Palmer LTER: Annual January cruise for 1998 (*LMG*R98-8; *LMG*R98-1)

David M. Karl, *Department of Oceanography, University of Hawaii at Manoa*

Langdon B. Quetin, *Marine Science Institute, University of California at Santa Barbara*

Karen S. Baker, *Marine Research Division, Scripps Institution of Oceanography, University of California at San Diego*

Annual sampling for the sixth Palmer Long-Term Ecological Research (LTER) January cruise was completed in two legs, adding to our growing knowledge of the area west of the Antarctic Peninsula (Ross, Hofmann and Quetin et al 1996). Zooplankton sampling and bird observations within the foraging range of penguins near Palmer Station (high-density grid) was performed aboard the research ship *Abel-J* (LMGR98-8: 18 January-24 January) with 5 crew and 9 LTER science participants. The full LTER grid (transect lines 600-200) and additional inshore station sampling were performed aboard the research ship *Laurence M. Gould* (LMG98-1: 28 January-13 February) with 15 crew, 5 Antarctic Support Associates, and 21 LTER participants. The cruise began one week later than the previous January LTER cruises (Ross and Baker, 1997). The *Abel-J* was chartered for the first leg of the cruise, as research ship *Polar Duke* contract had expired and the maiden voyage of the newly built research ship *L.M.Gould* was delayed.

The tables 1 and 2 summarize the chronology (table 1) and sampling division (table 2) of the cruise. These tables summarize both the sampling over the mesoscale grid (figure 1) as well as the higher density observations within the foraging range of Adélie penguins near Palmer Station (figure 2). Initial nearshore Palmer work on the first cruise leg included repeated visits to nearshore stations (E, B, H, I, J), two transects (picket lines) that maintained a fixed distance from Palmer Stations (PL 3.7 and 10 km), and a survey of the high-density grid (HD1 10 km x 20 km) with five hydrographic stations. Stations on the LTER mesoscale grid (600.040, 600.060, and 600.080) were occupied, followed on 23 January by four inshore stations in the Lemaire and Grandidier. Measurements included optic (using a profiling radiometer) and hydrographic [hydrography using the station CTD deployed to a depth of 100 meters (m)]. Six 5-liter Go-Flo bottles were deployed routinely from the port side (using a hand winch) to collected water for nutrients, plant pigments, primary production, and plant physiology. A Palmer zodiac was used to collect krill. Bioacoustic surveys were completed aboard the *Abel-J* at 4.5 knots, the ship's minimum speed. Water for nutrient and productivity measurements was taken back to Palmer station. Nutrients were shipped to the University of California at Santa Barbara Analytic Facility for analysis.

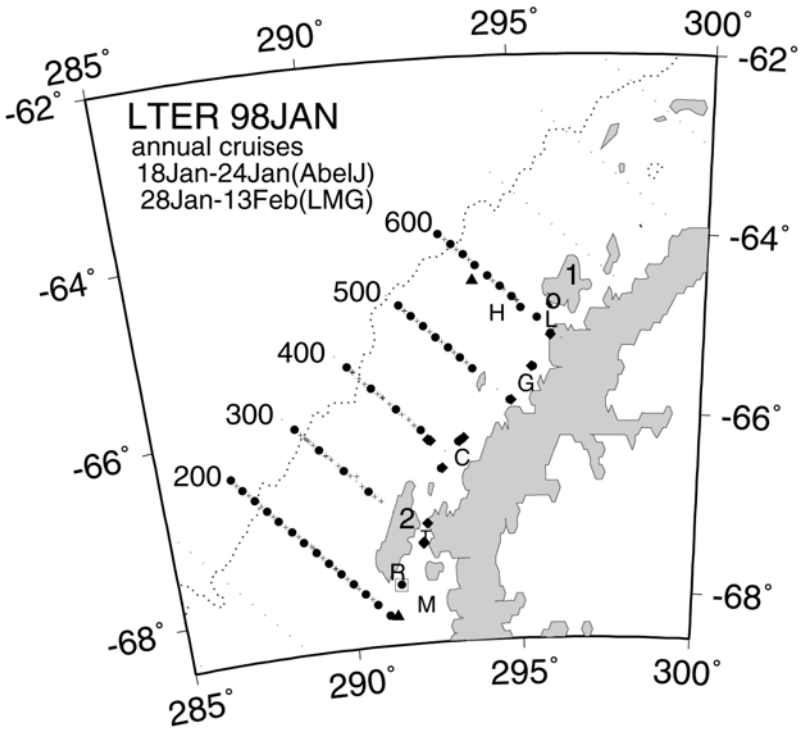

Figure 1. The cardinal station of the Palmer LTER regional grid (dots) off the Antarctic Peninsula are overlaid for LMG98-1 to indicate stations occupied (large dots), XBT stations (X) and inshore stations (diamonds), sediment trap station (triangles). Labeled are Anvers Island (1) with Palmer Station (o), Hugo AWS (H), Adelaide Island (2), Lemaire Channel (L), Gradidier (G), Crystal Sound (C), Tickle Passage (T), Marguerite Bay (B), Rothera Station (R), and Ginger Island (open square). The dotted line denotes the 1,000-meter bathymetry line.

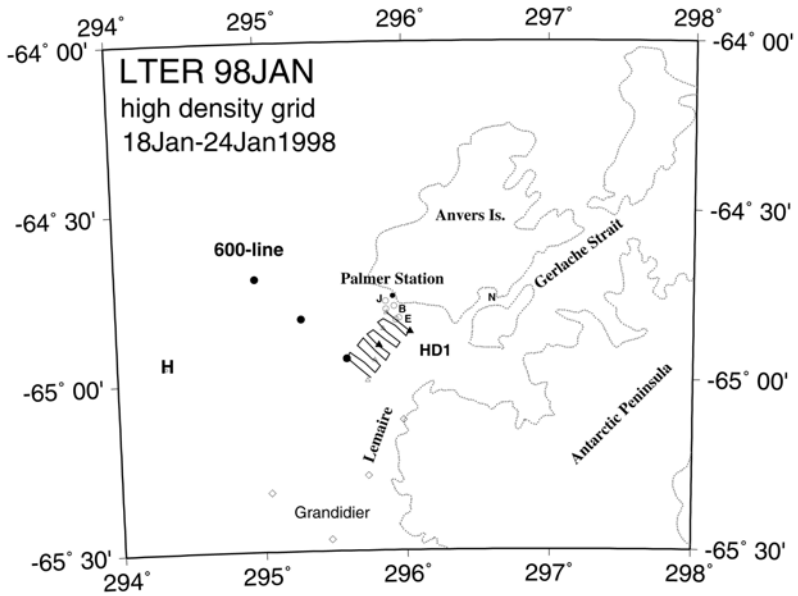

Figure 2. Sampling area near Palmer Station on Anvers Island with the Neumeyer (N) and Gerlache Strait to the East. The Hugo AWS (H) location is given. The high-density sample grid (HD1) is shown with CTD stations (triangles). Palmer stations B, E, and J are shown (open circles). The LTER regional grid 600 line stations 040,060 and 080 (filled dots and inshore stations (diamonds) are marked.

Table 1. Overview of LTER Cruises LMGR98-1 and LMG98-1. Day of the month and activities are listed including LTER grid locations (xx.xx), LTER Palmer basin stations (B, E, H, I, J), high-density grid sampling (HDI), Inland North (InN) and South (InS) stations.

January (*AbeIJ*)	
13	Puerto Williams to Punta Arenas
14	Transect
15	Transect
16	Punta Arenas, Chile, arrive
17	Dock
18	E&B; dock; PL3.7; PL10
19	Dock; E; 600.040; HD1/prod (610.035; 620.030); E; dock
20	HD1 (600.030; 605.38; 610.035; 615.037; 620.040); dock
21	HD1/krilltarg; dock; zodiac
22	Zodiac; Hugo AWS; Sclause; 600.080;600.060; 600.040; dock
23	InN-LeMair (597.013); InN-Grandid (575.010; zodiac; 550.005; 550.030)
24	Dock; E; B; IJ; H; dock; Hugo

January (*L.M. Gould*)	
28	Dock; 600.040
29	B; 600.040; 600.060
30	600.080; 600.100; 600.120; 600.140
31	600.160; 600.180; 600.200

February (*L.M. Gould*)	
01	500.180; 500.160
02	500.140; 500.120; 500.100; 500.080; 500.060
03	InS-Ncrystal (430.015); 400.040; 400.060; 400.080; 400.100; 400.120; 400.060
04	400.160; 400.180; 300.180; 300.160
05	300.140; 300.120; 300.100; 300.080; 300.040
06	200.200; 200.180; 200.160
07	200.140; 200.120; 200.100
08	200.060; 200.040; 200.020; 200.000
09	20.020; 200.040; GingerIsn; 200.060
10	Trap; Tickle (295.033; 316.021)
11	InS-Crystal (380.010; 420.015); 500.00
12	InN-Grandid (550.05); Lemaire (595.015)
13	600.040; E; B; dock

On 22 January, we replaced the batteries at the Hugo Automatic Weather Station (AWS). The AWS electronics box was removed, so we could replace components, and was returned on 24 January, restoring the station to full functionality. The time spent at Hugo permitted a complete bird survey of the Hugo archipelago.

Table 2. Summary of LTER Cruises LRGR98-8 and LMG98-1 events.

Parameter	Number of events	Number of days per event	Number of days	Percentage of cruise time
Gird lines	-	-	11	46
Grid north/south	-	-	4	17
Gird inshore B, E	6	0.33	2	8
High-density grid	1	3	3	12
Picket line/3.7, 10	2	0.33	0.66	3
Bird zodiac	3	0.5	1.5	6
Weather/tests	-	-	1	4
AWS Hugo	1	-	1	4
Total			24	100

During the second cruise leg, stations on grid line transects 600 through 200 were completed with 20-km station spacing on grid lines 600, 500 and 200, and 40-km station spacing on grid lines 300 and 400, using expendable bathythermographs (XBT) to fill at 20-km spacing. To simplify equipment and personnel support, the light and hydrographic measurements were performed on separate casts (unlike the past five annual cruises). Profile measurements included hydrographic casts using the ship's CTD to a range of 500 m, with 12-liter Go-Flo bottles run from a starboard Baltic Room, as well as separate radiometer casts. Other measurements included microbial parameters, plant pigments, nutrients, primary production, plant physiology, and krill physiological measurements. Bio-acoustic transects and net tows were performed at 20-km spacing on all transect lines. Some planned acoustic work was canceled due to bubbles sweeping from the hull on the 3.5 kHz transducer port. Continuous underway measurement systems logged partial pressure of carbon dioxide, pH, dissolved oxygen, fluorescence, temperature and conductivity of near-surface waters. Adélie penguin diet samples were collected at Ginger Island (toward the end of the cruise) before proceeding to inshore stations in the South (Tickle Passage and Crystal Sound) and the North (Grandidier and Lemaire). The cruise ended with repeat visits to station 600.040 and to nearshore stations B and E.

On 30 January, the LTER sediment trap mooring near Hugo was recovered and redeployed. We were unable to deploy a trap at Marguerite Bay on 10 February.

As part of the Palmer LTER Education Outreach, Besse Dawson, a high school marine sciences teacher from Texas, was aboard ship as a participant in the NSF Teachers Experiencing Antarctica (TEA) program. She filed real-time field reports to

online classrooms via the Internet. Another program supported by Palmer LTER personnel during the northbound Drake Passage crossing was the XBT study, directed by Janet Sprintall of Scripps Institution of Oceanography. Ice-free open water was observed during most of the cruise. We did encounter brash-ice in the Lemaire (inshore North) and the Tickle Passage (inshore South). We also encountered occasional high winds—on 18 January during coastal sampling; on 31 January, preventing 600.200 offshore sampling; and on 07 February during sampling of the mid 200 transect line. For the 1997-1998 season, we completed one foraging grid rather than two. Ship-based censuses in the Adélie penguin foraging area (from both *Abel-J* and the *Laurence M. Gould*) suggest that birds were concentrated inshore, within 15 km of their rookeries. This pattern is consistent with other data. We also found foraging trips to be of shorter durations, than during the 1996-1997 season; we again detected the presence of large numbers of small krill in their diets. An item that will be the subject of further discussion is the fact that compared to our former research ship *Polar Duke*, the *Lawrence M. Gould* affords much inferior visibility from its bridge for seabird and marine mammal.

Chlorophyll (chl) concentrations indicate low phytoplankton standing stocks throughout the study region, averaging less than 1-2 mg chl/m3 even in the nearshore stations. The frequently observed onshore-to-offshore gradients in chlorophyll (Smith, Baker, and Vernet et al 1998) were minimal this year as they were last year. Further, the south-to-north chlorophyll gradient is entirely absent. Surface-dissolved oxygen and dissolved carbon dioxide concentrations indicate that both biogenic gases are essentially at equilibrium with the atmosphere, unlike previous years when supersaturated dissolved oxygen and undersaturated carbon dioxide were found.

Indications are that primary production appears low, compared to previous years. Large interannual variations in the magnitude and timing of the spring-summer export have been documented. During late December 1996 and early January 1997, the 1996-1997 sediment trap samples gave dramatic visual evidence for a large export flux event (lasting for about two weeks), but no comparable export event was observed in the 1997-1998 samples (through this past austral summer prior to 8 January 1998). How the ecosystem changes we observed may relate to the 1997-1998 El Nino events will be the subject of further investigation.

This research cruise was composed of the Palmer LTER research team, including team leaders P. Duley (Fraser, S-013), C. Johnson (Smith, S-032), D. Karl (Karl, S-046), W. Kozlowski (Vernet, S-016) L.Quetin (Quetin/Ross, S-028). Special thanks to the Palmer LTER research team members, the Antarctic Support Associates, and as well as the Captain and crew of the *Abel-J* and the *Laurence Gould*. This material is based upon work supported by the National Science Foundation under OPP 96-32763, with additional funding provided by the Regents at the University of California. Palmer LTER Contribution No. 148.

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