

Fall feeding aggregations of fin whales off Elephant Island (Antarctica)

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Abstract

From 13 March to 09 April 2012 Germany conducted a fisheries survey on board RV *Polarstern* in the Scotia Sea (Elephant Island - South Shetland Island - Joinville Island area) under the auspices of CCAMLR. During this expedition, ANT-XXVIII/4, an opportunistic marine mammal survey was carried out. Data were collected for 26 days along the externally preset cruise track, resulting in 295 hrs on effort.

Within the study area 248 sightings were collected, including three different species of baleen whales, fin whale (*Balaenoptera physalus*), humpback whale (*Megaptera novaeangliae*), and Antarctic minke whale (*Balaenoptera bonaerensis*) and one toothed whale species, killer whale (*Orcinus orca*). More than 62% of the sightings recorded were fin whales (155 sightings) which were mainly related to the Elephant Island area (116 sightings). Usual group sizes of the total fin whale sightings ranged from one to five individuals, also including young animals associated with adults during some encounters. Larger groups of more than 20 whales, and on two occasions more than 100 individuals, were observed as well. These large pods of fin whales were observed feeding in shallow waters (< 300 m) on the north-western shelf off Elephant Island, concordant with large aggregations of Antarctic krill (*Euphausia superba*). This observation suggests that Elephant Island constitutes an important feeding area for fin whales in early austral fall, with possible implications regarding the regulation of (krill) fisheries in this area.

Keywords: Fin Whales; Antarctic; Feeding grounds; Survey –Vessel

Introduction

Knowledge of species distribution and abundance in the Southern Ocean generally is limited as dedicated cetacean surveys consume significant amount of ship time, are personnel intensive and hence rather costly. In March/April 2012, the German icebreaker RV *Polarstern* conducted a multidisciplinary research cruise in the Scotia Sea (South Shetland Island area), offering the possibility to opportunistically collect data on cetacean occurrences in this area. This cruise was particularly interesting, as it took place during early austral fall, a season for which to date little data are available. Most of the abundance, distribution and density information of cetaceans and in particular on fin whales in Southern Ocean, including the Scotia Sea, stems from visual surveys conducted during the austral summer months (December-February).

Branch and Butterworth, (2001) listed 31 fin whale sightings within Area II from IWC/IDCR-SOWER surveys in the 1970s and 1990s, Sirovic *et al.*, (2006) reported 15 fin whale sightings from the central Scotia Sea during a combined visual and acoustic survey. Scheidat *et al.*, (2007) reported 9 fin whale sightings during an aerial survey from December 2006 to January 2007 in the same area during an earlier CCMLAR fisheries cruise. Pankow and Kock, (2000) reported of a total of 21 fin whale sightings during their CCMLAR-Cruise in November-December 1996.

This study presents preliminary results of locally exceptionally high cetacean presence. In addition, large aggregations of feeding fin whales were observed within the shelf waters off Elephant Island.

Method

Opportunistic cetacean sighting data were collected from 13 March to 9 April 2012 during the research expedition ANT-XXVIII/4 (Punta Arenas - Punta Arenas, Chile). The main focus of the cruise was investigating

the distribution, abundance and state of fish stocks by means of bottom trawls in the framework of the Commission for the Conservation of Antarctic Marine Living Resources (CCAMLR) in the Scotia Sea.

From 17 March to 5 April the Elephant Island, South Shetland Island, and Joinville Island area, located within the IWC Area II (encompassing the areas south of 40°S and 0° to 60°W), was surveyed (Fig. 1). Visual sighting data were collected from the bridge of the research icebreaker “*Polarstern*” during daylight hours (approx. 12 hrs/day) by at least two trained cetacean observers. Cetacean observations were conducted at an average speed of 5.5 kns along the preset ship’s track. The track did not follow a systematic transect survey layout but was determined by necessities of the fishery efforts, resulting in an inhomogeneous coverage of the area (Fig.1).

Two observers scanned the sea surface using regular binoculars (Fujinon 7-50 FMT/ MT Field of view 7-300) and naked eye, from 135° port to 135° starboard side (with 0° dead ahead). The binoculars were equipped with a reticle scale for distance estimation. Sightings data were recorded electronically via dedicated data logging software “WALOG software”, developed by AWI (WALOG vers. 1.3) (Burkhardt 2009). This software allows logging sighting information (e.g. species, group size, certainty) together with ship metadata (e.g. GPS position, wind speed, visibility). For each cetacean sighting, date, time, GPS position, species, group size/composition, certainty of species identification and behavioural data, if possible, were recorded. Additional digital photography was used to assist in later species identification. Augmental environmental data, including sea state, glare, weather condition, ice coverage (%) were recorded hourly via the WALOG comment field, or more frequently if changes in conditions occurred.

Results

During the entire 26 days of the cruise observers were on effort for 295 hrs. Twenty days were spent in study area (Elephant Island: 11 days, South Shetland Island: six days, Joinville Island: three days), resulting in a total of 234 hours sighting effort there. Four different cetacean species were identified. 248 sightings were collected: 155 fin whales, eight humpback whales, two Antarctic minke whales and one killer whale. The remainder of the sightings were classified according to the following categories: unidentified large whale (75 sightings), unidentified whale (six sightings) unidentified small whale (one sighting). Species observed and details are listed in Tables 1 to 3 and shown in Figure 1 below.

The most abundant species was the fin whale (62.5% of all sightings). 74.8% of fin whale sightings occurred near Elephant Island (Tab. 2). Both travelling and feeding behaviour were observed. Group sizes ranged from one to five individuals for nearly all fin whale sightings (Tab. 3) with a mean group size of four animals. During 10 fin whale encounters, small individuals were observed in association with adults suggesting mother-calf pairs. Group sizes with more than 100 fin whales were recorded on two occasions (17 and 21 March 2012) on the north-western shelf off Elephant Island in shallow waters (less than 300 m of depth (Fig.1)). These large pods of over hundred fin whales displayed surface feeding behaviour, i.e. the whales moved quickly in close associations with a narrow ranging surface pattern, and emerged at the surface while opening their mouths, engulfing krill by expanding their ventral pleats (authors' observation).

Antarctic Krill (*Euphausia superba*) was observed in the upper water layers in the area where the fin whale aggregations occurred. Krill was visible with binoculars (surface patches) and as dense clouds on the echosounder, indicating the presence of large krill swarms up to 50 m depth. Concurrently, several tonnes of Antarctic fishes of the families *Nototheniidae* (rock cods) and *Channichthyidae* (ice fishes) such as marbled rockcod (*Notothenia rossii*), *N. coriiceps* and mackerel icefish (*Champocephalus gunnari*) were caught. These species are known to feed (almost exclusively) on krill (Karl-Hermann Kock, pers.comm.). Antarctic krill was also found in the stomach content of the caught fish (especially for the ice fish species *Champocephalus gunnari* as well as the Antarctic cod *Notothenia rossii* and *N. coriiceps*) and classified as *Euphausia superba* (Volker Siegel pers.comm).

Table 1: List of all Cetacean sightings during ANT-XXVIII/4.

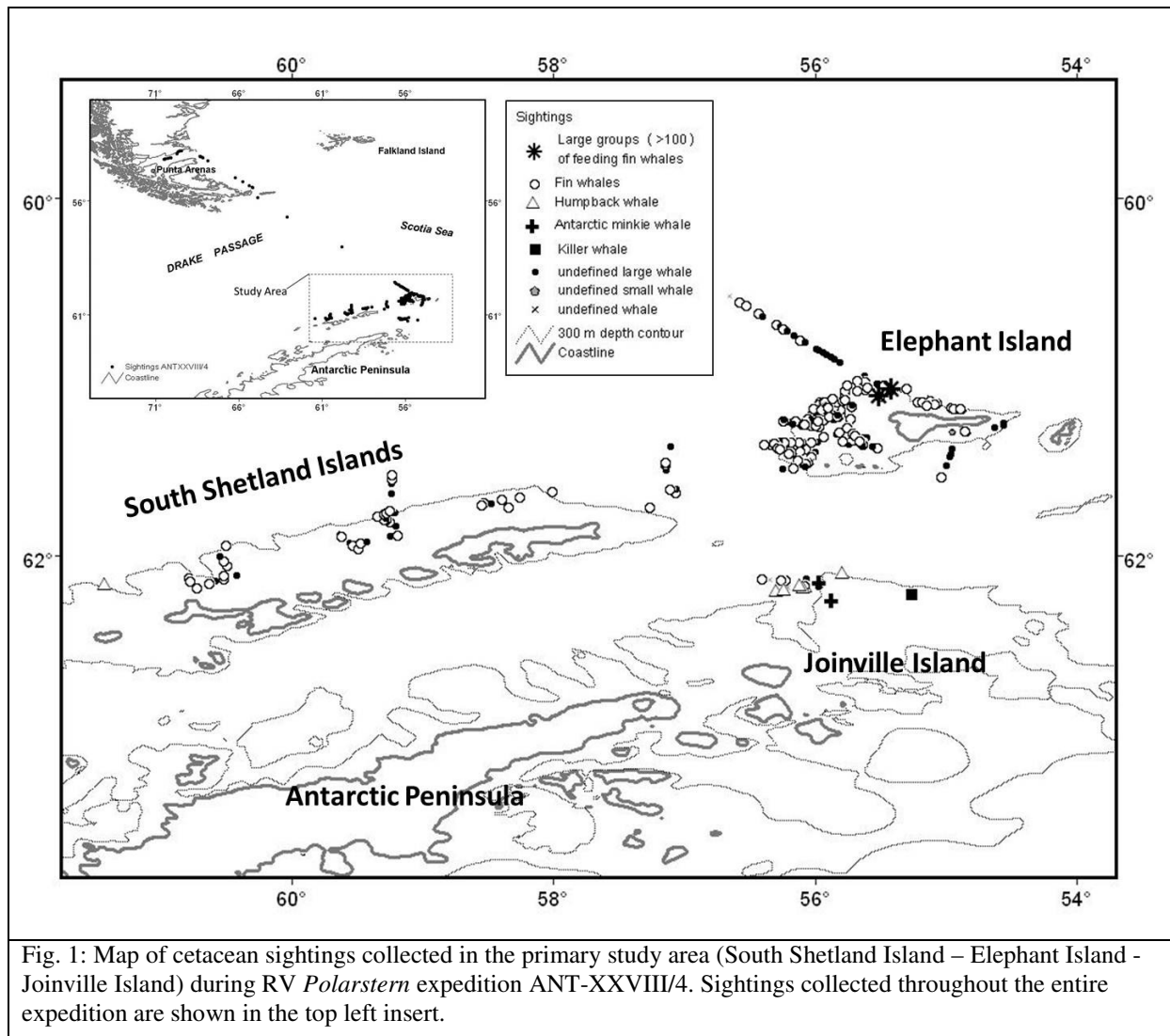
Species	# Sightings	%	Mean Depth (m)	Calf/Juv
Fin whale	155	62.5	289	10
Humpback whale	8	3.2	380	0
Antarctic minke whale	2	0.8	215	0
Killer whale	1	0.4	227	1
undefined large whale	75	30.2	822	0
undefined whale	6	2.4	874	0
undefined small whale	1	0.4	53.5	1
Total	248	100		

Table 2: Cetacean group size of sightings during ANT-XXVIII/4 .

Species	Group size category					Total
	(1-5)	(6-9)	(>10)	(>20)	(>50)	
Fin whale	124	14	9	6	2	155
Humpback whale	8	0	0	0	0	8
Antarctic minke whale	2	0	0	0	0	2
Killer whale	1	0	0	0	0	1
undefined large whale	68	3	3	1	0	75
undefined small whale	1	0	0	0	0	1
undefined whale	6	0	0	0	0	6
Total	210	17	12	7	2	248

Table 3: List of cetacean sightings collected: EI= Elephant Island, SSI= South Shetland Island and JI= Joinville Island.

Species	Study Areas			Total
	EI	JJ	SSI	
Fin whale	116	4	35	155
Humpback whale	1	6	1	8
Antarctic minke whale	0	2	0	2
Killer whale	0	1	0	1
undefined large whale	57	2	16	75
undefined small whale	1	0	0	1
undefined whale	2	4	0	6
Total	177	19	52	248



Discussion

According to Hoyt (2005) a critical cetacean habitat may be defined as an area regularly used by cetacean groups, populations or species to perform tasks essential for survival and maintaining a healthy population growth rate, giving special emphasis to those areas where feeding, breeding and calving activities take place. However, to date only few fin whale aggregations have been observed and consequently only little is known about possible fin whale foraging areas near the Antarctic Peninsula, particularly during austral fall.

In this paper we document recent observations of large fin whale aggregations engaged in feeding activity in association with observations of large Antarctic krill swarms (V. Siegel pers. comm.) in the austral fall season in the area of Elephant Island. During the cruise both feeding and travelling fin whales were observed. Travelling fin whales were mainly recorded at lower latitudes (i.e. deep waters, > 1000 m, north of Elephant Island), whereas large groups of feeding fin whales were recorded off Elephant Island. These observations suggest this area is an important feeding area and could serve as a critical habitat for this species. Most observations of fin whales occurred in mid latitude regions (40°-60° S) during austral summer and the authors are unaware of any other report on such large (> 100) fin whale aggregations in Antarctic waters. Sightings of fin whale are also reported in the Elephant Island area, albeit in smaller group sizes (Branch and Butterworth, 2001; Pankow and Kock, 2000; Reid *et al.*, 2000; Reilly *et al.*, 2004; Scheidat *et al.*, 2007; Sirovic *et al.*, 2006; Sirovic *et al.*, 2009).

Acevedo *et al.* (2012) report of a sighting of a large fin whale school of more than 100 animals in the eastern subtropical Pacific (21°27'S, 97°34'W) in 2010, and assumed these whale were migrating from higher latitude feeding grounds to lower latitude breeding grounds. Nowacek and colleagues (2011) recently reported similarly

large feeding aggregations of humpback whales concordant with extremely high krill density in late austral fall in Wilhelmina Bay (Western Antarctic Peninsula). Finally, fin whales were also shown to be acoustically present in the Scotia Sea during fall (Sirovic *et al.*, 2009) although information if these whales were involved in feeding could not be derived from the acoustic data. Fin whale calls were also recorded at the PALAOA station located on the Weddell Sea coast (Atka Bay, 70°31'S 8°13'W) during the fall and winter months of 2009 (I. van Opzeeland pers. comm.).

Elephant Island might constitute an important feeding ground for fin whales on their northward migration during (early) austral fall due to its geographical position and the apparent favourable environmental conditions for krill. This assumption is supported by Lascara *et al.* (1999) who observed substantial amounts of krill biomass in the upper water layers (about 50 m of depth) west of the Antarctic Peninsula during austral fall. The availability of prey in the upper water layers during fall, possibly attract whales to the area forming large feeding aggregations. Given the occurrence of high prey densities in these shallow areas, foraging in these waters is likely to be energetically beneficial as costly deep foraging dives can be avoided (Acevedo-Gutierrez *et al.*, 2002; Croll *et al.*, 1998; Simrad and Laroie, 1999). To further investigate the seasonal occurrence of fin whales in the Elephant Island area, the AWI's Ocean Acoustic Group plans to deploy a passive acoustic recorder, possibly as early 20012/13, to monitor fin whale acoustic presence in this region for two to three years.

To conclude, our results have revealed Elephant Island as an important feeding area for fin whales in austral fall and furthermore show that the use of opportunistic research platforms can add valuable data on species' spatial distribution and behavioural activity which in turn provides the basis for conservation and management of marine life in the Southern Ocean.

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References

- Acevedo-Gutierrez, A., Croll, D. A., and Tershy B. R. 2002. High feeding costs limit dive time in the largest whales, *J Exp Biol*, 205(12): 1747-1753.
- Branch, T. A., and Butterworth D. S. 2001. Estimates of abundance south of 60° S for cetacean species sighted frequently on the 1978/79 to 1997/98 IWC/IDCR-SOWER sighting surveys, *J. Cetacean Res. Manage.*, 3(3): 251-270.
- Burkhardt, E. 2009. <http://epic.awi.de/29131/1/Bur2009a.pdf>.
- Croll, D. A., Tershy B. R., Hewitt, R.P., Demer, D. A., Fiedler, P.C., Smith, S. E., Armstrong, W., Popp, J.M., Kiekhefer, T., Loperz, V. R., Urban, J. Gendron, D. 1998. An integrated approach to the foraging ecology of marine birds and mammals. *Deep Sea Res. Part II*. 45: 1353-1371.
- Hoyt, E. 2005. Marine Protected Areas for Whales, Dolphins and Porpoises: A worldwide handbook for cetacean habitat conservation. Earthscan, London.
- Pankow, H. and Kock K.H. (2000), Results of a cetacean sighting survey in the Antarctic Peninsula region in November - December 1996, *IWC SC/52/E23*.
- Reid, K., A. S. Brierley, and Nevitt G. A. 2000. An initial examination of relationships between the distribution of whales and antarctic krill *Euphausia superba* at South Georgia. *J. Cetacean Res. Manage*, 2(2): 143-149.

Reilly, S., Hedley, S., Borberg, J., Hewitt, R., Thiele, D., Watkins, J., and Naganobu, M. 2004. Biomass and energy transfer to baleen whales in the South Atlantic sector of the Southern Ocean, *Deep Sea Res Part II*. 51(12-13): 1397-1409.

Scheidat, M., K.-H. Kock, A. Friedlaender, L. Lehnert, and R. Williams 2007. Preliminary results of aerial surveys around Elephant Island and the South Shetland Islands, *IWC, SC/59/IA21*.

Simrad, Y., and Laroie, D. 1999. The rich krill aggregation of the Saguenay St. Lawrence Marine Park: hydroacoustic and geostatistical biomass estimates, structure, variability, and significance for whales. *Can. J. Fish. Aquat. Sci.* 56:1182-1197.

Sirovic, A., Hildebrand, J. and Thiele D. 2006. Baleen whales in the Scotia Sea during January and February 2003, *J. Cetacean Res. Manage.* 8(2): 161-171.

Sirovic, A., Hildebrand, J. A., and Wiggins, S. M. 2009. Blue and fin whale acoustic presence around Antarctica during 2003 and 2004. *Mar Mammal Sci.* 25(1): 125-136.