NBP0104

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SO GLOBEC

International Whaling Commission

Cetacean Visual Survey and Biopsy

Cruise Report

Ari S. Friedlaender

Rebecca Pirzl

Introduction

Recently, the International Whaling Commission (IWC) developed proposals for collaborative work in the Southern Ocean with the Commission for the Conservation of Antarctic Marine Living Resources (CCAMLR) and the International Global Ocean Ecosystem Dynamics (GLOBEC) program under the IWC Southern Ocean Whale Ecosystem Research (SOWER) program. This research program has the long-term aim to "*define how spatial and temporal variability in the physical and biological environment influence cetacean species in order to determine those processes in the marine ecosystem which best predict long-term changes in cetacean distribution, abundance, stock structure, extent and timing of migrations and fitness'.*

This objective is being pursued through collaboration with GLOBEC and CCAMLR using multidisciplinary ecosystem approach to data collection, analysis, and modeling. The IWC also recognizes that it lacks the data to determine baseline patterns of distribution (and the biological and physical processes responsible for such patterns) of baleen whales from which to judge the potential effects of climate change. Therefore, three further objectives have been defined by the Commission. They are: *to characterize foraging behavior and movements of individual baleen whales in relation to prey characteristics and physical environment, to relate distribution, abundance and biomass of baleen whale species to same for krill in a large area in a single season, and to monitor interannual variability in whale distribution and abundance in relation to physical environment and prey characteristics*.

SO-GLOBEC studies provide the ideal platform for such long-term studies, where scientists from a range of disciplines can conduct intensive focussed studies, within the framework of long term data synthesis and planning. Given the shared objectives among the IWC, GLOBEC and CCAMLR, the IWC has determined that the most effective means of investigating these ecological issues is to focus a considerable body of cetacean research within the framework provided by these programs.

The first of the "Predator Science Questions" in SO-GLOBEC has been formulated : How does winter distribution and foraging ecology of top predators relate to the distribution and characteristics of the physical environment and prey (krill).

Methods

Standard methodology for multidisciplinary studies will be used throughout all GLOBEC collaborative cruises. This will involve experienced cetacean researchers conducting line transect sighting surveys throughout daylight hours in acceptable weather conditions. Data are recorded on a laptop based tracking program (Wincruz), and photo and video records are also obtained for species identification, group size verification, feeding (and other behavior), ice habitat use, and individual identification.

During this cruise, observations were made from the ice tower or the bridge level of the *RVIB Nathaniel B. Palmer* by two observers (AF&RP). When conditions permitted, the observer was outside along the cat-walk of the ice tower, otherwise, observations were made from inside. Effort was focused 45° to port and starboard of the bow ahead of the vessel, while also scanning to cover the full 180° ahead of the vessel. In ice, the method was adjusted to include searching to the beam and behind the vessel track as well, in order that cetaceans and seals hidden by ice would be detected more readily. The observers used a combination of eye and binocular (7x50 Fujinon) searching. Effort commenced when the following conditions allowed: appropriate daylight, winds less than 20 knots or Beaufort Sea State less than or equal to 5, visibility greater than 1 mile (measured in the distance a minke whale blow could be seen with the naked eye as judged by the observer) and the ship was actually steaming.

Observation effort and sightings were recorded on a laptop computer based Wincruz Antarctic program. This program logs gps position, course, ship speed continuously as well as a suit of other environmental and sighting conditions described by the observers (Beaufort sea state, sighting conditions, visibility, cloud cover, ice coverage). Visual observations were made both during the station-transect portion of the trip, as well during transit. When possible, photographic and/or video documentation was made of each sighting for later use in individual identification, species confirmation, and habitat description.

A second component to the marine mammal work is biopsy sampling from small boats. On the occasion that weather conditions, daylight, timing, and whales were present, biopsy sampling was attempted from Zodiacs. Samples were obtained with a

Barnett Wildcat Crossbow equipped with custom made floating bolts, and screw-on hollow point biopsy plugs. The bolts are designed to penetrate the skin and blubber (depending on the size of the plug; either 1inch or 0.5 inches) to the end of the plug, where the float begins, and bounce out of the whale, securing a sample with three small barbs inside the plug. Skin samples are preserved in dimethyl sulfoxide solution and will be send to the National Marine Fisheries Service, Southwest Fisheries Science Center for genetic analysis. Blubber samples will be frozen for later use in contaminant, pesticide, heavy metal, etc. analysis.

Results

Sightings

Generally, sighting conditions were good during the cruise. The appropriate combination of environmental and ship conditions did not lend to long transit times for surveys, however, nearly 110 hours (108:35 hours total, 107:09 hours in the survey grid) of sighting effort were made during the entire cruise (Figure 1). This is an improvement over last cruise, when only 79:33 hours of observation time were logged.

A total of 15 cetacean sightings of 27 animals were made during this trip (Figure 1, Table 1). In Antarctic waters (south of 60°S), 11 cetacean sightings of 18 animals were made (Figure 2). These include 9 sightings of 14 minke whales, *Balaenoptera acutorostrata,* 1 sighting of 1 unidentified whale, and 1 sighting of 3 killer whales (*Orcinus orca)* (Table 2).

All of the sightings south of 60°S, except the killer whales, were from within the study area as defined by the survey grid (Figure 2). The fist cue seen for all of the sightings within the survey grid was a ‘blow’. The entire study area was covered in pack ice ranging between 5-10/10ths coverage, and thus, there was not a lot of open water in which whales could be seen. As the case was, the whales were surfacing in smaller leads, less than 50 metres across, in areas where the ice was not flat, but rather contained pressure ridges. This made seeing the body of a surfacing animal difficult. As air temperatures were constantly well below freezing, the blows of warmed air would freeze quickly and hang suspended for several seconds before dissipating, giving the observers time to sight them. This was confounded a bit in that when there were larger

areas of open water, there would often times be sea smoke. This fog, or vapor, of warmer ocean water meeting the cold ambient air made it difficult to distinguish a blow. This is one potential bias to our sighting effort that had not previously been discussed.

During the transit to the study area, one remarkable group of sightings took place. On 24 July (1800 UTC) a group of 3 killer whales were seen 600 metres off the bow of the ship, porpoising from port to starboard. After they passed the starboard beam, they were seen porpoising through moderate swell towards 2 sperm whales that recently surfaced 500 metres beyond the killer whales. The pattern of the sperm whales surfacing and the killer whales chasing lasted until the animals were out of sight, 15 minutes later. Soon thereafter, another 2 killer whales swam close by the ship across the bow. A single mature male (as evidenced by it's large size and extremely high dorsal fin) remained near the ship (100 metres) for several seconds in full view. The whales then sped off towards the previous group.

Later on that day (1945 UTC) 2 southern bottlenose whales (*Hyperoodon ampluattus)* surfaced 50 metres off the starboard bow. The animals were easily recognized by their size (approximately 7 metres), the slate grey coloration on the backs, the large bulbous melon that was visible when the animals surfaced (also scarred white) and the placement and shape of a triangular, falcate dorsal fin well back on the body.

Biopsy

No biopsy sampling was attempted during the voyage.

Preliminary Findings/Discussion

As stated earlier, a primary research objective of the cetacean studies within SO GLOBEC is to determine the winter distribution and foraging ecology of baleen whales in relation to the characteristics of the environment and the distribution of their prey. Sightings data from this cruise show only minke (*balaenoptera acutorostrata)* whales present in the study region in the late austral winter. Sighting numbers of minke whales were lower than last cruise despite the increased survey time.

The hydrographic processes described on this cruise (see Hydrography section of cruise report; Klinck et al.) are different than those of the previous cruise (NBP 0103). However, some statements about winter cetacean distribution relative to the hydrography of Marguerite Bay can be made. It appears that the northern and eastern most minke whale sightings occur along the intrusion path for oceanic water towards Marguerite Bay. This is represented as plume features in surface salinity and ammonia, as well as subpycnocline temperature and silicate values (as described in the Hydrography section by Klinck et al.).

Alternatively, the western and southernmost sightings of minke whales were made over the continental shelf break, while the inner sightings described above, occur in deep water in the Marguerite trough. Thus, late winter distribution of minke whales may be influenced by water depth around Marguerite Bay.

As well, the estimated circulation cell boundaries of water around Marguerite Bay, based on water density at 300 metres, also show a qualitative correlation to the minke whale sightings.

The most remarkable difference between this cruise and last, save the lack of humpback whales, was the ice coverage. The entire study region was ice covered to some extent. Throughout the study region ice conditions varied in percent coverage as well as thickness and ice type. Generally, ice conditions were less dense and consolidated to the west and north of the survey grid. Ice conditions inside the Bay and to the south were generally very dense with very few leads, or areas of open water. However, all of the sightings made in the survey area were made in 9-10/10ths ice coverage. Sightings were also restricted to small leads. On one occasion, whales were seen surfacing on either side of a large pool of open water, and even traveling towards the open water, but were never seen to venture out of the thin cracks surrounding. The most absolute factor limiting the distribution of whales in the study area, and in most of Antarctica during winter time, is the ability to find open areas to breath. Brief examination of the satellite images of ice cover though, revealed that even in areas of complete ice coverage and high pressure, there appeared to be veins of open water, or at least thinner ice, that streaked throughout the study area from southwest to northeast, and may offer avenues of entrance and exit for whales. Further assessment

of the ice condition data is necessary before further statements about its correlation to whale distribution can be made.

What is clear from the data collected during the first year of the SO GLOBEC study is that whales can be found in Marguerite Bay throughout the winter. Species diversity, numbers of animals, and distribution patterns all differ from the ice-free early winter to the deep, ice-covered winter habitat that we observed during this cruise. Understanding the changes that occurred from the first cruise to the second, will greatly enhance our understanding of the environmental conditions that are critical to cetacean habitat during Austral winter in Marguerite Bay. Continued analyses and collection of cetacean sightings data in conjunction with concurrent prey and hydrographic distributions will allow determination of the causal relationships underlying austral winter cetacean distributions in the Antarctic Peninsula region.

Tables and Figure Legends

Table 1.

All cetacean sightings made during SO GLOBEC II/NBP 0104

Date	Time (UTC)	WOS	Species	No. animals
24/7/01	1800	1	killer whale	3
24/7/01	1800	2	sperm whale	2
24/7/01	1815	3	killer whale	2
24/7/01	1946	4	southern bottlenose whale	2
29/07/01	1650	5	minke whale	1
29/07/01	1916	6	minke whale	1
3/8/01	1350	7	minke whale	3
14/08/01	1718	8	minke whale	2
14/08/01	1743	9	unid	1
14/08/01	1745	10	minke whale	1
22/08/01	1728	11	like minke whale	1
22/08/01	1754	12	like minke whale	2
22/08/01	1833	13	like minke whale	2
22/08/01	1854	14	like minke whale	1
27/08/01	2100	15	killer whale	3

Table 2.

All cetacean sightings made in Antarctic waters (South of 60°S)

Species	Sightings	Animals
Minke Whale (*Balaenoptera acutorostrata)*	5	8
Like Minke Whale	4	6
Killer Whale (*Orcinus orca)*	1	3
Unidentified Whale	1	1

Figure 2. GIS image of Margeruite Bay survey area with survey track lines and all cetacean sightings made during the cruise.

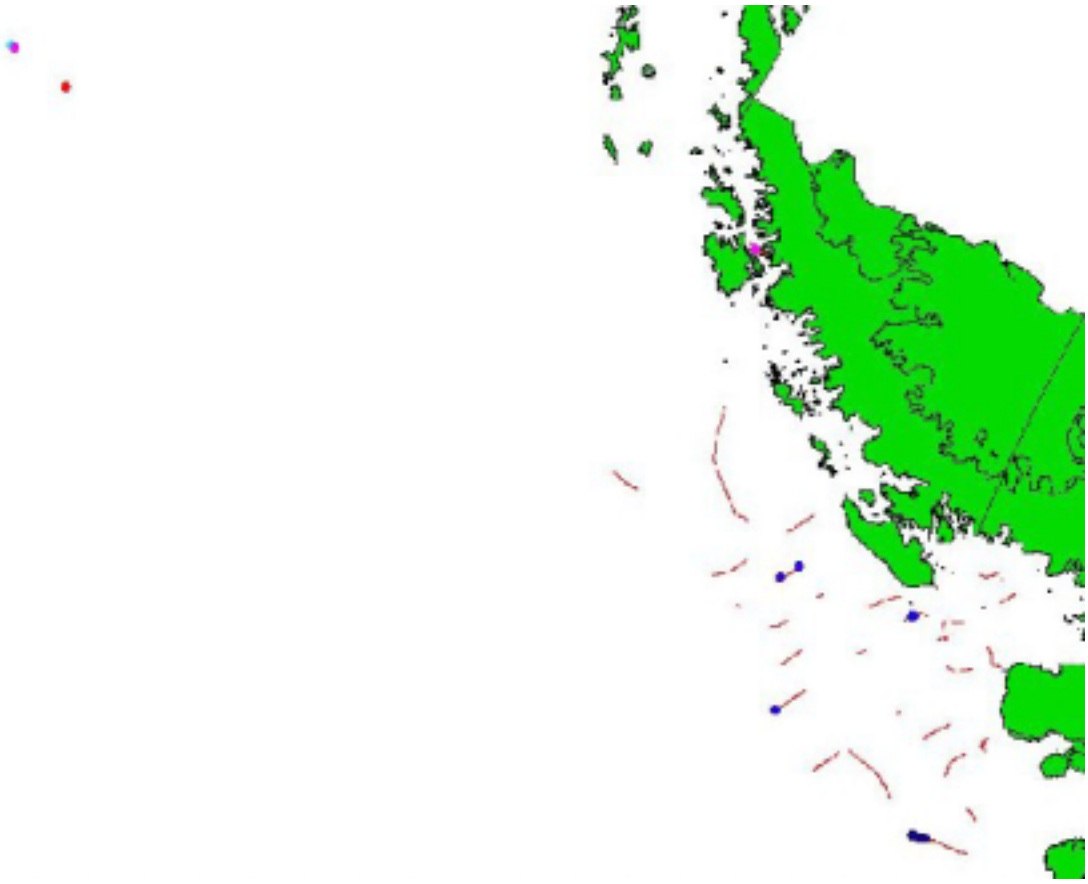

Figure 3. GIS image of Marguerite Bay survey area with track lines and all cetacean sightings made in Antarctic waters (south of 60°S).