed shags. An analysis of Inventory data for the period January 1994 to January 2000 indicate a downward trend in blue-eyed shag nesting populations at five of thirteen sites where the Antarctic Site Inventory has identified nesting shags: the cliffside colonies near Almirante Brown Station, Paradise Bay (NW); Hannah Point, Livingston Island (SH); Jougla Point, Port Lockroy, Wiencke Is. (NW); Petermann Island (SW); and the Orne Islands (NW).

Shag nests in the vicinity of the Almirante Brown Station declined 50%, from 100 to 49, in the 1994–2000 period. Shag nests at the Orne Islands visitor site declined from fifteen nests in November 1994 to zero in December 1999. However, for Petermann Island and Jougla Point, the null hypothesis that the negative slopes of the log-transformed data were the result of chance alone could not be rejected. Declines at the other sites were either highly significant (Almirante Brown, $P < .001$, $r = .9786$, 5 df; Orne Islands, $P < .001$, $r = .9765$, 4 df) or significant (Hannah Point, $P < .05$, $r = .7422$, 6 df). (Naveen, et. al, 2000b)
The Almirante Brown and Orne Islands colonies are either inaccessible to tourists or receive few tourist visits (Naveen: 1997a, 1999). This suggests that human disturbance is an unlikely cause of such declines. In December 1999 at the Orne Islands site, which has a northwestern-to-southwestern exposure to the Gerlache Strait, one-meter-deep snow was noted on the shags' nesting ledges. At the other three sites (Petermann Island, Jougla Point, Hannah Point), the shag population now may have stabilized or slightly increased since the decline from 1994–1995 levels.

Collectively, the declines observed over seven seasons at different sites throughout the Peninsula suggest that blue-eyed shag numbers should be further monitored. These declines may be indicative of some underlying environmental change affecting shag nest success.

9. Southern giant petrels. Four Inventory study sites — Hannah Point (SH), Penguin Island (SH), the Aitcho Islands (SH), and Turret Point (SH) — contain easily accessible colonies of southern giant petrel (*Macronectes giganteus*). The Inventory has begun annual, site-wide censuses of this species at the first three of these sites, but it is too early to suggest any population trends. However, there is considerable concern regarding potential disturbances to these easily accessible assemblages (Naveen: 1997a, 1997b, 1999). Extreme care is necessary because nesting southern giant petrels are easily pushed off of their eggs during the nesting season, and eggs easily may be predated by skuas. Once an egg is lost, southern giant petrels are unable to relay and breed successfully that season (Emslie, 1996). This species's breeding cycle spans the entire length of each tourism season: A single egg is laid in early November, the incubation period lasts for approximately sixty days (until January), and each season's cohort of chicks — if they survive — will not fledge until 100-130 days after hatching (March and later).

Future assessment and monitoring

Inventory experience suggests a number of concerns regarding the assessment and monitoring of Peninsula visitor sites, and possibilities for refining and improving such efforts in the future.

1. Data comparability. As noted above, the *CEMP Standard Methods for Monitoring Studies* (Scientific Committee for the Conservation of Antarctic Marine Living Resources, 1997) require penguin nest counts achieved during the peak of egg-laying each season, and chick censuses during the subsequent peak of chick-crèching. Inventory-related publications (Naveen: 1996, 1997a, 1999; Naveen, et. al, 2000a) routinely reference historic penguin nest and chick censuses that have been compiled in Woehler (1993) and SCAR (1996). However, it is important to emphasize the difficulty in using much of the historic data to assess population trends.

Clearly, the compilations are valuable sources of information about penguin distribution and often reflect more detailed work being done at particular locations. But extreme care in using these data is urged.

Historic censuses may not be comparable because they were made at various times and in varying fashions, and not necessarily in accordance with the *CEMP Standard Methods for Monitoring Studies* (Scientific Committee for the Conservation of Antarctic Marine Living Resources, 1997). The only filter consistently applied to these compiled data relates to the exactitude of the counts themselves (i.e. whether they represent actual nest counts or estimates with varying degrees of accuracy).

Regarding some of the historic censuses, only the year is listed for a particular nest or chick count. In other instances, it is unclear at which point

the census occurred within a particular breeding season. In other cases, where specific dates are ascribed to penguin nest or chick censuses (or where dates may be gleaned from primary source material), it is unclear how close the censuses were to either the peak of egg-laying or chick-crèching in that particular breeding season.

For future monitoring efforts, reliance on the *CEMP Standard Methods* will ensure that collected data are fully comparable with data collected by the Inventory or by other long-term Peninsula projects using the same, standard procedures. In turn, this enables a greater confidence in assessing and describing trends that may be suggested by such comparisons.

2. Focused effort at key sites. Clearly, it is both economically and physically impossible to monitor a large number of visitor sites. However, given the developing baselines of data and information about Peninsula tourism sites, it should be possible to monitor a few, select sites. Again, as noted, it would be important to identify the kinds of cumulative impacts potentially resulting from multiple tourism visits and, if feasible, to list and rank the relative importance site characteristics most likely to determine the nature and severity of cumulative effects. (Benninghoff and Bonner, 1985; Abbott and Benninghoff, 1990; SCAR, 1996)

Relevant factors in this selection might usefully include: geography and visitation patterns; diversity of flora and fauna; and a site's particular sensitivity to potential environmental disturbances. To enable comparisons, it may be prudent to select tourism sites with a close proximity to related and ongoing, long-term Peninsula studies.

3. Other potentially relevant variables. Future assessment and monitoring efforts likely require a consideration of other potentially important factors; for example, climate change and prey distribution and availability. This is bolstered by changes the Inventory has detected in breeding blue-eyed shag populations that have minimal visitor traffic.

Analyzing these other factors will enable a better understanding of whether any detected changes are naturally occurring, produced perhaps by human activities, or result from other direct, consequential, synergistic, and cumulative effects. (Benninghoff and Bonner, 1985; Abbott and Benninghoff, 1990; SCAR, 1996)

4. Additional research needs, analyses. To reiterate: the *CEMP Standard Methods* mandate that nest censuses be achieved as near as possible to the peak of egg-laying, and chick censuses as near as possible to the peak of chick-crèching. However, given that Inventory site visits occur opportunistically, this is not always possible. Consequently, to

ensure that Inventory censuses may be used for determinations of breeding success/productivity, annual survival, and recruitment, correlation studies are being considered to establish how close censuses occur to the respective peaks of egg-laying and chick-crèching, respectively.

Accurate breeding chronologies at key tourism sites will enable comparisons to the visitation chronology of tourists, perhaps to determine how the timing of visits relates to times within each breeding cycle when eggs or chicks are most vulnerable to disturbance. Determining accurate breeding chronologies at key tourism sites will enable comparisons, suggested above, with results obtained at nearly locations to ascertain whether detected changes are area-wide trends or site-specific aberrations.

While the effort continues to photodocument flora on a site-by-site basis, the Inventory has not yet instituted floral degradation studies at sites with abundant and easily accessible patches of lichens and mosses.

5. Improved site-visit reporting. There are a number of ways that site-visit reporting by tour operators may be improved. There continues to be reporting of sites that cannot be identified precisely as to actual location. Of the 165 Peninsula sites listed in the NSF/OPP compilations, eighteen refer to broad geographic features or areas known to contain other regularly visited sites: Coronation Island; Laurie Island; Signy Island; Elephant Island; Deception Is.; Fildes Peninsula; King George Is.; Martel Inlet; Maxwell Bay; Charlotte Bay; Errera Channel, small peak; Melchior Islands; Paradise Bay; James Ross Island; Prince Gustav Channel; Seymour Island; Danger Islands; and Argentine Islands. (Naveen: 1997a, 1999)

For purposes of analyses by the Inventory, landings data from eight sites (four pairs of two) have been combined because they appear to refer to the same location (Baily Head and Rancho Point; Damoy Point and Dorian Bay; Georges Point and Rongé Island; and Port Lockroy and Jougla Point. In the Port Lockroy vicinity tourists are now visiting the recently restored hut on Goudier Island, which is a separate visitor site from nearby Jougla Point. (Naveen: 1997a, 1999)

6. Additional data. With respect to analyzing potential environmental impacts from Antarctic Peninsula tourism activity, some additional data sets may be useful.

One set involves the exact dates and timings of zodiac landings. Presumably, such data may be gleaned from site-visit reports now being submitted, but as yet such data are not compiled by NSF/OPP. These data would enable the previously noted, potentially useful, comparison of breeding chronologies and visitation chronologies.

Further, noting that the International Association of Antarctic Tour Operators strives to coordinate itineraries so "no more than 100 people are ashore at any one time in any one place" (IAATO, 1991), it may be useful to know how many 100-passenger groups comprise a single zodiac landing. This raises the matter of Antarctic expedition vessels carrying more than 100 passengers on a single Antarctic departure, and which may or may not be IAATO members. To the extent these vessels report a landing, it may involve a landing with more than one, 100-passenger group going ashore, and thus equate to a number of landings tallied by smaller capacity vessels.

Also, there exists no compilation of data reflecting yacht visits to Antarctic Peninsula visitor sites, or the number of yacht passengers visiting particular sites. IAATO has encouraged yacht operators to join its association, but as yet no coordinated mechanism exists to obtain potentially relevant visitation data from the yachting portion of the Antarctic tourism industry.

Finally, as new types of activities are added to the tourism experience in the Antarctic Peninsula, it also would be helpful if site visit reports and subsequent NSF/OPP compilations precisely noted which new activities are undertaken, where these activities take place, and how many visitors partake in them.

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Attachment 16

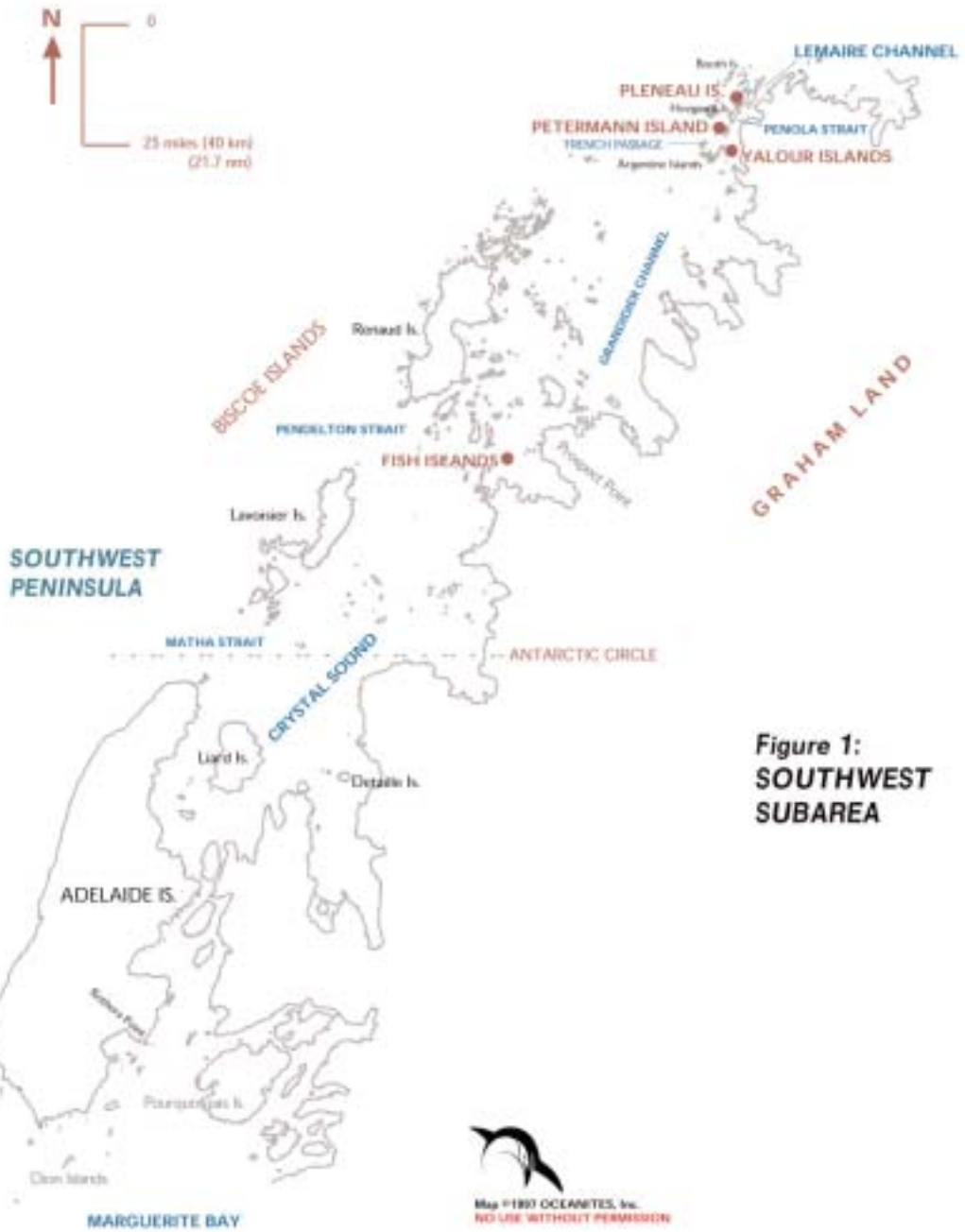

Figure 1:
SOUTHWEST SUBAREA

Attachment 16 (continued)

Figure 2:
SO. SHETLANDS SUBAREA
and parts of
NORTHEAST *and*
NORTHWEST SUBAREAS

Attachment 16 (continued)

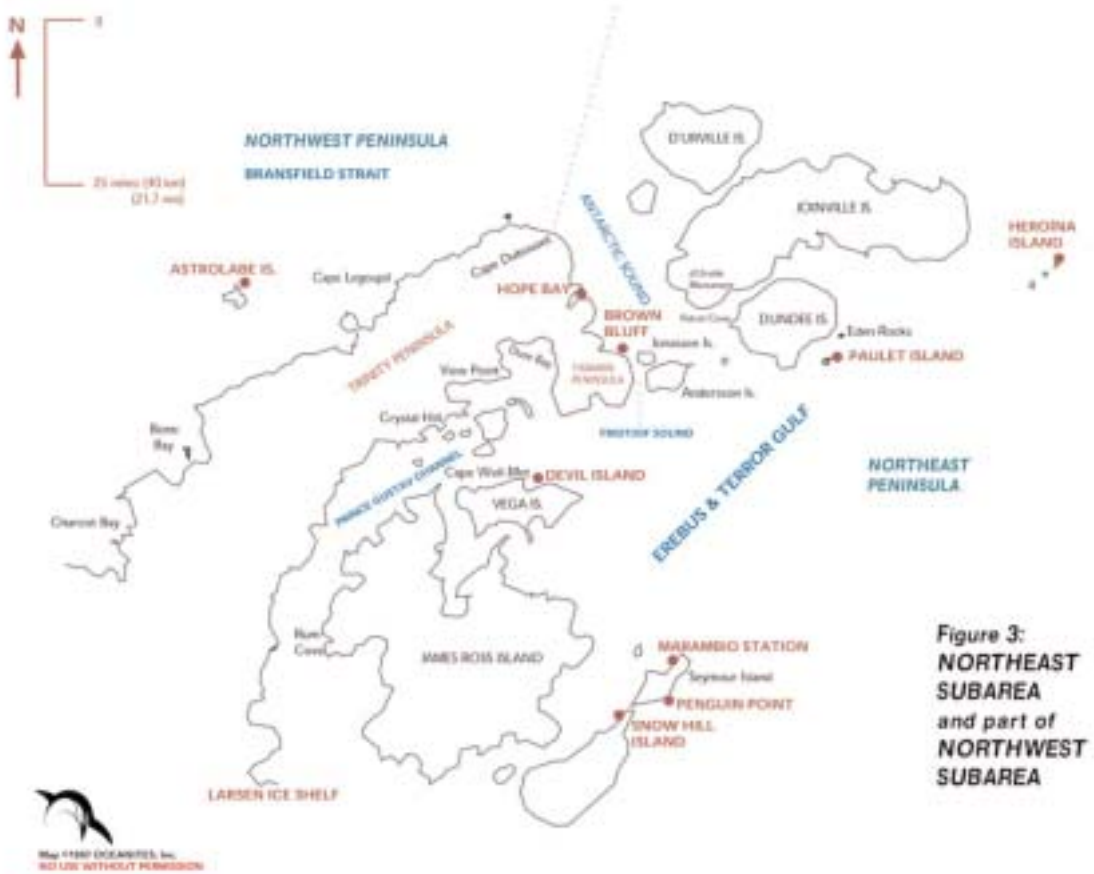

Figure 3:
NORTHEAST SUBAREA
and part of
NORTHWEST SUBAREA

Attachment 16 (continued)

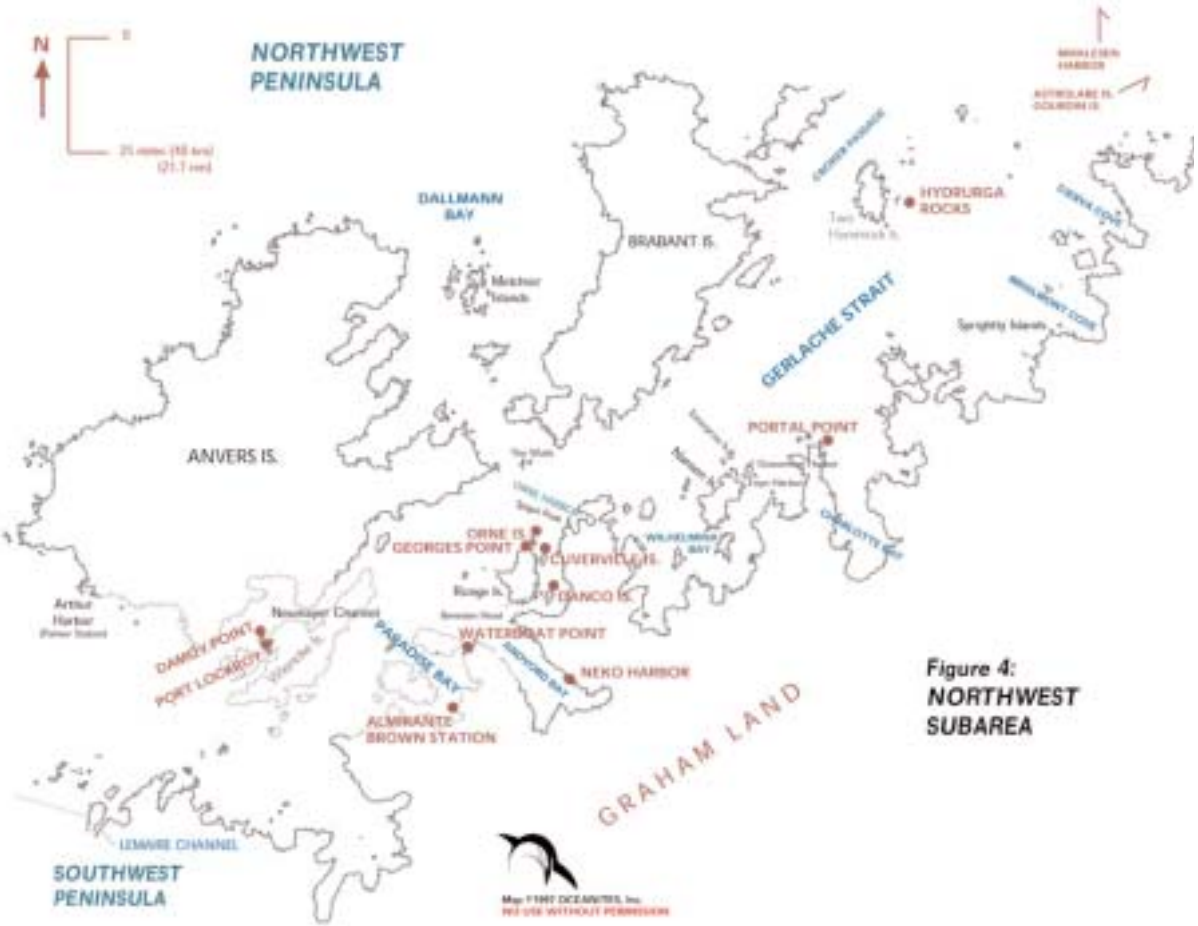

Figure 4:
NORTHWEST SUBAREA