

FLAG EXPEDITION REPORT

Flag Number 19



ANTARCTICA: Eye Witness Impact of Tourism 2014 compared to 1999

Submitted by

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JUNE 26, 2014

Flag Number: 19

Title of Expedition:

ANTARCTICA: Eye Witness
Impact of Tourism 2014 compared to 1999

Location of Expedition:

2014	Antarctic Peninsula and South Shetland Islands
1999 - 2001	Macquarie Island, South Shetland Islands, South Orkney Islands, South Georgia. And in Antarctica proper: Antarctic Peninsula, Queen Maud Land, Ellsworth Land, Berkner Island, Victoria Land, Ross Island and Ross Ice Shelf.

Dates of Expedition:

For the 2014 expedition, two voyages to the Antarctic were made between January 3rd and February 17th.

For the two austral summers 1999-2000 and 2000-2001, consecutive Antarctica expeditions took place between first November through end March.

WINGS Flag #19 was carried during the 2014 expedition.

Expedition Participants:

Rosemarie Keough – Leader, interviewer, photographer, researcher, reporting
Pat Keough – photographer, supporter

Expedition Sponsors and Funding:

The 2014 expedition was opportunistic, piggy-backed upon a paid professional assignment. The Keoughs were engaged as lecturers aboard *MS Seabourn Quest* for two Antarctic voyages. While approval was received by Seabourn's Antarctica Program Manager for Rosemarie Keough to conduct the WINGS expedition, Seabourn is not a participant in the information gathered by the Keoughs or the report prepared. All opinions are those expressed by the Keoughs and by the interviewees, speaking at arms length from Seabourn Cruise Line.

The 1999 – 2001 expeditions were entirely financed by Nahanni Productions Inc., Rosemarie and Pat Keough's photographic arts company.

Purpose of Expedition:

The purpose of the 2014 Flag Expedition was for Rosemarie and Pat Keough to observe and record the impact of Antarctic tourism and make comparisons to their first-hand experiences of 1999 through 2001 when the couple spent two austral summers extensively exploring the Antarctic taking photographs for their tome ANTARCTICA.

Per statistics kept by the International Association of Antarctica Tourism Operators (IAATO) tourists making landings during the austral summer have nearly doubled between 1999 through 2014. The most recent statistics publicly published are for 2012-13 when there were 34,316 Antarctic tourists of which 25,246 made landings. This compares to 1999-2000 when there was a total of 14,762 tourists of which 13,826 made landings. The visitation at the more popular sites has increased disproportionately. For example, Cuverville Island, which supports a large Gentoo Penguin rookery (of approximately 6468 breeding pairs per Birdlife International IPA) has seen visitation triple during the same period: from 4,950 tourists in 1999-2000 to 17,799 in 2012-13. And Half Moon Island, with a large Chinstrap Penguin rookery, has seen visitation increase over the same years eight fold, from 1,500 to 12,969. To be noted, the peak of tourism was 2007-08, the season prior to the 2008 Economic Meltdown. That austral summer saw 46,069 tourists come to Antarctica, of which 32,637 made landings, well over double that of 1999-2000.

The Expedition Experience:

During the 2014 expedition, Rosemarie and Pat were members of the Seabourn Expedition Team, with IAATO certification as Field Guides for Antarctica and South Georgia. As per IAATO guidelines there is a minimum of 1 field guide to 20 tourists ashore, and at the landings made during these voyages, there were 100 tourists or less ashore at any time (the maximum permitted under IAATO guidelines).

Rosemarie and Pat were ashore as guides and photographers at the following landings for up to 8 hours each on the stated dates pertaining to two Antarctic voyages.

- Yankee Harbour, Greenwich Island. 62°32' South, 59°47' West:
 - January 9 & February 4, 2014
- Cuverville Island. 64°41' South, 62°38' West:
 - January 10 & February 7, 2014
- Waterboat Point, Antarctic Peninsula. 4°49' South, 62°51' West:
 - January 12 & February 6, 2014
- Half Moon Island. 62°36' South, 59°55' West:
 - January 13, 2014
- Brown Bluff, Antarctic Peninsula. 63°32' South, 56°55' West:
 - January 14, 2014
- Neko Harbour, Antarctic Peninsula. 64°50' South, 62°33' West:
 - February 8, 2014

From the outer decks of the ship *Seabourn Quest*, the Keoughs were photographing while voyaging through the South Shetland Islands, the Gerlache Strait, the Neumayer Strait, Paradise Bay, Lemaire Channel, Errera Channel, Antarctic Sound and other waters.

For the extensive Antarctic explorations of 1999 – 2001, the Keoughs experienced the Antarctic via small ship operators including: Quark Expeditions, Aurora Expeditions, Abercrombie and Kent, and Victor Emanuel Nature Tours. Rosemarie flew into Ellsworth land and onward to Vincent Massif, Berkner Island, and the Dawson Lambton Glacier region facilitated by Adventure Network International. As paying passengers with a mission to take photographs for their own project, the Keoughs worked within the parameters of the operators' expeditions.

Expedition Techniques:

Prior to returning to Antarctica the Keoughs familiarized themselves with the IAATO Field Operations Manual, a comprehensive body-of-work organized in three parts with 22 sub-sections, within each of which are up to 34 documents. The information, guidelines, and reporting is extensive and extremely useful, covering topics ranging from Standard Operating Procedures for Environmental Impact Mitigation and Activity Codes of Conduct; Prevention of Introduction of Non-Native Species; Wilderness Etiquette; Cetacean Watching guidelines; Seal Watching Guidelines; Bird Watching Guidelines; Site Specific Guidelines and Site Resources; Antarctic Treaty Related Documents; Science data collection for Marine Mammals, Penguins, and Climate Change projects; Collection of Hydrographic Data; Emergency Contingency Plan; etc. Judging from the dates of these documents, the Keoughs believe the majority to be new, the balance revised since their previous Antarctic experiences over a decade ago.

While in the Antarctic January through mid-February 2014 Rosemarie and Pat were alert to tourism management policy and techniques. In their professional role as photographers and lecturers, they were directly involved with enforcing IAATO guidelines. They took photographs, on the ship, on Zodiacs, and on shore documenting observations. A selection of annotated photos are included in this report as Attachment 3. Five respected Antarctic scientists, expedition guides, and tourism consultants were interviewed. Transcripts along with short biographies of the interviewees are included as Attachment 2. Literature pertinent to the anthropogenic impacts was reviewed, a list of which (with weblinks) comprises Attachment 4. Assimulating these observations, experiences, and readings, discussions then followed and a summary prepared comparing the impact of tourism 2014 compared to 1999-2001.

Expedition Results:

SUMMARY

You want to look at negative impact of tourism in Antarctica? I don't see it. The data doesn't support it. I just think people throw it out there willy-nilly.

Brent Houston – Polar biologist with five years experience at US Antarctic research bases, and over 100 Antarctic trips as a scientist and expedition guide.

The goal of the tourism industry is to tread lightly, take a precautionary approach, and try to have no impact. We're also mandated to do that by law – whether you are a US operator, British, Australian, etc. We have very strict guidelines to follow because we're organizing in one of the 29 nations that govern activities in Antarctica. With the restrictions and obligations on operators, the bar is set very high to have no more than a minor, transitory impact. With priority accorded to science, the playing field is not always level and that's okay. We just have to do our part to maintain that our aspect of visitation doesn't have an impact.

Victoria Wheatley – Antarctic Tourism and Treaty consultant, representing the US government's private sector advisor to the Antarctic Treaty since 1999.

In summary, having conducted our expedition and research, we are in agreement with the above two statements. During the 2014 Wings Expedition, we did not notice any significant negative effects to the environment directly caused by tourism, despite that roughly double the number of tourists come annually to the Antarctic as compared to a decade ago when last we were south ourselves. Along with more tourists, there are more operators. The small circle of Antarctic tourism operators, just 17 in 1999, has grown to IAATO's current membership of 119 (International Association of Antarctica Tourism Operators). Through the intervening years, regulations and guidelines self-imposed by IAATO have expanded greatly in response to this increase in polar tourism. These many new restrictions on operations serve to maintain wilderness qualities for wildlife and for guests while ensuring, as best possible, a safe experience for all. Tourists with whom we interacted (some 800 over two voyages) all spoke in superlatives of their "trip-of-a-life-time." Thus the restrictions did not affect enjoyment of their expeditions. For the work that we did in between 1999 and 2001 the current restrictions, while protecting the environment from the impact of tourists, certainly would have curtailed freedoms such as we enjoyed. Consequently several of the photographs that we took for our ANTARCTICA tome – interiors of whaling station buildings, Southern Giant Petrels on nests, Elephant seal wallows – would be difficult if not impossible to obtain today.

While we did not notice differences in distribution and numbers of whales, seals, and such birds as Wilsons Storm Petrels, Snowy Sheathbills, Antarctic and South Polar Skuas, we did observe the expansion of Gentoo Penguin populations and contraction of Adélie. Brown Bluff was the only Adélie rookery we visited in 2014. Whereas during our earlier visits, the Adélie had claimed the entire area for breeding, this year, nesting Gentoos occupied a large territory. We saw fewer Kelp Gulls and Southern Giant Petrels than in 1999-2001. We did not have opportunity to see Elephant seals, save one youngster hauled out at Yankee Harbour, Greenwich Island. The only Chinstrap colony that we visited in 2014 – Half Moon Island – was quite active. As we had not visited this island previously, we cannot comment on population change. Likewise, as we didn't revisit the Chinstraps at Deception Island, Laurie Island and other colonies with which we do have knowledge, we cannot make comparisons. Recent scientific studies have found that over the years since we were last at Baily Head, Deception Island, for example, the Chinstrap penguin population has declined by at least 39%. And over the past three decades the Adélie at Palmer Station have declined an alarming 80%. These studies have identified climate change as the major factor and that the impact of tourism is nil or insignificant.

Ron Naveen, biologist: *"We now know that two of the three predominant penguin species in the Peninsula – Chinstrap and Adélie – are declining significantly in a region where, in the last 60 years, it's warmed by 3° C. (5° F.) annually and by 5° C. (9° F.) in winter. By contrast, Gentoo Penguins, the third of these species, are expanding both its numbers and range. These divergent responses are an ongoing focus of our Inventory work effort."*

Heather Lynch, biologist: *"While there has been considerable focus in the policy and management community about the potential impact of tourism on these penguin populations, we cannot forget the overwhelming evidence that climate is responsible for the dramatic changes that we are seeing on the Peninsula. If tourism is having a negative impact on these populations, it's too small an effect to be detected against the background of climate change."**

Excerpts from Oceanites interview posted at <http://iaato.org/decline-in-breeding-chinstraps>

A. WILDERNESS QUALITY and LANDING SITES

Landing sites seemed pristine, aside from many boot prints where there was snow. Usually a few rock piles made by previous parties, used to support flag poles, could be seen. Our expedition guides used some of these, or made new cairns, to prop our flags demarking a route for tourists to follow. Deviations were not permitted. The guides, briefed on the Site Guidelines for the particular location, set up the flags along the recommended walking route, which avoided sensitive areas closed to tourists. Closures would include moss beds, mosses that require hundreds of years to grow and cannot tolerate much trampling. Closed areas also include the nesting sites of Kelp Gulls and Southern Giant Petrels, species which when disturbed are likely to permanently abandon their egg or chicks. As to our observations ashore, we saw no litter, no escaped tissues or plastic bags. On ship, the tourists were warned to prevent their jackets from flapping, or to let anything be picked up by wind and blown over the penguin colony: the potential being to disturb the adults from their nests, leaving eggs or young chicks vulnerable to predation by opportunistic skuas and petrels. We saw no inappropriate behaviour on the part of tourists. When we departed, the sites seemed very much as when we arrived.

Whereas a decade or so ago, landing sites may have been visited every other day, during the current tourist season key sites can be visited two and even three times daily. IAATO maintains a reservation system to ensure that only one ship occupies a landing at a time; that there is an hour or more between ships; and that there are evening hours of complete rest for the penguins without any visitation by tourists. The feeling for tourists is one of exclusivity and privilege of being among the few to have such an experience. As per the Site Guidelines prepared by IAATO together with Oceanites, sites have a maximum number of visitors ashore at any one time and a maximum number of visitors per day. Ashore, the ratio of expedition guide to tourist is 1 to 20; in some places it is 1 to 17. Guides ensure that tourists respect the flagged route; maintain the 5 meter minimum distance from penguins (although penguins can choose to approach more closely to humans); acknowledge that penguins have the “right-of-way” between their colony and the beach; and, in short, that tourists behave in a way that is respectful to the wildlife and environment. Guides also draw attention to wildlife behaviour and share natural history information or historical details as the case may be.

Excerpts from Interviews (see Attachment 2 for full, fascinating interviews):

Rosemarie Keough – *When we first came to Antarctica 13 years ago, at Patriot Hills, as an example, even human urine and excrement were flown out to Chile for processing. The prevailing understanding amid tourists and explorers was that if we transgressed beyond an undefined threshold, there was a possibility that the continent would be closed to all non-scientific activity. Tourists had to be extra good. That being said, bases could do whatever they want.*

Victoria Wheatley – *During this trip we did the hike at Cuverville to about the midpoint of the island. One of the assistant expedition leaders, Chris, had noticed there were footprints in the moss bed above where we were. I advised him we needed to report to IAATO that we visited on this date and we noticed there were relatively fresh footprints. IAATO will see which other ships had visited prior to us. It may have been a private yacht coming in, like we saw at Yankee Harbour. We don't know. We still want to be proactive and report it and we certainly don't want to be blamed for causing the damage to the moss beds. We're very conscious of making sure that we report it, say it was not us, and here is what was observed.*

Peter Clarkson (Antarctic geologist, 1967-1989; Executive Secretary of the Scientific Committee on Antarctic Research, 1989-2004; polar author, IAATO observer.) – *I think I've seen one example of cumulative impact from 1975 when I was down here working in South Shetland Islands. We were working on Penguin Island. We walked around the volcano crater, took photographs and the odd specimen. When I was back on a tour ship in 1998-99 there was an activity for passengers to trek around the crater.*

They wanted to observe the crater. It was Tom Loudon the US geologist who was leading the trek. I was left on the beach from where I could see a very definite footpath up to and around the crater. Obviously people were keeping to the footpath, which is a good thing. However, it was a footpath for which there was no evidence whatsoever when I was there in 1975. That is the only example of cumulative impact that I've seen. I haven't been back to Penguin Island since.

Victoria – There's also Aitcho Island, a Category #1 Landing Site open to tour ships carrying fewer than 200 passengers. A few years ago there were footpaths that have really damaged the moss beds. IAATO proactively said we're not going to visit Aitcho. We're going to exclude ourselves and essentially close the area to visitation until the site recovers. But this site is also visited heavily by researchers so you don't know what's going on when you're not there. The tourism industry tries to be incredibly proactive and it was the industry that started site guidelines for the various landings sites to minimize impact.

Rosemarie – I don't recall that there were closed areas when we were travelling here last 1999-2001.

Victoria – The tourism industry started developing their own set of site guidelines to identify what landing sites were appropriate to Category #1 ships (the smaller ships carrying up to 200 passengers) for example, and what sites were more appropriate to the Category #2 ships (ships carrying 200 to 500 passengers). This essentially set down a criteria to determine which sites were appropriate for the size of a given operation. This approach to site management then started being formerly adopted through the Antarctic Treaty System so that the Treaty Parties brought it into Resolution status. But this is still a guideline approach; Resolutions are not mandatory, nor legally binding on an operator. They are merely recommendatory, however IAATO members always agreed that anything adopted by the Treaty Parties, they'll abide by.

Brent Houston – Have I seen damage done by tourism at the sites? No. One of the things that really bugs me is the general consensus that tourists were trampling the moss beds, particularly at Aitcho Island where you went across to see the Elephant seals. Most of that so-called moss is an annual algae that grows and dies off each year. It is not a long-term moss that grows for hundreds or thousands of years.

We, as expedition staff, flag paths to walk on Yankee Harbour, and we take our flags but leave our small piles of rock when we depart the site. I come to what appears to be a pristine site and I see rock piles all the time. Do we impact things? Yeah, we pick up rocks and we move things. I think you could actually establish a trail and add to the value of that site and have minimal impact on sensitive areas.

Another thing Hannah Point has that wallow up top with Elephant seals. I happened to be up there one time when an Elephant seal went over the cliff and fell and split in half at the bottom. At Hannah there is the potential for the Giant Petrels and also the Kelp Gulls that nest right there at the landing site to get scared off their nests. So there are no landings permitted until mid-January to let those chicks get big enough and fledge and the Elephant seals moult. So there's one that works. You sacrifice, if you will, a landing site for wildlife, but then you are able to use it later on. That's a positive use of limitations. ...

In my talks all over the world, people always ask me, "Aren't there too many people going to Antarctica?" Well what does that mean that there are too many? ... We know exactly how many people have been to the visited spots. There's interesting research about at Torgersen Island at Palmer, where I had been working for four years. We had half of the island available for tourists to visit, and the other half was off-limits. Both were visited equally by the scientists. We found zero impact by the visitors. Not 1%, not 2%, but zero. There were and are a lot of people visiting Torgersen in my view, but is that automatically too many. Obviously no.

Peter – When I have seen people walking through or around penguin colonies, the penguins on the whole don't appear to be affected at all. An interesting case here, the penguins at Lockroy are more successful despite all the tourist visits, than the unvisited colony just around the corner at Jougla Point. It is thought the reason for this is that the skuas are being frightened off by the humans and so they are moving along to Jougla Point where there is excessive predation.

Rosemarie – *You once said that the penguin are all elite Olympians, else they wouldn't survive.*

Brent – *They are all Olympic athletes or they are dead.*

Rosemarie – *Historically, except South Georgia and Macquarie, there has been no or little human predation of penguin. So they don't know to be frightened of us. When you see the Giant Petrels and skuas flying over a rookery, all the penguins get anxious, huddle closer and call loudly. They don't when we walk by.*

Brent – *No and here's why. There's no land predator that walks up to a penguin. Most predators on penguins are aerial predators. A skua flies over and it drives them crazy. That's why there are helicopter limits. If you flew a kite, or had a flapping jacket, they freak out. A helicopter, even a half, mile high freaks them out. But you walk up to them, and walk around them, they're fine.*

Excerpts from Scientific Reports (see Attachment 4 for detail):

Lynch Heather et al. 2012. *“Results from integrated analyses confirm that Adélie Penguins are decreasing at almost all locations on the Antarctic Peninsula. Results also resolve previously contradictory studies and unambiguously establish that Chinstrap Penguins, thought to benefit from decreasing sea ice, are instead declining regionally. In contrast, another open-water species, Gentoo Penguin, is increasing in abundance and expanding southward.”*

Naveen, Ron, et al. 2012. *“In the first ever field census of individual penguin nests at Deception Island (December 2–14, 2011), we find 79,849 breeding pairs of Chinstrap Penguins, including 50,408 breeding pairs at Baily Head and 19,177 breeding pairs at Vapour Col. Our field census, combined with a simulation designed to capture uncertainty in an earlier population estimate by Shuford and Spear, suggests a significant (>50 %) decline in the abundance of chinstraps breeding at Baily Head since 1986/1987. A comparative analysis of high-resolution satellite imagery for the 2002/2003 and the 2009/2010 seasons suggests a 39% decline over that 7-year period and provides independent confirmation of population decline in the abundance of breeding Chinstrap Penguins at Baily Head. The decline in Chinstrap Penguins at Baily Head is consistent with declines in this species throughout the region, including sites that receive little or no tourism; as a consequence of regional environmental changes that currently represent the dominant influence on penguin dynamics, we cannot ascribe any direct link between chinstrap declines and tourism from this study.”*

Aronson Richard et al, 2011: *“Studies of tourism impacts on wildlife along the Antarctic Peninsula have focused on the pygoscelid penguins. Results have been mixed, with some studies finding no impact of human disturbance ... whereas other studies do report impacts. Responses to human visitation may be species-specific There are almost no studies of the potential impacts of tourism on other species of Antarctic birds.”*

Carlini, A.R., et al, 2007: *“Our data suggest that environmental influences currently exert greater effects than human disturbance on the penguin population at Esperanza Bay.”*

Fraser, W.R. et al. 2009: *“The data do not suggest that tourism is not impacting Adélie Penguins, but rather that impacts, if present, are not detectable relative to the much larger effects of environmental variability on the processes that regulate demography.”*

Fraser, W.R. et al. 2003: *“To assess whether human activities due to tourism were negatively impacting Adélie Penguins, we compared long-term population trends at visited and control sites on Torgersen Island considering underlying factors associated with environmental variability. ... Tourism appears to have no detectable impact on Adélie Penguin breeding population size or breeding success; comparisons between population trends in visited and control sides of the island were either not significant or inconsistent with site-specific tourist visitation patterns.”*

Crosbie Kim, 1999: *“The dramatic increase in tourism to the Antarctic has prompted speculation that the presence of tourists at a penguin colony could cause enough distraction to increase the vulnerability of the colony to predation. This study ... observations revealed no evidence that the presence of parties of visitors within feeding territories influenced skua predatory behavior.”*

The Adélie Penguin colony of Palmer Station has declined by 80% within three decades through to 2003. Meanwhile the numbers of breeding Gentoo Penguins at Palmer have increased from none to 5000 pair, each pair in a good year rearing two chicks. Brent Houston explains that unlike the Gentoo, the Adélie is a polar desert bird. It does not fare well with the warming climate of the Antarctic Peninsula that now sees higher snowfall and receding sea ice (to which the Adélie's food is associated). The adults arrive underweight. Being site-specific creatures, they return to the same rookery where they themselves hatched. The breeding period is short, and should the birds find too much snow upon arrival, they are motivated to build their nest atop the snow. Then when the snow melts, their nest collapses, the egg rolls away, and a skua gets it. During snow storms, the birds are literally buried in the snow, and are unable to make the exchange between male to female during incubation. Chicks depart underweight, and very few if any survive their first three years at sea. Consequently recruitment of young to the breeding grounds fails. Only mature adults return; no young adults – a sure way for a population to age and decline. Reasons for the expansion of Gentoos are shared in the interviews, Attachment 2.

People ask: “Hasn't this happened before?” I say yes; however, I think that anything that happens in our lifetimes that affects an animal in such a drastic way needs to be seriously addressed, especially when their environment has been been stable over a long term. If you want to say how does this relate to what's going on in industrialized nations or is it natural or is a cycle. I don't know, but apparently a lot of people think they know. I'm telling you that what is happening to the Adélie penguins in the middle of the peninsula is shocking. It's shocking. Even if it were a slow decrease you should be alarmed – even if it happened every thousand years. I mean, if this happened every thousand years or 10 thousand years and they were wiped out this quickly and this completely, we wouldn't have Adélie penguins. And if these are indicators of a problem to the north in industrial nations and we're seeing things down here, the tip of the iceberg so to speak, you have to start to address the canaries in the coal mine. How many canaries do you need? There are thousands, and this is just one of them. – Brent Houston, interview

To be noted, the population decline of Adélie's and Chinstraps is happening specifically along the Antarctic Peninsula, South Shetland and South Orkney islands also known as Maritime Antarctica, or “the banana belt.” Ironically the seasonal ozone hole located in the stratosphere above the Antarctic, has shielded continental Antarctica from the effects of Global Warming. As such, temperatures of the bulk of Antarctica are unchanged, perhaps even cooling somewhat. Whereas the Gentoos are expanding their range along the Peninsula, and the Adélie's retreating, this is not the case elsewhere. For Continental Antarctica, which is yet a polar desert, the Adélie's populations are stable or growing. Chinstrap penguins have a much more restricted range than do Adélie's. We have not found population studies of Chinstraps aside from those pertaining to colonies along Maritime Antarctica. Climate change being beyond the scope of this report, the excerpt shared on the following page is from an IAATO bulletin summarizes what is known about Climate Change in Antarctica.

Source: IAATO

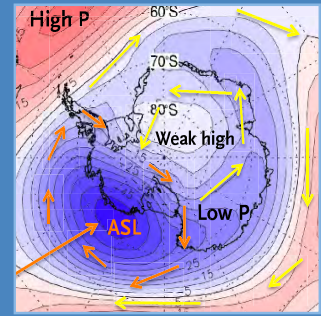
A positive effect of the Ozone Hole?

The Antarctic “ozone hole” – a human-caused environmental impact – was one of the most significant scientific discoveries of the last century and has had a profound impact on the Antarctic environment, including increased biologically harmful UV-B radiation.

However, the ozone hole has intensified the polar vortex – a ring of winds around Antarctica. These westerly winds have increased by about 15% over the Southern Ocean and, consequently, have acted to further isolate much of Antarctica from the rest of the planet. As a result there has been little change in either surface temperature or levels of snowfall across most of the continent over the last 30 years. This isolating effect of the polar vortex has also resulted in an increase in sea ice coverage in the Ross Sea and East Antarctic region since the 1980s.

What is happening in the Peninsula?

The exception is the Antarctic Peninsula that juts northwards from the continent into the path of the polar vortex. Here, the increased winds have resulted in distinct warming of average summer and autumn temperatures as they bring relatively warm and moist air from the oceans onto the Peninsula. Those warm winds have led to a marked decrease



in sea ice cover and increased precipitation there, and approximately 90% of the Peninsula's glaciers have retreated over recent years. The loss of sea ice along the Peninsula balances the growth in the Ross Sea, the net effect for the whole continent being a 10% increase in sea ice since 1980.

The warming has also affected floating ice shelves around the peninsula, and several have collapsed in recent years, notably the Larsen B ice shelf, which disappeared suddenly in March 2002.

The distribution and success of the Peninsula's plant and animal life has also been affected by this warming. Plant communities have expanded rapidly and newly available land has been colonised by plants and animals. Plant and animal communities have also become more susceptible to invasion from non-native species, which – fostered by the warmer, wetter climate – can have detrimental effects on the local ecosystems.

B. PATHOGEN TRANSFER, INVASIVE NON-NATIVE SPECIES, and BIOSECURITY CHECKS

We have seen how tourism operators and their expedition staff are very conscious of the threat of invasive non-native species and pathogen transfer. In an introductory briefing aboard ship, tourists are educated to the dangers of inadvertently transferring a pathogen from one landing site to the next. The concern is that a virus or bacteria from one penguin could be carried, for example, in dried mud on the bottom of boots to an uninfected colony. More detail to follow. Tourists also comply with the mandatory biosecurity checks – if they refuse, they are not permitted shore landings in Antarctica. We were among the expedition staff engaged to conduct the biosecurity checks prior to our ship's arrival in Antarctica. Every guest aboard ship individually brought their outer clothing – hats, mitts, jackets, waterproof pants, and boots – for thorough inspection by our fellow staffers. Also they were instructed to bring their backpacks, camera bags, walking sticks, and if they had one, their camera tripod, every item that might touch ground in Antarctica. In our search, we paid particular attention to pockets, cuffs, and velcro strips looking for seeds, mud and lint. All questionable items were vacuummed thoroughly. Once “cleared,” the guest was then required to sign their names to the following declaration:

ANTARCTIC PRE-ARRIVAL BIOSECURITY DECLARATION

I have thoroughly cleaned all items which will come into contact with the ground ashore, removing any material and washing with the disinfection solution provided, including all footwear to be worn ashore, tripod/monopod feet and walking sticks, ski poles, snowshoes etc. In addition, I have removed all seeds and loose items from the pockets, folds and Velcro of all items to be worn or taken ashore, including all clothing, particularly outerwear, my backpack, camera bag, etc.

- I understand the need for biosecurity between Antarctic regions and individual
- landing sites to prevent the introduction of alien plants or diseases.
- I undertake to clean all necessary items before and after each landing in the
- Antarctic & Sub-Antarctic Islands including South Georgia.
- I agree not to take food ashore (except if individually permitted by the Expedition
- Leader) and not to dispose of any waste either ashore or overboard.

In detail regarding pathogens.... Upon disembarking the vessel, staff and tourists would step with boots into a disinfectant tub, also dipping the ends of walking sticks and tripods, prior to being permitted to board the Zodiac. Following an excursion on land, while at the beach, everyone cleaned and scrubbed their boots at "boot cleaning stations" set up along shore in the shallow sea water. At random, boots and walking sticks/tripods were inspected to be sure that all mud and guano was removed. These stations can be seen in the photographs of Appendix 3. Into the Zodiac and back to the ship's loading platform, everyone once again stepped through a disinfectant tub. Aboard this particular ship, all boots were left in lockers where the ship's crew would retrieve all for one final thorough, cleaning with disinfectant. The disinfectant would be left to dry thoroughly rather than be rinsed off, desiccation being one mode of controlling some harmful micro-organisms. We have to say that we are very impressed with the thoroughness of this operation.

These stringent regulations instigated by IAATO have been enhanced since our 1999-2001 expeditions. At that time procedures were rudimentary, with no shore-side cleaning, other than stepping in the seawater should you have chosen to do so. Upon return to the ship following a landing, tourists would immediately then step their boots into a disinfectant tub. Using a long-handled scrub, they would give the treads a going over. As more and more guests returned to the ship, the tub and brushes got dirty; cleaning compromised. Occasionally the disinfectant liquid was refreshed. All tourists co-operated because, beyond reducing the risk of pathogen transfer, scrubbing also reduced the reality of introducing the distinctive odor of penguin colony into one's own cabin where boots were stored, or in the hall immediately outside one's cabin door.

For both pathogens and alien species, the keys to control are: prevention, surveillance and response. From our eye-witness standpoint, these measures are being well attended.

The risk of non-native species is quite real. The Chown, Stephen L et al, 2011 study found that though few tourists did have seeds stuck to their velcro or carried in dry mud on their water-proof pant cuffs, the number of seeds per visitor averaged 9.5. This research found that the largest risk of seed transfer was not actually from the tourist, but rather from the scientific and tourism support personnel, many of whom are *bi-polar*, working in the arctic June through September, and the Antarctic November through March. Further analysis showed that "roughly half of the vascular plant seeds reaching the Antarctic are from environments – e.g. Arctic, sub-Antarctic, alpine – that include species capable of surviving the conditions likely to be encountered in the areas of Antarctica most commonly visited."

The signing of the Biosecurity Declaration by each tourist re-enforces the message that Antarctic, as best possible, is to be kept pristine, and gives recognition to the fact that Antarctica's climate and remoteness in itself does not give adequate protection from pathogens and non-native invasive species.

In a bulletin concerning invasive species, IAATO writes: "During the 2011/2012 season a gospel group was found scattering barley seeds as part of a spiritual ritual in Deception Island. The group were stopped, and to the best of the field staff's ability, the seeds collected. There is an assumption that some seeds remained." These seed could feasibly have germinated, Deception Island having thermal springs and Maritime Antarctica having a warming climate. On King George Island grows an annual, blue grass grows that was inadvertently introduced, and both sexes of the North Atlantic spider crab have been found in the waters near the Antarctic Peninsula, likely discharged from ballast water. Periantarctic islands such as South Georgia and Macquarrie are hosts to some 200 introduced species from reindeer and rats to plants and insects, most of which arrived with the former industrialized whaling and sealing operations. With today's access to Antarctica via ships and planes, and with changing climate, the tourism industry is being very responsible in doing all it can to avoid transfer of disease and species. Hence the recent requirement of all tourists to sign the Biosecurity Declaration prior to landing in Antarctica.

C. TOURIST SHIPS and ENVIRONMENTAL IMPACT

IAATO statistics show that 21 tourist ships and yachts made 154 voyages during the austral summer 1999-2000. This compares to 45 tourist ships and yachts making 258 voyages during austral summer 2012-13. Double. (These figures exclude private yachts operated by non-IAATO members.) In recent decades there have been accidents, with no loss of human life, and fuel has spilled into the sea. The cruise ship *M/S Explorer* sank in Bransfield Strait, November 2007 with about 190,000 litres of diesel, 24,000 litres of lubricant, and 980 litres of gasoline. In January that same year, *M/S Nordkapp* ran aground near the caldera of Deception Island ripping open a 24-meter hole along ship's side. All passengers were evacuated, and the ship leaked fuel at Deception and all the way back to port in Argentina. The Argentine supply ship the *Bahia Paraiso*, sank near Palmer Station, Anvers Island, January 1989 spilling 600,000 litres of marine diesel into the sea. Environmental concerns lead the International Maritime Organization in August 2011 to impose a ban on heavy fuel oil in Antarctic waters, both as fuel and as bulk cargo (formerly used at research stations for heating and to generate power). More ships plying the Antarctic waters equates to additional risk of marine incidents involving ice, uncharted shoals, also marine mammal collisions.

From our eye-witness standpoint, we can say that during the two Antarctic voyages of 2014 we saw only two sailboats and two large cruise ships. A third tourist ship intentionally approached to transfer an injured guest to our ship aboard which were superior hospital facilities. Considering the compressed tourist season with the heaviest visitation to the tip of the Antarctic Peninsula (90% of all Antarctic tourist activity), relatively few vessels pass one another. This is not by chance, rather it is deliberate so as to preserve an atmosphere of exploration for guests. Bridge officers from the ships are in frequent communication with one another and purposefully stay out of each other's line-of-sight. Even in or when approaching popular passages such as the Neumayer Channel or the narrow Lemaire Channel, a ship can slip into a bay or around a bend until the other passes.

Excerpts from Interviews (see Attachment 2 for full fascinating interviews):

Dr. John Dudeney (Antarctic physicist and historian, 40-year career with British Antarctic Survey from research scientist to Deputy Director) – *The thing that bothers me and it's the first time I'd seen it in action is the big ships, and we saw two. I hadn't realized they were quite doing what they were. When we went to Cuverville we had to wait because there was another ship there, the Zandamm. She appeared to be right next to Cuverville, she's almost as big as Cuverville for goodness sake. They are not allowed to do landings, but I didn't realize they were taking the ships so close. And we passed that other ship in the Gerlache Strait, the Celebrity Infinity. Neither of those ships are designed to go into the Antarctic. I suppose they are now burning marine gas oil because of the IMO regulations on heavy fuel oil. Still, I don't think it's too smart. I don't think it's too much of an exaggeration to say that those ships run the risk of a serious accident. And it is hard to see how an effective emergency response could be mounted to do anything about it. There's just too many people on board. Also what's the point? Why not watch an Imax film. That's what you are doing, you're watching. A penguin is a little dot in the water. You have to be careful because the waters are not well charted. There are large areas on the Antarctic Peninsula where there's no chart at all, or if there is, the soundings are far spaced. We know in the fiords that rocks and reefs come up out of nowhere. I worry about the big ships.*

Rosemarie – *Over a decade ago, sailing into King Haakon Bay, South Georgia, Pat saw a bit of foam ahead, which proved to be an uncharted rock. The captain didn't take note until almost too late. Did he ever put the reverse brakes on as best he could. Fortunately, this was a small, maneuverable ship.*

John – *It's happened to national operator ships. Many years ago one of the British Antarctic Survey ships with a very experienced captain was not many yards off the normal track going into Rothera travelling at service speed and whack, onto a rock.*

Brent – *At the moment the tourists visiting here are not having a direct affect on the animals. ... It's the carbon emissions in the atmosphere coming on global thermal currents that have the effect of changing the temperatures down here. Even if you had a bunch of industrialized factories in Antarctica, they still would not be causing the local climate effect that is occurring to the penguins. That's the thing. .*

Meriwether Gil (marine mammal biologist, educator and guide) – *In regard to marine mammals, I think captains now a days are pretty good about the following the approach regulations, but it's just again more ships, more potential with marine mammal collision. There's a lot of whales that we were not intentionally approaching and you know you look out the window and one is just right there.....*

Vessels such as this one, which can travel in open waters at 21 knots, how are you going to avoid a collision? If you have a whale that pops up right in front of you, going at that speed. And right now there are no speed regulations that I am aware of.

[Keough's note, while plying Antarctic waters we observed our ship mostly travelling at slow speed – to avoid ice, minimize risk of marine mammal collision, allow for scenic cruising, and to mark time, distances between landings often being short.]

Meriwether – *The other thing just as far as all these vessels being in Antarctica, there hasn't been that much Humpback whale research or other whale research. We know some of these bays that are very sensitive to mothers and calves and so these waters are restricted. But there's not that much research to be able to say this is a sensitive area or a high frequency channel for the Humpback whales. We don't know how they migrate to Antarctica. Are there certain waterways that they frequently use that vessels could stay away from to avoid collision? We just don't know.*

Rosemarie – *Here along the Antarctic Peninsula we know there's a lot feeding in the Gerlache, so that's where we all watch for whale.*

We had exceptional whale watching opportunities from our ship and from Zodiacs. Photos included in Attachment 3. As Meriwether is quoted above, the captains operating tourism vessels in Antarctica are cognizant of the IAATO guidelines for approach to whale so as to avoid harmful disturbance. While we do not purport to be biologists or scientists of any ilk, that whales stayed near our ship, while the vessel was halted or slowly moving, indicated to us that they were not stressed. In fact, we had a Humpback spy-hop along side the Zodiac landing ramp, seemingly to have a look at the personnel there. On another occasion, two Humpbacks were on starboard side, and then swum just two feet under the vessel's bow (measured by the depth sounder) to blow on the port side... and then returned to blow again on starboard. One could interpret such behavior as play. Certain Antarctic waters are more important feeding grounds than others. Expedition leaders all know that for example, Humpbacks are quite reliably seen in Lemaire Channel and Paradise Bay for example; and both Humpbacks and Killer whale in the Gerlache Strait. It is possible that individual whale or a particular pod would receive repetitive attention from tourists over the austral summer, which potentially could be stressful. Thus far, we've not heard of anyone touching or patting a whale, as occurs in Magdalena Bay, Baja California where Grey whale have been conditioned to approach Zodiacs to receive pats.

Often we had watched seals from the ship, the Zodiacs and also from shore. As with tourists on African safari hoping to see the "Big 5", or when in Alaska to see lots of bear, people thrill to encounter top predators. In Antarctica, these are the Killer whale and the Leopard seal. In addition to the aforementioned approach guidelines for penguins and whales, IAATO members abide by guidelines for seals. Brent Houston shares his thoughts on Leopard seal viewing:

Brent – That [leopard] seal was resting on an ice flow. It wouldn't be on the flow unless he wanted to rest. He's taking a break. And that's what they do. We know that the Zodiac fumes bother them a lot. They always raise their head. It clearly disturbs them from sleep. There's also the sound, but it's mostly the smell of the engine exhaust. I think that sometimes you can watch a seal from shore or from a ship with binoculars just as well as you can from a Zodiac. I don't know how long that seal was on that ice floe, but it was clearly asleep. Then again, the counter argument is that if the seal is really bothered, it just has to slip into the water. That's a disturbance, but not very critical if you ask me. They are in charge of their behavior all the time, and most times they tolerate our presence, fumes and noise and all. I try to cruise the Zodiac down wind, which is easy for boats to do, and most of us consciously do that. We are responsible. We don't want the seal to leave the floe because we want all of the passengers to see it, but more importantly we are responsible and compassionate people. We learned by experience what bothers them, and what is OK, and all the guides I know are acting accordingly. No one wants to see animals bothered by our visits. So are leopard seals declining because of human disturbance; not at all. No way. I strongly believe that people should see seals on ice. You are thousands of times more likely to protect an animal or a place that you have seen and experienced.

Excerpt from "Tourism in Marine Environments" (see Attachment 4 for detail):

Williams, Rob et al., 2007. "Shipboard visitors to the Antarctic are routinely rewarded with whale sightings. However, careful management and dedicated research are needed to ensure that the growing Antarctic marine tourism industry does not inadvertently harm these populations, which are recovering from heavy exploitation in the early part of the 20th century. Ongoing research by the International Whaling Commission (IWC) aims to monitor whale population recovery, and the International Association of Antarctica Tour Operators (IAATO) has developed operational guidelines to minimize and mitigate potential impacts, some specific to marine mammals and marine wildlife watching. Nonetheless, while boat-based tourism has the potential to affect whales, responsible tourism also has a substantial contribution to make to Antarctic whale conservation and research through collaboration."

D. POSITIVE IMPACTS OF ANTARCTIC TOURISM

We are convinced that tourism has a positive impact upon the Antarctic environment. Tourists today are concerned about the integrity of wilderness. In the past, the presence of humans in Antarctica was primarily about exploration, national territorial claims, and wildlife exploitation. The blubber pots, boilers, oil tanks, and facilities left by the whalers and sealers are historic monuments to what became industrialized whaling which led to the near extinction of the larger cetaceans. The South Georgia Heritage Trust states: "In the whole of the Antarctica region some 1,432,862 animals were taken between 1904 and 1978, when hunting of the larger species ceased." Aside from the whalers, following World War II through to the International Geophysical Year 1957-58, Antarctica was exclusively the domain of scientists and military. With the IGY and the subsequent signing of the Antarctic Treaty, the first tourists came to the Antarctic, annual numbers being under a thousand through to 1990-91. What benefit were and are these tourists to the environment?

Our interviewees speak of the "watch-dogs" dating from 1987, Greenpeace and tourists.

Dr. Peter Clarkson – Years ago when Greenpeace were doing their inspections they saw many things that formal Treaty inspectors did not see, and told everybody about them in their reports. To some extent it could be said that within the Treaty it was a case of you scratch my back and I'll scratch yours. You don't want to rock the boat. Greenpeace of course rocks every boat or blows it up. A woman from Greenpeace International came up to me at a meeting years ago and said to me "What do you, as a representative of SCAR, think that Greenpeace ought to be doing at the moment." This was at the time they had their World Park Base. I said, "Well the first thing to do is to close that silly base of yours, it's not really doing anything worthwhile. But what you can do is to expand your inspection program. You see all sorts of stuff that the Treaty Party inspectors don't see." Unfortunately she said, "Oh well, yes, it's just so expensive."

Brent Houston – Right. McMurdo wouldn't have cleaned up their act if, one, Greenpeace hadn't come down and made photos available to everybody; and two, tourists were marching in there and seeing it, and talking to their Congress folks. I can tell you that for sure McMurdo was cleaned up in a very quick period of time. I was there. I was down there just one season. But I was there the year Greenpeace was there. They were really doing the protests and hammering everything. Subsequently my friends went down there years afterward, and I've seen pictures, and I've heard all kinds of things about it. Right, watch-dogs work.

Today's transparency via tourists visits to several of the more accessible Antarctic bases helps ensure that national science programs and tourists all abide as best and practically possible to a low-impact environment policy. Tourism today also provides for "Citizen Science".

For some years scientists have been actively collecting photographs of whales taken by tourists. This reportage by tourists is an important contribution to such programs as the Antarctic Killer Whale Identification Catalogue, compiled by Dr Ingrid Visser; and the Antarctic Humpback Whale Catalogue maintained by the College of the Atlantic. Some operators make a point of including scientists as guests aboard, allowing them to further their research. Other operators assist by transporting scientists between field camps, or to pick-up a researcher from a remote location and bring him/her back to the Falklands, Chile or Argentina.

Tourist ships and nationals informally share hydrological information. As Dr. John Dudeney pointed out, much of the information on charts is insufficient. Some of the data dates back to the early 1900s, the heroic era of Scott and Shackleton, some areas are not charted at all. Last season, the French Hydrographic Office provided a surveyor to accompany a bespoke Antarctic

tourist expedition. During this expedition, hydrological surveys were conducted to the standards of the International Hydrographic Organization, which has added to the official navigational data for Antarctica. In a press release from IAATO Dr. Kim Crosbie, Executive Director of IAATO said *“the costs and difficulties of working in the remote Antarctic environment often limits the abilities of countries to conduct surveys. With regular visits each year by IAATO member vessels, which often have small auxiliary craft and other vessels that can safely access shallow water areas, there is real scope to work collaboratively with Hydrographic Offices in improving our knowledge of the sea floor and continue to strengthen safe navigation for shipping.”*

Our final question to interviewees: *“All these people who have been down here are so thrilled. They have had the trip of a lifetime. They go home. What positive benefit do you see that these first-hand experiences have had, and in what way might tourism help the Antarctica?”*

Here are the answers:

Victoria – *The goal that all of us have in the industry, is that your guests become ambassadors for the protection of the continent. This can take shape in many different ways. During a trip they've been exposed to Antarctic research, for example on this cruise through the work that ACAP is doing with albatrosses and petrels; the Oceanites Site Inventory project on penguins; or some of the Humpback whale work through the College of the Atlantic. Hopefully you spark their interest into go back and perhaps become members of those groups, become active and financially support them. Many of these people are well connected through business or politics. We want them to encourage their country, if not a member of the Antarctic Treaty System to perhaps consider becoming a member. I think visitors can do a lot of good. Operators also have journalists on board and these people are going to be writing for major publications. This also not only encourages people to go to Antarctica, research the right company for them to travel with, but also it can help encourage them to want to help to protect the place. There are many, many spin-offs.*

Peter – *Obviously there are some very wealthy people on this ship, some of them will also be very influential people, or they will have very influential friends. You just have no idea when this will pay off. We used to have visits at BAS by government ministers from time-to-time which was a pain. But you'd never know when that minister was in a position to say, “Oh no no no! You're not cutting the budget of British Antarctic Survey.”*

Meriwether – *I have a wonderful quote: “For in the end, we will only conserve what we love, we will only love what understand, and we will only understand what we are taught.”*

John – *That's a good way of summing up actually, provided the industry stays somewhat self-limiting, and dare I say, expensive. You get a particular, socio-economic class coming down here. They tend to be people who have influence. They tend to be opinion formers. That's how I see the balance. There is some cumulative negative impact in the Antarctic as a result of tourism. You just look at the paths on Cuverville. I don't mean it is significant, but it is there. The balance is, there's this whole cohort of people going back to their home towns, who know enough about Antarctica that when issues come up they can speak with some authority and try and guide discussion in the right way. They know it's a protected area, and that people are actively trying to protect it.*

Brent - *I always believe in tourism as a positive.*

From all that we observed and recorded during this Wings Expedition and during our earlier explorations, combined with all that we have learned directly from experts and have read in the scientific literature, tourism in Antarctica has had little negative impact upon the environment. As compared to 1999-2001, the tourist coming to the Antarctic will experience less freedoms, the tourism industry self-policing itself with ever-more stringent regulations implemented to benefit the wildlife and environment, also to maintain safety of guests. Several of these guidelines are in

process of becoming law in Treaty countries, demonstrating that IAATO has been and continues to be a positive force for the management of tourism in the Antarctic. Populations of Adélie, Chinstrap and Gentoo penguins are dramatically changing throughout Maritime Antarctica correlated to the affects of a changing climate. Negative impact resulting of tourism, if any, is indiscernable in comparison to this larger reality of warming temperatures, increased precipitation, and variable sea ice.

As with all things, tourism is not static. Issues being addressed today include the use of the remote-controlled quad-copter cameras and other Unmanned Aerial Vehicles (UAVs). Scientists are making good use of these new tools, and similarly certain tourists are enraptured by the new technology. We have personally had tourists, enthusiastic photographers, asking about how they could bring a quad-copter camera so as to facilitate their taking unique aerial photographs of their ship, icebergs, and penguin colonies. IAATO recognizes that this new technology has positive applications as well as serious potential negatives. As Brent Houston emphatically says, "Helicopter drones used over a penguin colony would scatter the penguins off their nests catastrophically." IAATO has responded with recently developed restrictive guidelines for UAVs inclusive of quad-copters and drones to be implemented by IAATO tourism operators immediately.

Also notable is the rise in tourist demand for "Adventure Travel" such as kayaking, skiing, coastal camping, marathon races and motorized expeditions into pristine areas of Antarctica. While some such activity has occurred in past years, this form of tourism is gaining momentum and there could be an impact upon the environment. IAATO recently held a workshop to gain understanding of this growing tourism segment and evaluate the many aspects of risk involved.

Another notable change over the past decade is the interest of Chinese tourists to visit to Antarctica. Previously the top three tourist nationalities were, in order: American, Australian, and German. This past season the Chinese rose to third place, bumping the Germans. From IAATO's press release of May 27, 2014: "In line with global tourism trends, the number of Chinese visitors increased to make up 9% of the total. Ten years ago, in the 2003-2004 season, they represented just 0.2% of total visitors to Antarctica. China moved ahead of Germany and the UK to sit behind the USA and Australia, which made up 33% and 11% of visitors respectively." While, cultural norms of the Chinese may translate to a greater impact of tourism in the Antarctic, the Chinese tourism operators have earned their membership in IAATO through demonstrating their willingness to follow the IAATO regulations.

This report would be incomplete without lighting upon the subject of the growing krill fishery. Geoff Green, founder Students-on-Ice, spoke of being in the South Shetland Islands this past season with a group of students, watching Humpback whales bubble-net feeding and numerous penguins porpoising toward shore, and simultaneously viewing two large, industrial trawlers harvesting krill. Geoff put it, "the fishermen were literally taking food out of the mouths of the wildlife." To be noted, Chinstrap and Adélie penguins, which are under environmental stress as it is, are highly dependent upon krill for their diet. Whale species that had been decimated by commercial whaling that ended just four decades ago, are only now in recovery mode, and they too eat krill, as do seals, and other birds. Krill is the key forage species of the Antarctic ecosystem. Despite the recent promotion of Antarctic Krill Oil as a human health supplement, its omega-3 fatty acids purported to be a panacea for heart ailments, arthritis inflammation, premenstrual syndrome, brain function, psoriasis, skin cancer, thinning hair and nails etc., the main krill harvest finds its way into world markets as fish feed for salmon farms, pig feed, and fertilizer. While this topic is beyond the scope of this report on tourism impact, the krill harvest is

driven by perceived human need. Each of our interviewees have spoke on the subject, their concerns recorded in the transcripts included as Attachment #2. From Wikipedia: “In 1982, the Convention on the Conservation of Antarctic Marine Living Resources (CCAMLR) came into force, as part of the Antarctic Treaty System. CCAMLR’s purpose is to regulate the fishery in the Southern Ocean to ensure a long-term sustainable development and to prevent overfishing. ...The annual catch of *Euphausia superba* since the mid-1990s is about 100–120,000 tonnes annually, i.e., about one fiftieth of the CCAMLR catch quota. Still, the CCAMLR is criticized for having defined its catch limits too generously, as there are no precise estimates of the total biomass of Antarctic krill available and there have been reports indicating that it is declining since the 1990s.”

Rosemarie Keough
Wings WorldQuest Fellow

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ATTACHMENT 1: MAPS



Google Map



Google Map

ATTACHMENT 2: INTERVIEWS

Interviews conducted by Rosemarie Keough on February 14, 2014 with five respected Antarctic scientists, expedition guides, and tourism consultants.

Interview with Dr Peter Clarkson (PC) and Victoria Wheatley (VW), Pat Keough (PK) and Rosemarie Keough (RK)

Dr Peter Clarkson – IAATO Observer

Peter joined the British Antarctic Survey in 1967 as a geologist. He conducted several seasons of Antarctic fieldwork through to 1989 when he took up the position of Executive Secretary of the Scientific Committee on Antarctic Research. SCAR is an international organization that "initiates, promotes and coordinates scientific research in the Antarctic and provides independent scientific advice to the Antarctic Treaty System." Since retirement in 2005 Peter has written numerous articles about Antarctica, contributed to encyclopaedias, authored his own book on volcanoes, and lectured on Antarctic-bound cruise ships. Peter also is engaged by IAATO, the International Association of Antarctica Tour Operators as an "Independent Observer" to monitor and report upon tourism operations by cruise ships. In 2010 Peter was awarded the Member of the Order of the British Empire for services to Antarctic Science.

Victoria Wheatley – Antarctic Tourism and Treaty Specialist

Since 1999 Victoria served as the US government's private sector advisor attending the Antarctic Treaty Consultative Meetings. In this capacity she is responsible for providing informed views on industry, advising on technical issues, and consulting on industry and visitor regulations and management plans, including matters regarding potential environmental impact from human visitation. Since 2010 she works as a consultant to the expedition travel and cruise industry, frequently doing projects for the International Association of Antarctic Tour Operators.

RK – What has changed over the years? What is the impact of tourism? What's happening to the environment? What about public knowledge of the Antarctic? Regarding the change of behavior on scientific bases was that caused by tourism and Greenpeace reporting, or was just the Treaty coming in and more awareness?

PC – When I have seen people walking through or around penguin colonies, the penguins on the whole don't appear to be affected at all. An interesting case here: the penguins at Port Lockroy are more successful, despite all the tourist visits, than the unvisited colony just around the corner at Jougla Point. It is thought the reason for this is that the skuas are being frightened off by the humans and so they are moving along to Jougla Point where there is excessive predation.

VW – With Kim Crosbie's research through Scott Polar Research Institute on Cuverville Island, a woman Amanda Nimon looked into the skua interaction, impact and reaction to humans. She found that penguins are stressed no matter if there are skuas nearby to them or sheathbills walking through the colonies or visitors on shore... it's all in the distances, and backing away if you need to back away to minimize impact. It's a momentary stressor, not a long term, harmful one and it's transitory in terms of impact.

RK – Base personnel are with penguin all the time and see that the penguin tolerate their presence; the birds returning to breed each year, their nests, in some cases right beside the buildings or within a few feet of concrete paths. The tourists have been told in the lectures to keep 3 metres distant from penguins and that the birds have the right-of-way. Being amid the penguins is almost like a sacred encounter for the tourist. However, if you live on a base, a penguin is just another penguin. Is familiarity an issue?

PC – There are many cases of base personnel behaving less well than tourists. I think familiarity was the issue.

VW – A couple years ago we picked up Sue Trivelpiece, one of the lead US penguin researchers from their field camp near the Polish station, Arctowski on King George Island. A skua landed on the deck of the ship, and she said, “Watch this.” Having seen the metal band on its leg, she put her hand out toward the bird, which approached her, an indication that the bird was being fed by the researchers. Normally a skua would not approach you. It's a clear indication of what is happening at some of the bases.

The goal of the tourism industry is to tread lightly, take a precautionary approach, and try to have no impact. We're also mandated to do that by law – whether you are a US operator, British, Australian, etc. We have very strict guidelines to follow because we're organizing in one of the 29 nations that govern activities in Antarctica. With the restrictions and obligations on operators, the bar is set very high to have no more than a minor, transitory impact. With priority accorded to science, the playing field is not always level and that's okay. We just have to do our part to maintain that our aspect of visitation doesn't have an impact.

RK – When we first came to Antarctica 13 years ago, at Patriot Hills, as an example, even human urine and excrement were flown out to Chile for processing. The prevailing understanding amid tourists and explorers was that if we transgressed beyond an undefined threshold, there was a possibility that the continent would be closed to all non-scientific activity. Tourists had to be extra good. That being said, bases could do whatever they want.

PC – I don't know what briefing is given to research and support people at the bases in terms of the equivalence of the IAATO guidelines. But it is easy to get the impression they are not as stringent or enforced to the same extent as is done during tourist visits.

RK – Enforcing that's a good point. How are IAATO guidelines enforced? What happens if a tourism operator that is a member of IAATO fails to comply?

PC – Victoria could answer better. What I hope would happen is that there would be peer pressure at IAATO meetings. One company would say we heard or have evidence of your tourists doing such-and-such and we cannot allow this because you will ruin for everybody this opportunity to see Antarctica and the Falkland Islands.

VW – There are a couple of different things. Let me first explain how the process works and let me give you an example from this trip of something we have observed on one of the landing sites and how we follow-up as an operator and member of IAATO. Operators have two different things that they are dealing with: membership requirements through IAATO and regulatory mechanisms through their national authority. US tourism companies, for example, deal with five government agencies: State Department, National Science Foundation, EPA, Coast Guard and NOAA. The enforcement agency is the National Science Foundation. We have US laws, most notably the Antarctic Science, Tourism and Conservation Act which implements domestic regulations for American researchers working in Antarctica and Americans or US companies organizing activities in Antarctica. That law applies to all of us, however there are some things that do not apply to the tourism operators, like permits to conduct scientific work. Researchers have some exclusions that don't apply to tourists. Most notably for tourism operators is harmful interference. If we harass or molest wildlife, if we change an animal's behaviour, if we collect anything... all of that falls under that US law. Civil penalties include a one-year jail term and up to a \$25,000 fine if you are found to have violated that law. If a violation were reported, the report would go the National Science Foundation and their General Counsel's office would research it for a possible enforcement action.

Then you also have the management of the industry through IAATO. IAATO is a trade association but they don't have any enforcement teeth per se, as they are not a regulatory body. They have guidelines, standard operating procedures and bylaws. To to be a member in good standing you have to comply with the terms and conditions set forth by the association. Within the association there is a new procedure, a compliance and dispute resolution procedure. Through this procedure any member can report anything that they wish against another member for review and possible disciplinary action. This is a very formal process of review; it's also a very open process. An action can be cancelled at any time and a violation

could also be dropped out if it was not perceived to be of a certain level. A serious violation could ultimately work its way through that system and result in an operator being required to carry an observer. A member could be put to probation, or even expelled from the association. Right now every operator belongs to that association. There is very good reason to be within that group, also if you wish to make landings at South Georgia as the Government of South Georgia and the South Sandwich Island requires that if you make a landing at a wildlife site you must be a member of IAATO.

PK – If somebody tried to make an unauthorized landing they could be arrested?

VW – They would be subject to Government of South Georgia's regulations. In Antarctica, if you are outside of the Antarctic Treaty System, the system can't deal with you. For example, if you're from Zimbabwe or Liberia or something like that, these countries are not party to the treaty so the safeguards and high standards the Treaty Parties have put into place would not apply.

PK – And you can come do whatever you want.

VW – That's always the threat that everyone's worried about. For example, during this trip we did the hike at Cuverville to about the midpoint of the island. One of the assistant expedition leaders, Chris, had noticed there were footprints in the moss bed above where we were. I advised him we needed to report to IAATO that we visited on this date and we noticed there were relatively fresh footprints. IAATO will see which other ships had visited prior to us. It may have been a private yacht coming in, like we saw at Yankee Harbour. We don't know. We still want to be proactive and report it and we certainly don't want to be blamed for causing the damage to the moss beds. We're very conscious of making sure that we report it, say it was not us, and here is what was observed. That's an example of what operators do when they see something amiss. Also when we see a private yacht, we get the name of the yacht, try to get the flag state, who the skipper is, and report that to IAATO because the Treaty Parties want to make sure that the vessel is authorized to be here by whichever country it was registered through.

PK – Have you seen a degradation of sites since you've been involved.

PC – I think I've seen one example of cumulative impact from 1975 when I was down here working in South Shetland Islands. We were working on Penguin Island. We walked around the volcano crater, took photographs and the odd specimen. When I was back on a tour ship in 1998-99 there was an activity for passengers to trek around the crater. They wanted to observe the crater. It was Tom Loudon the US geologist who was leading the trek. I was left on the beach from where I could see a very definite footpath up to and around the crater. Obviously people were keeping to the footpath, which is a good thing. However, it was a footpath for which there was no evidence whatsoever when I was there in 1975. That is the only example of cumulative impact that I've seen. I haven't been back to Penguin Island since.

VW – There's also Aitcho Island, a Category #1 Landing Site open to tour ships carrying fewer than 200 passengers. A few years ago there were footpaths that had really damaged the moss beds. IAATO proactively said we're not going to visit Aitcho. We're going to exclude ourselves and essentially close the area to visitation until the site recovers. But this site is also visited heavily by researchers. So you don't know what's going on when you're not there. The tourism industry tries to be incredibly proactive and it was the industry that started site guidelines for the various landings sites to minimize impact.

RK – When did that come in?

VW – That came in probably 10-12 years ago.

RK – I don't recall that there were closed areas when we were travelling here last 1999-2001.

VW – The tourism industry started developing their own set of site guidelines to identify what landing sites were appropriate to Category #1 ships (the smaller ships carrying up to 200 passengers) for example, and what sites were more appropriate to the Category #2 ships (ships carrying 200 to 500 passengers). This essentially set down a criteria to determine which sites were appropriate for the size of a given

operation. This approach to site management then started being formerly adopted through the Antarctic Treaty System so that the Treaty Parties brought it into Resolution status. But this is still a guideline approach; Resolutions are not mandatory, nor legally binding on an operator. They are merely recommendatory, however IAATO members always agreed that anything adopted by the Treaty Parties, they'll abide by.

RK – Going into the future, are there changes anticipated to the regulations? Is there not a constraint to how many tourists can visit the Antarctic each summer? There's only so many appropriate landing sites.

VW – It's not changing. The Treaty Parties in 2009 adopted a legally-binding Measure which requires ships carrying more than 500 passengers to be cruise-only; and ships carrying fewer than 500 to be able to make the landings – provided there are no more than 100 passengers on shore at any time; only one ship at a landing site at one time; and that operators ensure a guide-to-passenger ratio of 1-to-20. These conditions are not changing, and are becoming legally binding. The US, for example, is developing implementation legislation. It hasn't come yet, but it will come under US law shortly.

RK – My thrust is that already today, with so many tourists coming each year and the IAATO reservation system for landing sites, combined with the reality of changeable weather, ice conditions and hence flexible itinerary plans, has a maximum capacity of tourism already been reached in the Antarctic Peninsula? Is there a limit to how many tourist ships can operate in Antarctic waters?

VW – The benchmark is not to have more than a minor, transitory impact on the Antarctic environment. That's not only for IAATO members but also at the Treaty level. If that threshold ever gets exceeded, that there is data to show that we are having more than a minor, transitory impact, then things may change. The problem is that we don't yet have adequate long-term, baseline data to know what is happening at these sites. Penguin populations are changing, which may or may not be related to human visitation. Climate change is one factor, as may be the presence or lack of sea ice during the rest of the year. Antarctica is one of those environments where it is difficult to pin down what is cause and effect, for example, where an impact may be coming from versus what's occurring naturally in the ecosystem.

PC – I was on *Minerva* about five years ago, and we called at one site in the South Orkney Islands. The scout boat went ashore and there were no penguins at all, none at all. Had it been a site of mass mortality, then where were the bodies? There were maybe one or two penguins, but what was once a vibrant site just evaporated. I don't know what happened, I've never followed it up.

VW – We found something similar in South Georgia, at Cooper Bay, where it turned out there had been a case of avian cholera. When I was in Stanley, one of the ground operators was saying the same thing occurred at one of their wildlife sites. They had a huge penguin colony near to where the floating pier used by the operators and other vessels, and now the penguin colony is gone. The penguins just didn't return one year. So the question is what happened to it? Where have they gone? Was it a mass die-off? If so, it occurred out at sea as there was no evidence on shore at the colony. I don't think anyone has studied it.

The problem becomes the ship's scheduling for the landing sites. The trend is toward larger ships. The older, smaller ships are going to leave the market. Into the future it's going to be the larger ships with maybe 200 to 500 passengers. That will put more pressure on getting the landing sites appropriate to that size of ship and dealing with congestion issues.

RK – Years ago we were told that Russian polar ships like the *Professor Molchanov* and *Professor Multanovskiy* with capacity for around 50 guests, are economic to operate because they were built during the Cold War and later converted to tourism. To replace this size of vessel at today's cost is not viable.

VW – Now you have to look at a model of building an expedition ship with a carrying capacity of at least 180 passengers or greater to have it be economical to build, one that is ice-strengthened and purpose-built for polar cruising.

RK – So as these older vessels are headed to the ship graveyard, the new vessels will be bigger and more restricted as to which landings are appropriate for the number of guests going ashore.

VW – Operators can visit sites not yet covered under official site guidelines or they can abide by the site guidelines at the 40 or so sites that have been covered. The ones that are covered are certainly the key sites and, as such, the most desirable and most highly visited sites. These are the best of the bunch and everyone wants to go there whether you are a smaller ship operator or a larger ship operator.

More tourists will create more pressure. It may come to the point that out of five days in the Antarctic, maybe one day is spent whale watching and another day might be spent Zodiac cruising and not doing a landing. You may have to craft itineraries differently so you're not always doing shore landings. That may have to happen.

PK – I wanted to ask about the die-off on penguins, is anyone doing studies on commercial fishing? We keep hearing stories of mining krill. Is food scarcity an issue?

PC – I don't know because I haven't been involved with CCAMLR (Commission for the Conservation of Antarctic Marine Living Resources). I would have thought that CCAMLR is directly or indirectly undertaking studies.

VW – It's a very hard thing to quantify. The stocks of krill are just like the stocks of fish; how do you census something that is below the surface of the ocean? It's clear there are times when penguins can't get enough food because the krill swarms are probably too far out for them to reach the food. But what is the cause of that? Is it an increase in the whale populations that have resulted in more competition for food? Is it a heavy ice year or a low ice year, the density or depth of the ice? There are so many variables it's really hard to point to its cause and effect. Whether it is due to human visitation, for example, from tourism activities, is hard to tell but researchers are continuing to look at the stressors to see if they can determine cause and effect.

RK – Viruses, disease. I'm impressed with our ship's boot cleaning protocol. Years back, people would step in-and-out of a bleach bath and do a little scrubbing with a hand brush when back aboard ship following a visit to a penguin colony, that bleach bath getting progressively quite dirty and rank. Today as you leave this ship, you first step with your clean boots and dip tripod-legs and points of walking sticks into a tub of disinfectant. Later, when ready to return to the ship, you thoroughly clean your boots of mud and guano using the substantial, effective boot scrubbers set up in the shallows along the landing site and only then are you permitted to get into the Zodiac; once back at the loading dock of the ship, there is a further disinfectant tub, which everyone steps into; and that same evening the ship's crew gives all boots one additional thorough cleaning and disinfecting. Guests appreciate this, as you don't have the distinctive penguin odor in your room. The procedure certainly helps prevent the spread of disease from one site to another. Are other tour operators as diligent?

VW – I think they are as the tourism industry truly wants to do the right thing. If we don't protect this place we know we will all lose our livelihood. Everyone then has a vested interest. It's a pretty closed community as staff work between the companies; we know people in the different companies; we hear what's going on and we observe each other informally. IAATO also works diligently to ensure best practices to again help operators towards their goal of minimizing impact and conducting safe and responsible tourism to Antarctica.

RK – Would recommendations be shared? Peter you've been recommending that the boot scrubbing stations would be better with the addition of a scrubber down the middle, not just at the sides.

PC – Yes it's in the report. And the chief engineer and people said that's a great idea. I didn't think of it. It's just that I've used it myself on other ships.

VW – If I was ashore during the first trip and seen the boot scrubbers I would have noted it immediately. I was at the platform and didn't go ashore. This is a good example of someone from outside, like Peter, seeing a simple and minor modification that could be implemented quickly to lead to a better procedure!

RK – So this is cross-pollination of personnel between different companies.

VW – Yes, you pick up ideas and bring the best operational procedures in from a lot of sources. Someone says we do it this way, or another ship has this type of set up. Everyone works co-operatively. It's very unusual industry association. We're competitors, but at the same time, from the very beginning everyone has always worked co-operatively to help each other out. If you need something like an X-ray for the guest on another cruise ship, you help out. As you know, we did this during this cruise to assist another ship as we had a more sophisticated medical facility than they did aboard their ship.

PC – It comes down all the way from the Treaty. I've often said to people, the Treaty is a unique organization. Consider the tax laws in any country: there are armies of accountants and lawyers employed find the loopholes to exploit for the benefit of their clients. Conversely, what happens in the Treaty every now and again, when they realize they have found a loophole, they say "Oh goodness we didn't mean that. What we meant is ..." and this is how they proceed.

VW – IAATO is the same way. If members see that somebody intentionally wants to take advantage, we work very quickly within the trade association to take the necessary steps, or we bring it to the attention of the Treaty Parties to bring the matter up through their system so it can become legally binding or placed under guidelines or a legally-binding measure to affect future change that would be applicable to all.

PC – One of the complaints from the NGOs the Greens, call them what you like, is that there is no policing in Antarctica, that all the policing is self-policing. And you see examples of this. Years ago when Greenpeace were doing their inspections they saw many things that formal Treaty inspectors did not see, and told everybody about them in their reports. To some extent it could be said that within the Treaty it was a case of you scratch my back and I'll scratch yours. You don't want to rock the boat. Greenpeace of course rocks every boat or blows it up. A woman from Greenpeace International came up to me at a meeting years ago and said to me "What do you, as a representative of SCAR, think that Greenpeace ought to be doing at the moment." This was at the time they had their World Park Base. I said, "Well the first thing to do is to close that silly base of yours, it's not really doing anything worthwhile. But what you can do is to expand your inspection program. You see all sorts of stuff that the Treaty Party inspectors don't see." Unfortunately she said, "Oh well, yes, it's just so expensive."

VW – Even the IAATO observation program, like we've just been through with Peter, is very beneficial, because it's another set of eyes that are looking at the operation. He has years of experience, not only as a researcher but also being aboard other tourist ships. So that fresh look, like with the boot scrubber, is important for us to improve the operation,

RK – So many tourists coming to the Antarctic are having once-in-a-lifetime experiences. Everyone on this ship feels they have seen so much that they are almost overwhelmed. I'm wondering your feelings on this first-hand knowledge that people will be sharing when they are back at their homes. How might this affect future policy regarding the Antarctic?

VW – The goal that all of us have in the industry, is that your guests become ambassadors for the protection of the continent. This can take shape in many different ways. During a trip they've been exposed to Antarctic research, for example on this cruise through the work that ACAP is doing with albatrosses and petrels; the Oceanites Site Inventory project on penguins; or some of the Humpback whale work through the College of the Atlantic. Hopefully you spark their interest into go back and perhaps become members of those groups, become active and financially support them. Many of these people are well connected through business or politics. We want them to encourage their country, if not a member of the Antarctic Treaty System to perhaps consider becoming a member. I think visitors can do a lot of good. Operators also have journalists on board and these people are going to be writing for major

publications. This also not only encourages people to go to Antarctica, research the right company for them to travel with, but also it can help encourage them to want to help to protect the place. There are many, many spin-offs.

PC – Obviously there are some very wealthy people on this ship, some of them will also be very influential people, or they will have very influential friends. You just have no idea when this will pay off. We used to have visits at BAS by government ministers from time-to-time which was a pain. But you'd never know when that minister was in a position to say, "Oh no no no! You're not cutting the budget of British Antarctic Survey."

RK – When we did all our work in the sub-arctic of Canada, in the Nahanni country where Pat and I, met, fell in love, and named our company – our daughter was almost named Nahanni – anyway... we produced a coffee-table photo book and a one-hour television special on the Nahanni. At the time a lot of folks asked why are we telling people about this wilderness, because now everyone will want to go there. First off, it's not easy to get to the Nahanni. Second, if you do go there you're the right type of person, you're committed. The land itself is challenging. By experiencing it, you appreciate it, and then you become a spokesperson for its continued preservation. Lo and behold 20 years later Nahanni National Park Reserve, which used to be a narrow strip park with boundaries that went from peak-to-peak following the river course that Pierre Trudeau canoed, is now among the world's largest parks. That was just realized in two stages over the last five years, but it took a lot of work and in the meantime, it happened because people like us brought the public's attention to the region. If you don't know something exists, you can't care about it. There's so much else taking your attention. So I agree with you fully.

VW – Another thing too when you look at the growth of the industry, we are so regulated now and so entrenched in environmental principles on how to conduct Antarctic tourism. It's a good thing. There's nothing bad about that!

RK – Who started IAATO? The foundation is strong.

VW – When I started in the Antarctic industry in 1986 there were three companies operating four ships. You had Society Expeditions, the company I worked for, with their two ships (*Society Explorer* and *World Discoverer*), Travel Dynamics with the *Illiria* and Mountain Travel Sobek who would charter ships for their sailings. By the late 1980s there was growth in the industry when some Russian research vessels became available and started being used by tour operators to conduct Antarctic tourism. This led to IAATO's founding in 1991 by seven operators who were active at the time. And it's grown from there. With the voting members, affiliates and associate members, I think there are now nearly 120 companies that belong to the association.

RK – As an operator, there's no way you'd not want to be part of IAATO. If you're not in it, you're not going to be able to reserve the landing sites. If you go as a "rogue" expecting to make a landing, you can't count on success for your client. You have to be part of this club.

VW – Membership in IAATO is, in essence, a "Good Housekeeping Seal of Approval" of sorts. It is an indication to a traveler that the operator is operating in a safe manner and conducting responsible tourism in the Antarctic.

RK – Thank you both very much. It's been great to speak about these things.

Interview with Brent Houston (BH) and Pat Keough (PK) and Rosemarie Keough (RK)

Brent Houston – Polar Biologist and Expedition Guide

Brent is a scientist with a Masters in wildlife ecology. From 1988–1993 Brent worked on research projects based in McMurdo and Palmer stations, Antarctica, followed by his involvement with the Oceanites Antarctic Site Inventory and Visitor's Site Guide. He has returned to the Antarctic annually, with over a 100 trips as a scientist and as an expedition guide. Brent has been awarded two US Antarctic Polar Medals. Brent's Antarctic expertise is penguins, and his overall knowledge is vast.

BH – Have I seen damage done by tourism at the sites? No. One of the things that really bugs me is the general consensus that tourists were trampling the moss beds, particularly at Aitcho Island where you went across to see the Elephant seals. Most of that so-called moss is an annual algae that grows and dies off each year. It is not a long-term moss that grows for hundreds or thousands of years.

RK – Aitcho is off the list isn't it? Tourists can't visit there.

BH – You can't go over to Aitcho at any time during the season, which I think is a crime because it can be managed, just like everything else. We built roads through Yellowstone; we have tourists in Antarctica. I don't have a problem even with a permanently, marked path. On Aitcho, you could restrict tourists to a corridor say 100 feet from the top and 200 feet from the bottom. We, as expedition staff, flag paths to walk on Yankee Harbour, and we take our flags but leave our small piles of rock when we depart the site. I come to what appears to be a pristine site and I see rock piles all the time. Do we impact things? Yeah, we pick up rocks and we move things. I think you could actually establish a trail and add to the value of that site and have minimal impact on sensitive areas. Have a few trails. So what. We have trails all over the world and people don't go off trail and start tearing things up. That can be managed.

Another thing I found that got incorporated into the Oceanites Antarctic Site Inventory that ended up into site guidelines is Hannah Point. Hannah Point has that wallow up top with Elephant seals. I happened to be up there one time when an Elephant seal went over the cliff and fell and split in half at the bottom. At Hannah there is the potential for the Giant Petrels to get scared off their nests, also the Kelp Gulls that nest right there at the landing site. So there are no landings permitted until mid-January to let those chicks get big enough and fledge and the Elephant seals moult. So there's one that works. You sacrifice, if you will, a landing site for wildlife, but then you are able to use it later on. That's a positive use of limitations.

Getting back to Aitcho. Closing off that site entirely is a negative use of one of the landing resources. You can see Elephant seals on Aitcho relatively easily by going along a path that could be maintained. People want to see Elephant seals. We don't find them in many places. Let's manage Aitcho like we do Hannah's wallows and penguins and Giant Petrels. That's where I have an issue with the tourism industry.

In my talks all over the world, people always ask me, "Aren't there too many people going to Antarctica?" Well what does that mean that there are too many? Are there too many people diving in Cozumel, Mexico? Are too many people going down the Grand Canyon, which by the way is the only place in the United States where we know exactly how many people have been to a pristine area. Antarctica is also one. We know exactly how many people have been to the visited spots. There's interesting research about at Torgersen Island at Palmer, where I had been working for four years. We had half of the island available for tourists to visit, and the other half was off-limits. Both were visited equally by the scientists. We found zero impact by the visitors. Not 1%, not 2%, but zero. There were and are a lot of people visiting Torgersen in my view, but is that automatically too many. Obviously no.

The rapid decline of the Adélie population is due to other things. These animals are living lives that are tougher than we can imagine. Our presence does nothing to them. A Chinstrap penguin swims 150 miles, sometimes 200 miles in a five-day feeding trip in the cold Southern Ocean, he's a foot-and-a-half tall, he's swimming in -1°C water, diving continuously, marching up sometimes 3 miles to the colony, and you think we can bother them by standing there? No.

RK – You once said that the penguin are all elite Olympians, else they wouldn't survive.

BH – That's right. There are very few injured penguins that you see on land. They are either killed by skuas or Giant Petrels. If you have a broken leg and are a penguin, you're going to have a hard time. Skuas and petrels will see the weakness. I always say that there are no infirmed penguins out there – nor any other injured seabird by the way. And they are all Olympic athletes or they are dead. That's pretty much how it goes out here.

RK – Historically, except South Georgia and Macquarie, there has been no or little human predation of penguin. So they don't know to be frightened of us. When you see the Giant Petrels and skuas flying over a rookery, all the penguins get anxious, huddle closer and call loudly. They don't when we walk by.

BH – No and here's why. There's no land predator that walks up to a penguin. Most predators on penguins are aerial predators. A skua flies over and it drives them crazy. That's why there are helicopter limits. If you flew a kite, or had a flapping jacket, they freak out. A helicopter, even a half-mile high freaks them out. But you walk up to them, and walk around them, they're fine.

RK – That's interesting. A guest was asking Victoria for permission to bring a drone helicopter for photography on a trip next year. He was upset to find out that were he to be successful in getting a permit, the stipulation would be that he'd have to keep the drone 200 feet away from penguin colonies. He said that defeats his purpose.

BH – Exactly. Penguins have aerial predators and they will freak out. They won't just run around. They will run from the nest. I've seen it. I've seen helicopters come down. I've seen the Chileans do it and the Argentines do it, in one case, landing in a penguin colony, and in the other, next to a penguin colony, with chicks one time, the other with eggs. The adults ran away from the nests, scattered the chicks every which way, the eggs every which way. Those nests were complete failures – one helicopter. You put a drone up there, even people's jackets flapping in the wind, and you can have a huge impact. If we behave on the ground and we approach slowly and we keep our distances, penguin cannot be bothered, unless you are knocking them into a situation where a predator can get them. But again, they are tough as nails. When they are coming in and out of an area, we need to give them the right-of-way. In other words, if tourists behave, the penguins are fine.

RK – When we were at Half Moon, and we were walking from the one colony toward the main colony, and between is the area of penguin highway crossing. People were very good. But sometimes you'd see a penguin that would turn around and go downhill again. I'd think: Oh, he or she has come from so far, hiked from so far, and we've disturbed it. Would this be a temporary disturbance? There are so many tourists in this short breeding season, does our presence potentially cause a problem? Or is it not significant? Certainly the Gentoo populations are increasing, but what about Chinstraps?

BH – That's a complicated question and answer. Basically, you can really disturb penguins that are headed up to their nests if they turn around and run away and don't come back for a long time. But they will turn about and try again when they get the feeling there's no threat.

PK – I never saw a penguin running away.

BH –The danger of that is if you have people on the island 24 hours a day. Then you have traffic through there and eventually you'll have penguins affected going to and from their nests and that could be a problem for, especially chicks being fed. I have watched those little penguin highways for a long-long time and I think that we are managing it well with someone standing there. I've done it with several operations so it's not like one company is doing it well, and another poorly. Everyone is doing it reasonably. That's a good way to point out to people the penguin's right of way. It's painfully obvious that people need to slow down and/or stop to let the penguins by. And that's why IAATO requires a resting period for the birds between tourist visits. There's also consideration of the timing when penguins come and go from the colony. This year we saw Gentoo penguins coming and going all day long. That means food is available,

they're finding food all day long locally, they are fat and happy, and they are coming and going in the middle of the day, not just morning and afternoons. The other two, Adélie and Chinstraps, come in the late afternoon and evenings because they are out hunting in the daylight hours which is the best hunting. Tourists are there during the middle of the day when there is not that much traffic. That is a plus. If you did have people visiting at 4:00 in the morning until midnight, constantly through the path, I'd have something to say about that. Admittedly, a couple places have bottlenecks, but it's being well managed.

PK – There was one time, at the Chilean base, that you got pretty upset with the Zodiacs approaching a leopard seal.

BH – I was not so upset as concerned. That particular time, it was a long landing, but we were not directly bothering the leopard to the point of it leaving the area. That seal was resting on an ice flow. It wouldn't be on the flow unless he wanted to rest. He's taking a break. And that's what they do. We know that the Zodiac fumes bother them a lot. They always raise their head. It clearly disturbs them from sleep. There's also the sound, but it's mostly the smell of the engine exhaust. I think that sometimes you can watch a seal from shore or from a ship with binoculars just as well as you can from a Zodiac. I don't know how long that seal was on that ice floe, but it was clearly asleep. Then again, the counter argument is that if the seal is really bothered, it just has to slip into the water. That's a disturbance, but not very critical if you ask me. They are in charge of their behavior all the time, and most times they tolerate our presence, fumes and noise and all. I try to cruise the Zodiac down wind, which is easy for boats to do, and most of us consciously do that. We are responsible. We don't want the seal to leave the floe because we want all of the passengers to see it, but more importantly we are responsible and compassionate people. We learned by experience what bothers them, and what is OK, and all the guides I know are acting accordingly. No one wants to see animals bothered by our visits. So are leopard seals declining because of human disturbance; not at all. No way. I strongly believe that people should see seals on ice. You are thousands of times more likely to protect an animal or a place that you have seen and experienced. That is tourism at its best. Kim Heacox (conservationist, writer and photographer) told me once long ago that, "seeing is saving." Can't get any more succinct than that. I can't tell you how *pro-responsible* tourism I am. It's a huge part of my fortunate and extraordinary life. It's not only my livelihood, it's the only way I know how to behave.

PK – That gets back to the animal should decide what to do, not that we impose.

PK – Then there's Lemaire Channel and all the humpbacks we see there. When we met you down here, many years ago, there were not many of us floating around. The numbers of people sure have changed.

BH – You'd have to look at other data to see if the animals are being disturbed. I think it is a common misperception that there are too many people in a certain area and that this is bothering the wildlife and environment.

RK – I guess you'd see if the birth rates fell.

BH – Well, I don't know with the whales, but I do know with penguins. There are several studies. The heart rate studies, the success of the chicks being raised, productivity, or there is increased predation studies... all those studies found no impact. Although there was one in Australia that says yes it's bothering them. But a skua flies over or a Giant Petrel flies overhead, and the penguin's heart rate goes up. Swimming a hundred miles their heart rate goes up.

RK – Peter Clarkson had an interesting comment. He said at Port Lockroy, the side-by-side comparison that the penguins were more successful where the tourists were and conversely where there had been equilibrium, on the control, they were not doing as well because there were extra skuas and Giant Petrels went over there and predation was high.

BH – That's a plus minus sort of thing. The penguins can relax because people are keeping the predators away. Yin-yang on that one. I think it's more important to look at other issues that are happening to

penguins. If you want to study the overall, large-scale tourist impact on giant petrels and kelp gulls, there is none. The breeding areas have all been closed off. If those areas hadn't been closed off, tourists would have a giant impact because those birds fly away and don't come back. Penguins jump off the nest when something happens and they'll come right back. The Giant Petrel will leave and not come back.

RK – The giant petrels just like albatrosses are already in threatened are they not?

BH – Giant Petrels are in trouble because of long line fishing. I don't know the status specifically.

RK – They are in trouble because the issues are exactly the same as the albatrosses. So in addition to that they leave their nests.

BH – They leave their nests if tourists are too close and a skua jumps right in. And there's the weather. If it's cold and rainy, chicks can become hypothermic easily. Eggs are usually pretty fine for several minutes. We know this from studying them. We have birds that leave the nest. We work with them that way. Scientists haven't seen any decreased productivity by birds leaving the nest so long as they come right back. So that's specific behavior. We scientists know how to walk around giant petrels. Tourists don't. They scare them, coming up too quickly.

Here's another point that I think is rarely addressed as it relates to tourism in the Antarctic. Most of the areas that have the highest diversity with sensitive areas of mosses, lichens, plants, breeding areas for some seals, certainly for some penguins, were set aside as Specially Protected Areas a long time ago. We forget that about half the places that tourists could potentially visit have always been off limits and have never been visited by tourists. So the rest of the available sites are good for tourism. Those sites have had concentrated visitations and have shown no or very little negative impact. That is something to remember. So not only did we set aside a bunch of areas that have never been visited and are pristine, we've narrowed it down to the sites that people can visit regularly in a difficult environment and we've managed those sites very well. You want to look at negative impact of tourism in Antarctica? I don't see it. The data doesn't support it. I just think people throw it out there willy-nilly.

PK – That's very well said.

RK – Studies like Kim Crosbie's on the heart beats of the penguins...

BH – They didn't find anything. They didn't find tourist impact upon the penguins. They said there could be potential effects. Did the heart rates go up? Yes. Has productivity changed on Cuverville? No. Has productivity changed on Aitcho? Yes, for different reasons.

PK – What do you think... they were telling us about some of these large penguin die-offs that have taken place without any explanation.

BH – I've heard about that with red tide. I remember Bill Fraser telling me there was starting to be red tide down here and I believe also on South Georgia. It's new. Red tide is generally a warmer-water phenomenon. I'm not sure if that affects penguins directly. I can't claim to know anything about it. I do know there was a die off of Chinstraps on South Georgia, which I believe was found to be viral.

RK – And do those colonies start to come back if there were a few survivors?

BH – Depends upon the mortality.

PK – What caused it?

BH – They thought it was an avian flu kind of thing going on, but again, I'm not positive on this.

PK – Where would that have come from?

BH – Good question. I mean, birds migrate over long distances. Could have been a skua, Arctic Tern. Who knows? That may not be the culprit at all. That's just speculation.

We should talk about the drop in Adélie Penguins due to climate change.

RK – And also I guess competition, because of the climate change the Gentoos getting the best ground first. Is that what we're seeing at Brown Bluff?

BH – No

PK – Years ago at Brown Bluff, the Adélies were all the way across the bluff. Now Gentoos are moving in.

BH – No. I don't know what's going on in the northern part of the peninsula. I've just noticed general trends with the Adélies tightening up their breeding areas and the Gentoos have actually shifted a little bit in their spatial arrangement, which I think has to do with snow. You see Gentoos in the wet area. Gentoos are going to take the flatter areas first, as opposed to taking the upper sides first. Adélies will arrive at the same exact spots. You're not going to see Gentoos marching into an Adélie colony and taking over. You're going to see Gentoos taking over an Adélie rookery because there is space available due to the losses of Adélies. That's what's happening. It's not competition directly; it's survivability and availability of nesting sites.

RK – So unlike albatrosses that go back to their natal island, and probably the same area, the Gentoo will be opportunistic and take new territory as it comes available.

BH – Gentoos are wanderers. They'll go from beach to beach. They'll settle down here and there. They can make a nest on their own and do well. They are very successful in beginning a colony with just a few birds. They don't need the colonial periphery-thing to protect the whole colony. They can thermo-regulate their body temperature better in colder climates than in warmer ones, so that's why they are able to do well farther south as the climate warms. And as Gentoos are bigger-bodied, the skuas are less inclined to drag their chicks off the nests. Also, Gentoos can breed later in the season. They have a longer chick-rearing period into the colder months. Adélies can't do that. Adélies are a real polar, desert animal that has a very confined time line as to when it can breed. A Gentoo marches down here and says: I can wait a little while or I'll go over here. They are sort of like beach bums. They can like it over here, over there. They switch mates. They switch nesting sites. They can move around very, very easily. Adélies and Chinstraps have site tenacity or site-specific breeding. Gentoos don't have that. So the Gentoo wanders around onto a colony where Adélies are dropping like flies. There are now spots available to build a nest. There are pebbles for a nest. There's not much problem in getting established there. So not direct competition at all, just taking advantage of opportunity.

The Adélies are declining in the middle of the Peninsula where I've done my work and where Bill Fraser has done his work. There has been an 80% decline in Adélies throughout the study area. In 30 years! Two things are happening that you can maybe not figure out immediately. The extent of the sea ice can be as extensive as it used to be, but it is not consecutively extensive in enough years to produce the habitat for the penguins to come and do well. The Adélies are travelling farther for food. They are arriving skinnier when they start the breeding season; the chicks are leaving with less weight than they have historically; and there's no recruitment of the youngsters because they are having trouble finding food in the first years. That all relates to declining sea ice which has phytoplankton growing under it and the larval fish and krill living under it, during the winter time. Everything is against these guys relating to sea ice.

Secondly, snowfall has increased in the middle of the peninsula and is literally burying the penguins during the breeding season. So the nest are either collapsing due to being built on snow; sites are not available because of snow; or the penguins are being buried in during these heavy spring snow storms. More moisture in the air, warmer temperatures, more snow. The peninsula is heating five faster than the rest of the world. It is super heating right now.

RK – Years ago we were on Devil Island and it was above freezing. We passed Vega Island and there were these waterfalls with rainbows. When we got to Devil, the Adélie chicks acted like children with fever. When a child is silent you know something is wrong. These chicks were silent. Their wings were open. Their bills were open. They were still and so silent. They were so overheated.

BH – The Weddell Sea spots like Devil Island, Paulet, those are volcanic. The rocks absorb more heat, don't hold the moisture as well, and drain quite well. There are differences in those sites. And those penguins feed in different areas. So there are lots of different things going on. But if you look at any question about why the Adélie penguins are decreasing rapidly in the middle of the peninsula, all of the answers have been yes. Availability, timing, you have to fledge your chicks when there is the most food, but if the ice is way far away they have to swim farther, all the things you can think of... The survivability of krill, krill can live up to seven years, and they can also starve for one year. The periodicity of sea ice, years ago there was expansive sea ice four out of five years. So for every four out of five years you could have one bad ice year. And guess what, krill can go without food for one year. So if phytoplankton productivity is down, krill can survive. But they cannot survive two years without food. They will die. So now if you have ice that not extensive, phytoplankton is not being produced. There are different kinds of phytoplankton, phytoplankton that grow under the sea ice, those that grow in the open ocean, and there are other things going on as well. But you cannot have larval krill starve. Flat out can't have that.

RK – I think you mentioned earlier if the populations crash even if you have a good ice year there's not enough population to expand quickly.

BH – The problem with Adélie with expanding is that there is no recruitment. All of the penguins breeding in that area that we are talking about are older penguins. We just can't get any of the chicks to come back and breed there. There's a tipping point of weights and it's down to like ounces. Polar bears have it. The females have to go into their den with an exact weight or above to produce cubs and come out of the den. Below that, they abort. Same thing with Adélie Penguins. If chicks don't leave the rookery at a certain weight, at a certain time, they are not going to survive. It's down to the ounce. It was a very, very stable pattern for thousands of years that has produced these colonies. We can dig down into the pebbles and find out how long they have been there by carbon dating bones.

PK – Like they have been doing at Cape Adare.

BH – Exactly. It's called taphonomy: the study of the age of a penguin colony due to the carbon matter, which is Otoliths, fish ear bones, and squid beaks. We've turned it from a polar desert into a sub-Antarctic ski area. It snows like crazy now a days. Here's one of the most popular questions. Why don't the penguins just go farther south? Well you can go farther south and feed up to a point. But in the wintertime below the Antarctic Circle it's dark 24 hours a day. If you're on the sea ice and it's dark 24 hours a day, it doesn't matter where the food is, if you can't see it. So you need ice and you've got to have a period daylight to be able to hunt. And if all the sea ice is south, where there's less daylight to feed. They are not going to make it.

RK – So you mean early in the season, since they stay beyond the edge of the ice fringe.

BH – Correct. There's a tipping point of the sea ice the maximum and minimum extent. The minimum keeps creeping farther south and they have stay with it, or they are done. There's travel time involved. Let's not forget about recruitment, and krill. Here's something else that's happening the diet samples of Adélie penguin at Palmer Station 25 years ago the diet samples were 50% ice fish, 50% notothenids. Guess where the ice fish live, the larval fish are under the pack ice. Now there is zero percent ice fish in the Adélie diet studies that we do during the summer. Everything you ask. Is it climate related that the Adélie penguins in the middle of the Antarctic Peninsula have dropped 80%? Every single question you ask. Is it related to climate change? The answer is yes. You can't find a no.

RK – Regarding the recruitment of the young... are they not returning to breed because they have died?

BH – They haven't survived the first three years.

RK – Only the mature continue to survive but no young.

BH – Right. The quickest way to increase your population is to have all the young survive. Gentoos are doing that. The quickest way to decrease your population is to have all the young die. Adélie's are doing that. For instance, when I was at Palmer Station, there were zero Gentoos in the study area. And now it's over 5000 pairs.

RK – When did you do your study?

BH – That was between 1989-93. This book is critical to understanding what is happening. "Fraser's Penguins: A Journey into the Future of Antarctica," by Fen Montaigne. He's a reporter, a newspaper reporter, and a National Geographic journalist. He wrote it from a reporter's point of view using facts and questions and answers. He lived with Bill Fraser five months during the studies I did for four years. He has written in a clear and concise way that is highly readable. If you want to read one book that describes what's going on with penguins in the Antarctic Peninsula, that's it.

RK – ISBN 978-0-8050-7942-5 Fen Montaigne

Haven't we had climate change like this many years ago? We picked up scientists who were working at Cape Adare looking at 8000 years of records of pancake-flat, freeze-dried penguin bodies. We never heard the results of their studies, but that was one area that was always open of ice for Adélie breeding for millenniums. Haven't we had cycles of warmth here before and the Adélie's survived?

BH – Absolutely. You always will. But an 80% die-off in 30 years is a catastrophic die off. That's not a gradual decline in Adélie's due to slow changes in the environment.

PK – Is that the case in the Ross Sea area?

BH – No no no. We're not talking about southerly Adélie's. They've got different habitat.

PK – That's to do with daylight?

BH – No not necessarily. You have Adélie's all the way south to the McMurdo Station. So that's a different animal. Their breeding season there is different than those on the Peninsula and I promise you it's not snowing on those guys. It's not ruining their nests.

RK – Are the Peninsula Adélie's suffocating in the snow?

BH – No, they are just buried beneath it and are not able to make the exchange from male to female during incubation. Also if there's too much snow they are building their pebble nests on top of the snow, they can't wait, they've got to do it, and then the snow melts quickly the nest collapses, and the egg rolls away, and a skua picks it up. It's a huge, huge issue.

People ask: "Hasn't this happened before?" I say yes; however, I think that anything that happens in our lifetimes that affects an animal in such a drastic way needs to be seriously addressed, especially when their environment has been stable over a long term. If you want to say how does this relate to what's going on in industrialized nations or is it natural or is a cycle. I don't know, but apparently a lot of people think they know. I'm telling you that what is happening to the Adélie penguins in the middle of the peninsula is shocking. It's shocking. Even if it were a slow decrease you should be alarmed – even if it happened every thousand years. I mean, if this happened every thousand years or 10 thousand years and they were wiped out this quickly and this completely, we wouldn't have Adélie penguins. And if these are indicators of a problem to the north in industrial nations and we're seeing things down here, the tip of the iceberg so to speak, you have to start to address the canaries in the coal mine. How many canaries do you need? There are thousands, and this is just one of them.

RK – We don't hear there is such an alarm over the Adélie's. On these tours we've had people of influence who have some power to help change things.

BH – What you hear is about coral reefs and bleaching. You hear about the spruce budworm moving farther north and ruining trees. When it becomes a problem for people in the temperate regions they start to listen. Nobody is really listening to Adélie penguin stuff unless it relates to climate change. Bill Fraser has been addressing Congress before on these issues. Thirty years ago when we proposed this, everyone thought: You're nuts. Climate change could not possibly be occurring in Antarctica, it's the frozen continent. Guess what, they are listening now. It does have to do with what is going on in the north.

RK – You see it in the arctic. The land is slumping as the permafrost melts. In Greenland...

BH – I work with polar bear. The Churchill polar bears that I work with are going to be gone. Twenty years they will be gone. I never thought I would say in my lifetime as a wildlife biologist, that it is crazy what's happening to populations of wildlife right now because it's so fast. They can't adapt.

PK – To summarize. The tourists visiting here are not having a direct effect. The bigger effect is climate change.

BH – At the moment the tourists visiting here are not having a direct effect on the animals.

PK – Other people argue that a ship like we are on right now is better for the environment because it is so high tech, and engines run better, than a lot of the little *Molchanovs* and the other old Russian ships that used to come down here.

BH – Carbon emissions down here aren't directly affecting the animals here. It's the carbon emissions in the atmosphere coming on global thermal currents that have the effect of changing the temperatures down here. Even if you had a bunch of industrialized factories in Antarctica, they still would not be causing the local climate effect that is occurring to the penguins. That's the thing.

PK – The long and short what we are doing with this ship and with all the other ones...

RK – ... and there may be a positive effect with all these people going home saying that the Antarctic is precious.

BH – I always believe in tourism as a positive.

PK – You told us before about what you witnessed in places like McMurdo and that...

BH – Right. McMurdo wouldn't have cleaned up their act if one, Greenpeace hadn't come down and made photos available to everybody; and two, tourists were marching in there and seeing it, and talking to their Congress folks. I can tell you that for sure McMurdo was cleaned up in a very quick period of time. I was there. I was down there just one season. But I was there the year Greenpeace was there. They were really doing the protests and hammering everything. Subsequently my friends went down there years afterward, and I've seen pictures, and I've heard all kinds of things about it. Right, watch-dogs work.

PK – There's a lot of impassioned people on this ship right now who have had the best time of their lives who would be spokespeople.

BH – I think it's best for us to reach out. If you do the math a ship like this for our 21-day cruise has got to be in the .00001 range of overall carbon emissions on earth. To get the earth to stop warming as quickly as it is, is going to take a ginormous change of attitude. What I would propose that we should be doing is to tell people how to watch out for things that are very susceptible and maybe move to get ready for a warmer climate in some aspects, rather than trying to catch up with something that is a run-away freight train. People ask: "What can I do about it?" I often say, get ready. Meaning watch out for certain signs, try to save stuff that you find important.

RK – One of our friends on Salt Spring is an environmental consultant who has done a lot of work in Mongolia. He says it's too late for Mongolia. Don't bother putting in more money and time there. Go to other places that haven't yet reached the tipping point. You can't save it all.

BH – Churchill is one of those. There's nothing you can do about Churchill. The sea ice is not going to return.

PK – We talk about this all the time. There's only one problem and that there's five billion too many people on the planet. We talk to scientists who know. The sustainable population of humans on the planet is 1.5 to 2 billion. We just went over 7 billion. But no politician, nobody will address the issue of human population, birth control, family planning. It's taboo. They are frightened of doing so.

BH – Here's another aspect that I've often said. Seven billion people behaving the way they do now is not the way seven billion people should be behaving. We are behaving like there is no tomorrow. And we have now reached the scenario where there is no tomorrow in the sense of longevity for the earth. You could have billions of people on the Earth if they would pay attention to the environment and live simply and closely to the earth with proper behavior. It's just insane.

PK – Most people don't want to spend the time to think about how to clean anything up.

RK – Or there's this hue and cry if the economy gets a chill.

PK – The economic indicator, when you listen to the morning news, is if the housing starts are down a bit, there is panic.

RK – We need a new model for our economy. Capitalism with restraints.

BH – You have to be responsible for your impact. One of the reasons people are NOT responding to these calls is that they don't believe the science. Look at the 1970s. Paul Ehrlich in his book, "The Population Bomb," said that at seven billion people there would be pandemic diseases, worldwide famine, and complete social unrest. We have it, but it really hasn't affected the affluent at all. It didn't happen to them. The earth did not collapse. Of course we had increased disease and problems all around, but in a sense that generation says we've had alarm bells since the 1970s and guess what, we're still pumping along. Of course technology has changed and communication. So here we are with climate change. Also I point back to the 70s when you say remember the oil embargo and there was rationing of gas. People started paying attention then to resources. That's because it affected them in the way they drive their car. Nothing has really affected the American people, mostly industrialized folks, directly. They turn their light switch on, it works. They turn on the AC. It works. Their kids aren't choking to death from pollution.

RK – We were in Greenland not too long ago people told us they had to put down half their sled dogs because they don't have a prolonged season of sea ice any more, and it costs a lot of time to get seal meat for dog food. So the dogs aren't as useful any more. And, any dog that has gone south of the Arctic Circle isn't allowed back, and likewise any dog from the south can't come north. The Greenland Husky is a very special breed and it seems awful to destroy it.

BH – To quote Bill Fraser, "The animals and people who are taking it in the neck are those who have nothing to do with this mass hysteria of carbon emissions."

RK – I think we've touched on a lot of good topics. Thank you Brent very much.

PK – You're great.

Interview with Meriwether Gil (MG) and Dr. John Dudeney Pat Keough (PK) and Rosemarie Keough (RK)

Meriwether Gil

Meriwether's specialty is cetology, her Masters in marine mammal behavior and training. She interned at the Dolphin Research Centre, Florida, and worked as an educator at SeaWorld, Florida and later as a research scientist for the Pacific Whale Foundation based Hawaii. Much of her field studies were focused upon Humpback whales. Recent years Meriwether has been a guide on tourist expeditions to the Antarctic, Far East Russia, Alaska and the Galapagos.

Dr. John Dudeney

John joined the British Antarctic Survey in 1966 as a physicist. Over his 40-year career – including 2 winters and 24 summer seasons in Antarctica – John held roles of research scientist, research leader, and base commander through to deputy director. John is an individual member of the Parliamentary and Scientific Committee of the UK Houses of Parliament. He was awarded the Polar Medal in 1976, and a second clasp in 1995 by Her Majesty Queen Elizabeth II for services to Antarctic Science, and was made an OBE in 2005 in recognition of his many and varied contributions to Antarctic affairs.

RK – Tourism over the past decade has had a huge increase in numbers. Has this had an impact on the Antarctic?

JD – Actually tourist numbers have decreased since a peak in 2008, but the thing that bothers me and it's the first time I'd seen it in action is the big ships, and we saw two. I hadn't realized they were quite doing what they were. When we went to Cuverville we had to wait because there was another ship there, the *Zandamm*. She appeared to be right next to Cuverville, she's almost as big as Cuverville for goodness sake. They are not allowed to do landings, but I didn't realize they were taking the ships so close. And we passed that other ship in the Gerlache Strait, the *Celebrity Infinity*. Neither of those ships are designed to go into the Antarctic.

I suppose they are now burning marine gas oil because of the IMO regulations on heavy fuel oil. Still, I don't think it's too smart. I don't think it's too much of an exaggeration to say that those ships run the risk of a serious accident. And it is hard to see how an effective emergency response could be mounted to do anything about it. There's just too many people on board. Also what's the point?

RK – Why not watch an Imax film.

JD – Yes, why not watch an Imax film. That's what you are doing, you're watching. A penguin is a little dot in the water. You have to be careful because the waters are not well charted. There are large areas on the Antarctic Peninsula where there's no chart at all, or if there is, the soundings are far spaced. We know in the fiords that rocks and reefs come up out of nowhere. I worry about the big ships.

RK – Over a decade ago, sailing into King Haakon Bay, South Georgia, Pat saw a bit of foam ahead which proved to be an uncharted rock. The captain didn't take note until almost too late. Did he ever put the reverse brakes on as best he could. Fortunately, this was a small, maneuverable ship.

JD – It's happened to national operator ships. Many years ago one of the British Antarctic Survey ships with a very experienced captain was not many yards off the normal track going into Rothera travelling at service speed and *whack*, onto a rock.

MG – In regard to marine mammals, I think captains now a days are pretty good about the following the approach regulations, but it's just again more ships, more potential for marine mammal collision. There are a lot of whales that we were not intentionally approaching and you know, you look out the window and one is right there.

JD – I looked out of my porthole, we were going at service speed, and one was right there.

PK – I remember. You said you could have touched it.

MG – Vessels such as this one, which can travel in open waters at 21 knots, how are you going to avoid a collision? If you have a whale that pops up right in front of you, going at that speed. And right now there are no speed regulations that I am aware of.

RK – What about the whale that was off to starboard, then coming underneath our ship, popped up to port as our ship was stationary to facilitate a whale-watching experience for guests. Robin told everyone to watch port-side guessing that the whale would appear there. He didn't know that would happen, but all of a sudden the depth sounder momentarily indicated there was only two feet clearance, this reading being taken from the whale's body as it swam right under the instrument. Are they playing with us?

JD – They are just interested I think. Same with Zodiacs. I've been in groups of Zodiacs, just sitting and had whales that apparently are in transit somewhere, come back just to look at us. I don't think they are interested in the humans. They interested in what these black things are, and they come really, really close, go under, come up the other side. Spy hop.

RK – And what about sound?

MG – And that's the thing too. Down in Magdalena Bay, in Sea of Cortez, the Gray whales are attracted to the sound of the engine of the Zodiacs. So when they approach Zodiacs it's often from the stern. I think acoustically they are drawn to the low res.

JD – So are Leopard seals. They seem to be attracted to the engine. They'll come right up to the rotating propeller and almost touch it, come right up. They tend to approach from the stern. They'll come up and spy hop...

PK – We've seen that. We've been on a Zodiac when they've done that.

JD – ... and come up and bite at the pontoons at the stern.

RK – This picture (on our ANTARCTICA brochure of a Leopard seal under water, near the surface) was taken from a zodiac as the leopard seal was coming up. He bit the fuel line! Why are they attracted?

JD – I think that they are interested and they wonder what it is. If there is diver in the water, the seals come because of the bubbling. They are sort of aggressively interested in divers. They'll come up close. There's more than one authenticated example of a leopard seal going and catching a penguin and bringing it to the divers.

RK – We've heard that too. Canada's Paul Nicklen, the underwater photographer – Leopard seal, Narwhale, Walrus – he had a female Leopard seal bringing him a penguin twice and he recorded it.

MG – The other thing just as far as all these vessels being in Antarctica, there hasn't been that much Humpback whale research or other whale research. We know some of these bays that are very sensitive to mothers and calves and so these waters are restricted. But there's not that much research to be able to say this is a sensitive area or a high frequency channel for the Humpback whales. We don't know how they migrate to Antarctica. Are there certain waterways that they frequently use that vessels could stay away from to avoid a collision? We just don't know.

RK – These animals are going toward Australia and New Zealand for the winter?

MG – Yes and that's their breeding and calving grounds, but we don't know their migratory routes and which waterways are more sensitive to them than others.

RK – Here along the Antarctic Peninsula we know there's a lot feeding in the Gerlache, so that's where we all watch for whale.

JD – I've been in the Gerlache before in a ship and had that experience. Lots of Humpbacks, doing their circling, blowing their bubbles, breaching, and generally just everywhere.

RK – It's hard to tell people to stay away because we all come to see the whale.

Victoria was mentioning that at the Chilean base, one person was trying to get our guests to move closer to the penguins for a photo. She said no, you have to stay back 15 feet. But base personnel are so used to the penguin. They are there all the time, whereas for us it's sacred.

JD – That is true, and walking on moss is another thing. A lot of national operator staff have to walk on moss because of their work, and there is a danger that they end up doing it all the time.

MG – A lot of our guests, when they went to see the King penguins, they said, "You had instilled these regulations and approaches with us and when we got to the Falkland Islands our guide let us get right close."

JD – When I went fishing in the Falklands at my favorite fishing spot, the one thing that struck me is all the litter. People drive out there, and just leave their litter, which is a terrible thing. It's sort of so familiar to you, familiarity tend to breed contempt.

MG – I think too a big thing will be interesting to watch over the course of upcoming years, is the whole krill industry, and how that is going to impact.

JD – There's two things going on. The industry is increasing apparently because of the need for fish food. A lot of the product goes to feed farmed fish, presumably much to Chile. The other is the impact of receding sea ice, the feeding grounds of immature krill. But at the moment the CCAMLR total allowable catch for krill is far greater than what the catch actually is, so there does not appear to be an immediate crisis.

PK – We were just told that there have been a few major penguin die-offs.

JD – These have over the years, generally put down to very bad krill years. Every now and again South Georgia wildlife has a serious problem because all of the populations depend upon the krill. And the krill depends upon the sea ice off the Antarctic Peninsula where the krill nurseries are. The krill are caught in the current and taken to South Georgia, just the same as Shackleton was. That's how the krill get there.

RK – The krill issue then affect not only the penguin, but also the birds, the seals, whales everything.

MG – Yes, krill is the primary producer, that's the base of the food chain.

RK – Everything, the seals, has done so well, because the whales were taken out of the ecosystem

JD – That's one of the arguments as to why the fur seals have bounced back, because they were opportunistic and started eating krill as well as fish... true or not...

RK – Meriwether, any comments? We're seeing Crabeaters are everywhere. Now there's competition for krill from more whale and today also from humans. Might we see Crabeaters, Humpbacks, penguins go down in numbers... or maybe there's enough for everyone.

JD – One of the problems is to estimate the population of Crabeaters there are because they all live out on the pack ice.

MG – Ten to 15 million Crabeaters is the estimate that I have from the Marine Mammal Encyclopedia, which is a lot.

JD – It's a huge population and there's now an awful lot of Fur seals on South Georgia.

RK – Even a decade ago there was talk about doing a cull so that the petrels can have cover in the tussocks.

JD – Don't mention that subject.

PK – Are there even more Fur seals today on South Georgia than a decade ago?

JD – I think they've reached a point where they are probably self-limiting. The population is too big now, to some extent destroying their habitat, by destroying the all the tussock grass.

PK – That was the issue when we were there last.

JD – One interesting thing is that 45 years ago you didn't see any Fur seals down the Antarctic Peninsula at all.

RK – When we were coming down a decade and a half ago, the comment was, "Oh! You can now see fur seals at Bailey Head, Deception Island, where you hadn't been able to before."

JD – I've seen them at Rothera Point, 68-degree south. They're not breeding, young males mostly.

RK – Exploring.

JD – They are getting all the way down there again. And I suppose that they will start breeding again on the South Shetlands.

RK – Perhaps as the temperatures are getting a bit warmer, just like the Adélies are retreating, species are moving southward.

JD – But they used to be there, at least the South Shetlands, which is why the sealers were there to kill them.

RK – But not down at Rothera.

JD – From the sound of it, Davis didn't see any Fur seals when he went down to as far as Hughes Bay. I doubt others went much further south. They probably were no further south than South Shetland Islands.

RK – On our coast it's not uncommon to hear of collisions, and even to have a whale stuck on a ship's bulb.

MG – There's the classic case of a cruise ship coming in with a Fin whale draped over the bulbous bow.

JD – I've not heard of any in Antarctica.

MG – Brent can speak of it. I know there have been situations where a seal has been whacked by a Zodiac or two.

RK – Sometimes you hear people say, "I actually touched a whale." Good or bad to have this human-whale contact?

MG – I think if it's on the whale's terms it's okay. Like in Magdalena Bay, Sea of Cortez, the Gray whales will come up to the Zodiac because they are very tactile and they love that tactile stimulation. If a Gray whale presents itself for that, I think it's fine to do the rub. But they are creating a monster because you do have these friendly, curious whales, and the Zodiac drivers realize they are going to get tips if their people on the boat can pat a whale. So they force the issue. They create the encounter, which then is no longer on the whales' terms.

JD – The whales occasionally come that close to Zodiacs down here in Antarctica. I've not known of anyone actually patting one.

MG – Another thing, should you start touching the whale, and they like it – remember the Killer whale in British Columbia on the far side of Vancouver Island, the one that would follow the boats? – conditioning the whale to approach boats which is not good either. You are thinking you are doing something innocent because the whales are asking for a pat down, but then you are conditioning them, whether you're feeding them with off-cuts from the fishing industry or whether you're patting them.

RK – That's interesting about patting. I never thought of that. I know our whales like to rub on the rocks at "rubbing beaches", but I hadn't realized how much they might like it from a human.

MG – They do. If you go to SeaWorld, the trainers will feed the whales as positive reinforcement. Another reinforcement is a rub down.

RK – Interesting. I guess you can't rub your own back.

Last question. All these people who have been down here are so thrilled. They have had the trip of a lifetime. They go home. What positive benefit do you see that these first-hand experiences have had, and in what way might tourism help the Antarctica?

MG – I have a wonderful quote: "For in the end, we will only conserve what we love, we will only love what understand, and we will only understand what we are taught."

JD – That's a good way of summing up actually, provided the industry stays somewhat self-limiting, and dare I say, expensive. You get a particular, socio-economic class coming down here. They tend to be people who have influence. They tend to be opinion formers. That's how I see the balance. There is some cumulative negative impact in the Antarctic as a result of tourism. You just look at the paths on Cuverville. I don't mean it is significant, but it is there. The balance is, there's this whole cohort of people going back to their home towns, who know enough about Antarctica that when issues come up they can speak with some authority and try and guide discussion in the right way. They know it's a protected area, and that people are actively trying to protect it.

MG – Or to give financial support to non-profits that are. I think in our lectures we should say: These are the organizations within my field that are doing some wonderful things. This organization is doing this; these researchers are doing this work with Killer whales. And help guests channel this newfound love and passion about Antarctica. A lot of them wouldn't otherwise know what to support. We can do an even better job of channeling and doing more encouraging.

RK – Thank you both very much.

ATTACHMENT 3: ANNOTATED EXPEDITION PHOTOS

(Photo Credit for all images: Pat & Rosemarie Keough)



Rosemarie Keough with Wings Flag #19. Cuverville Island, Antarctic Peninsula.





Yankee Harbour, Greenwich Island – Tourists (orange jackets) follow the flagged route, maintaining 5 metres min. from penguins. Average 1 Field guide (yellow jackets) per 20 tourists.



Field guides at stations, watchful, helpful, and ensure distances are respected.



Tourists stop to let Gentoo Penguins pass; and below to await Southern Giant Petrel to move along, which eventually it did.





Gentoo Penguins descending “Penguin Highway”, Cuverville Island



Chinstrap Penguins have the right-of-way. Penguins are busy caring for and feeding their young. Tourists are on vacation and can wait. And tourists greatly enjoy watching the birds.



For many tourists, to quietly watch the penguin go about their daily lives is akin to a sacred experience. Penguins are permitted to approach humans; but not vice-versa.



Tourists observe the Adélie Penguin colony at Brown Bluff keeping 5 metres distant.



Viewing from 5 metres is close enough for humans, and non-threatening to penguin. Binoculars and zoom lenses allow for more intimate viewing. These Chinstrap Penguins and chicks are at Half Moon Island, South Shetland Islands.





Super powerful lenses put you right in the nest, without harassing the penguins.





Prior to boarding the Zodiac for a shore landing, people step into a disinfectant bath to sterilize their boots; also dip tripods and walking sticks. The objective is to avoid introducing a bacteria or virus to wildlife.





Category #2 ships (200 to 500 passengers) have specific sites where landings are permitted under IAATO regulations. At any time, a max. of 100 tourists are allowed ashore, a capacity that we noted was meticulously monitored and never exceeded.





IAATO site guidelines indicate where tourists are permitted, and stipulate closed areas. Certified Field Guides ensure compliance, while sharing natural history interpretation.



Scientists concur that environmental changes have far bigger affect, than do tourists, on penguin populations. Adélies, a polar desert bird, do not thrive in the rain and heavy snow conditions that now are frequently experienced on the Antarctic Peninsula.



Whale watching from ship, Captain following approach, speed, and distance guidelines developed by IAATO to minimize and mitigate potential marine mammal impacts.



Female Killer whales and calf. Note the yellow tinge of their white patches, stained by diatoms that grow on the underside of sea ice. Tourist images of whales taken during voyages are important contributions to Antarctic whale identification image libraries.



Humpback whales sound. Petrels forage on krill brought to the surface by the whales. Viewed aboard ship from 100 feet above sealevel using a telephoto lens. (above)
Humpback feeding, Lemaire Channel, while ship slowly passes. (below)

IAATO Guidelines take into account the approach toward whale, an optimal viewing area, and maximum time spent viewing. The aim is to allow the animals to dictate the encounter so that tourism operations avoid disrupting feeding, reproductive or other social behaviours, while providing satisfying viewing opportunities.





As ships get larger, pressure will increase on landing sites that can accommodate such size and numbers compared to sites that can be accessed only by smaller vessels. Landing 450 Tourists, with 100 ashore at any time, dictates one landing operation daily, each tourist ashore for 90 minutes. Landings constrained, water-based activities such as Zodiac scenic-touring and kayaking provide alternative experiences, bringing people up-close to marine life.





Chile's Presidente Gabriel Gonzalez Videla Base shares Waterboat Point with Gentoo Penguins whose colony predates the station. The penguins ignore people, and return year after year to breed. Base personnel are equally familiar with the birds. At this colony are several leucistic penguins, which lack pigmentation in their feathers.





Mandatory boot scrubbing in the sea water prior to getting into the Zodiac is the first of three cleanings. These brushes remove the majority of mud and guano. Upon return to the ship, the tourist steps again into the disinfectant boot bath. Overnight, staff then give boots a through disinfectant. The objective is to ensure no disease is carried from one penguin colony to another.





Four “cruise-only” vessels are projected to bring 9720 tourists to Antarctica during the austral summer 2014-15, over four times that of 2000-01, when two “cruise-only” vessels brought approximately 2250 tourists. For the budget minded and those lacking agility to make landings, this is a viable option to experience the Antarctic.





Crabeater seals and Humpback whale photographed from Zodiac, Lemaire Channel.





Rosemarie Keough and castellated iceberg, Errera Channel
Wings Worldquest Flag #19

ATTACHMENT 4: REFERENCES & PERTINENT LITERATURE (abstracts partly abridged)

Aronson, Richard B., Sven Thatje, James B. McClintock, Kevin A. Hughes. 2011.

Anthropogenic impacts on marine ecosystems in Antarctica.

Annals Of The New York Academy Of Sciences

<http://share.disl.org/heck/Shared%20Documents/Aronson%20et%20al%20Ann%20NY%20Acad%20Sci%202011.pdf>

Abstract: Antarctica is the most isolated continent on Earth, but it has not escaped the negative impacts of human activity. The unique marine ecosystems of Antarctica and their endemic faunas are affected on local and regional scales by overharvesting, pollution, and the introduction of alien species. Global climate change is also having deleterious impacts: rising sea temperatures and ocean acidification already threaten benthic and pelagic foodwebs. The Antarctic Treaty System can address local- to regional-scale impacts, but it does not have purview over the global problems that impinge on Antarctica, such as emissions of greenhouse gases. Failure to address human impacts simultaneously at all scales will lead to the degradation of Antarctic marine ecosystems and the homogenization of their composition, structure, and processes with marine ecosystems elsewhere.

Carlini, A.R., N.R. Coria, M.M. Santos, M.M. Libertelli, G. Donini. 2007.

Breeding success and population trends in Adélie penguins in areas with low and high levels of human disturbance

Polar Biology, June 2007, Volume 30, pp 917-924

<http://link.springer.com/article/10.1007%2Fs00300-006-0251-1#page-1>

Abstract: The breeding performance and population trends of Adélie penguins (*Pygoscelis adeliae*) was studied at Esperanza/Hope Bay, Antarctic Peninsula, by comparing an area with low levels of human disturbance (LLD) and an area with high levels of human disturbance (HLD), close to an Argentine research station. From 1995/1996 to 2004/2005 (except for 1999/2000 and 2003/2004), the following population parameters were measured in both areas: (1) the number of breeding pairs, (2) the number of chicks in creches and (3) the number of chicks produced by breeding pairs. Breeding success (chicks fledged per marked nest) did not differ significantly between areas for most of the seasons compared. In 1996/1997, breeding success was significantly higher in the HLD area. Our data suggest that environmental influences currently exert greater effects than human disturbance on the penguin population at Esperanza Bay.

Chown, Stephen L, H. L. Huiskes, Niek J. M. Gremmen, Jennifer E. Lee, Aleks Terauds, Kim Crosbie, Yves Frenot, Kevin A. Hughes, Satoshi Imura, Kate Kiefer, Marc Lebouvier, Ben Raymond, Megumu Tsujimoto, Chris Ware, Bart Van de Vijver, and Dana Michelle Bergstrom, 2011.

Continent-wide risk assessment for the establishment of nonindigenous species in Antarctica

Centre for Invasion Biology, Stellenbosch University, South Africa.

<http://www.pnas.org/content/early/2012/02/27/1119787109.full.pdf+html?with-ds=yes>

Abstract: Invasive alien species are among the primary causes of biodiversity change globally, with the risks thereof broadly understood for most regions of the world. They are similarly thought to be among the most significant conservation threats to Antarctica, especially as climate change proceeds in the region. However, no comprehensive, continent-wide evaluation of the risks to Antarctica posed by such species has been undertaken. Here we do so by sampling, identifying, and mapping the vascular plant propagules carried by all categories of visitors to Antarctica. ... Visitors carrying seeds average 9.5 seeds per person, although as vectors, scientists carry greater propagule loads than tourists. ... Alien species establishment is currently most likely for the Western Antarctic Peninsula. ... With climate change, risks will grow in the Antarctic Peninsula, Ross Sea, and East Antarctic coastal regions. Our evidence-based assessment

demonstrates which parts of Antarctica are at growing risk from alien species that may become invasive and provides the means to mitigate this threat now and into the future as the continent's climate changes. Crosbie Kim. Scott Polar Research Institute, University of Cambridge. 1999.

Interactions between Skuas Catharacta sp. and Gentoo Penguins Pygoscelis Papua in relation to tourist activities at Cuverville Island, Antarctic Peninsula

Marine Ornithology 27: 195–197.

http://www.marineornithology.org/PDF/27/27_26.pdf

Abstract: The dramatic increase in tourism to the Antarctic has prompted speculation that the presence of tourists at a penguin colony could cause enough distraction to increase the vulnerability of the colony to predation. This study aimed to assess whether this hypothesis was correct for one heavily visited site supporting breeding Gentoo Penguins *Pygoscelis papua* in the Maritime Antarctic, that of Cuverville Island. A total of 164 hours of observation throughout one season was completed. One third of these were periods when tourists were present. Skua *Catharacta* sp. behaviour was categorised and monitored throughout these periods. These observations revealed no evidence that the presence of parties of visitors within feeding territories influenced skua predatory behavior.

Dr. Maj De Poorter, Dr. Neil Gilber, Bryan Storey, Michelle Rogan-Finnemore. 2006.

Non-Native Species In The Antarctic

Gateway Antarctica, University of Canterbury, Christchurch, New Zealand

<http://www.anta.canterbury.ac.nz/resources/non-native%20species%20in%20the%20antarctic/Final%20Report%20Non-native%20Species%20Workshop.pdf>

Selection of Points from the reports Executive Summary

- 2) Whilst Antarctica has natural environmental advantages, these are not enough to stop invasive species, pests and diseases.
- 3) Invasive alien species have already significantly affected the sub-Antarctic islands.
- 8) Human activities will inevitably lead to some introductions, but the aim of management should be to minimise the unintentional as well as intentional introductions of any non-native species.
- 9) A changing more benign climate, particularly in the Antarctic Peninsula, is likely to increase the risks of alien species establishing themselves.
- 14) The principle components of any management programme are prevention, surveillance and response, with prevention being the most effective means of minimizing any impact.
- 15) Increasing awareness on the risks posed by non-native species and on the need to prevent their introduction is a key requirement for successful management.

Fraser, W.R., D.L. Patterson, A.L. Easter-Pilcher. 2003.

The effects of human activity and environmental variability on long-term changes in Adélie Penguin populations at Palmer Station, Antarctica.

Proceedings of the VIIIth SCAR International Biology Symposium

<http://pal.lternet.edu/docs/bibliography/Public/240lterc.pdf>

Abstract To assess whether human activities due to tourism were negatively impacting Adélie penguins (*Pygoscelis adeliae*), we compared long-term population trends at visited and control sites on Torgersen Island considering underlying factors associated with environmental variability. To this end, a hillshade model of Torgersen Island was developed; linear regression and discriminant function analyses were used to examine breeding population/landscape interactions. Results suggest that variability in population trends on Torgersen Island are forced primarily by colony aspect and colony area. Colonies with south-facing aspects are decreasing faster than colonies with north-facing aspects. Smaller colonies are decreasing faster than larger colonies. Both trends are likely due to interactions between the effects of increased snow deposition and decreasing egg and/or chick survival due to predation and flooding. To examine human influences, subsequent analyses were standardised by pairing Adélie penguin colonies according to area and aspect on the visited and control sides of Torgersen Island. Tourism appears to have no detectable impact on Adélie penguin breeding population size or breeding success; comparisons

between population trends in visited and control sides of the island were either not significant or inconsistent with site-specific tourist visitation patterns.

Fraser, W.R. , D.L. Patterson. 2009.

Distinguishing Human Impacts At Palmer Station, Antarctica

Polar Oceans Research Group, PO Box 368, Sheridan MT

XXXII Antarctic Treaty Consultative Meeting

www.ats.aq/documents/ATCM32/ip/Atcm32_ip080_e.doc

Introduction and conclusion: The number of tourists visiting Antarctica has more than doubled in less than five years with the Antarctic Peninsula alone recording approximately 46,000 visitors during the 2007/08 season. The management and oversight of tourism thus presents an ever-growing challenge in Antarctica, and concerns about potential impacts on both wildlife and other features of the natural environment are at the forefront of possible impacts. Anthropogenically driven responses by resident wildlife, however, can be species-specific, location-specific, and/or activity-specific hence it is not surprising that research designed to tease apart these interactions and their relationship to the impacts of specific tourist activity regimes have produced inconsistent results. The data do not suggest that tourism is not impacting Adélie penguins, but rather that impacts, if present, are not detectable relative to the much larger effects of environmental variability on the processes that regulate demography. Importantly, although it could be argued that this conclusion may only apply to Palmer Station due to its well-managed tourism activities, other researchers exploring similar questions with different species and/or at sites where vastly larger numbers of tourists occur have reached similar conclusions.

Hodgson, Jasmine. 2009.

Responses of Antarctic Penguins to the Effects of Climate Change

Gateway Antarctica, University of Canterbury

<http://www.anta.canterbury.ac.nz/documents/PCAS%2012%20Reports/Hodgson%20Jasmin%20Penguin%20&%20Climate.pdf>

Abstract: Penguins are adapted to live in extreme environments, but they can be highly sensitive to climate change, which disrupts penguin's life history strategies when it alters the weather, oceanography and critical habitats. (Forcada & Trathan, 2009) This review will overview the current knowledge of how Adélie and Emperor penguins specifically respond to the current changing climate.

IAATO, International Association of Antarctica Tourism Operators.

Climate Change in Antarctica: Understanding the Facts

<http://iaato.org/documents/10157/100441/ClimateChangeA4.pdf>

IATTO, Press Release May 27, 2014

IATTO Release Tourism Figures for the 2013-2014 Season: Chinese visitors move ahead of Germany and the UK

<http://iaato.org/documents/10157/509608/IAATO+25+Meeting+commences.++Chinese+figures/92aa4bea-6380-46f4-9699-6316b8823000>

IATTO, Press Release January 7, 2014

Expedition Vessels and the International Hydrographic Organization collaborate to chart Antarctic waters

<http://iaato.org/documents/10157/509608/IAATO+Expedition+Vessels+and+the+International+Hydrographic+Organization+collaborate+to+chart+Antarctic+waters/6e26b0ca-d27a-4352-a65c-9e684292e5d1>

About IAATO (From IAATO press release)

IAATO is a member organization founded in 1991 to advocate, promote and practice safe and environmentally responsible private-sector travel to the Antarctic. IAATO currently has 119 members. IAATO Members work together to develop, adopt and implement operational standards that mitigate potential environmental impacts. Numerous guidelines have been adopted over the last 20 years that have proven to be successful methods in avoiding such impacts. These include but are not limited to: site specific guidelines, site selection criteria, passenger to staff ratios, limiting numbers of passengers ashore, boot-washing guidelines and the prevention of the transmission of alien organisms, wilderness etiquette, garbage policy, ship scheduling and vessel communication procedures, emergency medical evacuation procedures, emergency contingency plans, reporting procedures, marine wildlife watching guidelines, station visitation policies and more.

Sourced from www.IAATO.com several documents including:

Tourism overview	Tourism Statistics	Visitor Guidelines	Site Guidelines
Biosecurity Checks	Marine Mammal Approaches	IAATO Field Operations Manual	

Llget, Daniela, Alison McIntosh, Anna Thompson, Neil Gilbert, Bryan Storey. 2010.

From frozen continent to tourism hotspot? Five decades of Antarctic tourism development and management, and a glimpse into the future

Gateway Antarctica, University of Canterbury, New Zealand

<http://www.studentsonice.com/antarctic2013/documents/Llgett%20et%20al.%20Antarctic%20tourism%20reading%20.pdf>

Abstract: Representing the main commercial activity on the Antarctic continent, Antarctic tourism is increasingly thrust into the limelight as both benefactor and detractor to the environmental and political integrity of Antarctica. In view of its unprecedented growth, questions arise about the limitations of future tourism development in Antarctica. This paper assesses Antarctic tourism development over the last five decades and evaluates its current and future status from the viewpoints of Antarctic tourism stakeholders. This assessment is informed by interviews with Antarctic tourism stakeholders and a Delphi study undertaken in 2007. The authors found that Antarctic tourism stakeholders are concerned about the increasing scale and diversification of Antarctic tourism and generally subscribe to a conservation imperative when expressing their hopes for the future use of Antarctica and the development of Antarctic tourism. In conclusion, the rapid development of Antarctic tourism requires structural, institutional and legislative changes if Antarctic tourism regulation is to remain successful

Lynch Heather J., Ron Naveen, Philip N. Trathan, and William F. Fagan. 2012.

Spatially integrated assessment reveals widespread changes in penguin populations on the Antarctic Peninsula. Ecology 93:1367–1377.

<http://www.esajournals.org/doi/abs/10.1890/11-1588.1>

Abstract: As important marine mesopredators and sensitive indicators of Antarctic ecosystem change, penguins have been a major focus of long-term biological research in the Antarctic. ... Integrating diverse census data from 70 breeding sites across 31 years in a robust, hierarchical analysis, we find that trends from intensely studied populations may poorly reflect regional dynamics and confuse interpretation of environmental drivers. Results from integrated analyses confirm that *Pygoscelis adeliae* (Adélie Penguins) are decreasing at almost all locations on the Antarctic Peninsula. Results also resolve previously contradictory studies and unambiguously establish that *P. antarctica* (Chinstrap Penguins), thought to benefit from decreasing sea ice, are instead declining regionally. In contrast, another open-water species, *P. papua* (Gentoo Penguin), is increasing in abundance and expanding southward. These disparate population trends accord with recent mechanistic hypotheses of biological change in the Southern Ocean and highlight limitations of the influential but oversimplified “sea ice” hypothesis. Aggregating population data at the regional scale also allows us to quantify rates of regional population change in a way not previously possible

Naveen, Ron, Heather J. Lynch, Steven Forrest, Thomas Mueller, Michael Polito, 2012
First direct, site-wide penguin survey at Deception Island, Antarctica, suggests significant declines in breeding chinstrap penguins.

Polar Biology December 2012, Volume 35

<http://link.springer.com/article/10.1007%2Fs00300-012-1230-3>

Abstract: Deception Island is one of the most frequently visited locations in Antarctica, prompting speculation that tourism may have a negative impact on the island's breeding chinstrap penguins. ... In the first ever field census of individual penguin nests at Deception Island (December 2–14, 2011), we find 79,849 breeding pairs of chinstrap penguins, including 50,408 breeding pairs at Baily Head and 19,177 breeding pairs at Vapour Col. Our field census, combined with a simulation designed to capture uncertainty in an earlier population estimate by Shuford and Spear, suggests a significant (>50 %) decline in the abundance of chinstraps breeding at Baily Head since 1986/1987. A comparative analysis of high-resolution satellite imagery for the 2002/2003 and the 2009/2010 seasons suggests a 39% decline (from 85,473 ± 23,352 to 52,372 ± 14,309 breeding pairs) over that 7-year period and provides independent confirmation of population decline in the abundance of breeding chinstrap penguins at Baily Head. The decline in chinstrap penguins at Baily Head is consistent with declines in this species throughout the region, including sites that receive little or no tourism; as a consequence of regional environmental changes that currently represent the dominant influence on penguin dynamics, we cannot ascribe any direct link between chinstrap declines and tourism from this study.

Patterson, Donna L, Eric J. Holm, Karen M. Carney, and William R. Fraser. 1996.

Effects of Tourism on the Reproductive Success of Adélie Penguins at Palmer Station

Antarctic Journal of the United States Review 1996

<http://www.nsf.gov/geo/plr/antarct/ajus/nsf9828/9828html/m6.htm>

Abstract: Factors that potentially influence Adélie penguin reproductive success are numerous and complex (Reid 1968; Wilson et al. 1990; Fraser et al. 1992; Fraser and Trivelpiece 1994). Based on the preliminary evidence resulting from this study, it appears that tourism as it is currently regulated at Palmer Station does not affect Adélie penguin reproductive success. As such, our results diverge from those of Giese (1996) but support the hypothesis (cf. Fraser and Patterson 1996) that environmental factors associated with variability in the breeding habitat (i.e., snow deposition, colony aspect, predation) may be more influential in determining the fate of nesting Adélie penguins than tourism.

Turner, John (editor), and Robert Blindschadler, Pete Convey, Guido di Prisco, Eberhard Fahrbach, Julian Gutt, Dominic Hodgson, Paul Mayewski, Colin Summerhayes. 2009.

Antarctic Climate Change and The Environment

A contribution to the International Polar Year 2007-2009

Scientific Committee on Antarctic Research

http://www.scar.org/publications/occasionals/ACCE_25_Nov_2009.pdf

ANTARCTIC Climate Change and the Environment: Top 10 Key Findings.

Scientific Committee on Antarctic Research

http://www.scar.org/publications/occasionals/ACCE_top_10_points.pdf

Williams, Rob* And Kim Crosbie**. 2007.

Antarctic Whales And Antarctic Tourism

*Sea Mammal Research Unit, Gatty Marine Laboratory,
University of St Andrews, St Andrews Fife, Scotland

**IAATO

http://www.oceansinitiative.org/wp-content/uploads/2010/11/williamsrosbie2007_antarctictourism.pdf

Abstract: Shipboard visitors to the Antarctic are routinely rewarded with whale sightings. However, careful management and dedicated research are needed to ensure that the growing Antarctic marine tourism industry does not inadvertently harm these populations, which are recovering from heavy exploitation in the early part of the 20th century. Ongoing research by the International Whaling Commission (IWC) aims to monitor whale population recovery, and the International Association of Antarctica Tour Operators (IAATO) has developed operational guidelines to minimize and mitigate potential impacts, some specific to marine mammals and marine wildlife watching. Nonetheless, while boat-based tourism has the potential to affect whales, responsible tourism also has a substantial contribution to make to Antarctic whale conservation and research through collaboration.

ATTACHMENT 5: IAATO TOURISM STATISTICS

From: IP 103: IAATO Overview of Antarctic Tourism: 2012-13 Season
and Preliminary Estimates for 2013-13 Season
Prepared for the XXVI Antarctic Treaty Consultative Meeting Brussels
2013 <http://iaato.org/current-iaato-information-papers>

SUMMARY OF ACTUALS for 2012-13 SEASON
(All Tourist Types)

Types of Tourism	Number of Vessels	Number of Departures	Total Number of Passengers
IAATO Seaborne Tourism Peninsula	22	178	22,369
IAATO Seaborne Tourism Ross Sea/Continental	4	8	608
IAATO Sailing Vessels/Yachts	17	41	328
IAATO Air/Cruise Peninsula	3	24	1,587
IAATO Cruise-Only/Peninsula	4	7	9,070
IAATO Air/Land Tourism			354
IAATO Member Air/Overflights/Peninsula			0
TOTAL	54	258	34,316

* Total reflects the use of the same vessel in multiple types of tourism; e.g. Landed/Peninsula and Air-Cruise/Peninsula

Total Visitors for 2012-13 Season:	
Seaborne Traditional Tourism (with landings)	23,305
Seaborne Tourism Cruise-Only (no landings)	9,070
Air/Cruise	1,587
Air/Land Tourism	354
Over-flights (no landing)	0
Total	34,316

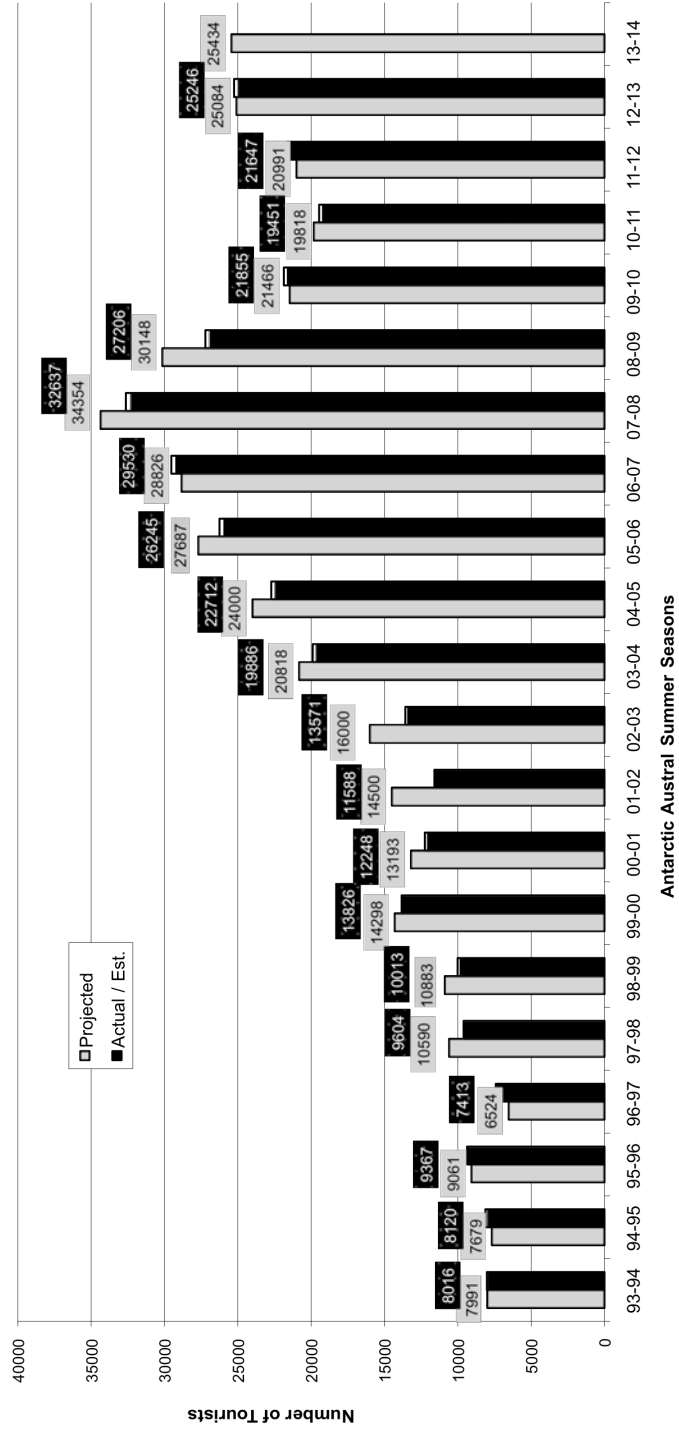
IAATO's summary of Landed Visitors 1993-4 through estimated 2013-14

Appendix 2

1992-2013 ANTARCTIC TOURIST TRENDS - Landed Passengers

Includes Ship and Air/Land passenger numbers.

1997-98 onwards includes some small sailing yachts or motor vessels
May 6, 2013



ATTACHMENT 6: EXPEDITION TEAM BIOGRAPHIES

ROSEMARIE and PAT KEOUGH

400 Meyer Road, Salt Spring Island, British Columbia Canada, V8K 1X4
www.keough-art.com Rosemarie@keough-art.com Pat@keough-art.com
telephone: 250-653-4993

Profession: Photographers, explorers, authors, lectures and publishers
Founders and owners of the private press: Nahanni Productions Inc.
1985 to present

Previous positions:

Rosemarie – Finance Manager, Procter & Gamble Inc (1981-1984)
Pat – Operations Manager, Consumers Gas Ltd. (1974-1987)
– Captain and Tool Pusher, Underwater Gas Ltd. (1969-1973)
– Driller, Western Australia Petroleum Ltd. (1964-1966)

Education:

Rosemarie – Self-taught photographer, author, designer
– Honors Business Administration, University of Western Ontario, 1981
Pat – Self-taught photographer, author, designer
– School of life abroad and at sea. Renfrew High School, 1962

Awards:

Rosemarie and Pat:
- Sweeney Medal, The Explorers Club, for contributions to the objectives of this club, 2014
- Queen Elizabeth II Diamond Jubilee Medals, for achievements and contributions to Canada, 2013
- Cherry Kearton Medal, Royal Geographical Society together with the Institute of British Geographers for outstanding photography of the Natural World, 2004
- Nature Photographer of the Year, International Photography Awards, 2003
Rosemarie: Stefansson Medal The Explorers Club, Canadian Chapter 2007

LABYRINTH SUBLIME: The Inside Passage – A Keough tome

- Gold - Fine Edition Books, Gold Ink Awards North America, 2012
- Outstanding Book of the Year – Best Book Arts Craftsmanship, Independent Publisher Book Awards, 2012

ANTARCTICA – A Keoughs' tome

- World's Best Photography Book, International Photography Awards, 2003
- Outstanding Book of the Year – Best Book Arts Craftsmanship, Independent Publisher Book Awards, 2003
- Gold - Fine Edition Books, Gold Ink Awards North America, 2003
- Benjamin Franklin Award, Premier Print Award, 2002. The Benny is the Oscar of the international printing and graphics arts community
- Craft, Art, Science Award, International Association of Printing House Craftsmen, 2002

Publications:

- Keough, Pat & Rosemarie. *Labyrinth Sublime The Inside Passage: Explorer Series, Volume 2*. Salt Spring Island, Canada: Nahanni Productions Inc., 2012.
- Keough, Pat & Rosemarie. *Antarctica: Explorer Series, Volume 1*. Salt Spring Island, Canada: Nahanni Productions Inc., 2002.
- Keough, Pat & Rosemarie. *The Beauty of Renfrew and Area*. Salt Spring Island, Canada: Nahanni Productions Inc., 1997.
- Keough, Pat & Rosemarie. *Wild and Beautiful Sable Island*, Salt Spring Island, Canada: Nahanni Productions Inc., 1993.
- Keough, Pat & Rosemarie. *Beautiful Arnprior*, Salt Spring Island, Canada: Nahanni Productions Inc., 1992.
- Keough, Pat & Rosemarie. *The Niagara Escarpment: A Portfolio*, Toronto, Canada: Stoddart Publishing Co. Limited, 1990.
- Keough, Pat & Rosemarie. *The Nahanni Portfolio*, Toronto, Canada: Stoddart Publishing Co. Limited, 1988.
- Keough, Pat & Rosemarie. *The Ottawa Valley Portfolio*, Arnprior, Canada: Nahanni Productions Inc., 1986.

Television and video:

- The Nahanni and Rebekka Dawn*. Toronto, Canada: Baton Broadcasting Inc. 1991. *Regional Contact*. Ottawa, Canada: CJOH-TV, numerous episodes 1986-1987.
- The Southern Chilcotin Mountains: A Gift from Man to Nature*. Vancouver, Canada: Earthscape: Artists of the Copper River Delta. Anchorage, USA: Baker-Jennings Inc. 1996. Half-hour video featuring the Keoughs' photography and the art of several international artists inspired by the Copper River Delta

Media:

Images, reviews, articles published since 2002 in Patek Phillipe International Magazine, Time, Forbes, Smithsonian, Departures, Photo District News, I.D., Outdoor Photographer, Camera Arts, PhotoMedia, Outpost, Outside, Macleans, Western Living, PhotoEd, Millionaire, Vanity Fair, Fine Books and Collections; also The Sunday Telegraph, Geographical, fotoMagazin, Snoecks and numerous other foreign magazines. Also in such newspapers as The Los Angeles Times (two entire pages), The Seattle Post Intelligencer, The Vancouver Sun, The Ottawa Citizen etc. Television reviews and interviews include The Today Show NBC-TV Gene Shalit, C-SPAN TV, KOMO-TV Seattle News, CNN Financial News Dolans Unscripted, Environmental News PBS, CBC News Canada, Vicki Gabereau Show Canada.

Solo Exhibitions:

- Labyrinth Sublime: The Inside Passage (80 framed images)
2009 M/V THE WORLD, Residensea
- Antarctica: Passion and Obsession (Tome plus 82 to 340 framed images)
2009 University of British Columbia: Vancouver, Canada
Bezirks Museum: Vienna, Austria
Institute of Ocean Sciences: Saanich, Canada
- 2008 Western Washington University, Bellingham Washington, USA
Colorado Christian University, Lakewood Colorado, USA
- 2007 University of Colorado at Boulder, USA
University of Innsbruck, Austria
Szabó Ervin Metropolitan Library, Budapest, Hungary

- 2007 National Natural History Museum, Budapest, Hungary
University of California at Merced, USA (tome only)
- 2006 Lafayette College, Easton, Pennsylvania, USA
- 2005 Palace of Art, FotoFo Festival, Bratislava, Slovakia
- 2004 Harry Ransom Center, University of Texas at Austin, USA (tome only)

Group Exhibitions:

- 2007 Collected Works: A Public Legacy, Toronto Reference Library, Canada 2005-6
Behind the Seen: The Chrysler's Hidden Museum, Chrysler Museum of Art, Norfolk Virginia, USA
- 2004 Monumental Landscapes, Fahey/Klein Gallery, Los Angeles
- 2000 Alaska's Copper River Delta, New York State Museum
- 1999 Alaska's Copper River Delta, Smithsonian Institute
Alaska's Copper River Delta, Frye Art Museum
- 1998 Alaska's Copper River Delta, Art Museum of Santa Cruz County
Alaska's Copper River Delta, University of Alaska, Art Museum
Alaska's Copper River Delta, Anchorage Museum of History and Art

Collections:

The Keoughs' artists book ANTARCTICA is collected by Royalty of Austria, Jordan, Luxembourg, Netherlands, Monaco, and the United Kingdom; and by private and institutional collectors from six continents including: Australia: State Library of New South Wales; State Library of Victoria; University of Melbourne. Canada: National Library of Canada; Toronto Public Library; University of British Columbia; University of Alberta; York University Libraries; Emily Carr University of the Arts, Gordon Smith Gallery of Canadian Art, and Banff Center Library. Japan: National Institute of Polar Research. New Zealand: Auckland City Library; Auckland University; and the Canterbury Museum. United States of America: Library of Congress; Museum of Fine Art Houston; Chrysler Museum of Art; Phoenix Public Library; The Grolier Club; Brown University; University of Southern California; University of Colorado at Boulder; University of Georgia; Hamilton College; Louisiana State University; University of Oregon; Harry Ransom Center, University of Texas; Western Washington University; Yale University; Claremont Colleges; Kenyan College; Lafayette College; Wellesley College; The Huntington Library. United Kingdom: The Natural History Museum.

Membership in cultural and scientific institutions, societies:

Wings World Quest (Rosemarie Fellow)

The Explorers Club

- Fellows International 2001, Sweeney Medalists
- Rosemarie: Director at Large, Canadian Chapter, 2010 to present,
Regional Chair, British Columbia and Yukon, 2003 to 2010
- Annual Salt Spring Symposium, Founders and Directors, 2003 to present
- Rosemarie: Stefansson Medalist, Canadian Chapter

Royal Canadian Geographical Society – Fellows

Salt Spring Island Folk Dance Festival, Founders and Directors, 2003-2013

National Geographic Society

World Wildlife Fund Canada – 100 Canadians

Canadian Parks and Wilderness Society – Life Members



Pat and Rosemarie Keough, Waterboat Point, Antarctica
(photo by Rory Martin)