

## Distribution, abundance and behavior of seabirds and mammals at sea

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**Abstract** The at-sea distribution and density of seabirds and marine mammals was estimated through observations made during the 2008/09 AMLR Survey. A total of 3,301 km of survey effort was completed on the AMLR grid. This year's observations included:

- the largest number and broadest spatial distribution of fin whale sightings on a January AMLR survey;
- a pod of killer whales feeding on a kill north of Elephant Island;
- a large influence of sub-Antarctic seabirds on avian community composition; and
- seabird feeding aggregations that were patchy and observed in fewer locations than in previous field seasons, presumably due to the variability of the southern ACC front and patchy distribution of krill.

### Introduction

This investigation focused on the at-sea distribution and density of seabirds and marine mammals during the 2008/09 AMLR Survey. The primary objective was to map the density and distribution of seabirds and mammals at sea. The resulting data set, summarized in this report, will be used to investigate:

1. the influence of krill abundance and patchiness on seabird and mammal distributions at sea,
2. community structure and habitat selection by predator groups, and
3. inter-annual spatial variability of foraging seabirds and mammals at sea.

### Methods

Three predator observers were on rotation (2 per transect) inside the observation platform on the flying bridge (~13m) during underway shipboard operations. Data on predator abundance and behavior were collected using binoculars during daylight hours. Surveys for birds followed strip transect methods (Tasker et al., 1984) and counts were made within an arc of 300 m directly ahead and 90 degrees to one side of the ship. In this report, transects are defined as the duration of travel and space covered while the vessel was underway between stations. Sea state (Beaufort scale) and visibility were continuously monitored by the primary observer. Each sighting record was assigned a time and position directly fed by the ship's navigational computer, which was synchronized with the ship's data acquisition computer and the hydro-acoustic system used to collect krill biomass estimates.

Individual birds, or flocks of birds, were assigned a behavioral code. The behaviors were: flying, sitting on water, milling (circling), feeding, porpoising (penguins, seals, and dolphins) and ship-following. Ship-followers were entered when encountered and were ignored thereafter. Predators that were flying or porpoising were assigned a direction of travel.

Observations of baleen whales were made within an arc of 180 degrees in front of the vessel. Data recorded for baleen whales included behavior, traveling direction, distance and bearing from the ship's trackline.

When weather conditions permitted (i.e., no fog), there were always two observers on duty. This enabled better survey coverage for marine mammals and maximized survey effort on a daily basis (i.e. more transects are sampled). The senior avian observer on effort was responsible for collecting strip-transect data on birds. The role of the second observer was spotting and tracking baleen whales using high-powered image stabilized 20x60 Zeiss binoculars provided by SWFSC. All sightings were downloaded, error checked and stored in a database each day.

Underway observations of predators were successfully conducted during Leg I of the 2008/09 AMLR Survey. Distribution maps were made using ArcView (ESRI 2007); the location of Southern Ocean fronts, described in Orsi et al. (1995), were superimposed on predator distribution maps for reference only. Survey effort information is presented in Table 8.1, and the relative abundance (per km) of seabirds and marine mammals is presented in Table 8.2. A brief summary of the observations collected in each AMLR regions follows.

Table 8.1. Survey effort for under-way observations of seabirds and marine mammals during Leg I of the 2008/09 AMLR Survey.

Region	Hours	km
Elephant	72.53	1343.32
West	56.33	1043.29
South	32.53	602.52
Joinville	16.85	312.06
TOTAL	178.24	3301.19

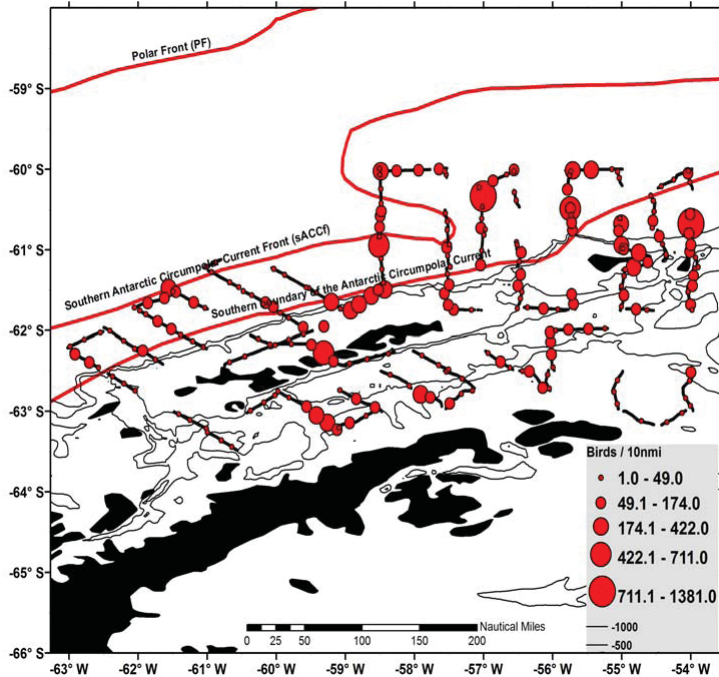


Figure 8.1. Spatial distribution and abundance of total seabirds during Leg I of the 2008/09 AMLR Survey.

## Results

### West Area

Twenty-one transects were completed, totaling approximately 1,043 km of survey effort (Table 8.1, Figure 8.1). The seabird community consisted primarily of (percentage-wise; see Table 8.2 for scientific names): cape petrels, chinstrap penguin, southern giant petrel, blue petrel, Antarctic prion, Antarctic fulmar, white-chinned petrel, black-browed albatross, Wilson's storm petrel, black-bellied storm petrel, gray-headed albatross, and wandering albatross (Table 8.2a). In addition, eight royal albatross (last recorded in the 2006 AMLR survey), three Antarctic petrels, and five soft-plumaged petrels were observed.

Seabird feeding aggregations (primarily cape petrels) were patchily distributed and were observed in four locations (Figure 8.2). A known feeding aggregation 'hotspot', detected north of King George Island during previous AMLR Surveys, contained numerous feeding birds. Another dense feeding aggregation was located ~40 nautical miles

north of Livingston Island.

A total of 24 fin whales (16 sightings), 12 humpback whales (nine sightings), and two minke whales (two sightings) were observed (Table 8.2b, Figure 8.3). In addition, 25 long-finned pilot whales were recorded during transit to the northern edge of the West Area, near the Shackleton Fracture Zone. As in previous AMLR surveys, fur seals were concentrated to the north-west of Livingston Island (Table 8.2b, Figure 8.3).

### Elephant Island Area

Forty transects were collected, totaling approximately 1,343 km of survey effort (Table 8.1, Figure 8.1). The seabird community consisted primarily of (percentage-wise): cape petrel, chinstrap penguin, prions, blue petrel, southern fulmars, white-chinned petrel, black-browed albatross, gentoo penguin, Wilson's storm petrel, black-bellied storm petrel, gray-headed albatross, southern giant petrel, light-mantled albatross, and wandering albatross. Interestingly, blue petrels, prions, and white-chinned petrels were highly conspicuous in offshore waters, especially near the Shackleton Fracture Zone. A strikingly similar pattern was observed in 2005, which may suggest a link between seabird community composition and changes in oceanographic conditions (Santora et al., 2005).

Seabird feeding aggregations (composed of cape petrels, black-browed albatrosses, gray-headed albatross, white-chinned petrel, and prions) displayed a high degree of patchiness and were distributed in a few locations situated along the shelf-break west of Elephant Island, north of Clarence Island, and offshore in the northeast corner of the Elephant Island grid (Figure 8.2). We found a similar spatial arrangement of seabird aggregations during 2006, when krill biomass was exceptionally low (Santora et al., 2009). At-sea observations of Antarctic fur seals indicated that they were concentrated to the northeast of Elephant Island and also further offshore, near the Shackleton Fracture Zone (Figure 8.4).

On 19 January we encountered a pod of five killer whales (-60.34, -57) on a kill. We were unable to determine what they were eating, but some video footage was captured. Thousands of birds, mostly cape petrels, albatrosses, storm petrels, white-chinned petrels, and prions, congregated around the feeding frenzy.

A total of 225 fin whales (114 sightings) were observed (Table 8.2b). This is the highest number of sightings ever recorded during Leg I of the AMLR Survey. In the last six AMLR Surveys, fin whales tend to concentrate in offshore waters of the Elephant Island Area, especially in the northeast corner (Santora et al., 2005, 2007). However, this year fin whales were more broadly distributed throughout pe-

Table 8.2a. Relative abundance (number per km) of seabirds recorded during underway transit on Leg I of the 2008/09 AMLR Survey.

Common Name	Latin Name	Elephant	Joinville	South	West	Total
Adélie penguin	<i>Pygoscelis adlie</i>	0.00000	0.14100	0.23451	0.00000	0.05634
Gentoo penguin	<i>Pygoscelis papua</i>	0.12060	0.00000	0.15689	0.00767	0.08027
Chinstrap penguin	<i>Pygoscelis antarctica</i>	0.86353	0.29161	0.81748	0.90195	0.81395
Macaroni penguin	<i>Eudyptes chrysolophus</i>	0.00074	0.00000	0.00000	0.00000	0.00030
Wandering albatross	<i>Diomedea exulans</i>	0.02084	0.00320	0.00165	0.02492	0.01696
Royal albatross	<i>Diomedea epomorpha</i>	0.00298	0.00000	0.00000	0.00671	0.00333
Black-browed albatross	<i>Thalassarche melanophrys</i>	0.26278	0.08011	0.03303	0.07572	0.14449
Gray-headed albatross	<i>Thalassarche chrysostoma</i>	0.08338	0.01282	0.01817	0.02300	0.04574
Light-mantled sooty albatross	<i>Phoebastria palpebrata</i>	0.01936	0.00320	0.00165	0.01054	0.01181
Southern giant petrel	<i>Macronectes giganteus</i>	0.14516	0.08652	0.09744	0.11023	0.11996
Northern giant petrel	<i>Macronectes halli</i>	0.00521	0.00000	0.00000	0.00767	0.00454
Un-identified giant petrel	<i>Macronectes spp.</i>	0.02308	0.00000	0.00000	0.00000	0.00939
Southern fulmar	<i>Fulmarus glacialis</i>	0.32978	0.69858	1.74396	0.08627	0.54738
Antarctic petrel	<i>Thalassoica antarctica</i>	0.01266	0.00000	0.00330	0.00192	0.00636
Cape petrel	<i>Daption capense</i>	3.10053	0.35570	0.44094	3.27713	2.41186
White-chinned petrel	<i>Procellaria aequinoctialis</i>	0.36030	0.08011	0.02147	0.07764	0.18266
Soft-plumaged petrel	<i>Pterodroma mollis</i>	0.01489	0.00000	0.00000	0.00479	0.00757
Snow petrel	<i>Pagodroma nivea</i>	0.00074	0.00000	0.00000	0.00000	0.00030
Antarctic prion	<i>Pachyptila desolata</i>	0.14591	0.00000	0.00000	0.10448	0.09239
Un-identified prion	<i>Pachyptila spp.</i>	0.59554	0.00000	0.00000	0.00383	0.24355
Blue petrel	<i>Halobaena caerulea</i>	0.50323	0.00000	0.00000	0.10927	0.23931
Wilson's storm petrel	<i>Oceanites oceanicus</i>	0.12134	0.28841	0.10239	0.05847	0.11390
Black-bellied storm petrel	<i>Fregetta tropica</i>	0.11092	0.07691	0.02312	0.04793	0.07179
Brown skua	<i>Catharacta antarctica</i>	0.00298	0.00000	0.01156	0.00192	0.00394
South Polar skua	<i>Catharacta maccormicki</i>	0.02382	0.00641	0.04954	0.01629	0.02454
Kelp gull	<i>Larus dominicanus</i>	0.00074	0.00000	0.00000	0.00000	0.00030
Antarctic shag	<i>Phalacrocorax bransfieldensis</i>	0.00074	0.00000	0.00000	0.00000	0.00030
Antarctic tern	<i>Sterna vittata</i>	0.01861	0.00320	0.02312	0.00671	0.01424
Snowy sheathbill	<i>Chionis alba</i>	0.00000	0.00000	0.00826	0.00096	0.00182

Table 8.2b. Relative abundance (number per km) of marine mammals recorded during underway transit on Leg I of the 2008/09 AMLR Survey.

Common Name	Latin Name	Elephant	Joinville	South	West	Total
Antarctic fur seal	<i>Artcocephalus gazella</i>	0.12804	0.15061	0.11891	0.03738	0.09996
Elephant seal	<i>Mirounga leoina</i>	0.00074	0.00000	0.00000	0.00000	0.00030
Leopard seal	<i>Hydrurga leptonyx</i>	0.00000	0.00320	0.00000	0.00000	0.00030
Humpback whale	<i>Megaptera novaeangliae</i>	0.00447	0.04166	0.14533	0.01150	0.03605
Fin whale	<i>Balaenoptera physalus</i>	0.16750	0.07050	0.00991	0.02300	0.08391
Minke whale	<i>Balaenoptera bonaerensis</i>	0.00223	0.00000	0.00165	0.00192	0.00182
Un-identified whale	<i>Balaenoptera species</i>	0.01266	0.00320	0.00330	0.00000	0.00606
Southern bottlenose whale	<i>Hyperoodon planifrons</i>	0.00149	0.00000	0.00000	0.00000	0.00061
Killer whale	<i>Orcinus orca</i>	0.00372	0.00000	0.00000	0.00000	0.00151
Long-finned pilot whale	<i>Globicephala melas</i>	0.00000	0.00000	0.00000	0.02396	0.00757
Hourglass dolphin	<i>Lagenorhynchus cruciger</i>	0.00372	0.00000	0.00000	0.00000	0.00151

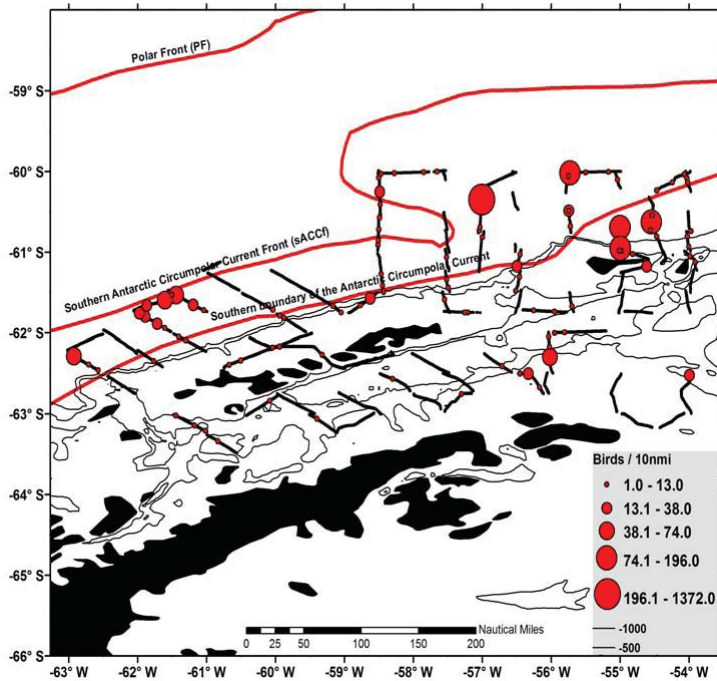


Figure 8.2: Spatial distribution and abundance of feeding seabirds (petrels and albatrosses) during Leg I of the 2008/09 AMLR Survey.

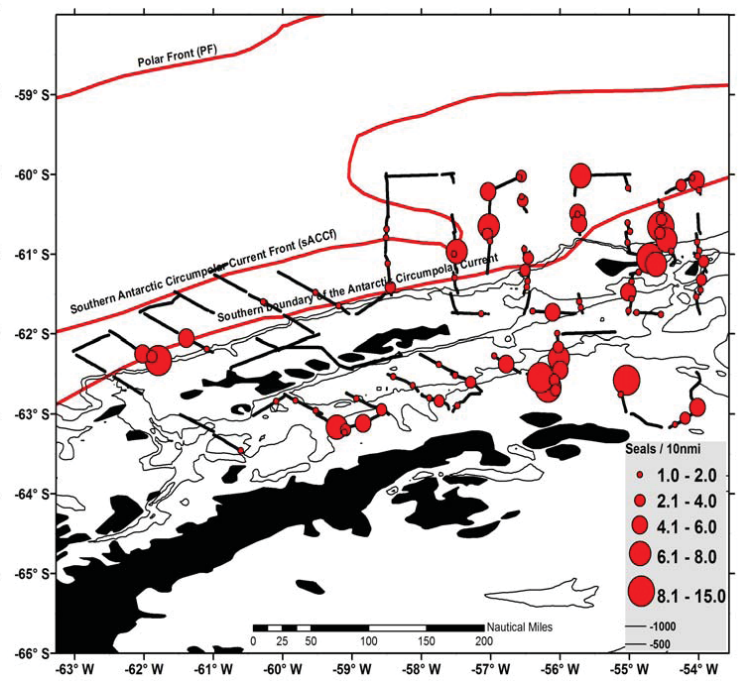


Figure 8.4. Spatial distribution and abundance of Antarctic fur seals during Leg I of the 2008-09 AMLR Survey.

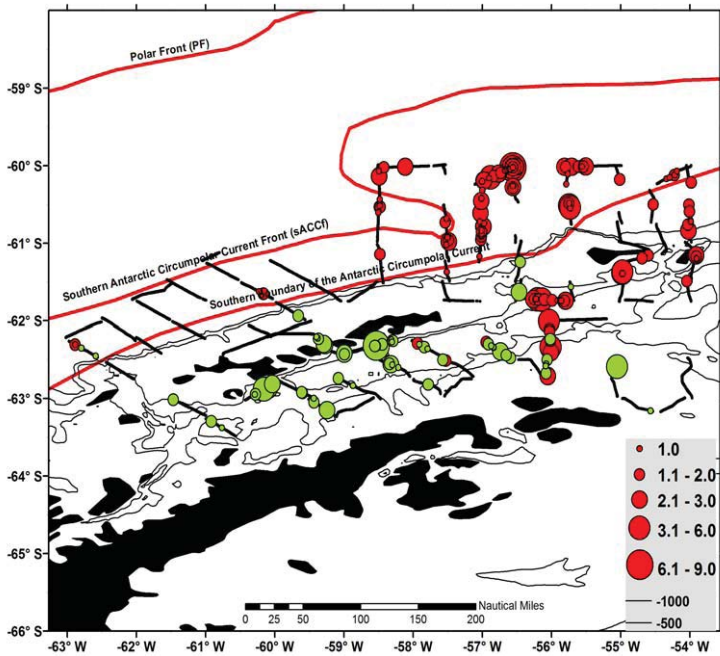


Figure 8.3: Spatial distribution of sightings and group size of fin whales (red) and humpback whales (green) during Leg I of the 2008/09 AMLR Survey.

lagic waters, the shelf-break region, and in waters farther south of Elephant Island. In addition, an all-time low count of humpback whales was recorded in the Elephant Island Area (three sighting, six animals). Two southern bottlenose whales sightings were recorded near the Shackleton Frac-

ture Zone.

*Joinville Island and South (Bransfield Strait) Areas*

Twenty-two transects were completed, totaling approximately 914 km of survey effort (Table 8.1, Figure 8.1). The seabird community consisted primarily of (percentage-wise): southern fulmar, chinstrap penguin, cape petrel, Adélie penguin, Wilson’s storm petrel, gentoo penguin, southern giant petrel, black-browed albatross, white-chinned petrel, black-bellied storm petrel, and South Polar skua (Table 8.2a).

The presence of fin whales in the AMLR Survey grid continued well into the Joinville Island and South Areas (Table 8.2b, Figure 8.3). A total of 28 fin whales were recorded (10 sightings) and were mainly clustered within the northeastern deep basin of the Bransfield Strait (Figure 8.3). As in past AMLR Surveys, we detected a spatial shift from fin to humpback whales as we surveyed farther south and east through the Bransfield Strait. A total of 101 humpback whales were recorded (52 sightings), which were predominantly concentrated in three hotspots detected during previous AMLR surveys (Figure 8.3, see also Santora et al., 2005, 2007).

**Discussion**

The unique oceanographic conditions observed during AMLR 2009 undoubtedly influenced the foraging behavior and spatial distribution of seabirds and marine mammals.

Seabird feeding aggregations were very patchy, due possibly to the high patchiness of Antarctic krill (a condition observed in 2006). Large numbers of prions, blue petrels, and white-chinned petrels (sub-Antarctic breeders) dominated the offshore avifauna, while fin whales were present in the largest numbers ever recorded during a January AMLR Survey. This survey will yield interesting comparisons with previous and future field seasons.

### Protocol Deviations

There were no major deviations from the marine mammal and seabird observation protocol.

### Disposition of Data

After all data have been thoroughly proofed, a copy will be available from Jarrod Santora, phone:(917) 647-4692; email: jasantora@gmail.com

### Acknowledgements

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### References

- ESRI (Environmental Systems Research Institute) (2007) ArcGIS geostatistical analyst. Redlands, CA.
- Orsi, A.H., Whitworth, T., and Nowlin, W.D. 1995. On the meridional extent and fronts of the Antarctic Circumpolar Current. *Deep Sea Research I*, 42: 641-673
- Santora, J.A., Futuyma, D.J., Force, M.P., Heil, R.S., Nikula, B.J. 2005. Distribution, abundance and behavior of seabirds and marine mammals at sea during the 2006/2007 AMLR survey. In: Lipsky, J. (ed.). AMLR 2004/2005 Field Season Report. NOAA-TM-NMFS-SWFSC-385. NMFS Southwest Fisheries Science Center, La Jolla, CA
- Santora, J.A., Force, M.P., and White, T.P. 2007. Distribution, abundance and behavior of seabirds and marine mammals at sea during the 2006/2007 AMLR survey. In: Lipsky, J. (ed.). AMLR 2006/2007 Field Season Report. NOAA-TM-NMFS-SWFSC-409. NMFS Southwest Fisheries Science Center, La Jolla, CA
- Santora, J.A., Reiss, C.S., Cossio, A.C., and Veit, R.R. 2009. Interannual spatial variability of krill influ-

ences seabird foraging behavior near Elephant Island, Antarctica. *Fish. Oceanogr.* 18: 20-35

Tasker, M.L., Jones, P.H., Dixon, T., and Blake, B.F. 1984. Counting seabirds at sea from ships: A review of methods employed and a suggestion for a standardized approach. *Auk* 101: 567-577.



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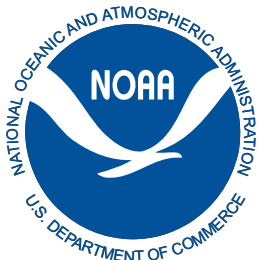
## AMLR 2008/2009 FIELD SEASON REPORT

### Objectives, Accomplishments and Tentative Conclusions

Edited by  
Amy M. Van Cise

**May 2009**

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