Marine birds and mammals in the Lazarev Sea: the summer influx. *(Polarstern ANT-XXIV-2, LAKRIS summer expedition)*.

Jan A. van Franeker, Bram Feij, Hauke Flores, André Meijboom & Michiel van Dorssen.
IMARES, P.O.Box 167, 1790 AD Den Burg (Texel), The Netherlands
Jan.vanFraneker@wur.nl

INTRODUCTION

IMARES participates in AWI's multi-year LAKRIS study with a special focus on the role of the surface layer on the biology and abundance of krill and other potential prey of marine top predators. The history of this involvement is that consistent observations of elevated densities of marine birds and mammals in the seaice zone remained largely unexplained in terms of known food availability (e.g. van Franeker et al. 1997). The poorly quantified under-ice habitat was thought to potentially hold missing explanations, which led to development of the Surface and Under Ice Trawl (SUIT) research (see Flores *et al*. this volume).

In the Southern Ocean, top predator abundances strongly suggest that biological production in sea ice is a major driving force behind Antarctic animal population sizes and biodiversity. Understanding the sea ice related foodweb is thus critical for a proper evaluation of the potential impacts of climate change, a key issue in the research of the International Polar Year 2007-2008. The interdisciplinary approach and seasonal spread in Polarstern's Lakris cruises offers an excellent framework to improve such knowledge of marine Antarctic foodwebs.

IMARES uses a top down approach in its ecosystem study which means that we start with a quantification of food requirements of the top predator community derived from detailed density surveys of birds, seals and whales. Results will be compared with catch data from the SUIT (Flores et al., this volume), the Rectangular Midwater Trawl (RMT) used in the CCAMLR krill survey (Siegel et al., this volume), acoustic surveys (Krägefsky et al this vol.) and ultimately all biological and physical information collected. This report presents the preliminary results of predator surveys in terms of food requirements of the top predator community.

METHODS

Two platforms, the ship and helicopter, were available for making quantitative counts of marine top predators during the Lakris expedition.

Ship-based censuses of birds and mammals were made from outdoor observation posts installed on top of the bridge of Polarstern (± 20 m height). The wooden observation posts have perspex windshields, a rain-hood and a small fan-heater that allowed usage in extreme conditions. The outdoor position gives an unobstructed clear view to all sides, crucial to detect all animals in the band transect and also needed to identify ship-associated birds that have to be omitted from density calculations. Birds are counted from the moving ship, in a band transect during time blocks of ten minutes. Ship-based bird censuses use band-transect methodology in which birds in flight are counted according to the so-called ‘snapshot-method’ (Tasker *et al*. 1984) in order to avoid density bias by bird movement. Ship speed and transect width can be used to convert observed numbers of animals to densities per unit of surface area for each ten-minute period. The standard width of the transect band is 300m, taken as 150m to each side of the ship. Under average conditions, this is considered the maximum distance to ensure detection of all individuals, even of inconspicuous species. Depending on viewing conditions such as seastate, light level and glare, the transect may be limited to one side of the ship and transect width may be adapted to a distance that maximizes detection of all individuals of different species. Special adaptation of band-width is sometimes necessary in dense and heavy ice, where the ship often follows an erratic course searching leads or cracks in the ice. As many predators aggregate in or around these leads, persisting in a narrow transect band would result in a highly (upward) biased census result. Under such conditions, the band-width of observations was widened at both sides to approximately half the floe-size between leads, to ensure that counts represent an adequate cross-section of the overall habitat.

Seal censuses are based on the same band records as used for bird observations. Band-transect counts are considered adequate for seal censuses (Laws 1980), but the Antarctic Pack Ice Seal Program (APIS) recommended line-transect methods where possible (SCAR Group of Specialists on Seals 1994). Therefore, for ship-based seal counts in ice areas, line transect data (Hiby and Hammond 1989) are currently being collected in addition to band transect observations. However, current analyses are still based on the band transect data. In the analyses hauled out seal numbers seen from the ship were corrected for diurnal patterns in haul-out behaviour.

In ship-based observations, whale sightings are recorded following line-transect methods, that is noting the angle and detection distance for each observation irrespective of distance. Since the focus of the observer is on the narrow band transect, chances for detection of whales at greater distances are reduced. Our current data analysis for whales is based on simple estimated 'effective detection ranges'; finer detection curves for Minke and larger whales will gradually be developed from our dataset.

Helicopter based surveys used band-transect methods for all species groups. A dedicated observer in the front seat focused all attention ahead on a narrow band-transect which, depending on viewing conditions, ranged between 200 and 300 m width. Band width was calibrated by perpendicular overflights of Polarstern (118 m length). By overflying the ship over bow or stern at least twice at the start of each survey, at the chosen altitude of 250 or 300 ft and standard speed of 60 knots, reference points for transect limits could be made using interior parts of the heli. Survey-tracks were subdivided into smaller units by making GPS waypoints approximately every three to four minutes and recording data in between waypoints. The GPS was operated by a second observer in the rear seat, at the same time making ice-records for each subsection of the survey. Observers in the rear also noted animal sightings outside of the transect band.

Analysis of survey data. Survey distance within each 10 min ship-survey was calculated from averaged ship-speeds in Polarsterns PODAS database system. For helicopter surveys accurate flight speed and distance covered were established using waypoints made. Surface surveyed was thus established from speed and band-transect width, allowing the calculation of densities (number of animals per km^2) for each count unit. Each count unit also has a number of environmental parameters, either noted during the counts (e.g. ice-conditions, sea-state, visibility etc) or extracted from the PODAS system (position, surface water-temperature, salinity etc.). Results of ice records are presented elsewhere in this volume. Top predator density data have been translated to daily prey requirements, expressed as kg carbon requirement of the top predator community per km^2 per day. Calculations are based on published literature of field metabolic rates and energy contents of prey as described in Van Franeker *et al*. *(*1997). In addition to the quantitative counts, qualitative information was collected on the occurrence of species outside transect bands or during oceanographical stations. Such data are not used for density estimates, but assist in more complete distribution mapping of species.

Analyses in this paper are based on averages of all 10 minute ship-counts and the 'between waypoints' helicopter-counts, mostly grouped over half a degree of latitude around station positions on each transect leg. Helicopter surveys were only conducted where sea-ice was present. Due to the speed of the observation platform, helicopter surveys are expected to give some underestimate of especially whale densities as diving individuals can be easily missed in fast overflight. However, seal data from heli-counts are expected to be more complete than those from the ship because all heli-surveys were conducted around midday, the peak haul-out period for ice seals. Furthermore, in contrast to the ship, the helicopter follows a straight unbiased transect line over seaice, where the ship often follows an erratic course in response to ice conditions. In a later phase, detailed comparisons of ship and helicopter results may lead to adaptations in data analyses.

RESULTS AND DISCUSSION

The long summer daylight periods for ship surveys plus the availability of helicopters resulted in good coverage of top predator surveys over the full grid area. Until the 23rd of January a total of 2094 counts was made: 1395 ten-minute counts from the ship, and 699 'between waypoint' counts made during 28 flights with the helicopter. The surface area thus covered by top predator counts amounts to 3061 km^2, of which 1537 km^2 from ship and 1524 km^2 from the helicopter. Helicopter counts were restricted to areas with sea-ice. These sample sizes include the observations during the southward voyage from Cape Town to Neumayer preceding the work in the study grid between 62°S-70°S and 3°W-3°E. Sample sizes and surface surveyed for different transects within the study-grid area are specified in Table 1. Ship based counts were continued throughout the northward voyage, and will be included in later analyses.

The overall north to south distribution of food requirements of top predators (Fig.1) shows the usual pattern of relatively low values in warmer open ocean, occasionally sharply elevated by incidental observations of large whales. In the seasonal sea ice zone (sea ice retreated from about 60°S to 67°S) requirements are consistently higher, largely due to regular presence of seals and whales. Birds, especially penguins were relatively scarce during this voyage, likely because most species retreat to land for breeding and moulting during this period, all at considerable distance from the study grid.

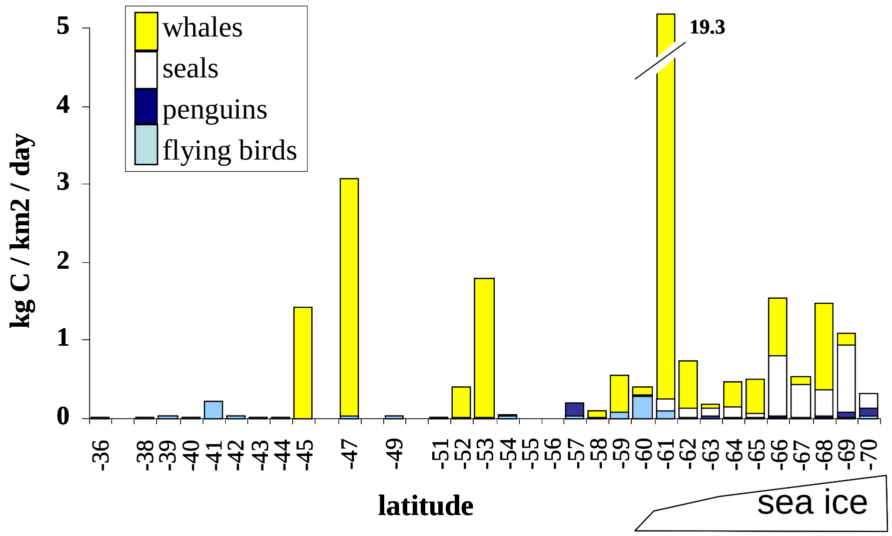

Fig.1 Latitudinal pattern of food requirements of top predators; all data from 29 Nov 2007 to 23 Jan 2008 averaged per degree of latitude. Sea ice retreated from about 60°S to 67°S during this period (n=2094 ship and helicounts over a surface area of 3061 km^2; label for latitude on x-axis omitted where no data available).

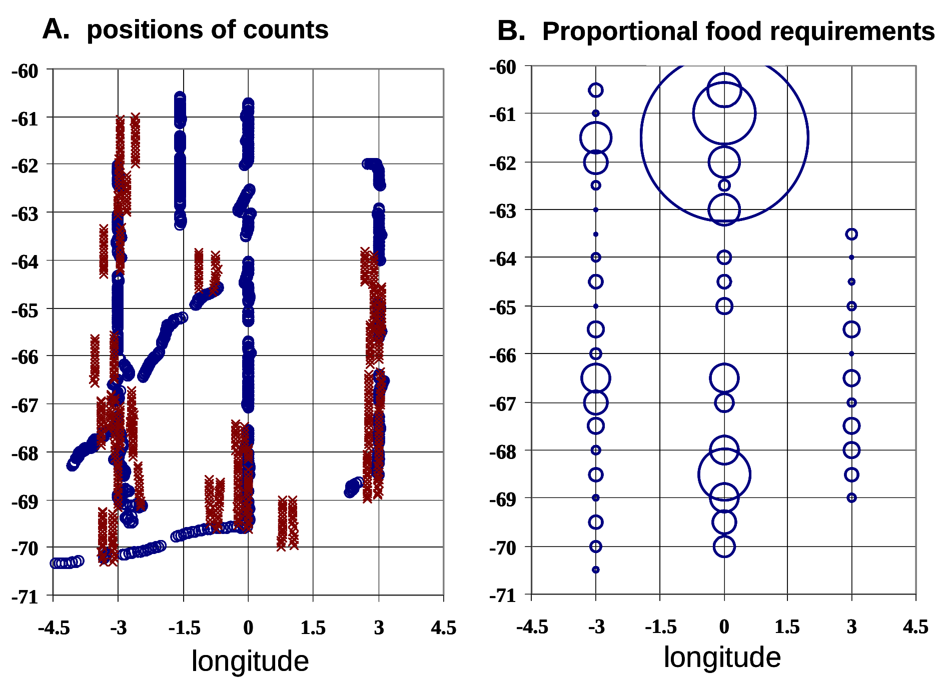

Fig.2 Data coverage in the survey grid (A: shipcounts circles; helicounts crosses) and proportional food requirements of top predators during the three north south transects, with data grouped in half-degree latitude and 3 degree longitude blocks around station positions (30 x ca 35 nm; disproportionate scaling of axes for clarity of the information.

Table 1 Carbon requirements of marine toppredators (seabirds, seals and whales) in and just north of the study grid, in half degree latitude zones around station positions. Sample size indicated by the number of counts (integrated helicopter waypoint counts and ship 10 min counts), and the total surface of band-transect investigated.

	Transect 0 10-14 Dec 2007 1°- 8° West			**Transect 1** 21-29 Dec 2007 3° West			**Transect 2** 01-06 Jan 2008 3° East			**Transect 3** 17-23 Jan 2008 0° Meridian		
Latitude	counts *n*	surveyed km2	C requirement kgC/km2/day	counts *n*	surveyed km2	C requirement kgC/km2/day	counts *n*	surveyed km2	C requirement kgC/km2/day	counts *n*	surveyed km2	C requirement kgC/km2/day
-60.0										*10*	9.5	1.86
-60.5	*6*	6	0.49							*2*	2	3.43
-61.0	*15*	14	0.07	*8*	16	0.13				*17*	17	11.58
-61.5	*10*	12	0.37	*15*	33	4.45				*17*	17	82.84
-62.0	*16*	14	**0.16**	*26*	42	**2.52**	*16*	11	**0.00**	*10*	10	**3.13**
-62.5	*20*	19	**0.21**	*23*	38	**0.22**	*8*	7	**0.00**	*9*	9	**0.37**
-63.0	*14*	12	**0.04**	*21*	37	**0.09**	*13*	11	**0.00**	*21*	17	**3.04**
-63.5				*31*	43	**0.07**	*20*	20	**0.34**	*9*	9	**0.01**
-64.0	*14*	26	**1.01**	*23*	39	**0.19**	*22*	37	**0.07**	*7*	7	**0.02**
-64.5	*22*	39	**0.44**	*16*	14	**0.61**	*15*	32	**0.11**	*18*	17	**0.98**
-65.0	*13*	25	**0.23**	*19*	20	**0.02**	*31*	50	**0.22**	*12*	12	**1.39**
-65.5	*21*	42	**0.12**	*18*	25	**1.44**	*34*	55	**0.90**	*3*	3	**0.00**
-66.0	*16*	27	**0.80**	*24*	43	**0.13**	*12*	29	**0.07**	*15*	17	**0.01**
-66.5	*8*	15	**1.75**	*24*	37	**2.88**	*26*	38	**0.82**	*16*	15	**2.55**
-67.0	*14*	31	**0.49**	*28*	38	**2.50**	*24*	45	**0.30**	*15*	12	**1.17**
-67.5	*26*	45	**0.60**	*52*	96	**0.78**	*35*	46	**0.82**	*8*	8	**0.01**
-68.0	*35*	66	**0.19**	*38*	81	**0.25**	*28*	43	**0.76**	*18*	15	**2.47**
-68.5	*14*	27	**0.29**	*33*	63	**0.65**	*31*	61	**0.60**	*23*	24	**8.19**
-69.0	*22*	47	**0.24**	*44*	91	**0.16**	*12*	26	**0.21**	*41*	64	**2.44**
-69.5	*45*	101	**0.55**	*26*	41	**0.63**				*62*	91	**1.78**
-70.0	*69*	144	**0.43**	*21*	43	**0.59**	*15*	13	**0.01**	*11*	20	**0.96**
-70.5	*53*	117	**0.30**	*10*	11	**0.10**				*12*	11	**0.60**
S of 62°S	*422*	796	**0.46**	*477*	801	**0.77**	*342*	524	**0.33**	*310*	360	**1.62**

Logistic commitments of Polarstern to support the delivery of building materials to Neumayer station caused a break in the transects in the study grid. This seriously complicates interpretation of spatial patterns of top predator distributions in the study grid between 60° to 70°S and 3°W to 3°E. Data are presented for the somewhat wider latitudes south of 60, as events a bit north of the grid were considered illustrative for results obtained within the grid. The combination of ship counts and helicopter based surveys allowed excellent coverage of all transects (Fig.2A). However, in this season of very rapid changes in ice conditions, the delay between the outer transects (3°W and 3°E) and the central one along the 0° meridian seems to have had an overruling effect on observed animal densities confusing a view on basic spatial patterns (Fig.2B).

As was the case during earlier winter observations, the 3°W transect showed higher densities of predators than the 3°E transect which runs over Maud Rise (Fig.3 B and C). However, food requirements during the delayed third and last transect moving north along the zero meridian showed no ‘matching’ intermediate pattern (Fig.3D). Strongly elevated food requirements from top predators were observed, largely caused by increasing densities of Crabeater Seal *(Lobodon carcinophagus)* in the constantly shrinking area of sea ice in the south and increased abundance of Antarctic Minke Whale (*Baleanoptera bonaerensis*) in and around the open and broad marginal ice zone. In winter, Minke Whales concentrated far south in heavy sea ice, but it appears these animals move to the melting zones in summer, likely increased with migrating individuals. On top of this, summer arrival of large

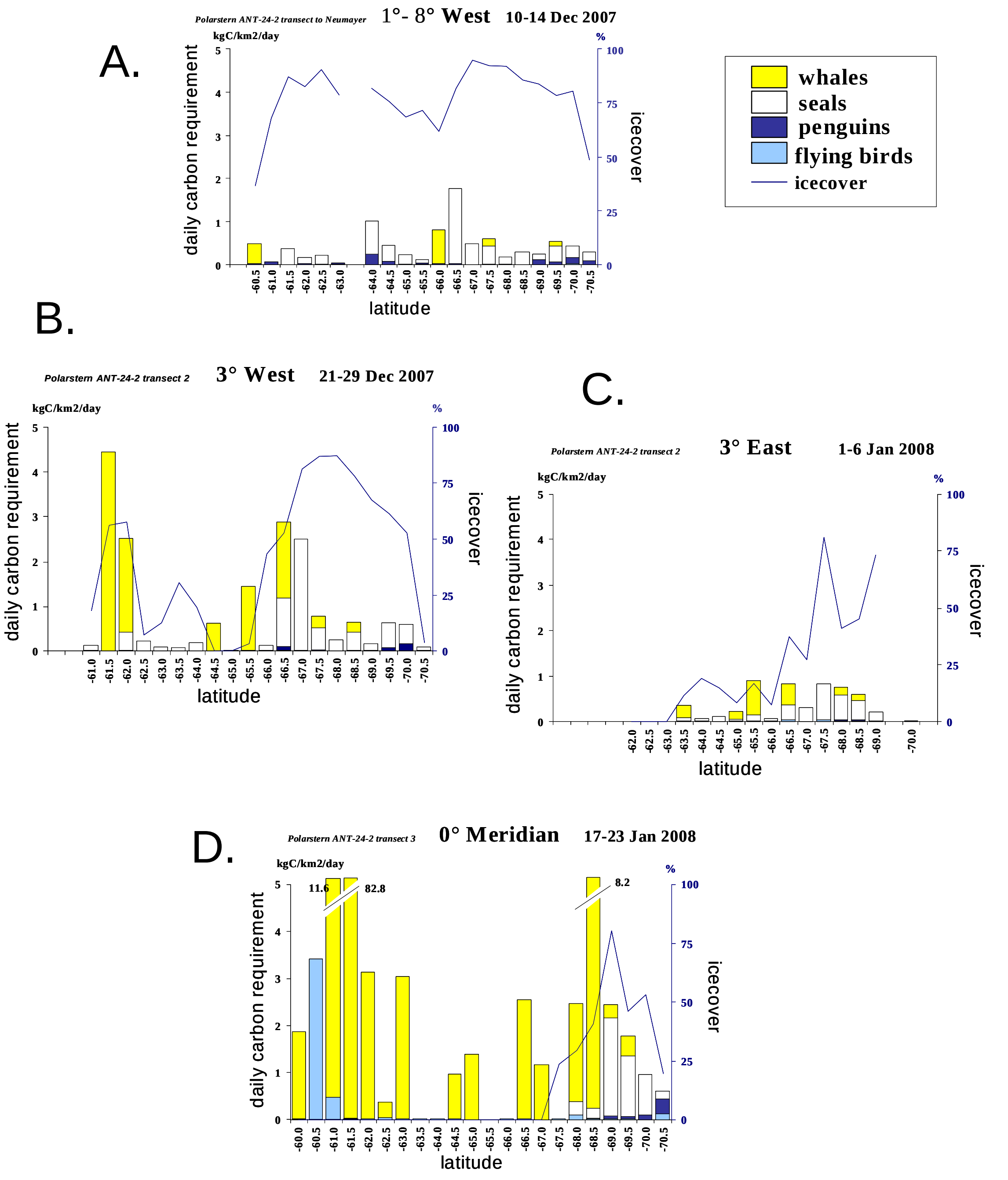

Fig.3 Food requirements of top predators (as kg Carbon per km^2 per day) in the separate transect legs of ANT-24-2 and sea ice cover at the time of observations. Transects along 3°W (B) and 3°E (C) were conducted in rapid sequence, but there is a considerable time-lag between these and the first (A) and last transect along 0° (D). Sample sizes are detailed in Table 1.

baleen whales added to sharply increased food requirements. In the rim of the sea ice, a rare observation of a Blue Whale (*Balaenoptera musculus*) was documented. At the northern side of the study grid, large numbers of migratory Humpback Whales (*Megaptera novaeangliae*) had arrived, and flocks of thousands of moulting Blue Petrels (*Halobaena caerulea*) further indicated rich and reliable food supply for predators. The seasonal change of seals concentrating in residual ice and arrival of migratory whales attracted by the productivity of the seasonal sea ice zone, is best seen by a comparison of the final transect along the zero meridian (Fig.3D) with the initial track to Neumayer (Fig.3A) about five weeks earlier which ran along 1°West until 65°S before gradually moving further southwest. In the five weeks time gap, sea ice had retreated over seven degrees of latitude and triggered a strong change in the composition of top predator community and a fourfold increase of top predator daily food requirements in the study grid (Table 1), clearly indicating the importance of the seasonal sea-ice zone.
Among the remarkable observations, Ross Seals (*Ommatophoca rossii*) need mentioning. Throughout the cruise, but particulary in the area around the 0° meridian, we observed unusually high numbers of this rarest among the ice seals. Where Bester et al. (2002) reported an already relatively high percentage of 1.7% Ross Seals in the seal populations of the Lazarev Sea, our observations add up to a more than three times higher percentage of 5.4% in summer 2007-2008.

In this early stage of data processing, no scientifically accurate evaluation of relations of predator abundance with catches from various nets, acoustics or other biological or physical parameters is possible. However, a quick initial survey of data was made with preliminary SUIT data (Flores et al. this vol), RMT data (Siegel et al this vol) and echosounding information (Krägefsky et al this vol). In many but not all cases, positive correlations between predator abundance and prey abundance are visible. However, only few correlations were significant in linear regressions. Three examples of correlations between specific predator groups and krill abundance are shown in Fig.4 using logaritmic data and simple linear regressions. Food requirements of petrels were positively related ($p<0.001$) to numbers of krill in the RMT net (Fig.4A) and requirements of seals were positively related ($p=0.03$) to mass of krill in the SUIT net. Simrad 38 kHZ backscatter over the upper 200m showed a near significant correlation ($p=0.052$) with food requirements of the total top predator community. Further analyses will be needed to combine prey abundance from all different indicators.
In conclusion, results of the ANT-24-2 expedition confirm a major role of the seasonal sea ice in supporting Antarctic food webs. Insight into finer scale relations and processes is increasing, but still very incomplete because that requires integration of results from different sampling devices over different depth ranges and needs to deal with extremely patchy distributions and strongly variable diel migration patterns.

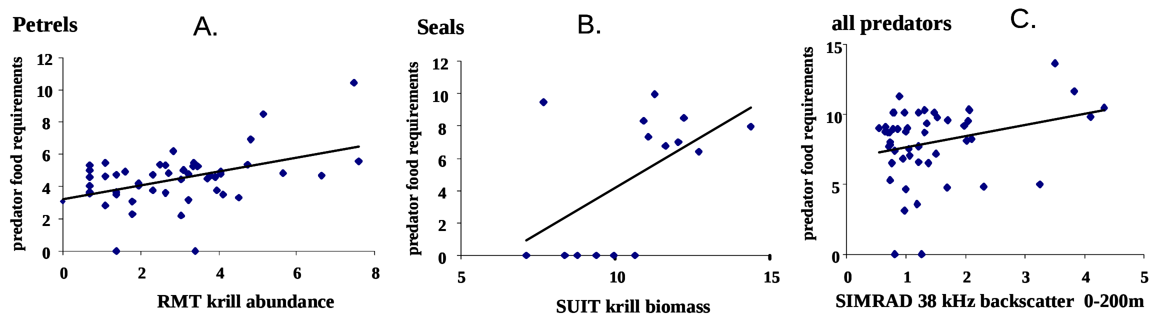

Fig.4 Examples of correlation graphs of predator abundance versus prey abundance (ln transformed data with linear regression lines). A: food requirements of petrels versus number of krill in catches of RMT (p<0.001); B: food requirements of seals versus biomass of krill in catches of the SUIT (p=0.03); C: food requirements of all top predators versus Simrad 38 kZ 0-200 m backscatter (p-0.05).

Additional work:

- *Fishing by helicopter*. During predator counts from from ship and heli, as in several earlier cruises, we observed "brown spots", i.e. discolourations in the water up to may tens of meters in diameter. Although zooplankton swarming was suspected, this remained unconfirmed as close subsurface swarming of zooplankton during daylight hours would be unusual. Sampling had been impossible so far, but with the team of Heli Transair we prepared a trial with a simple 50cm diameter plankton net on a 20m long rope deployed as sling load under the helicopter. We made one successful trial lowering the net to about 15m subsurface in a brown spot, hauling up uniformly young krill. Learning more about the species/age composition of such patchy swarms, their size and potential biomass contribution to the zooplankton community is crucial to understand the functioning of the Southern Ocean ecosystem and interpretation of catch data from conventional sampling net studies and even the SUIT net, which will rarely 'hit' these swarms. Given the opportunity in future expeditions, we will look into the development of a more quantitative type of sampling net to be deployed under helicopter, as better knowledge of the 'brown spot' phenomenon fully fits our objective to assess the role of surface layer phenomena in the functioning of the Antarctic ecosystem.
- *Atka Bay Emperor Penguin colony count.* During the first visit of Polarstern to Neumayer Station, conditions on 14 Dec were excellent for aerial photography of the colony of Emperor Penguins (*Aptenodytes forsteri*) in Atka Bucht. Chicks were distributed over eight different 'creches' that were all photographed with telelens from distance out of the helicopter. Counts of the photographic material shows that close to 11.000 chicks were present with about 1200 attending adult birds.
- *Opportunistic diet sampling.* In our research, birds accidentally landing on the ship are routinely measured and if possible a stomach sample is taken for diet studies. As expected in a mid-summer cruise accidental landings hardly occurred. Two Kerguelen

Petrels were reported on the ship, one of which took off again by itself. The other one had regurgitated its stomach content on the deck (krill). It was captured, measured and subsequently released, and the stomach content was collected.

- *Education, Outreach and Communication* Considerable effort was made by our group to produce 12 short videos for the Dutch IPY site (www.pooljaar.nl/poolijs) and the AWI ftp site, 9 weekly illustrated newsletters (in Dutch and German; www.jafweb.nl) and various other written and photographic contributions for general usage. During the voyage we also cooperated in a newspaper article and radio interview in the Netherlands.

Acknowledgements

We thank officers and crew of Polarstern, cruise leader Uli Bathmann and all colleagues on board for their frequent and extensive support for our project. Martina Vortkamp and Sören Krägefsky kindly assisted in providing preliminary RMT and SIMRAD data. Special thanks are expressed towards the HeliTransAir pilots and technicians. This project was funded by the Netherlands Ministry for Agriculture, Nature and Food Quality (LNV). Last but not least we are very grateful to the Alfred Wegener Institute for its open attitude to international cooperation through the sharing of costly logistic facilities.

References cited

Bester, M.N., Ferguson, M.N. & Jonker, F.C. 2002. Population densities of pack ice seals in the Lazarev Sea, Antarctica. Antarctic Science 14: 123-127.

Hiby A.R. and Hammond P.S. 1989. Survey techniques for estimating cetaceans. In: Donovan G.P.(ed). The comprehensive assessment of whale stocks: the early years. Rep.Int.Whal.Comn (Special Issue II). Cambridge. pp 47-80.

Laws, R.M. (ed) 1980. Estimation of population sizes of seals. BIOMASS Handbook No. 2: 21 pp. SCAR, Cambridge.

SCAR Group of Specialists on Seals 1994. Antarctic Pack Ice Seals: indicators of environmental change and contributors to carbon flux. APIS Program, draft implementation plan, Aug. 1994. SCAR Group of Specialists on Seals, Seattle.7 pp.

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

Van Franeker, J.A., Bathmann, U.V., & Mathot, S. 1997. Carbon fluxes to Antarctic top predators. Deep Sea Research II 44(1/2): 435-455.

Table 2 General abundance data on bird and mammal species observed during ship and heli-surveys in ANT-24-2. Column ship records includes all records, including birds repeatedly observed as associated to the ship or animals outside the transect area. Columns 'in ship transect' and 'in heli transect' give numbers used in density calculations.

Polarstern ANT-24-2 Bird & Mammal species list (*until 23 Jan 2008*)

part 1: BIRDS **English name**	***scientific name***	**latitudinal range**	**ship records**	**in ship-transect**	***in heli transect***
Emperor Penguin	*Aptenodytes forsteri*	-64 to -70	290	72	*115*
Adelie Penguin	*Pygoscelis adeliae*	-60 to -70	214	93	*71*
Chinstrap Penguin	*Pygoscelis antarctica*	-52 to -61	846	844	*2*
Rockhopper Penguin	*Eudyptes crestatus*	-52 to -52	1	1	
Unidentified penguin	*penguin sp.*	-49 to -69	18	13	*6*
Wandering Albatross	*Diomedea exulans*	-41 to -49	63	1	
Royal Albatross	*Diomedea epomophora*	-54 to -54	1		
Large albatross sp	*Diomedea 'large'*	-43 to -49	2		
Black-browed Albatross	*Diomedea melanophris*	-39 to -58	120	3	
White-capped Albatross	*Diomedea cauta*	-41 to -42	6	1	
Grey-headed Albatross	*Diomedea chrysostoma*	-41 to -59	35	1	
Light-mantled Sooty Albatross	*Phoebetria palpebrata*	-44 to -61	375	28	
Southern Fulmar	*Fulmarus glacialoides*	-49 to -70	292	89	
Antarctic Petrel	*Thalassoica antarctica*	-56 to -70	4457	976	*109*
Cape Petrel	*Daption capense*	-47 to -66	1046	33	*1*
Snow Petrel	*Pagodroma nivea*	-58 to -70	984	145	*180*
Northern Giant Petrel	*Macronectes halli*	-45 to -45	1		
Southern Giant Petrel	*Macronectes giganteus*	-49 to -70	116	12	*3*
Giant Petrel sp.	*Macronectes sp.*	-47 to -61	73	3	
Antarctic Prion	*Pachyptila desolata*	-49 to -65	679	100	
Unidentified Prion	*Pachyptila sp*	-41 to -47	688	257	
Blue Petrel	*Halobaena caerulea*	-47 to -61	1832	1476	
Prion or Blue P.?	*Pachyptila/Halobaena sp*	-61 to -61	800		
Great-winged Petrel	*Pterodroma macroptera*	-36 to -39	10	1	
White-headed Petrel	*Pterodroma lessonii*	-36 to -59	23	3	
Atlantic Petrel	*Pterodroma incerta*	-39 to -47	10	3	
Kerguelen Petrel	*Pterodroma brevirostris*	-49 to -65	247	93	
Soft-plumaged Petrel	*Pterodroma mollis*	-36 to -61	255	39	
Grey Petrel	*Procellaria cinerea*	-38 to -47	28	6	
White-chinned Petrel	*Procellaria aequinoctialis*	-36 to -55	98	8	
Great Shearwater	*Puffinus gravis*	-38 to -54	80	19	
Sooty Shearwater	*Puffinus griseus*	-39 to -42	3	3	
Little Shearwater	*Puffinus assimilis*	-41 to -41	7	4	
unidentified shearwater	*Puffinus sp.*	-52 to -52	1		
Wilsons Storm-petrel	*Oceanites oceanicus*	-57 to -70	36	9	*1*
Black-bellied Storm-petrel	*Fregetta tropica*	-39 to -62	182	41	
Unidentified Diving Petrel	*Pelecanoides sp.*	-41 to -49	6	4	
South Polar Skua	*Catharacta maccormicki*	-61 to -70	9		
unidentified large Skua	*Catharacta sp.*	-42 to -42	1		
Arctic Skua	*Stercorarius parasiticus*	-40 to -40	1	1	
unidentified smaller Larus	*Larus unidentified; small*	-64 to -64	1		
Arctic Tern	*Sterna paradisaea*	-39 to -69	637	361	*524*
Tern unidentified	*Sterna sp medium*	-52 to -52	2	1	

Table 2. Continued (for caption see previous page)

Polarstern ANT-24-2 Bird & Mammal species list (*until 23 Jan 2008*)

part 2: MAMMALS **English name**	***scientific name***	**latitudinal range**	**ship records**	**in ship-transect**	***in heli transect***
Crabeater Seal	*Lobodon carcinophagus*	-61 to -70	171	143	*455*
Leopard Seal	*Hydrurga leptonyx*	-68 to -69	2	2	*7*
Weddell Seal	*Leptonychotes weddellii*	-67 to -70	5	4	*24*
Ross Seal	*Ommatophoca rossii*	-66 to -70	20	11	*25*
unidentified seal (Phocid)	*Phocidae sp*	-62 to -70	12	3	*2*
Minke Whale spec	*Balaenoptera sp Minke type*	-62 to -69	9	9	
Antarctic Minke Whale	*Balaenoptera bonaerensis*	-62 to -69	66	59	*20*
unidentified small whale	*Cetacean small*	-59 to -69	18	18	
Sei/Fin?Whale	*Baleanoptera sp*	-45 to -45	1	1	
Blue Whale	*Balaenoptera musculus*	-67 to -67			*1*
Humpback Whale	*Megaptera novaeangliae*	-52 to -62	132	112	
Sperm Whale	*Physeter macrocephalus*	-47 to -47	2	2	
S. Bottlenose Whale	*Hyperoodon planifrons*	-58 to -58	1	1	
Killer Whale	*Orcinus orca*	-66 to -70	36	6	