

**Report on the Antarctic Expedition
of the r/v „Profesor Siedlecki” to the Sea-Ice Zone,
1988–1989**

The expedition was organized by the Institute of Ecology, Polish Academy of Sciences. Its purpose was to research the zone ahead of the pack-ice in the northern region of the Weddell Sea between Elephant Island and the South Orkney Islands. The research was conducted in the meso-scale (Fig. 1, Tab. 1) continuing the studies begun earlier further to the west (Rakusa-Suszczewski 1988). The region studied and the period of study complemented the EPOS research program (leg. 2).

Expedition Crew:

- | | |
|--------------------------------------|----------------------------------|
| 1. Zdzisław Bogaczewicz, M.Sc. | — cartographer |
| 2. Stuart Donachie, M.Sc. | — microbiologist |
| 3. Dr. Małgorzata Godlewska | — hydroacoustics specialist |
| 4. Alfred Grelowski, M.Sc. | — oceanographer |
| 5. Dr. Janusz Kalinowski | — hydroacoustics specialist |
| 6. Leszek Kamionka, M.Sc. | — hydroacoustics specialist |
| 7. Dr. Wojciech Kittel | — zooplanktonologist |
| 8. Dr. Elżbieta Kopczyńska | — phytoplanktonologist |
| 9. Dr. Ryszard Ligowski | — phytoplanktonologist |
| 10. Dr. Maciej Lipski | — hydrochemist |
| 11. Dr. Aleksy Łukowski | — toxicologist |
| 12. Marek Michalak, M.Sc. | — scuba diver |
| 13. Dr. Ewa Mikołajczyk | — protozoologist |
| 14. Dr. Andrzej Myrcha | — ornithologist |
| 15. Dr. Stanisław Rakusa-Suszczewski | — zooplanktonologist |
| 16. Dr. Jacek Siciński | — zooplanktonologist |
| 17. Krystyna Tabeńska | — zooplanktonologist, technician |
| 18. Dr. Ryszard Tokarczyk | — oceanographer |
| 19. Dr. Anna Wasik | — protozoologist |
| 20. Tadeusz Wojewódzki, M.Sc. | — oceanographer |
| 21. Dr. Marek Zdanowski | — microbiologist |

First Spanish Group (Atlantic)

1. Fernandez Rios, Aida
2. Pazos Gonzales, Yolanda
3. Penin Lopez, Ramon
4. Rellan, Rellan — Trinidad

Second Spanish Group (Antarctic)

1. Francisco Gomez Figueiras
2. Felix Fernandez Perez
3. Ricardo Prego Reboredo

Expedition Calendar

- | | |
|------------------|---|
| 4 November 1988 | — r/v „Profesor Siedlecki” embarked at 16:30 from Gdynia. |
| 7 November 1988 | — Docked at Horten, Norway to mount hydroacoustical equipment and navigational satellite. |
| 16 November 1988 | — Docked at Vigo to take on the first Spanish group, equipment and 11.8 tons of baggage. We re-embarked at 23:30. Atlantic hydrological studies were begun at 20 stations established by the Spanish group. |
| 12 December 1988 | — 9:00 docking at Rio de Janeiro. Change of the Spanish crews. Scientists from the University of Sao Paulo and also representatives of the Brazilian Navy visited us. |
| 26 December 1988 | — Stop-over at the H. Arctowski Station. Beginning of research at the calibrating stations in Admiralty Bay. |
| 29 December 1988 | — Beginning of work at the ice east of Clarence Islands. |
| 13 January 1989 | — End of programmed station work along the pack-ice and the beginning of hydroacoustical analysis in the Elephant Island region. |
| 16 January 1989 | — Control catch of fish on the Elephant Islands shelf. |
| 17 January 1989 | — End of fish catches and beginning of the return trip. |
| 22 January 1989 | — Docking at Punta Arenas. |
| 23 January 1989 | — Air departure of the Polish Academy of Sciences crew to Poland. |

Conclusions

During the research period the borders of the pack-ice were in continual flux and changed quickly and violently (Fig. 1). Physical factors such as wind, its velocity and direction, as well as air temperature and water eddies played

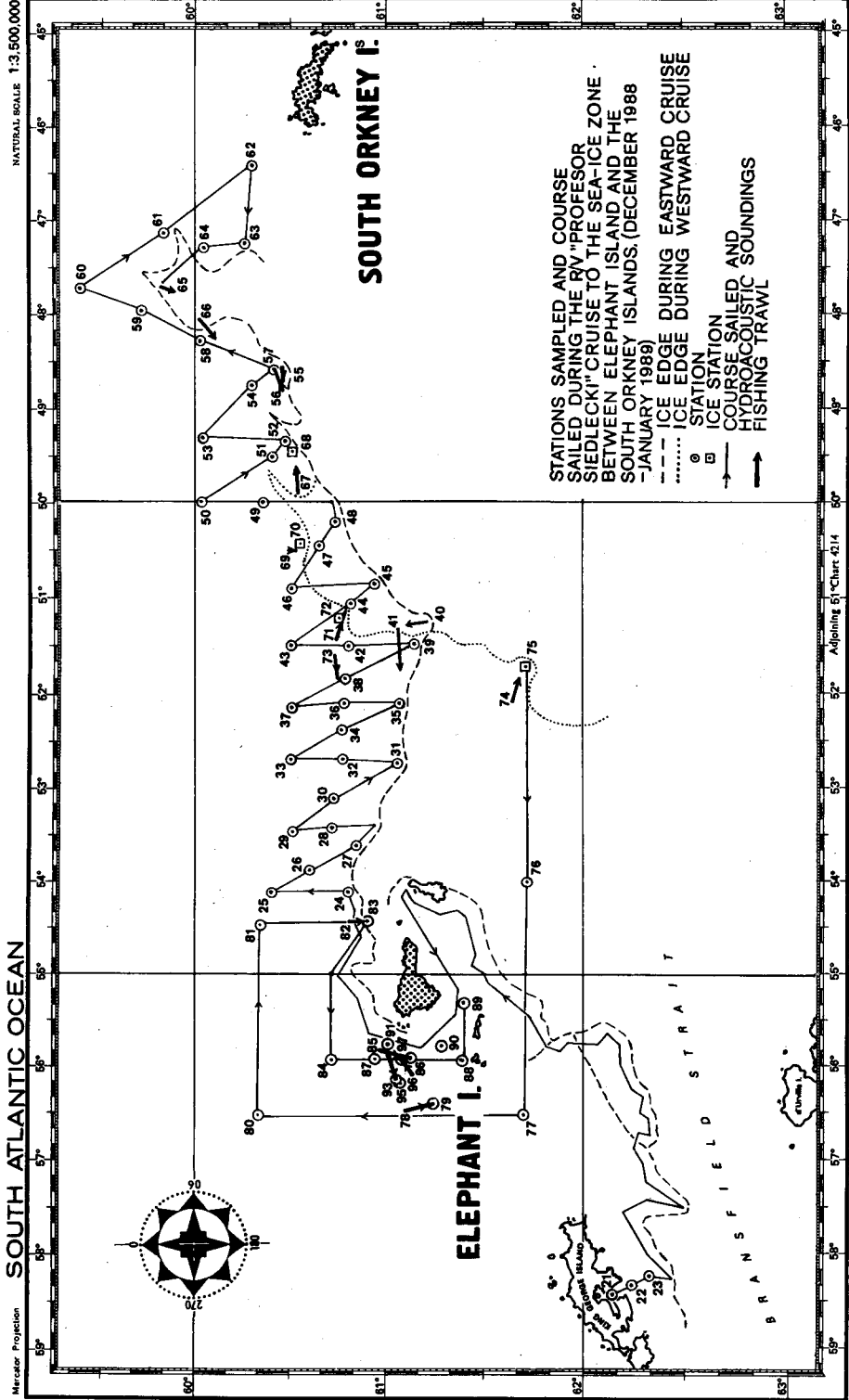


Fig. 1.

Table 1

Sampling Stations During Polish Academy of Sciences Antarctic Expedition R/V „Profesor Siedlecki”, 1988 – 89

Station number	Position Start – Finish	Time (GMT) Start – Finish	1988/89 Date	Maximum depth of sea at station	Codes	Notes
						Temperature and Salinity Plankton Ice Bacteria Protozoa Nutrients Trawl Bongo
1	2	3	4	5	6	7
21	62°09,0'S 58°24,5'W	21.55 / 00.10 26 / 27	26 12 88	485	TS PL B PR NT	NE 4 2°B 0°C
22	62°12,0' 58°21,3'	00.55 – 04.00	27 12 88	498	TS PL B PR NT BON 30' (2.0mM)	ENE 5 3°B -2°C
23	62°18,5' 58°13,0'	05.30 – 09.00	27 12 88	1400	TS PL PR	SE 3 2°B -2°C
24	60°49,9' 54°07,0'	11.30 – 18.30	29 12 88	1160	TS PL L B PR BON 1h (2.9mM)	N 3 2°B +3°C
25	60°24,9' 54°08,0'	22.00 / 00.05 29 / 30	29 12 88	3000	TS PL B PR NT BON 1h (3.0mM)	NW 3 2°B +4°C
26	60°37,0' 53°56,0'	03.45 – 06.30	30 12 88	2800	TS PL B PR NT	W 3 2°B +3°C
27	60°50,0' 53°36,0'	09.10 – 16.50	30 12 88	650	TS PL L B PR NT BON 55' (2.8mM)	WNW 3 2°B +4°C drift
28	60°42,9' 53°25,4'	18.50 – 19.15	30 12 88	470	TS	N 5 3°B +4°C

1	2	3	4	5	6	7
29	60°30,0'S 53°26,0'W	21.20 / 00.15 30 / 31	30 12 88	2400	TS PL PR NT	N 7 +4°C
30	60°42,7' 53°09,9'	02.40 - 05.00	31 12 88	421	TS PL PR NT	N 7 +3°C
31	61°04,6' 52°42,1'	09.35 - 14.55	31 12 88	1050	TS PL L B PR NT BON 1h (3.0nm)	WNW 3 +3°C
32	60°46,0' 52°41,0'	17.30 - 19.20	31 12 88	1700	TS PR	WNW 3 +5°C
33	60°30,0' 52°26,0'	21.40 / 00.35 31 / 01	31 12 88	550	TS PL BON 1h (3.0nm)	NW 3 +3°C
34	60°47,7' 52°26,0'	05.20 - 07.40	01 01 89	1500	TS	N 4 +1°C
35	61°04,0' 52°05,3'	12.20 - 17.40	01 01 89	1000	TS PL L B PR NT BON 1h (3.0nm)	NE 5 +3°C
36	60°46,0' 52°06,0'	20.30 - 21.30	01 01 89	2660	TS	NE 5 +3°C
37	60°30,2' 52°08,1'	00.00 - 04.15	02 01 89	602	TS PL PR NT BON 1h (3.0nm)	NE 5 +3°C
38	60°48,3' 51°52,0'	07.45 - 11.05	02 01 89	2300	TS PL NT	W 4 0°C
39	61°09,0' 51°29,0'	15.30 - 20.15	02 01 89	1052	TS PL L B NT BON 1h (3.0nm)	W 4 +2°C
40	61°07,0' 51°18,0'	20.50 - 22.00	02 01 89	1200	TR 1h10' (4.0nm)	W 4 +3°C
41	61°04,3' 51°18,9'	23.30 / 03.00 02 / 03	02 01 89	860	TR 40' (2.0nm)	W 6 +1°C
42	60°48,7' 51°28,5'	15.00 - 19.10	03 01 89	2640	TS PL PR NT	W 6-7 +1°C

1	2	3	4	5	6	7	
43	60°30,0'S 51°29,1'W	60°30,1'S 51°30,9'W	23.00 / 01.25 03 / 04	03 01 89	2520	TS PL PR NT BON 1h (3.0nM)	W +2°C 4°B SUN
44	60°49,0' 51°02,0'	60°49,3' 51°03,9'	05.50 - 06.50	04 01 89	2590	TS PL	W +2°C 4°B SUN
45	60°56,0' 50°51,6'	60°57,3' 50°44,0'	11.45 - 18.25	04 01 89	1150	TS PL L B PR NT BON 55' (3.0nM)	W +2°C 6°B SUN
46	60°30,0' 50°51,5'	60°31,1' 50°48,0'	21.45 / 00.20 04 / 05	04 01 89	1950	TS PL PR NT BON 1h (3.0nM)	W +2°C 6°B SUN
47	60°39,1' 50°26,7'	60°38,4' 50°26,7'	04.05 - 05.20	05 01 89	1500	TS	W +2°C 5°B
48	60°44,0' 50°11,1'	60°42,0' 50°00,0'	10.00 - 15.35	05 01 89	1400	TS PL L B PR NT BON 55' (3.0nM)	SW +2°C 5°B DULL/FOG
49	60°21,0' 50°00,0'	60°22,0' 49°56,0'	18.25 - 20.55	05 01 89	3500	TS	SW +2°C 4°B
50	60°02,0' 50°00,7'	60°02,3' 50°00,5'	23.25 / 02.00 05 / 06	06 01 89	3150	TS PL L B PR NT BON 55' (2.8nM)	SSW +3°C 3°B SUN
51	60°22,0' 49°30,7'	60°22,1' 49°29,1'	06.05 - 07.05	06 01 89	3500	TS	SSW 0°C 3°B
52	60°29,0' 49°20,0'	60°24,7' 49°20,7'	09.45 - 14.15	06 01 89	1520	TS PL L B PR NT BON 1h (3.0nM)	WSW +2°C 2°B DULL
53	60°02,0' 49°20,0'	60°05,8' 49°16,3'	17.00 - 20.25	06 01 89	3240	TS PL L B PR NT BON 1h (3.0nM)	WSW +2°C 2°B DULL/FOG
54	60°18,1' 48°44,9'	60°18,3' 48°50,2'	23.30 / 01.45 06 / 07	06 01 89	3880	TS PL PR NT	W 0°C 3°B
55	60°26,6' 48°34,2'	60°26,6' 48°42,3'	01.10 - 05.45	07 01 89	1600	TR 1h35' (3.8nM)	W 0°C 3°B
56	60°27,1' 48°48,1'	60°25,7' 48°35,5'	07.05 - 09.20	07 01 89	1650	TR 2h (6.0nM)	W 0°C 3°B

1	2	3	4	5	6	7	
57	60°25,0'S 48°40,0'W	60°21,6'S 48°41,4'W	10.25 - 14.15	07 01 89	1900	TS PL L B PR NT BON 55' (3.0nm)	W 5 3°B +1°C FOG
58	60°01,0' 48°16,3'	59°58,8' 48°17,0'	17.30 - 20.50	07 01 89	3850	TS PL L B PR NT BON 55' (3.0nm)	WSW 4 2°B +2°C FOG
59	59°43,8' 47°59,7'	59°39,6' 47°55,3'	23.00 / 01.35 07 / 08	07 01 89	4310	TS PL PR NT	SW 3 1°B +4°C FOG
60	59°22,0' 47°43,0'	59°21,8' 47°41,7'	04.45 - 05.45	08 01 89	3800	TS	SW 2 1°B -1°C
61	59°50,4' 47°09,0'	59°52,6' 47°03,6'	10.00 - 13.30	08 01 89	4700	TS PL PR NT BON 1h (3.1nm)	WNW 4 2°B +2°C SUN/DULL
62	60°15,8' 46°26,2'	60°17,2' 46°32,4'	17.00 - 20.10	08 01 89	2800	TS PL PR NT BON 55' (3.0nm)	NW 3 2°B +4°C DULL
63	60°15,7' 47°15,8'	60°14,4' 47°18,6'	23.10 / 01.50 08 / 09	08 01 89	1900	TS PL PR NT	NNW 4 2°B +2°C FOG
64	60°03,0' 47°18,0'	60°04,0' 47°17,9'	03.25 - 04.30	09 01 89	2000	TS	NNW 4 2°B +2°C
65	59°49,2' 47°41,4'	59°53,0' 47°42,0'	11.25 - 15.20	09 01 89	4350	TR 3h40' (8nm)	N 4 2°B +2°C FOG
66	60°01,4' 48°04,8'	60°06,3' 48°17,0'	17.10 - 20.00	09 01 89	2800	TR 2h30' (6nm)	N 4 2°B +2°C DULL
67	60°31,0' 49°57,1'	60°32,0' 49°59,2'	05.15 - 09.45	10 01 89	1520	TR 4h30' (11nm)	SW 3 2°B +1°C
68	60°31,0' 49°27,0'	60°30,0' 49°29,4'	13.00 - 20.30	10 01 89	1700	TS PL L B PR NT	SW 3 2°B +2°C
69	60°29,2' 50°31,4'	60°31,1' 50°32,0'	06.00 - 09.45	11 01 89	2200	TR 3h45' (9nm)	NW 5 3°B +2°C
70	60°33,4' 50°27,5'	60°32,7' 50°18,4'	12.30 - 21.30	11 01 89	2880	TS PL L B	W 5 3°B +3°C

1	2	3	4	5	6	7	
71	60°44.6'S 51°28.5'W	60°46.5'S 51°07.0'W	04.50 - 09.45	12 01 89	2880	TR 4h55' (14nM)	W +1°C 5 3°B FOG
72	60°45.9' 51°13.0'	60°45.0' 51°19.0'	12.30 - 17.50	12 01 89	1400	TS PL L B PR NT	NW +3°C 3 2°B
73	60°44.8' 51°40.9'	60°46.0' 51°53.0'	19.15 - 22.20	12 01 89	2800	TR 2h30' (6.0nM)	NW +3°C 4 2°B
74	61°38.8' 52°06.8'	61°40.0' 51°53.0'	05.40 - 09.55	12 01 89	2000	TR 4h15' (10nM)	N +1°C 5 3°B
75	61°43.8' 51°44.8'	61°40.9' 51°43.0'	12.30 - 19.40	13 01 89	2650	TS PL L B PR NT	NW +1°C 5 2°B
76	61°44.0' 54°00.0'	61°44.0' 54°00.0'	05.00 - 05.25	14 01 89	330	TS	W +3°C 5 3°B
77	61°41.8' 56°32.0'	61°49.0' 56°32.2'	13.45 - 14.10	14 01 89	553	TS	NW +3°C 3 2°B
78	61°06.5' 56°30.5'	61°14.3' 56°26.0'	19.35 - 21.40	14 01 89	1700	TR 1h45' (5.0nM)	NW +4°C 3 2°B DULL
79	61°14.7' 56°27.0'	61°14.7' 56°27.0'	22.00 - 22.15	14 01 89	419	TS	NW +4°C 3 2°B FOG
80	60°20.0' 56°34.2'	60°20.5' 56°35.2'	05.00 - 06.05	15 01 89	3880	TS	W 3-4 +4°C 2°B FOG
81	60°20.0' 54°28.3'	60°19.8' 54°28.2'	14.05 - 14.45	15 01 89	3800	TS	WNW +8°C 2 2°B FOG
82	60°49.2' 54°24.0'	60°53.1' 54°25.0'	18.10 - 20.25	15 01 89	1400	TR 1h55' (7.0nM)	SW +4°C 3 2°B FOG
83	60°54.5' 54°26.5'	60°54.3' 54°27.0'	20.50 - 21.20	15 01 89	696	TS	SW +3°C 2 2°B FOG
84	60°43.0' 55°58.0'	60°45.0' 55°59.8'	07.40 - 08.10	16 01 89	2800	TS	SW +3°C 2 2°B FOG

1	2	3	4	5	6	7		
85	60°58,1'S 55°51,0'W	61°08,0'S 55°56,2'W	12.25 – 15.45	16 01 89	200	TR 3h (10.0mM)	WNW 2 +3°C	1°B FOG
86	61°08,0' 55°56,2'	61°02,1' 55°57,5'	18.50 – 19.00	16 01 89	119	TS	NNE 2 +4°C	1°B FOG
87	60°57,3' 55°57,5'	60°57,6' 55°57,5'	18.50 – 19.00	16 01 89	330	TS	N 3 +5°C	2°B FOG
88	61°23,0' 55°58,6'	61°23,1' 55°59,4'	22.50 – 23.15	16 01 89	412	TS	E 2 +4°C	1°B mf
89	61°23,3' 55°19,0'	61°23,2' 55°18,8'	02.40 – 03.00	17 01 89	313	TS	ENE 4 +2°C	2°B
90	61°17,0' 55°48,8'	61°17,2' 55°48,9'	05.25 – 05.45	17 01 89	205	TS	ZM 1 +2°C	2°B DULL
91	61°01,1' 55°46,1'	61°00,5' 55°47,9'	10.00 – 10.20	17 01 89	172	TS	ENE 3 +1°C	3°B FOG
92	61°00,2' 55°52,9'	61°08,2' 55°06,8'	12.00 – 15.00	17 01 89	200	TR 3h (10.5mM)	ENE 3 +2°C	3°B FOG
93	61°08,0' 56°09,7'	61°09,5' 56°10,0'	15.00 – 15.20	17 01 89	200	TS	ENE 4 +3°C	3°B
94	61°09,2' 56°04,1'	61°09,5' 56°10,0'	16.30 – 19.45	17 01 89	200	TR 3h (10.5mM)	ENE 4 +3°C	3°B SUN
95	61°09,0' 56°11,0'	61°10,1' 56°10,5'	20.15 – 20.45	17 01 89	335	TS	ESE 6 0°C	3°B SUN
96	61°08,5' 56°06,0'	61°04,0' 55°57,0'	21.25 – 23.45	17 01 89	187	TR 1h40' (4.7nM)	ESE 6 0°C	3°B SUN
97	61°03,9' 55°57,0'	61°04,0' 55°59,1'	00.00 – 00.35	18 01 89	248	TS	ESE 6 0°C	4°B

deciding role in these changes. The influence of pack-ice on the water column is evident in the surface layer, and depends on drift, melting and season. The pack-ice/open water zone is an area with a great concentration of organic matter. This is true in the surface layer just under the ice (krill), in the ice (flora), on the ice (seals), and in the air (birds). This causes a considerable quickening of the organic material and energy cycles in this part of the ecosystem.

The sea-ice zone is a transient fragment of the ecosystem and is different from subpack ice, subfast ice (Rakusa-Suszczewski 1972) and from the open water.

In the area of our researches between Elephant Island and South Orkney Islands two different water masses were found:

1. Weddell-Scotia Front (stations: 26, 27, 28, 29);
2. Weddell-Scotia Confluence (rest of the stations).

The hydrographic, bacteriological, phyto/zooplankton including ichtioplankton and hydroacoustic researches confirmed three areas which can be distinguished: western, austral and eastern.

The higher biomass of chlorophyll/phytoplankton and krill concentrations were found in the eastern part of our investigation areas. It can be as a results of water eddies near north/western part of South Orkney shelf, melting of ice, higher (T/S) stratification of the water column and higher NH_4 concentration (cf. EPOS—results) as well. The physical factors are responsible for creation of such hydrobiological situation.

References

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Received September 5, 1990

Revised and accepted October 15, 1991

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