Distribution, Abundance, and Behavior of Seabirds and Mammals at Sea

Jarrod A. Santora and Michael P. Force

Abstract

The at-sea distribution and density of seabirds and marine mammals was measured through observation. A total of 5651 km (305 hrs) of survey effort was conducted on the U.S. AMLR grid, and four crossings of the Drake Passage (2500 km) were completed. This year's observations include:

- High concentrations of seabird, fur seal, and fin whale aggregations along the shelf break north of King George and Elephant Islands;
- Seabird community composition in the AMLR area reflected high diversity due to intrusion of sub-Antarctic species (e.g., shearwaters, prions, diving petrels), reflecting a signal previously detected in 2005 and 2009;
- During Leg I, Antarctic fur seals were abundant in Bransfield Strait, which is a pattern generally observed later in the season during Leg II;
- Humpback whales were less concentrated in Bransfield Strait compared to previous surveys. During Leg II, aggregations of humpback whales were clustered in Gerlache Strait; and
- In Drake Passage, numbers of Wandering and Royal Albatross were higher than in past AMLR surveys.

Introduction

This investigation focused on the at-sea distribution and density of seabirds and marine mammals during the 2010/11 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. Inter-annual spatial variability of foraging seabirds and mammals at sea;
2. Influence of krill abundance, patchiness and demography on foraging seabirds and mammals; and
3. Community structure and habitat selection by predator groups.

Methods

Observers collected data on predator abundance and distribution continuously during daylight hours between oceanographic stations along fixed transects distributed around the South Shetland Islands (Santora et al. 2009; Santora et al. 2010) (Figure 1). Ship speed during transits was 10 knots (~18.6 km/hr). Sighting data were entered into a computer using real-time mapping software, and positions were logged every 10 s while underway. Each record was assigned a time (to the nearest 0.1 s) and a spatial position from the ship's global positioning system (GPS). Sea surface state (Beaufort scale) and visibility (e.g., fog, glare) were monitored and effort during unfavorable conditions (e.g., Beaufort > 6, heavy fog) was excluded from the data set. Observers used hand-held binoculars and were located at a height of approximately 7 m above sea level.

Data on seabird distribution and abundance were collected during all four transits between the east end of the Strait of Magellan and the AMLR study area. Observations were conducted from the port side of the R/V *Moana Wave's* bridge. Counts of seabirds were made within an arc of 300 m directly ahead to one side of the ship while underway (Tasker et al. 1984). Individual birds, or flock of birds, were assigned a behavioral code. The behaviors were: flying, sitting on water or ice, feeding, porpoising (penguins), and ship-following. Ship-following birds were recorded when first encountered and ignored thereafter.

Surveys of whales were conducted using standard line transect theory by trained observers (Santora et al. 2010; Santora and Brown 2010). Weather conditions permitting, all cetacean sightings recorded were observed in a 180º arc forward of and up to 3 km away from the vessel. For each whale sighting, a best-estimate spatial position, bearing and a perpendicular distance estimate to the ship's trackline were logged. In addition, observations of seals were collected in a 180º arc forward of the vessel and included position and group size.

Data on survey coverage and the abundance and distribution of seabirds and marine mammals are presented in this report (Figures 1 and 2). Distribution maps were made using ArcView (ESRI 2007). Survey coverage in the AMLR area is presented in Figure 1 and represents the trackline where observations were collected during both legs. The relative abundances (per km) of seabirds and marine mammals observed during surveys in the AMLR area

are presented in Tables 1 and 2 (see this table for scientific names). A summary of effort and species observed during Drake Passage surveys is presented in Tables 3-5.

Results and Discussion

AMLR Survey Grid

Seabirds

Observations were continuously collected during daylight hours whenever the R/V *Moana Wave* was underway (e.g., between stations, to/from field camps). The combined trackline (Legs I and II) depicted in Figure 1 represents the spatial coverage completed by the AMLR Program during January – March. A total of 5651 km trackline was sampled for 305 observation hours (208 h for Leg I and 97 h for Leg II). A summary of sightings and relative abundance of seabirds and marine mammals collected in the AMLR area is presented in Tables 1-2.

The seabird community consisted of (percentage-wise): cape petrel, southern fulmar, chinstrap penguin, Wilson's storm petrel, black-bellied storm petrel, prion spp., southern giant petrel, white-chinned petrel, blue petrel, black-browed albatross, soft-plumaged petrel, gentoo penguin, grey-headed albatross, south polar skua, wandering albatross, and light-mantled albatross (Table 1).

Feeding aggregations of cape petrels were found in the far West Area north of Livingston Island, northeast of King George Island near the shelf break, and along the northwestern edge of the Elephant Island Area (Figure 2a). These feeding aggregations coincided with high densities of chinstrap penguins, Antarctic fur seals, and groups of feeding fin whales. Chinstrap penguins were highly clustered in space in large foraging flocks of 30 to 100 or more individuals adjacent to breeding colonies near Livingston, King George, Elephant, and Clarence Islands (Figure 2b). Numbers of black-browed and grey-headed albatrosses observed this year were significantly lower than in past AMLR Surveys (Figure 2c). However, we encountered a high concentration of albatrosses at a location identified as an albatross hotspot during past AMLR Surveys in the southwestern Bransfield Strait. Numbers of wandering albatross and light-mantled Albatross were both present in higher numbers than in the past three AMLR Surveys. The abundance of prions, blue petrels (Figure 2d), and common diving petrels (species that breed in the Sub-Antarctic) were greater in number than the long-term average for Leg I, possibly indicating a response to the high concentrations of copepods and *Thysanoessa macrura* larvae found this year by the zooplankton team in waters far offshore in the West and Elephant Island Areas. These species have not been sighted in these numbers since 2009, and 2005 before that. In addition, soft-plumaged petrels and white-chinned petrels were highly conspicuous in offshore waters and were also present in higher numbers than the long-term average (Figure 2e). Two species, the sooty shearwater and parasitic jaeger, were sighted during this field season for first time since 2003.

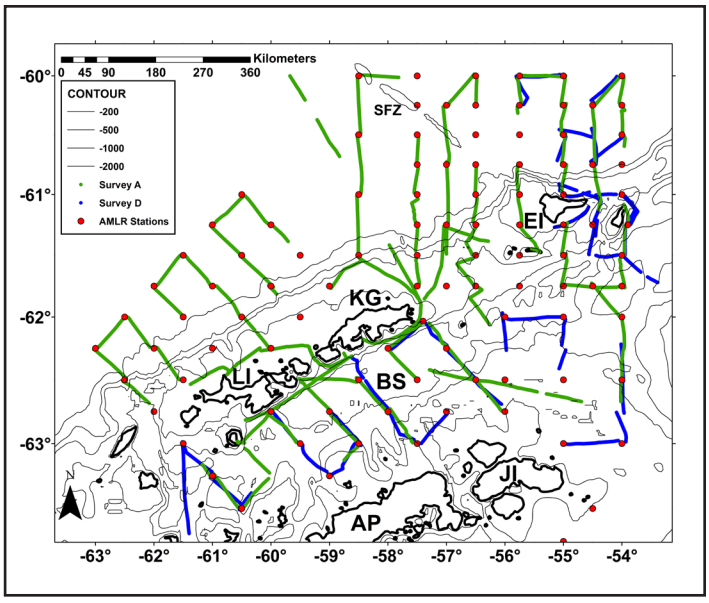


Figure 9.1. Survey trackline (daylight hours) sampled during AMLR 2011, January-March. Green trackline is Leg I (3857 km) and blue is Leg II (1794 km). Short survey conducted during Leg II in Gerlache Strait not shown. Locations: AP is Antarctic Peninsula, BS is Bransfield Strait, EI is Elephant Island, KG is King George Island, LI is Livingston Island, SFZ is Shackleton Fracture Zone. Red dots are AMLR station locations.

Marine Mammals

As in past AMLR Surveys (Santora et al. 2010), humpback whales were the numerically dominant baleen whale in Bransfield Strait, and 229 individuals were observed during 117 sightings (Figure 2e). However, the sightings and counts of humpback whales in the Bransfield Strait were slightly lower than average compared to past AMLR Surveys. Humpback whales were clustered throughout the Bransfield Strait over the deep basins, at the north and south ends of Nelson Strait, and within Hero Bay, north of Livingston Island (Figure 2f). During Leg I, the largest concentrations of humpback whales were observed east of King George Island near Cape Melville, at the north and south of Nelson Strait, and within Hero Bay en route to Cape Shirreff, Livingston Island. During Leg II, we observed fewer aggregations of humpback whales in Bransfield Strait, but sighted more individuals further south within Gerlache Strait.

Fin whales were common north of the South Shetland Islands, and 217 individuals were observed during 123 sightings (Figure 2f). Fin Whales were highly conspicuous in the shelf-break regions north of King George Island and to the west of Elephant Island during Legs I and II. The spatial distribution of their aggregations was highly clustered along the southern Antarctic Circumpolar Current front; for example, on three transects, 20 – 40 whales were sighted in groups of three to five individuals within a single hour (Figure 2f). At each of these locations, dense krill patches were detected on the acoustics system and net sampling revealed that the majority of krill captured were large mature females.

Table 9.1. Summary of seabirds observed in the AMLR area during Legs I and II.

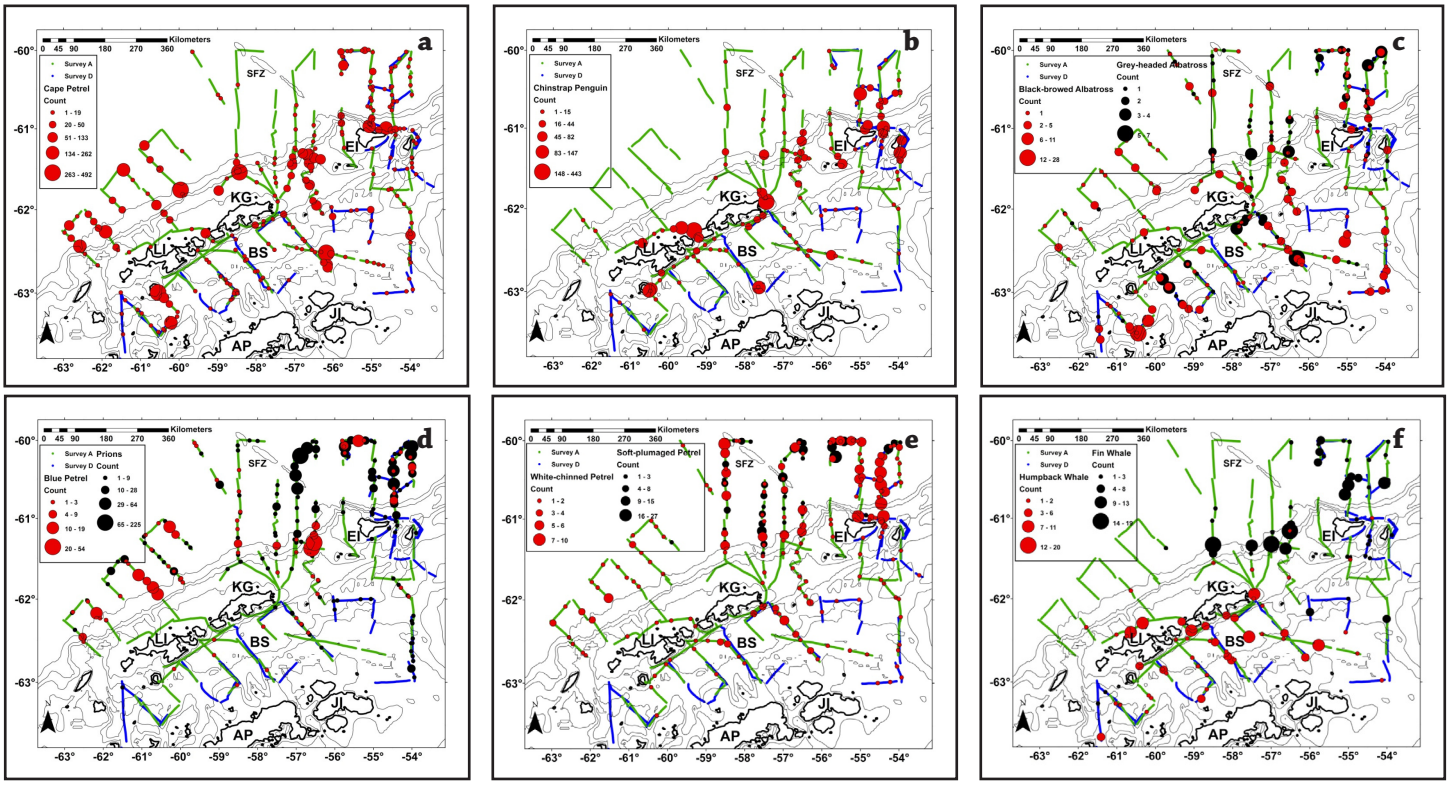
Species		Sightings	Individuals	Total/km
Adelie Penguin	*Pygoscelis adelie*	2	10	0.002
Gentoo Penguin	*Pygoscelis papua*	31	151	0.027
Chinstrap Penguin	*Pygoscelis antarctica*	481	3252	0.576
Macaroni Penguin	*Eudyptes chrysolohus*	5	7	0.001
Wandering Albatross	*Diomedea exulans*	31	31	0.006
Royal Albatross	*Diomedea epomophora*	1	1	0.000
Black-browed Albatross	*Thalassarche melanophrys*	225	252	0.045
Grey-headed Albatross	*Thalassarche chrysostoma*	119	120	0.021
Light-mantled Albatross	*Phoebetria palpebrata*	30	31	0.006
Southern Giant Petrel	*Macronectes giganteus*	339	433	0.077
Northern Giant Petrel	*Macronectes halli*	3	4	0.001
Southern Fulmar	*Fulamarus glacialoides*	1450	4272	0.756
Antarctic Petrel	*Thalassoica antarctica*	9	11	0.002
Cape Petrel	*Daption capense*	828	6274	1.110
White-chinned Petrel	*Procellaria aequinoctialis*	337	388	0.069
Sooty Shearwater	*Puffinus griesus*	7	7	0.001
Soft-plumaged Petrel	*Pterodroma mollis*	208	237	0.042
Kerguelen Petrel	*Lugensa brevirostris*	1	1	0.000
Snow Petrel	*Pagodroma nivea*	5	6	0.001
Antarctic Prion	*Pachyptilla desolata*	358	552	0.098
Prion spp.	*Pachyptilla spp.*	386	796	0.141
Slender-billed Prion	*Pachyptilla belcheri*	4	4	0.001
Fairy Prion	*Pachyptila turtur*	1	1	0.000
Blue Petrel	*Halobaena caerulea*	206	318	0.056
Wilson's Storm Petrel	*Oceanites oceanicus*	1276	1666	0.295
Common Diving Petrel	*Pelecanoides urinatrix*	11	16	0.003
Black-bellied Storm Petrel	*Fregetta tropica*	1328	1662	0.294
Brown Skua	*Catharacta antarctica*	8	8	0.001
South Polar Skua	*Catharacta maccormicki*	81	96	0.017
Kelp Gull	*Larus dominicanus*	15	17	0.003
Parasitic Jaeger	*Stercorarius parasiticus*	1	1	0.000
Antarctic Shag	*Phalacocorax branfieldensis*	5	10	0.002
Antarctic Tern	*Sterna vittata*	59	10	0.002
Arctic Tern	*Sterna paradisaea*	8	21	0.004
Snowy Sheathbill	*Chionis alba*	2	2	0.000

Table 9.2. Summary of marine mammals observed in the AMLR area during Legs I and II.

Species		Sightings	Individuals	Total/km
Humpback Whale	*Megaptera novaeangliae*	117	229	0.041
Fin Whale	*Balaenoptera physalus*	123	217	0.038
Antarctic Minke Whale	*Balaenoptera bonaerensis*	10	10	0.002
Un-identified Baleen Whale	*Balaenoptera spp.*	30	36	0.006
Southern Bottlenose Whale	*Hyperoodon planifrons*	5	6	0.001
Killer Whale	*Orcinus orca*	2	8	0.001
Hourglass Dolphin	*Lagenorhynchus cruciger*	8	40	0.007
Antarctic Fur Seal	*Arctocephalus gazella*	195	249	0.044

Table 9.3. Summary of survey effort and relative abundance of total birds collected during Drake Passage crossings. Transects are defined as 30 minute intervals.

Transit	Total # of transects	Survey effort (min)	Trackline surveyed (km)	Total species	Individuals	Birds/km	Density (birds/km^2)	Average sea state (Beaufort)
1	79	2315	769.1	27	3449	4.5	1.1	5
2	70	2083	635.9	24	1397	2.2	0.77	4
3	60	1779	607.9	26	4632	7.6	1.03	5
4	62	1782	459	18	630	1.4	0.48	7
Total	271	7959	2471.9	33	10108	4.1		



Figures 2a-g. Abundance (#/hr) and distribution of (a) cape petrels, (b) chinstrap penguins, (c) black-browed and grey-headed albatross, (d) Blue Petrel and Prion species, (e) white-chinned and Soft-plumaged Petrels, (f) humpback and fin whales, and (g) fur seals (continued on next page).

There were 10 sightings of Antarctic minke whales that were distributed throughout the AMLR area. In the offshore waters of the Southern Drake Passage, there were five sightings of Southern bottlenose whales (six individuals) and eight sightings of Hourglass Dolphins (40 individuals). As in past AMLR Surveys, at-sea sightings of Antarctic fur seals were generally greater in proximity to breeding colonies near Livingston and Elephant Islands (Figure 2g); however, compared to previous Leg I AMLR Surveys, sightings of fur seals were much greater in the Bransfield Strait this year, a condition that usually occurs during Leg II (late February – early March).

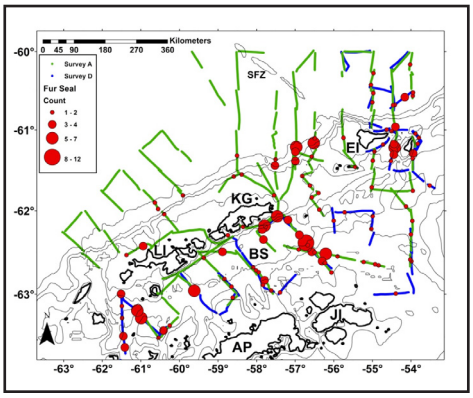


Figure 2g (fur seals) continued.

Drake Passage Crossings

Data on seabird distribution and abundance were collected during all four transits between the east end of the Strait of Magellan and the AMLR study area. Seabird observation effort employed a standardize 300 meter strip transect methodology using a series of continuous 30 minute transects conducted from the port side of the R/V *Moana Wave's* bridge (some transects were truncated due to weather and/or ship operational requirements). A brief summary of observation effort is presented in Table 3. A summary of all species seen and total individuals recorded while on effort arranged in descending order of relative abundance is presented in Table 4.

This year's survey effort approached last year's inten-

Table 9.4. Summary of seabird observations collected during Drake Passage surveys.

Species		Total Individuals
Black-browed Albatross	*Thalassarche melanophris*	2723
Sooty Shearwater	*Puffinus griseus*	2205
unidentified prion	*Pachyptila spp.*	1306
Slender-billed Prion	*Pachyptila belcheri*	791
South American Tern	*Sterna hirundinacea*	566
Great Shearwater	*Puffinus gravis*	441
Wilson's Storm-Petrel	*Oceanites oceanicus*	430
White-chinned Petrel	*Procellaria aequinoctialis*	414
Soft-plumaged Petrel	*Pterodroma mollis*	267
Southern Giant-Petrel	*Macronectes giganteus*	132
Manx Shearwater	*Puffinus puffinus*	112
Common Diving-Petrel	*Pelecanoides urinatrix*	77
Magellanic Penguin	*Spheniscus magellanicus*	75
Antarctic Prion	*Pachyptila desolata*	71
Cape Petrel	*Daption capense*	67
Black-bellied Storm-Petrel	*Fregetta tropica*	61
unidentified Sterna tern	*Sterna spp.*	48
Wandering Albatross	*Diomedea exulans*	43
Rockhopper Penguin	*Eudyptes chrysocome*	36
unidentified diving-petrel	*Pelecanoides spp.*	35
Royal Albatross	*Diomedea epomophora*	34
Gray-headed Albatross	*Thalassarche chrysostoma*	33

Species		Total Individuals
Chinstrap Penguin	*Pygoscelis antarcticus*	22
Chilean Skua	*Stercorarius chilensis*	20
unidentified Procellaria	*Procellaria spp.*	19
Blue Petrel	*Halobaena caerulea*	17
unidentified penguin	*Eudyptes spp.*	14
Imperial Cormorant	*Phalacrocorax atriceps*	10
Macaroni Penguin	*Eudyptes chrysolophus*	7
unidentified giant-petrel	*Macronectes spp.*	7
Westland Petrel	*Procellaria westlandica*	7
Magellanic Diving-Petrel	*Pelecanoides magellani*	7
Light-mantled Albatross	*Phoebetria palpebrata*	2
Northern Giant-Petrel	*Macronectes halli*	2
Great Grebe	*Podiceps major*	1
Southern Fulmar	*Fulmarus glacialoides*	1
Kerguelen Petrel	*Aphrodroma brevirostris*	1
Fairy Prion	*Pachyptila turtur*	1
Manx-type Shearwater	*Puffinus spp.*	1
South Polar Skua	*Stercorarius maccormicki*	1
unidentified skua	*Stercorarius spp.*	1
total individuals		10108
total species		33

Table 9.5. Summary of marine mammal observations collected during Drake Passage surveys

Species		Sightings	Individuals
Fin Whale	*Balaenoptera physalus*	14	41
Peale's Dolphin	*Lagenorhynchus australis*	10	41
Hourglass Dolphin	*Lagenorhynchus cruciger*	4	10
unidentified large whale	*Balaenoptera spp.*	3	4
unidentified dolphin	*Lagenorhynchus spp.*	2	3
Southern Bottlenose Whale	*Hyperoodon planifrons*	1	1
Minke Whale	*Balaenoptera acutorostrata*	1	1

sive coverage; 209 transects were completed, compared to 248 in 2010 (see Table 3). Mean number of transects based on comparable years (e.g., those with four transits, n = 8) is 145. Like last year, heavy weather was a factor, reducing the ship's speed and limiting navigable options with regard to heading, occasionally adding an additional day to the transit. This year was notable for the high numbers of White-chinned Petrels in the Drake Passage. Royal and Wandering Albatross numbers were also up over the last few years. A Wandering Albatross in fresh juvenile plumage on 15 February was only the second individual of this age class ever recorded on these surveys. Overall, abundance displayed widespread temporal and spatial variability. Diversity, on the other hand, was fairly consistent. Among the 10 most abundant species for 2010 and 2011, eight were common to both years: Black-browed Albatross, Sooty and Great Shearwaters, unidentified prion, Slender-billed Prion, Soft-plumaged and Southern Giant Petrels, and Wilson's Storm-Petrel.

Sightings of marine mammals were on an opportunistic basis and are summarized in Table 5. Marine mammal detection rates were inversely correlated with sea state. Fewer marine mammals were seen this year than last year, which is likely a direct result of poor weather on many transects. Furthermore, sightings were often clumped and patchy. For example, 88% of all fin whales, 13 of 14 detections, were concentrated along only a few kilometers of trackline just north of the AMLR study area.

Disposition of Data

All data are available from the NOAA/NMFS Antarctic Ecosystem Research Division, 8901 La Jolla Shores Dr., La Jolla, CA 92037. Ph: 858-546-7127; Fax: 858-546-7003.

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