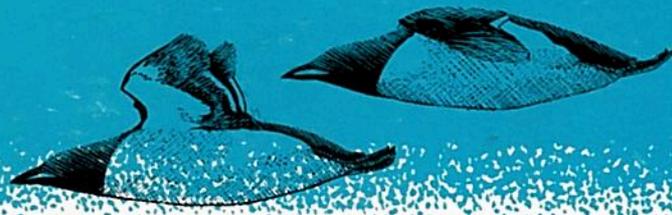


Polish Academy of Sciences
Institute of Oceanology
Institute of Ecology



ATLAS

of the Marine Fauna of Southern Spitsbergen

SUPPLEMENT

Seabirds distribution in
the Barents and Greenland
Seas, during the summer
seasons, 1991-1995

Atlas of the Southern Spitsbergen Marine Fauna

ed. R.Z. Klekowski, J.M. Węslawski

supplement - Seabirds distribution in the Barents and Greenland Seas, during the summer seasons, 1991-1995.

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Seabirds distribution in the Barents and Greenland Seas, during the summer seasons, 1991-1995.

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Introduction

Marine waters are differentiated considerably, both vertically and horizontally, with regard to the physical and chemical parameters. Those areas where different water masses meet, i.e. fronts, are of special ecological importance. On a short time-scale, a front may physically concentrate zooplankton at or near the surface. On a longer scale, it may concentrate nutrients, and thus enhance biological productivity in the area. Primary productivity, the abundance of chlorophyll and several other biological indices are usually higher in such areas. As a consequence, most of the zooplankton species, small pelagic shoaling fish and representatives of higher trophic levels, including seabirds are patchy in their distribution. Recent studies have shown that seabirds are virtually absent from large areas and concentrate at those food abundant.

Because of the non uniform distribution and mobility, many pelagic crustacean and surface-shoaling fish populations are extremely difficult and expensive to sample and monitor directly using traditional fishing gear or scientific equipment. As highly mobile, abundant and conspicuous (easy to observe) predators feeding principally on that type of prey, seabirds can be used as an effective sampling tool providing information on marine foods, reflecting changes in densities, spatial and temporal distribution of prey populations. Of course, like other marine sampling devices, seabirds reflect availability of prey rather than its absolute abundance. However, in most circumstances, food availability is correlated with absolute food abundance.

The use of seabirds as monitors of prey stocks is only possible at a very crude level and require detailed research into the relationships between the particular prey species and seabird populations. Avian data can be used to assess local productivity and trophic changes in marine ecosystems. They provide inexpensive, catch independent information complementing the traditional catch data. Integration of the marine ornithology into multi-disciplinary, oceanographic research programs should result in better understanding of the marine ecosystems.

Seabird counting is a relatively simple method which doesn't need any complicated equipment but good field experience of the observers. Standard methods of counting and data recording make comparison of the results obtained by different observers in different areas and seasons possible.

This report presents data collected in the areas close to three Arctic archipelagos - Svalbard, Franz Joseph Land and Novaya Zemlia. Our earlier faunistic studies concentrated in the region of southern Spitsbergen. Now we are fully aware that several ecologically important birds and mammals occurring there, undertake long seasonal (breeding) and even diurnal (foraging) migrations over vast areas of the Greenland and Barents seas. Population ranges of polar bears, walruses, fulmars and may be also some gull and auk species contain the whole area considered in this report.

A general assumption of this paper was to elaborate and present data in such a way they could be used by both oceanographers and ornithologists for their own purposes (compilations, syntheses, etc.).

Lech Stempniewicz

Jan Marcin Węslawski

Study

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Study area

Study area comprising eastern part of the Greenland Sea and almost entire Barents Sea, was divided into 42 squares 60 NM high and 60 NM wide (Fig. 1).

Sea ice is restricted during summer to the northernmost parts of the area. Minimal ice extent is observed in late July and August (Fig. 2).

Complicated hydrological situation and high interannual variability, makes necessary to simplify the general hydrological set up for the purpose of seabirds distribution presentation. Using the simplified water masses map (compiled by Koszteyn et al 1995) one can define five basic types of water masses (Fig. 3). The Polar Water (PW) originates in Central Arctic Basin, Arctic Water (ArW) is a mixture of Polar Water and North Atlantic Water (NAW) found over the deep Greenland Sea. Similar mixing over Barents Sea shelf results in Barents Sea Water (BsW). The belt of nearshore waters of Northern Scandinavia and southernmost Barents Sea is defined as Coastal Water (CW).

Table 1. Water masses characteristic, compilation from Koszteyn et al (1995)

Name	Abbrev.	Temperature range (°C)	Salinity (ppt)
North Atlantic Water	NAW	> 3	> 35
Coastal Water	CW	> 2	< 34.7
Polar Water	PW	< 0	34.3 - 34.8
Arctic Water	ArW	-1.8 - + 5	34.7 - 34.9
Barents Sea Water	BsW	-1.5 - + 2	34.7 - 35

Materials

Ornithological studies were carried out during eight scientific arctic cruises in the summer seasons 1991-1995. Data were collected during four cruises of s/y "Oceania" to Spitsbergen in June-August 1991-1995 (AREX 91-95). Moreover, the observers worked during the arctic cruises of r/v "Pomor" (Spitsbergen-Franz Joseph Land, August-September 1991-1993), and of the r/v "Dalnye Zelentzy" and "Ivan Kireev" (Novaya Zemlya- Franz Joseph Land, August-September 1992-1993).

All these cruises were the part of the international scientific project "RUS/NOR/POL - Coastal marine ecosystems of Franz Joseph Land and Svalbard", coordinated by Murmansk Marine Biology Institute, Norwegian Polar Institute and Institute of Oceanology PAS. Data compilation and form of their presentation were discussed during the international workshop of the "Murmansk Coordinative Committee" held in Hel Marine Station, University of Gdańsk in autumn 1993.

Methods

Seabird counting was based on standard methods described by Tasker et al. (1984). Those parts of the paper concerning particular cruises contain details of the methods used. In general, all data collected were calculated for 0.5 hour periods of observations. Tables and maps present seabird densities (number of birds per 5 square nautical miles) recorded on the route of the ship. Distribution of the four most common seabird species (fulmar *Fulmarus glacialis*, kittiwake *Rissa tridactyla*, guillemots *Uria spp.* and little auk *Alle alle* (or Auks in some cruises) - assigned as "main group" is presented both in tables and maps. Distribution of other species is presented in tables and in some instances also on maps, depending on their number during the particular cruise. The source data, stored on the discettes in EXCEL for PC are available from the editors upon request.

The following abbreviations of the seabird species are used in the paper:

Main group:

AALL - *Alle alle*, little auk;

FGLA - *Fulmarus glacialis*, fulmar;

RTRI - *Rissa tridactyla*, kittiwake;

USPE - *Uria spp.*, guillemots.

Other species:

CGRY - *Cephus grylle*, black guillemots;

FARC - *Fratercula arctica*, puffin;

GSTE - *Gavia stellata*, red-throated diver;

LHYP - *Larus hyperboreus*, glaucous gull;

PEBU - *Pagophila eburnea*, ivory gull;

SLON - *Stercorarius longicaudatus*, long-tailed skua;

SPAR - *Stercorarius parasiticus*, arctic skua;

SPOM - *Stercorarius pomarinus*, pomarine skua;

SSPE - *Stercorarius spp.*, skuas (except of great skua);

STPA - *Sterna paradisaea*, arctic tern;

SMOL - *Somateria mollissima*, common eider;

ULOM - *Uria lomvia*, Brunnich's guillemot;

UAAL - *Uria aalge*, common guillemot.

References

- Aebischer N.J., Coulson J.C. and J.M. Colebrook 1990. Parallel long-term trends across four marine trophic levels and weather. *Nature* 347: 753-755.
- Ashmole N.P. 1971. Seabird ecology and the marine environment. In: *Avian Biology*, Vol. 1. (D.S. Farner, J.K. King, K.C. Parkes, eds.). Academic Press, New York, pp. 224-286.
- Bowman M.J. and W.E. Esaias (eds.) 1978. *Oceanic fronts in coastal processes*. Springer Verlag, New York.
- Brown R.G.B. 1980. Seabirds as marine animals. In: *Behavior of Marine Animals* (J. Burger, B.L. Olla and H.E. Winn, eds.). Plenum Press, New York, pp. 1-39.
- Brown R.G.B. 1988. Oceanographic factors as determinants of the winter range of the dovekie *Alle alle* off Atlantic Canada. *Colonial Waterbirds* 11: 176-180.
- Cairns D.K. 1987. Seabirds as indicators of marine food supplies. *Biol. Oceanography* 5: 261-271.
- Camphuysen K. (ed) 1993. *Birds and marine mammals in Svalbard, 1985-91*. Sula 7, 3-44
- Croxall J.P. 1987. *Seabird feeding ecology and role in marine ecosystems*. Cambridge Univ. Press, Cambridge.
- Furness R.W. and D.N. Nettleship 1991. Seabirds as monitors of changing marine environments - introductory remarks. *Acta XX Congr. Intern. Ornith.* 20: 2239-2240.
- Gjertz I, Morkved B (eds) *Results from Scientific cruises to Franz Josef Land*. Medd. om Norsk Polarinstitut 126, 1-30
- Hunt G.L. Jr. 1991. Marine birds and ice-influenced environments of polar oceans. *J. Mar. Syst.* 2: 233-240.
- Hunt G.L. Jr., J.F. Piatt and K.E. Erikstad 1991. How do foraging seabirds sample their environment? *Acta XX Congr. Intern. Ornith.* 20: 2272-2279.
- Isachsen K, Bakken V. 1995. Seabird populations in the Northern Barents Sea. *Meddelelser om Norsk Polarinstitut* nr 135, 134pp
- Joiris C. 1983. Winter distribution of seabirds in the North Sea: An oceanographical interpretation. *Le Gerfaut* 73: 107-123.
- Klekowski R.Z, Węśławski JM (eds) 1990. *Atlas of the marine fauna of Southern Spitsbergen*. Vol.1 Vertebrates. Ossolineum, 284pp
- Koszteyn J, Węśławski J.M, Timofeev S, Malinga B. 1995. Size structure of *Themisto abyssorum* Boeck and *Themisto libellula* (Mandt) in European Arctic Seas. *Polar Biology* 15, 85-92
- Mehlum F, Fjeld P.E. 1987. *Catalogue of seabird colonies in Svalbard*. Norsk Polarinstitut Rapportserie nr 35
- Mehlum F. 1989. Summer distribution of seabirds in northern Greenland and Barents Seas. *Norsk Polarinst. Skr.* 191, 5pp
- Mehlum F., 1990. Seabird distribution in the northern Barents Sea marginal ice-zone during late summer. *Polar Res.* 8: 61-65.
- Mehlum, F. 1988. Summer distribution of seabirds in northern Greenland and Barents Seas. *Norsk Polarinst. Skrifter* 191: 1-56.
- Norderhaug M., Brun E., Mollen G.U. 1977. Barentshavets sjofuglressurser. *Medd. Norsk Polarinstitut* 104: 1-119.
- Pingree R.D., Foster G.R. and G.K. Morrison 1974. Turbulent convergent tidal fronts. *J. Marine Biol. Assoc. UK* 54: 469-479.
- Stempniewicz, L. & Węśławski, J.M. 1992. Outline of trophic relationships in Hornsund fjord, SW Spitsbergen (with special consideration of seabirds). in: Opaliński, K.W. & Klekowski, R. Z. (eds.) *Landscape, life world and Man in High Arctic*. Warszawa, IE PAN, 271-298.
- Temple S.A. and J.A. Wiens 1989. Bird populations and environmental changes: can birds be bio-indicators? *American Birds* 43: 260-270.
- Vinje T. 1985. Drift, composition, morphology and distribution of the sea ice fields in the Barents Sea. *Norsk Polarinst. Skrifter* 179 C, 26 pp.
- Vinje T.E. 1975. Sea ice conditions in the European Sector of the marginal seas of the Arctic, 1966- 1975. *Norsk Polarinstitut Arbok* 1975, 163-174

Fig. 1. Observer effort (nr of hours) in each square 1991 - 1995 and squares numbers referred to table nr 1

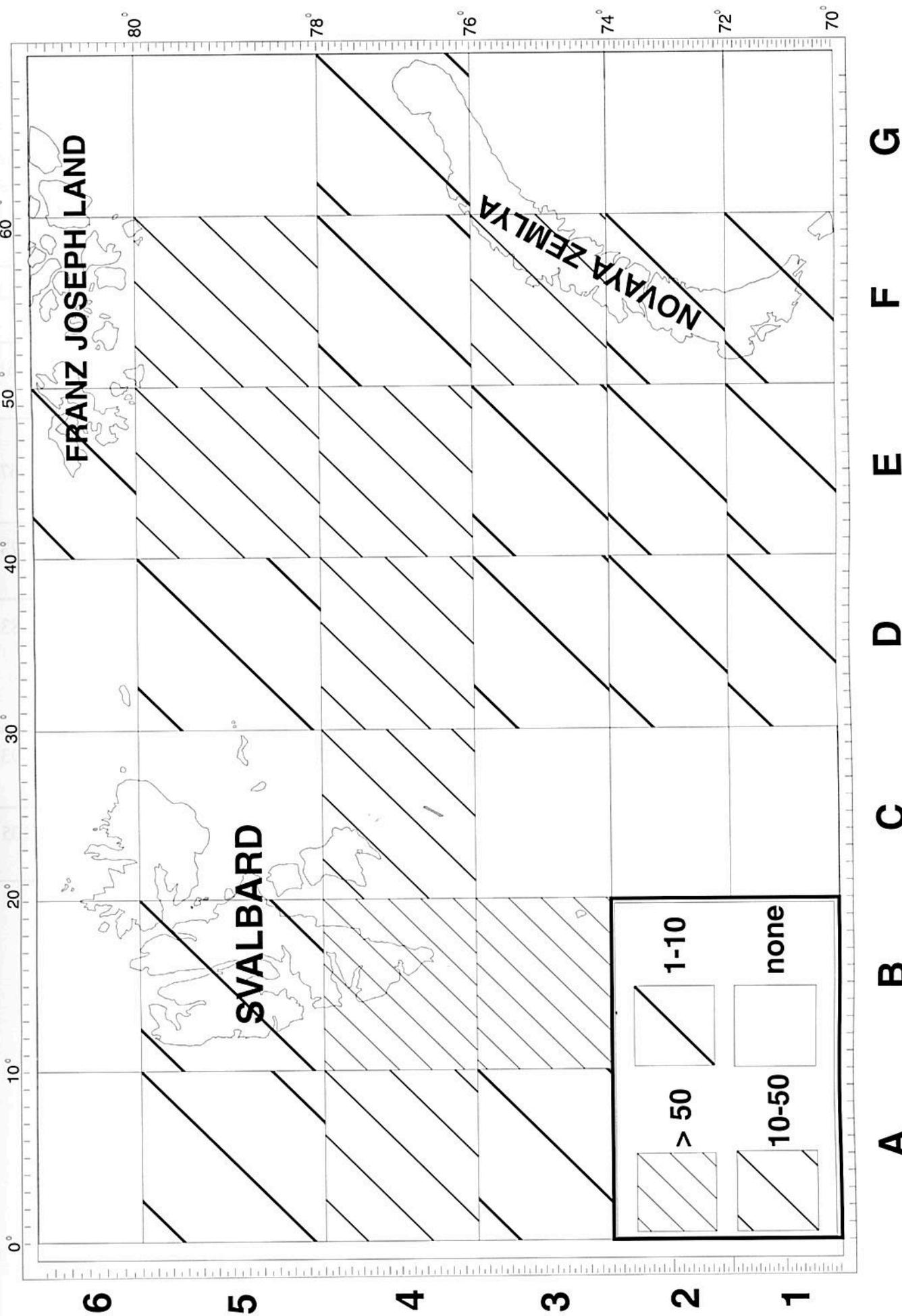


Table 1.

List of all cruises presented in publication

CRUISE	AUTHOR	OBSERVERS	TIME	AREA	PAGE
AREX'91	T. Postma	T.Postma	24.06-10.07	A:3,4; B:3-5	29
AREX'92	M.Malinga L.Stempniewicz	M.Malinga L.Stempniewicz	05.08-17.08	B:3-5; C4	41
AREX'93	M.Malinga	L.Kotwicki P.Wieczorek	07.07-16.07	A:3-5; B:3,4	53
AREX'94	M.Malinga	A.Jarocewicz M.Włodarska	05.07-22.07	A:3,4; B:3-5	61
AREX'95	M.Malinga	Z.Duris A.Legieżyńska P.Wieczorek	07.07-14.07	B:3,4	67
FJL'91	M.Skakuj	M.Skakuj	17.08-20.08	B4, C4, D:4, 5, E5, F5	73
FJL'92	L.Stempniewicz M.Malinga	L.Stempniewicz J.Węslawski L.Knutsen H.Strom	05.09-07.09	B4, C4, D4, E5, F5	83
FJL'93	L.Iliszko	L.Iliszko	12.08-31.08	D:1-3, E:1-5, F:4-6	93
NZEM'92	I.Pokrovskaya G.Tertitskii	I.Pokrovskaya G.Tertitskii	20.07-24.08	E:5,6, F:1-6, G4	105

Table 3

List of the sea birds observed during all cruises.

SPECIES	MONTH	AREA	CRUISE ¹	REMARKS
Fulmar <i>Fulmarus glacialis</i>	VI - IX	all in effort	all	max2: E1 - 21.07
Kittiwake <i>Rissa tridactyla</i>	VI - IX	all in effort except: D5	all	max: D1 - 21.50
Little Auk <i>Alle alle</i>	VI - IX	all in effort except: D 1-3, E 1-2	all	max: B4 - 32.24
Brünnich's Guillemot <i>Uria lomvia</i>	VI - IX	all in effort except: D5	all	max: E6 - 65.79
Black Guillemot <i>Cephus grylle</i>	VI - IX	all in effort except: A1, D:2,3,5, E:1-3, F4	all	max: E6 - 0.91
Puffin <i>Fratercula arctica</i>	VI - IX	all in effort except: A3, D:4,5, E:4,6, F:1, 4-6, G4	all except AREX' 91	max: E2 - 3.74
Razorbill <i>Alca torda</i>	VIII	E4	FJL' 93	1 bird
Arctic Tern <i>Sterna paradisica</i>	VIII	B:3,4, C4	AREX' 92	max: B3 - 0.11
Skua ³ <i>Stercorarius sp</i>	VI - IX	all in effort except: A: 3-5, E6	all except: AREX:93,95	max: E2 - 6.78
Glaucous Gull <i>Larus hyperboreus</i>	VI - IX	B:3-5, C4, D:3-5, E:4-6, F:1-6	all	max: B4 - 1.20 FJL'91: once in E5
Great black-backed gull <i>Larus marinus</i>	VIII	E1	FJL' 93	1 bird
Ross's Gull <i>Rhodosthetia rosea</i>	VIII	F4	FJL' 93	2 birds
Ivory Gull <i>Pagophila eburnea</i>	VIII, IX	E:4-6, F:5-6	FJL: 91-93, NZEM' 92	max: E6 - 3,64
Red-throated diver <i>Gavia stellata</i>	VIII	D1	FJL' 933	birds + <i>Gavia sp.</i> - 1 bird
Long-tailed Duck <i>Clangula hyemalis</i>	VIII	E4	FJL' 93	1 bird
Snow Bunting <i>Plectrophenax nivalis</i>	VIII	near Brady Isl. on FJL	FJL' 93	6 birds
Purple Sandpiper <i>Calidris minuta</i>	VIII	E2	FJL' 93	1 bird
<i>Arenaria interpres</i>	VIII	D2	FJL' 93	1 bird

1 - Include only cruises with verified informations, no information does not mean no observation.

2 - maximum number of birds/km²

3 - included: *S. longicaudus*, *S. pomarinus*, *S. parasiticus*, *S. skua*. For more details see Part II - disc data.

Table. 4. Number of birds/km*2 in all areas.

Area Number	FGLA	RTRI	USPE	AALL	FARC	SSPE	CGRY	LHYP	PEBU	STPA	ASPE	Total Time
A3	0,41	0,06	1,32	0,04	0,00	0,00	0,00	0,00	0,00	0,00	0,00	8h 40'
A4	1,38	0,65	1,40	2,09	0,02	0,00	0,03	0,08	0,00	0,00	0,00	13h 40'
A5	8,93	4,70	10,58	17,40	0,23	0,00	0,47	0,00	0,00	0,00	0,00	1h
B3	3,58	5,63	9,62	0,60	0,18	0,10	0,05	0,81	0,00	0,11	0,07	73h 50'
B4	5,52	8,31	25,17	32,24	0,41	0,06	0,05	1,20	0,00	0,06	0,13	99h 20'
B5	1,39	2,12	8,77	4,56	0,17	0,04	0,29	0,15	0,00	0,00	0,16	9h 40'
C4	3,89	6,55	4,98	4,85	0,17	0,20	0,41	0,36	0,00	0,01	0,00	21h 20'
D1	4,54	21,50	0,50	0,00	0,39	2,44	0,15	0,00	0,00	0,00	0,00	6h 30'
D2	17,48	5,01	2,64	0,00	1,85	3,03	0,00	0,09	0,00	0,00	0,00	8h
D3	12,49	17,26	2,23	0,00	3,37	3,06	0,00	0,07	0,00	0,00	0,00	5h
D4	18,63	7,89	7,50	1,63	0,00	0,70	0,01	0,30	0,00	0,00	0,00	13h 10'
D5	0,55	0,00	0,00	1,09	0,00	0,18	0,00	0,00	0,00	0,00	0,00	1h
E1	21,07	4,18	0,11	0,00	0,46	1,16	0,00	0,00	0,00	0,00	0,00	3h
E2	5,82	0,23	2,50	0,00	3,74	6,78	0,00	0,00	0,00	0,00	0,00	2h
E3	4,60	1,73	4,51	0,78	0,14	2,72	0,00	0,00	0,00	0,00	0,00	4h 30'
E4	13,61	7,03	36,78	5,87	0,00	1,82	0,05	0,19	0,05	0,00	0,00	11h 30'
E5	2,33	3,25	39,66	30,31	0,01	0,03	0,14	0,04	0,04	0,00	0,00	27h
E6	7,29	6,06	65,79	0,00	0,00	0,00	0,91	0,91	3,64	0,00	0,00	1h
F1	0,38	2,46	0,24	0,00	0,00	0,57	0,00	0,41	0,00	0,00	0,00	9h 30'
F2	1,74	9,81	34,37	0,00	0,35	0,32	0,17	0,03	0,00	0,00	0,00	6h
F3	2,50	1,03	36,70	13,54	0,01	0,38	0,07	0,03	0,00	0,00	0,00	18h
F4	1,73	1,69	7,81	10,21	0,00	0,52	0,00	0,08	0,00	0,00	0,00	5h 30'
F5	1,88	1,10	6,80	2,03	0,00	0,06	0,12	0,02	0,08	0,00	0,00	22h 30'
F6	2,44	2,85	6,61	1,56	0,00	0,04	0,07	0,08	0,18	0,00	0,00	10h
G4	1,27	9,93	20,22	22,76	0,00	0,03	0,23	0,00	0,00	0,00	0,00	6h 10'

Fig.2 Sea ice limit in summer (after Vinje).

Total Time
8h 40'
13h 40'
1h
73h 50'
99h 20'
9h 40'
21h 20'
6h 30'
8h
5h
13h 10'
1h
3h
2h
4h 30'
11h 30'
27h
1h
9h 30'
6h
18h
5h 30'
22h 30'
10h
6h 10'

**Fig.2 Sea ice limit in summer (after Vinje).
 MEANL- mean sea ice limit, MAXL- maximal sea ice limit.
 Minimal sea ice limit out of the map range.**

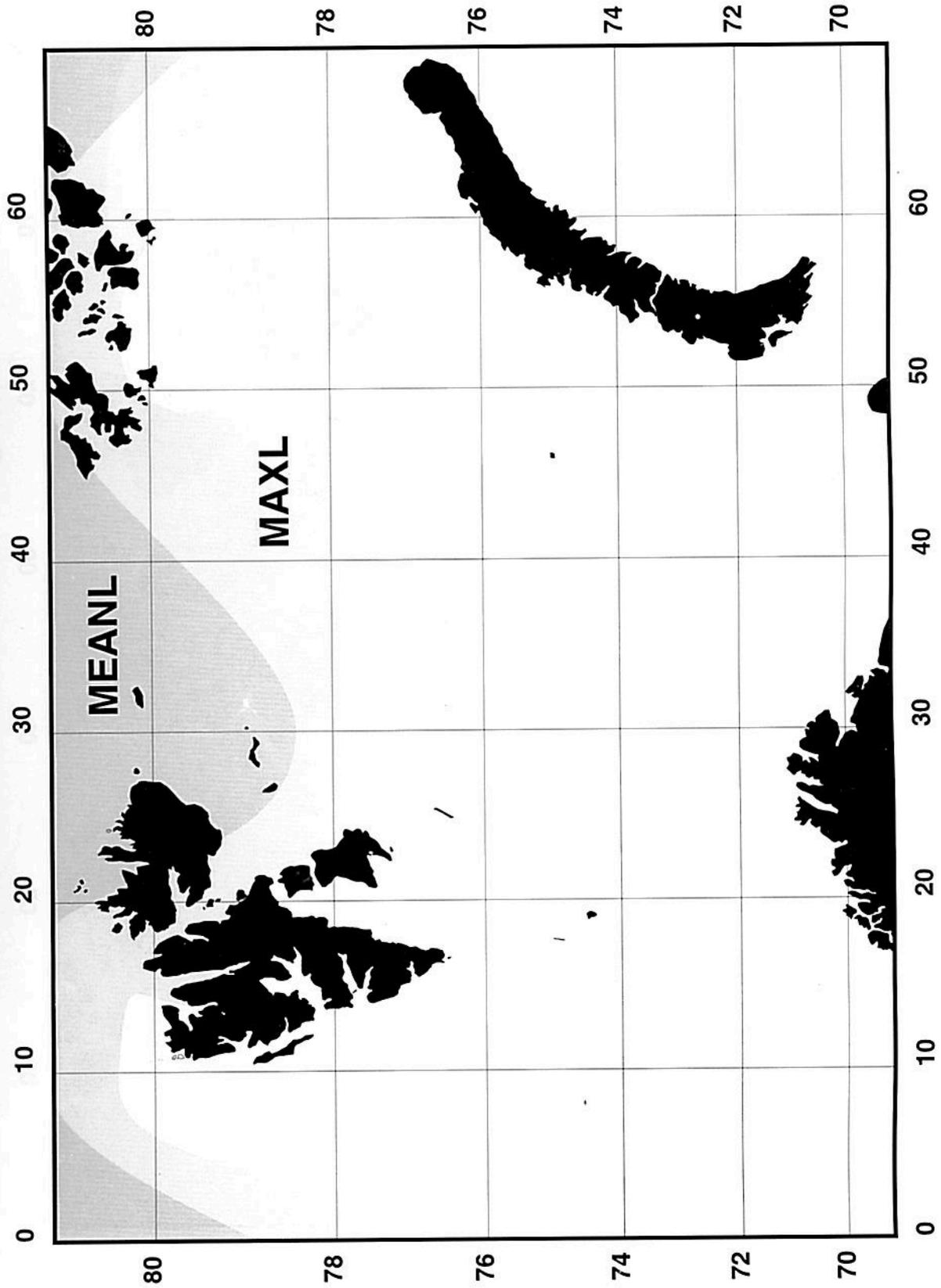


Fig.3 Water masses and fronts.
PW- Polar Water, AW- Arctic Water, NAW- North Atlantic Water,
BW- Barents Sea Water, CW- Coastal Water.

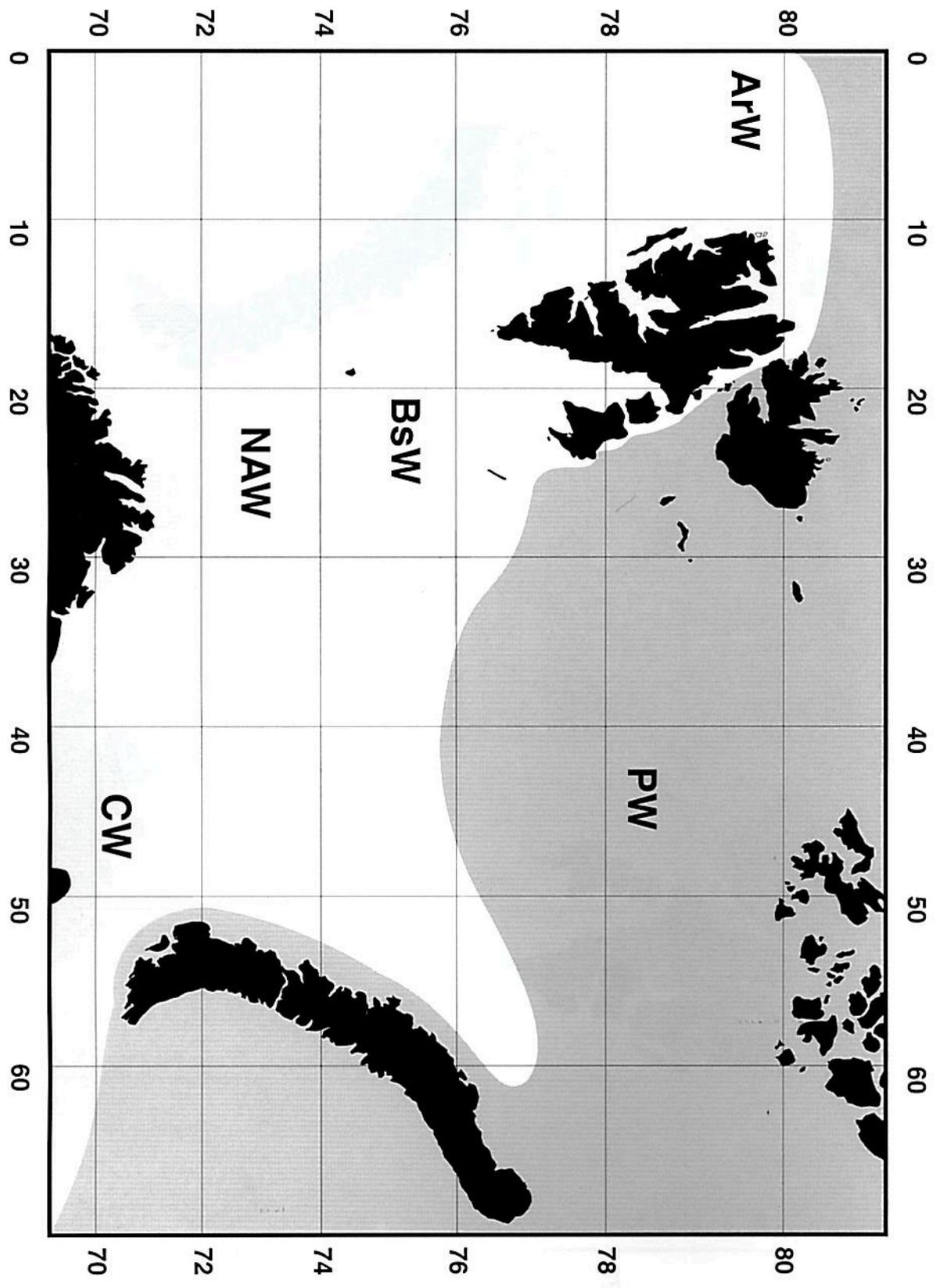


Fig.3 Water masses and fronts.

Fig. 4. Fulmarus glacialis (FGLA) - number of birds / 1km²

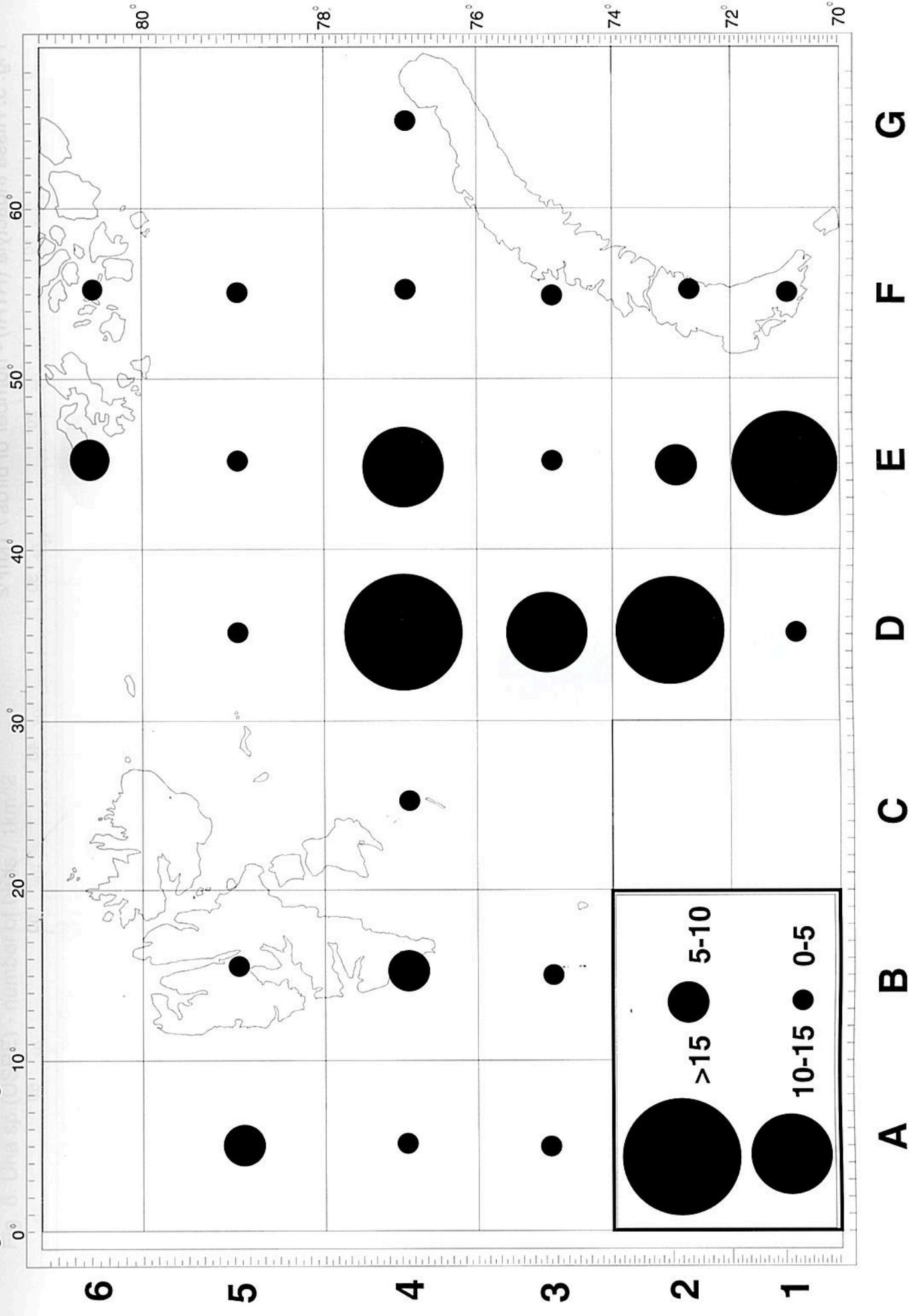


Fig. 5. *Hissa tridactylia* (HITH) - number of birds / 1km²

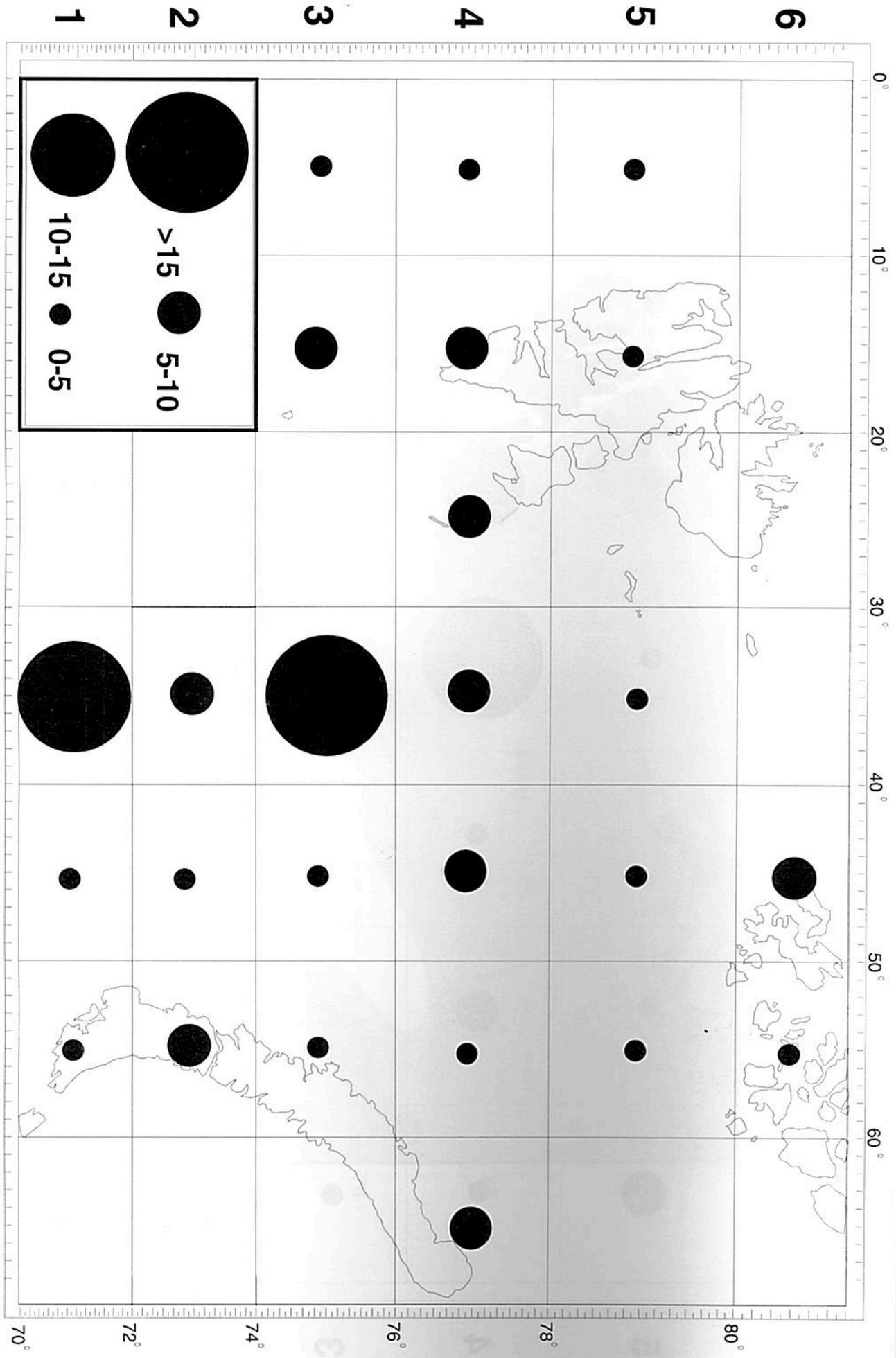


Fig. 6. *Uria sp.*(USPE) - number of birds / 1km²



Fig. 5. *Rissa tridactyla* (RTRI) - number of birds / 1km²

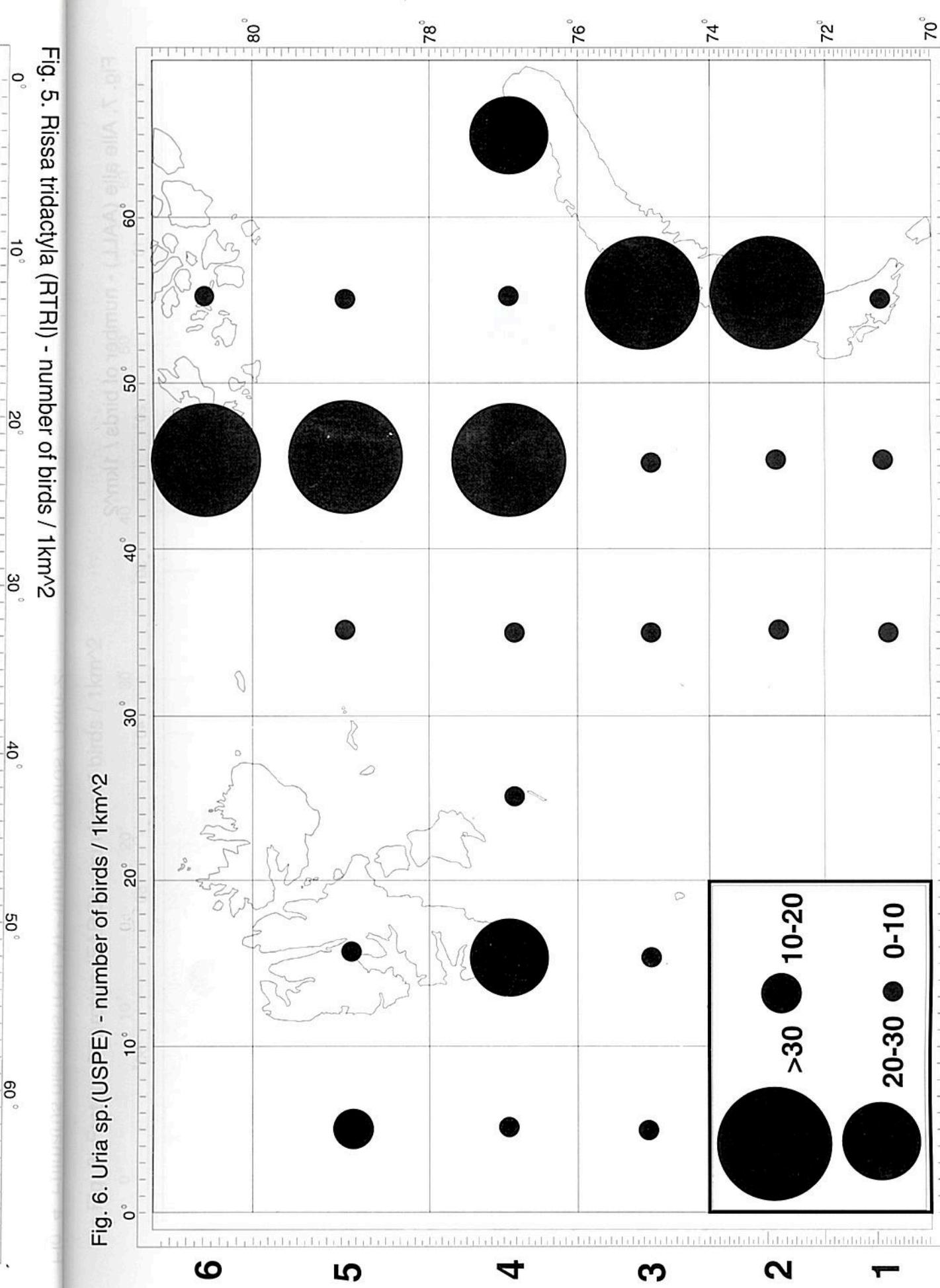


Fig. 6. *Uria* sp.(USPE) - number of birds / 1km²

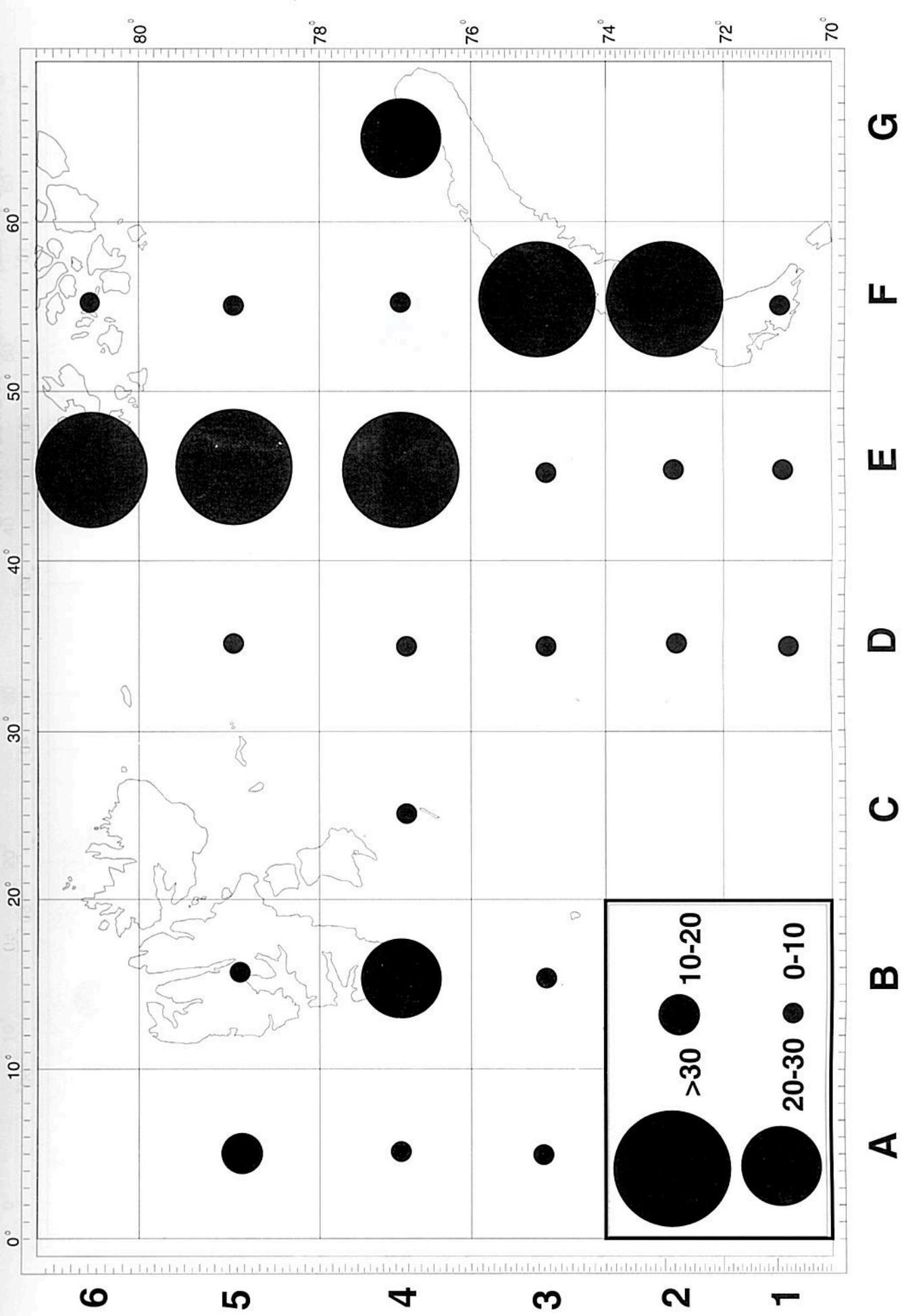


Fig. 7. Alle alle (AALL) - number of birds / 1km²

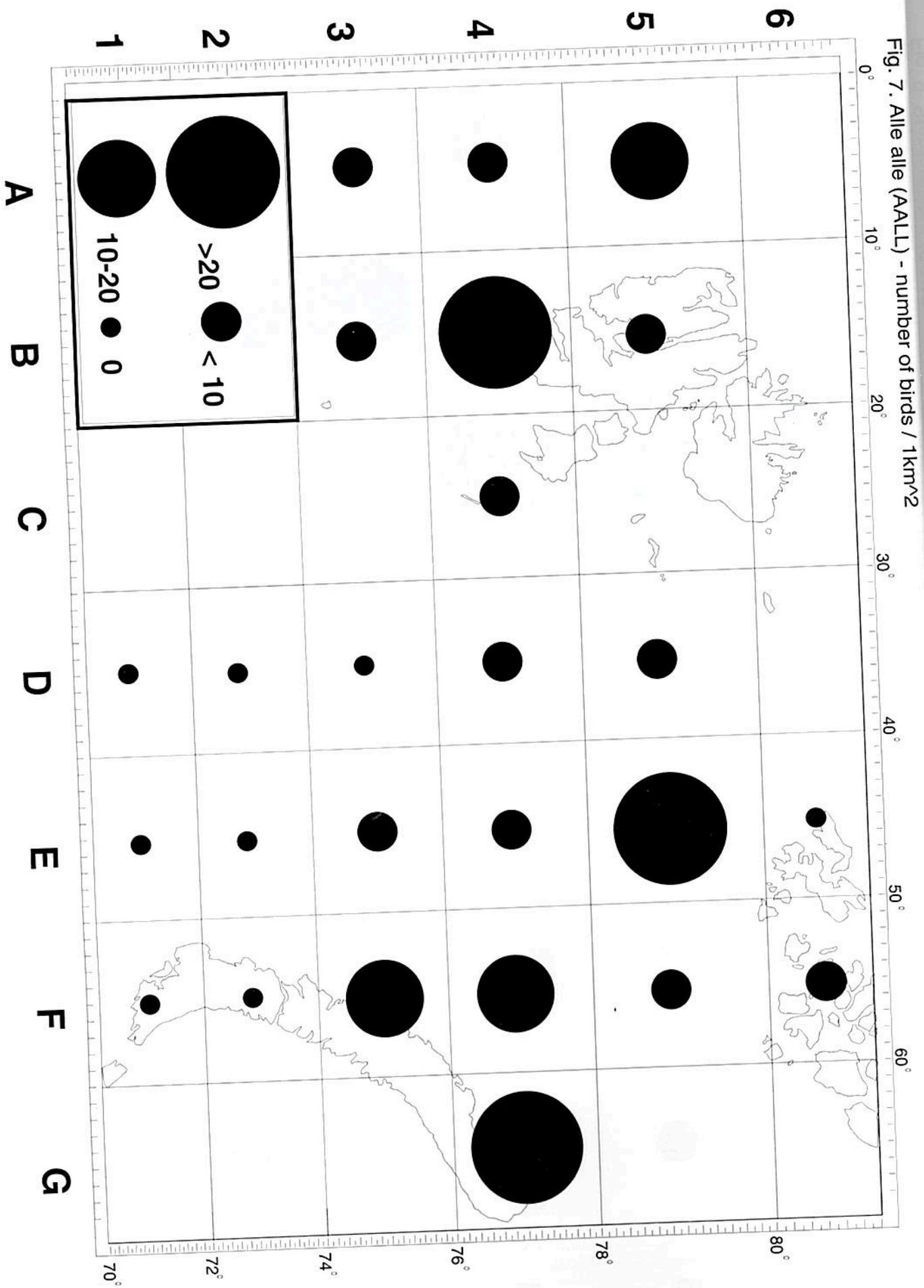


Fig. 7. Alle alle (AALL) - number of birds / 1km²

0° 10° 20° 30° 40° 50° 60°

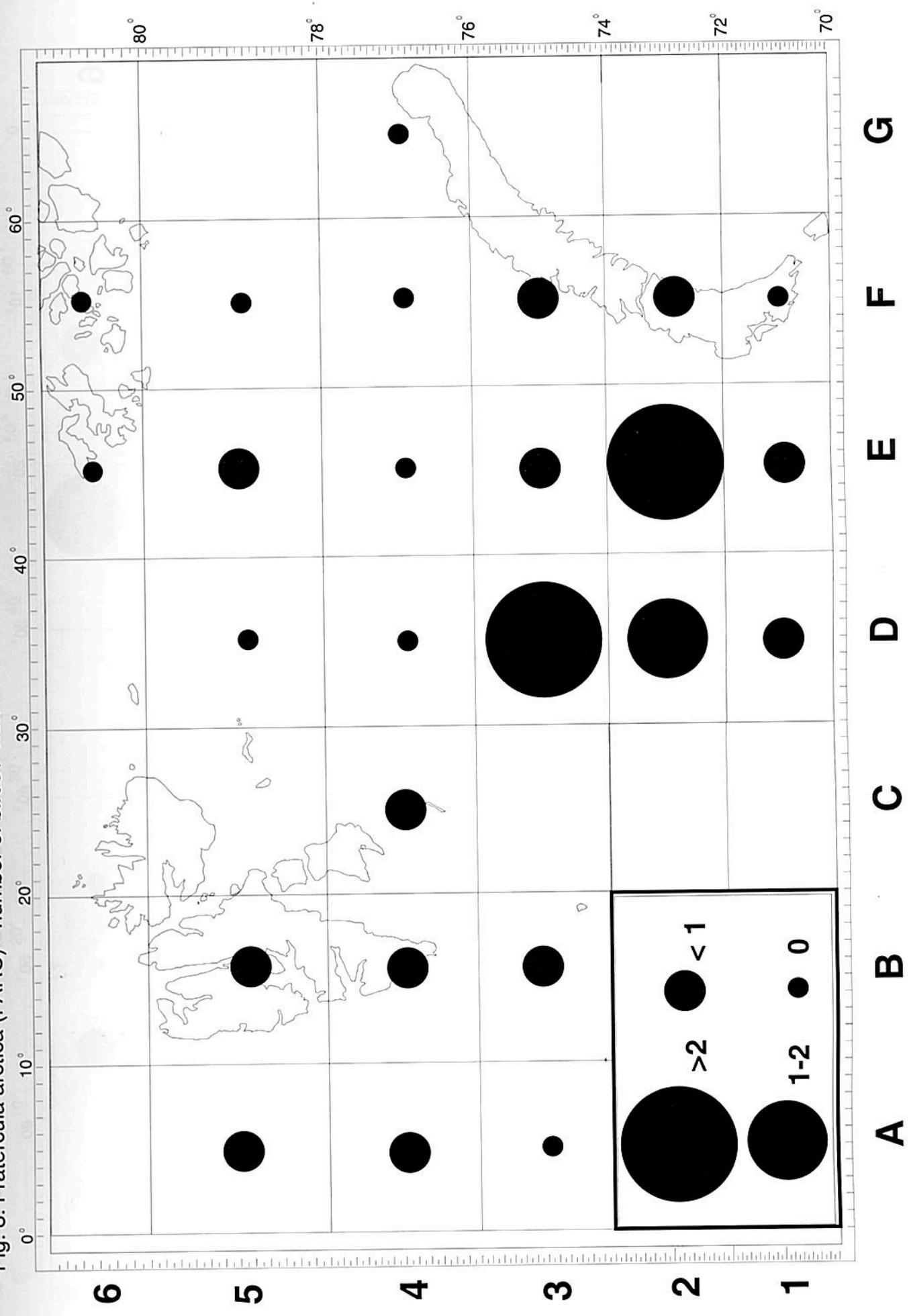


Fig. 9. Stercorariidae (SSPE = SPOM + SLON + SPAR + SSKU) - number of birds / km²

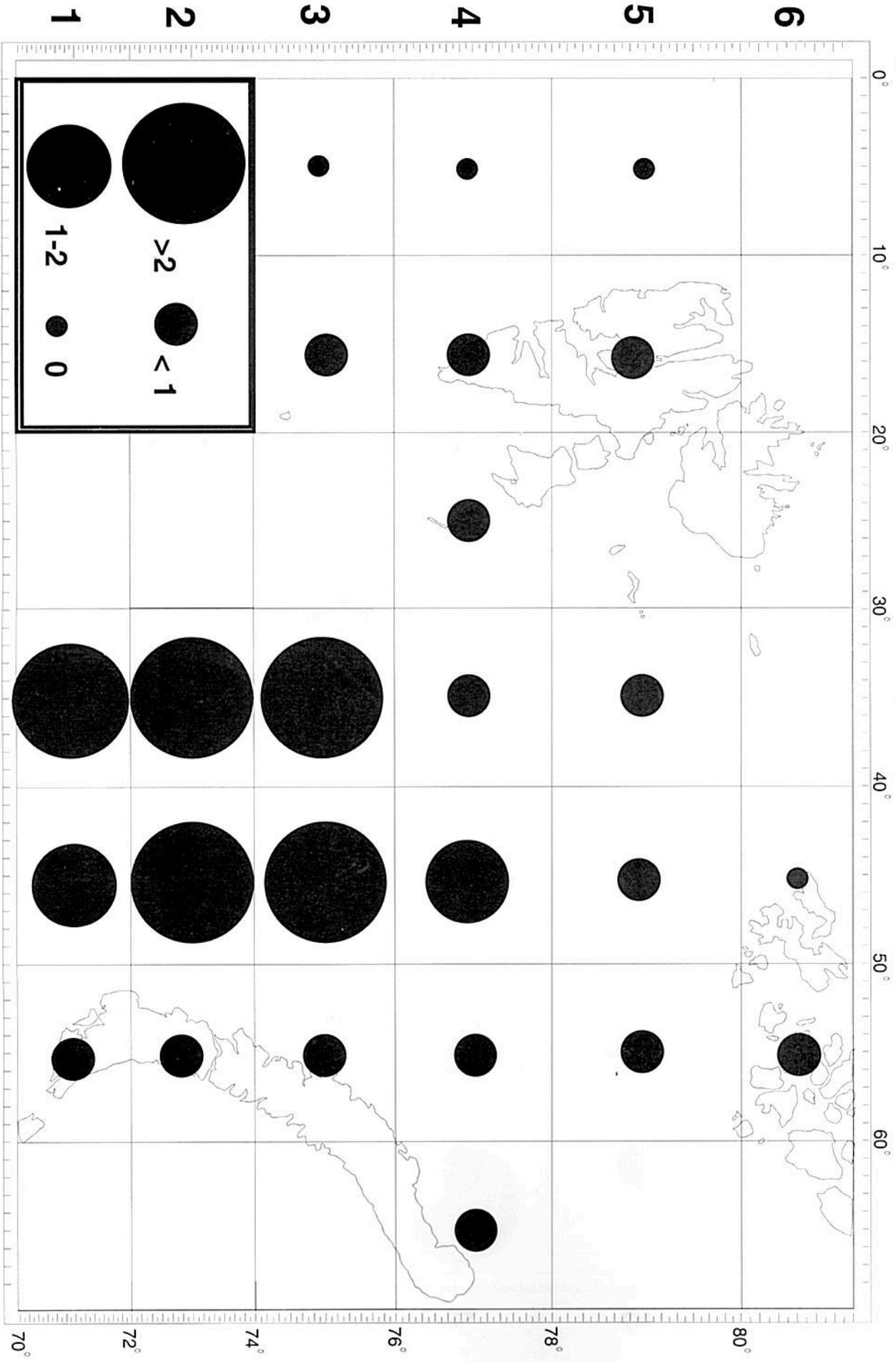


Fig. 10. Cepphus grylle (CGRY) - number of birds / km²

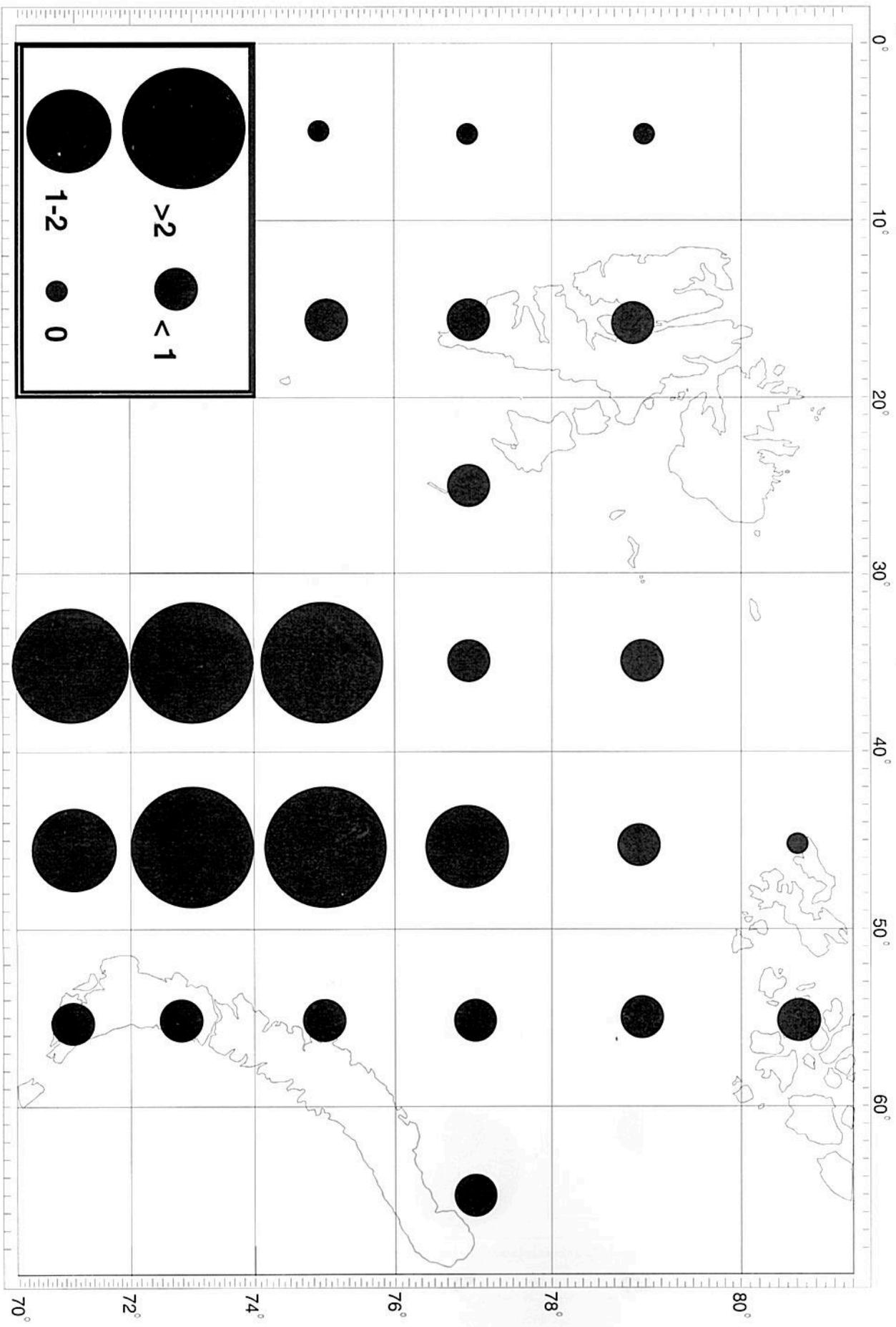


Fig. 9. Stercorariidae (SSPE = SPOM + SLON + SPAR + SSKU) - number of birds / 1km²

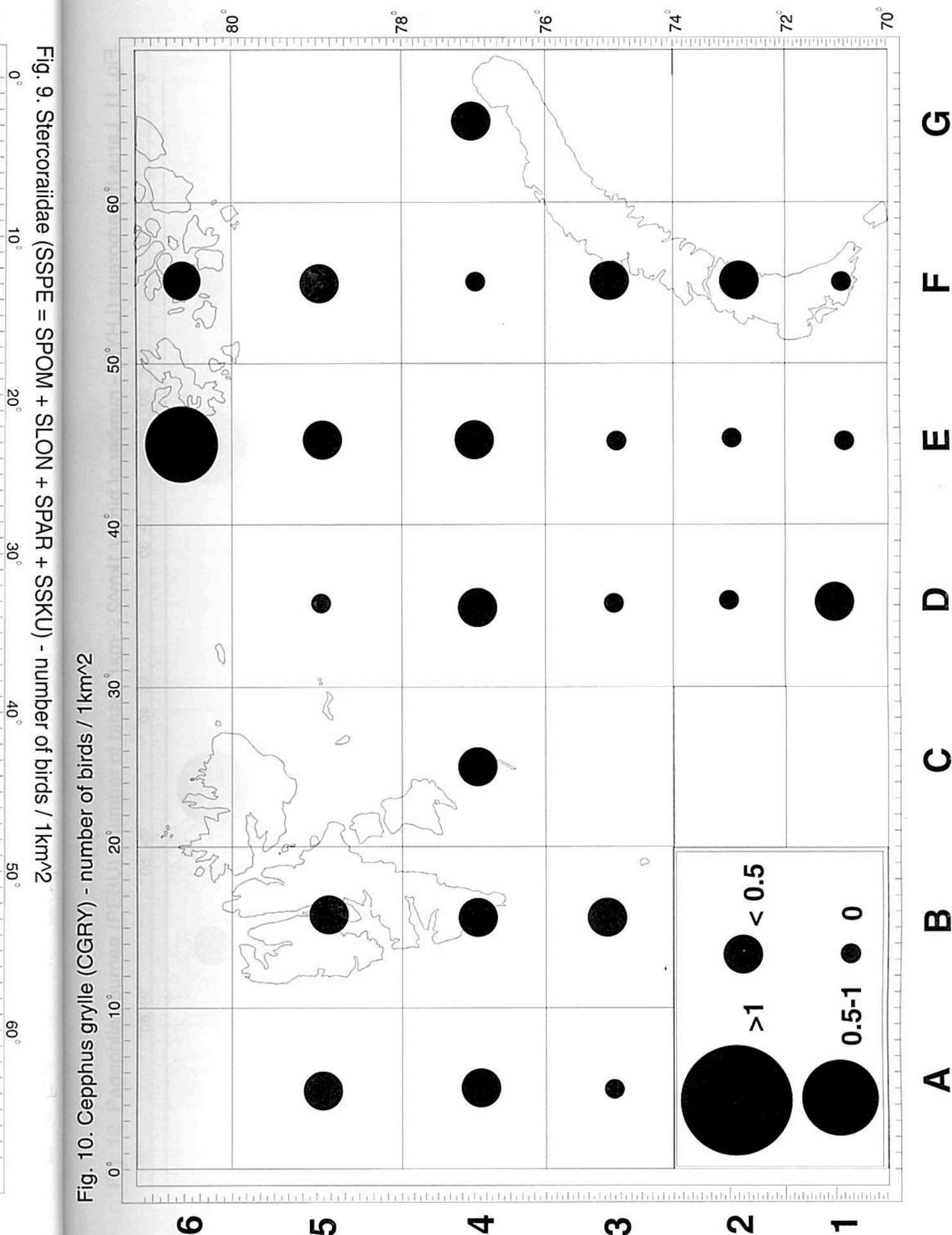


Fig. 10. *Cephus grylle* (CGRY) - number of birds / 1km²

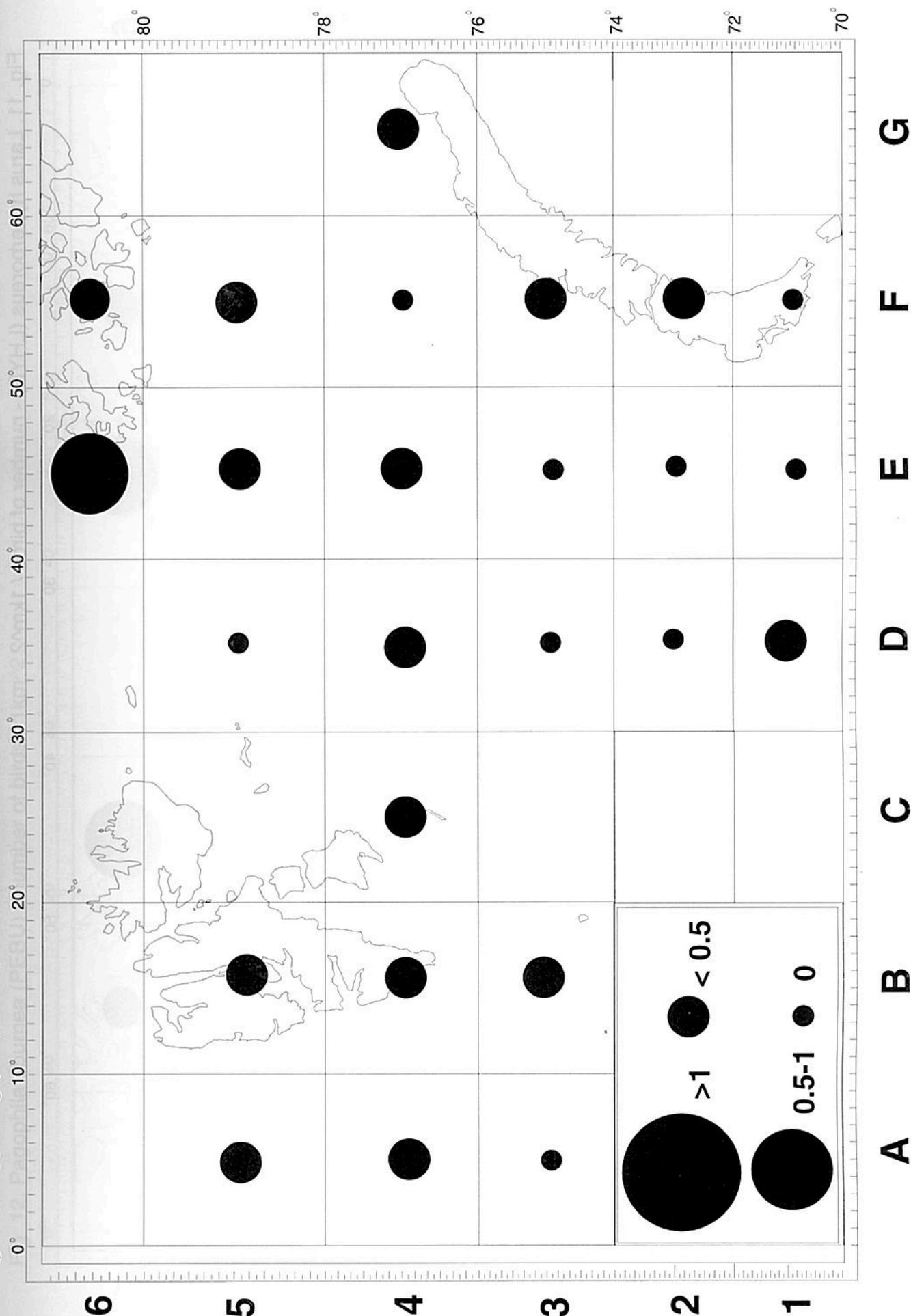


Fig. 11. *Larus hyperboreus* (LHYP) - number of birds / 1km²

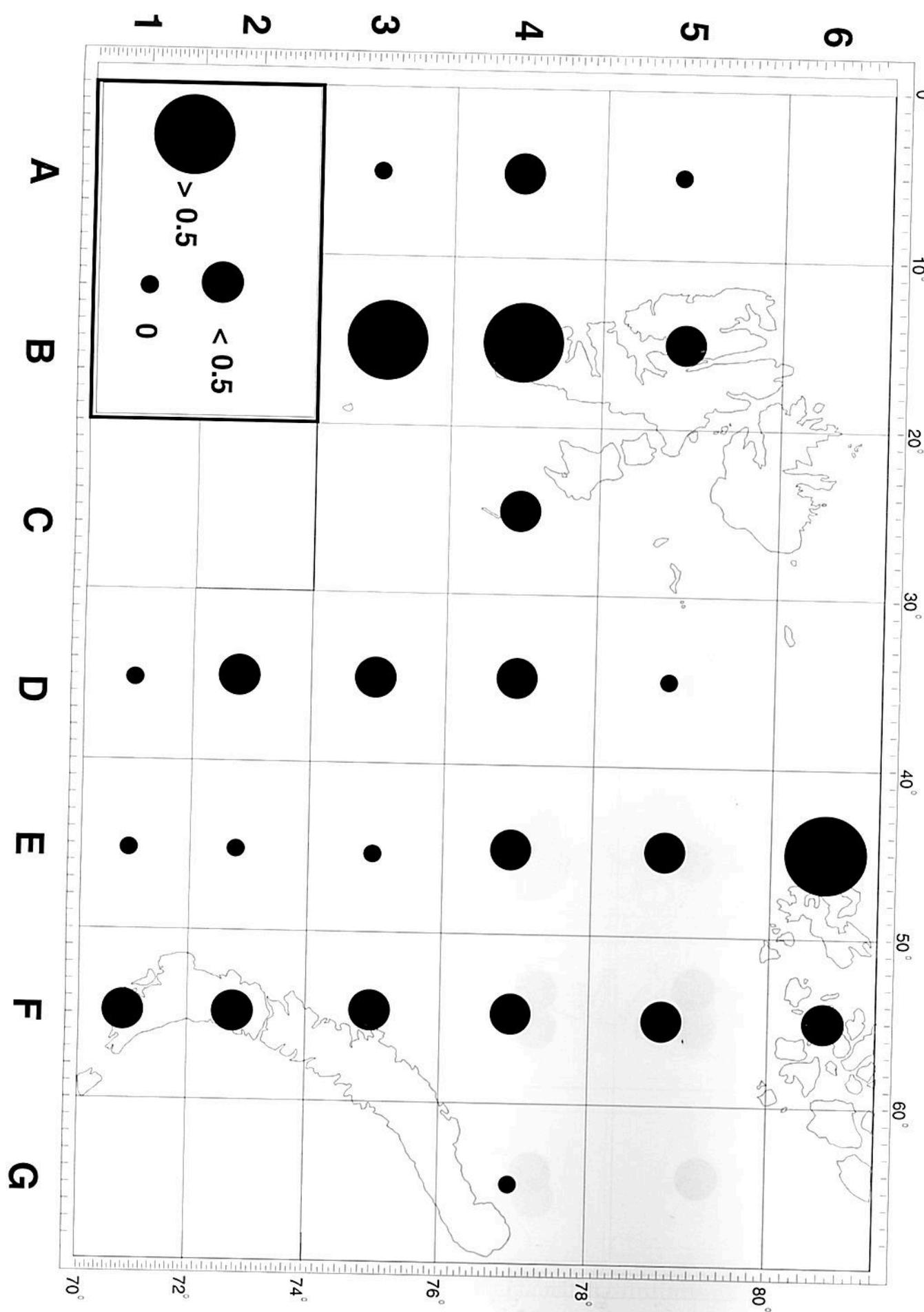


Fig. 12. *Pagophila eburnea* (PEBU) - number of birds / 1km²

Fig. 12. *Pagophila eburnea* (PEBU) - number of birds / 1 km²

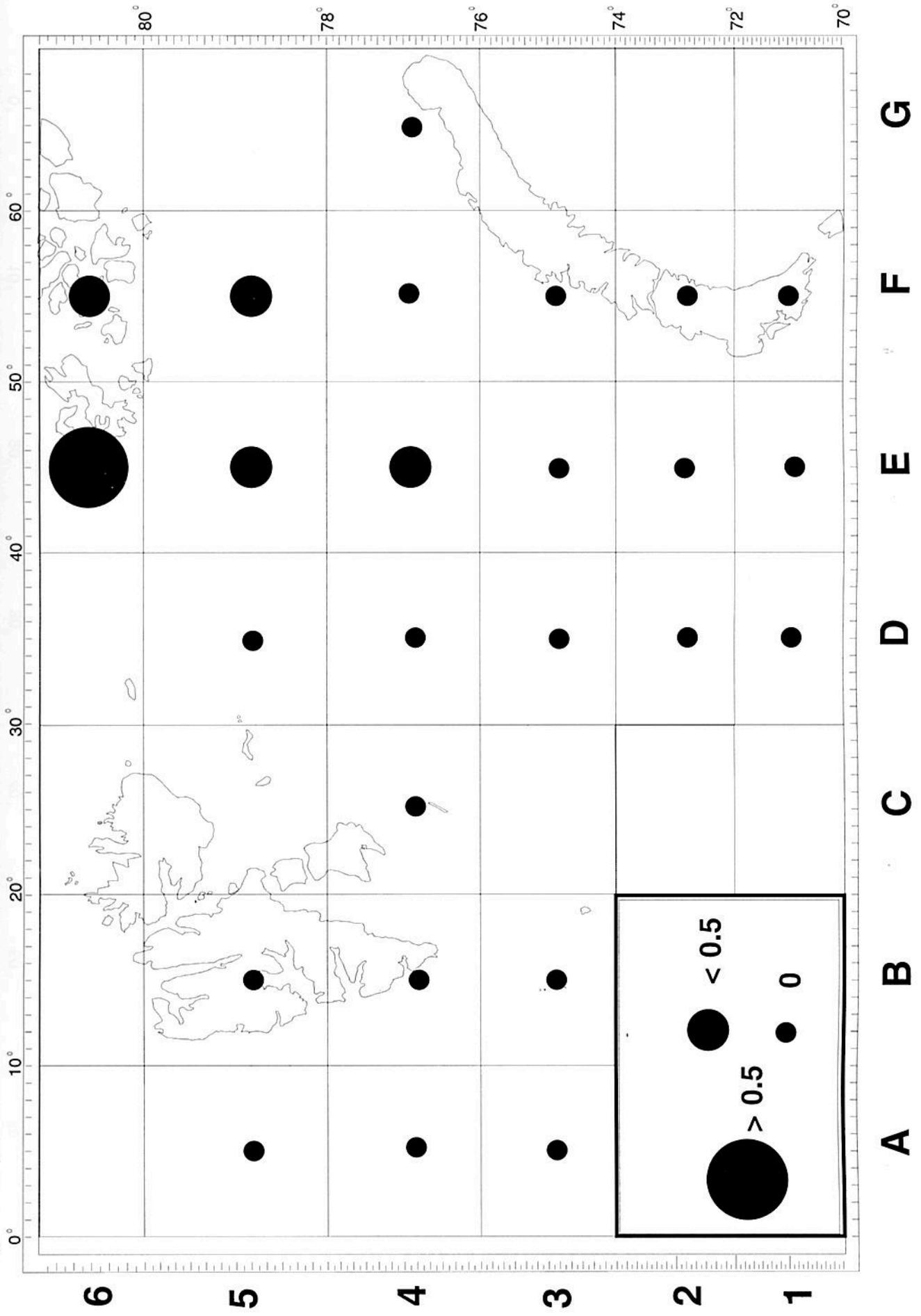
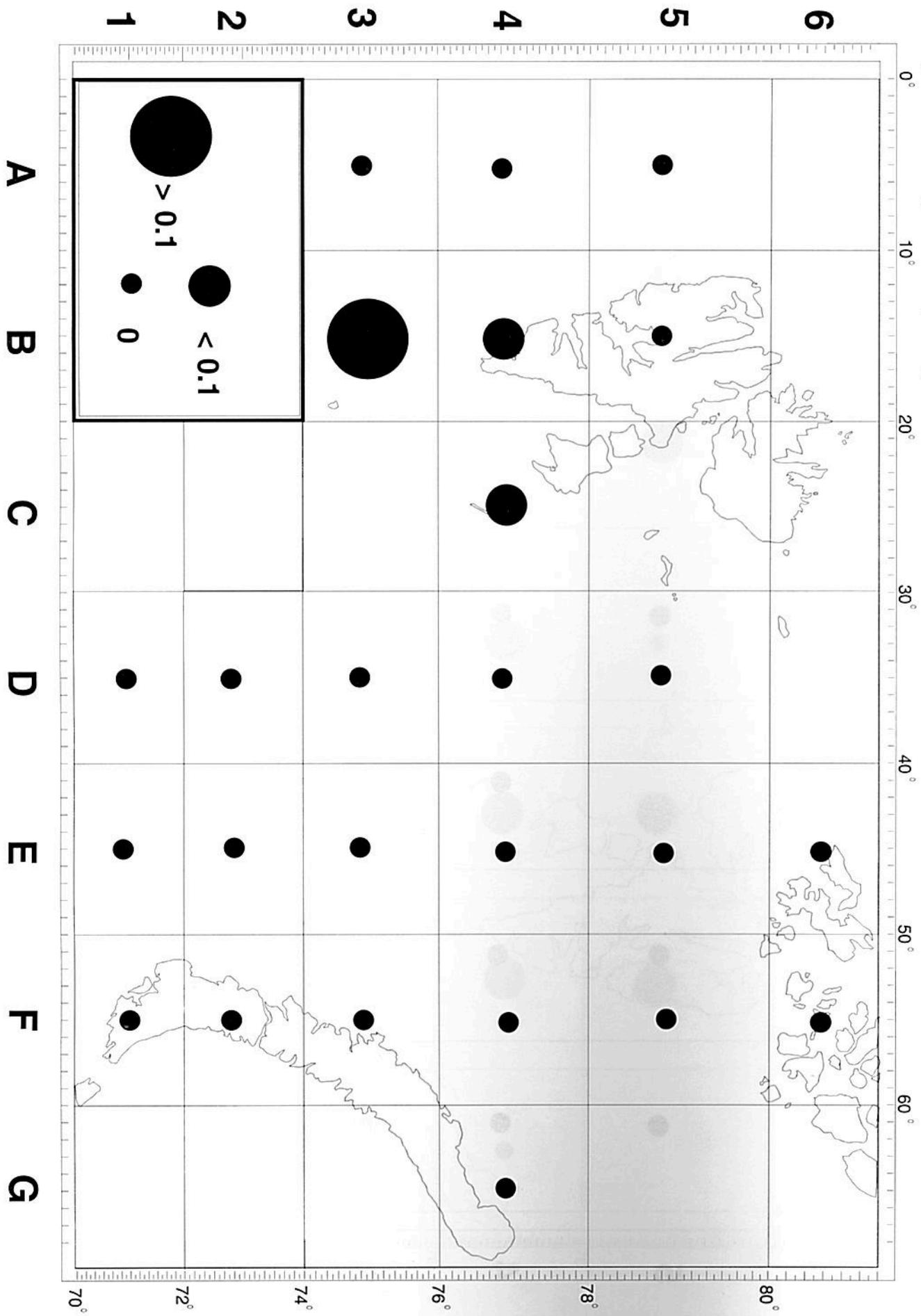


Fig. 13. *Sterna paradisaea* (STPA) - number of birds / 1km²



II

KEY SPECIES

Fig. 13. *Sterna paradisaea* (STPA) - number of birds / 1km²

**Seabird counting during the arctic cruise of s/y "Oceania"
from Bear Island to Spitsbergen (June - July 1991)
AREX'91**

**Theo Postma
Stichting Bonobo, Postbus 41139, 9701 CC Groningen, Netherlands**

Methods

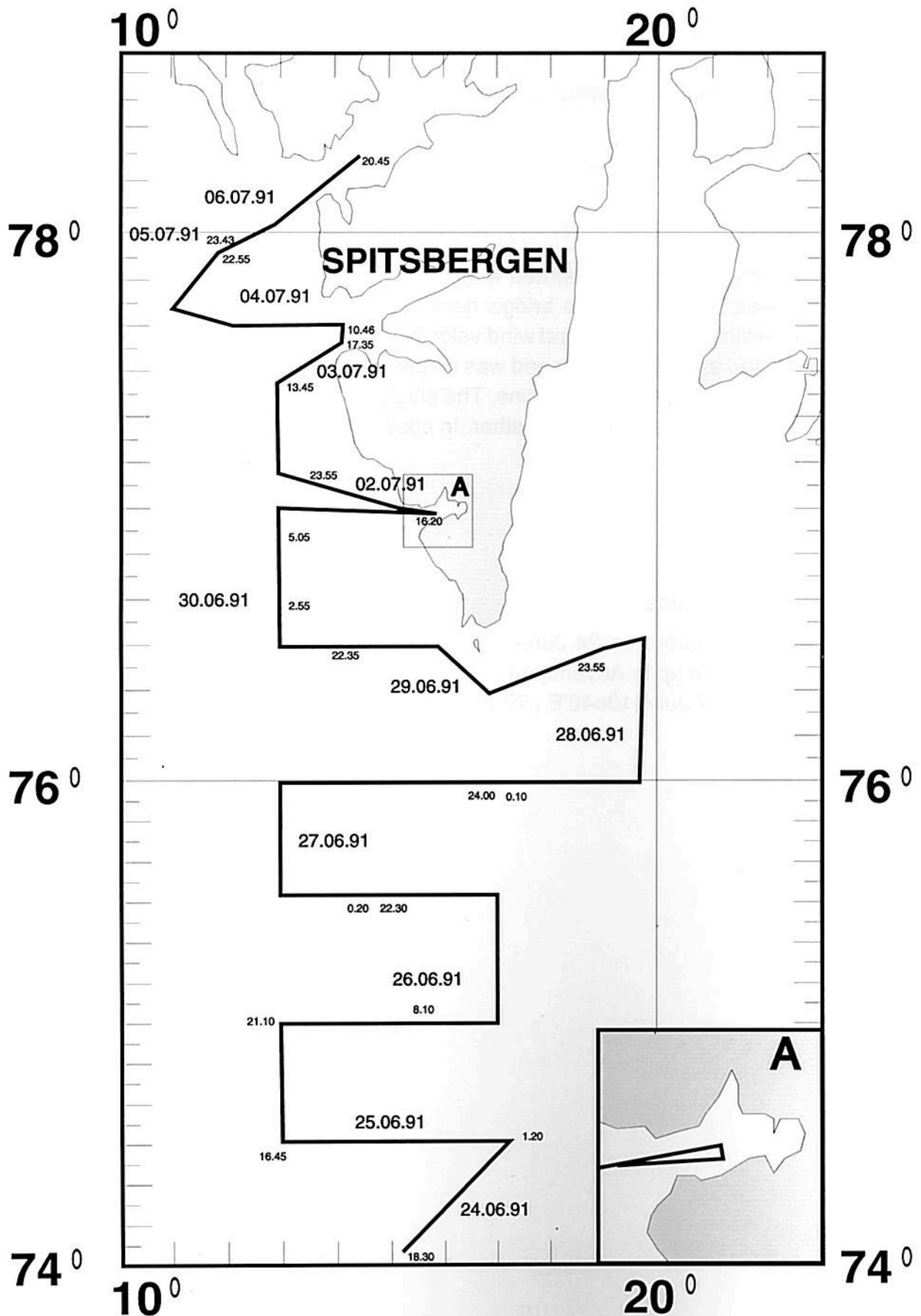
Sea birds and mammals were counted within 300 m zone by the one side of the ship. The observation point was situated on the bridge deck, about 4 m above the sea level. Weather conditions such as visibility, ice cover and wind velocity were noted during the observations. Each counting session lasted at least 0.5 hour and was divided into 10 minute periods. In total 73 hours and 10 minutes of the observations were done. The ship's speed was 4-10 knots. Flying birds and those sitting on the water were counted together. In case of fulmars a proportion of light and dark variants was noted.

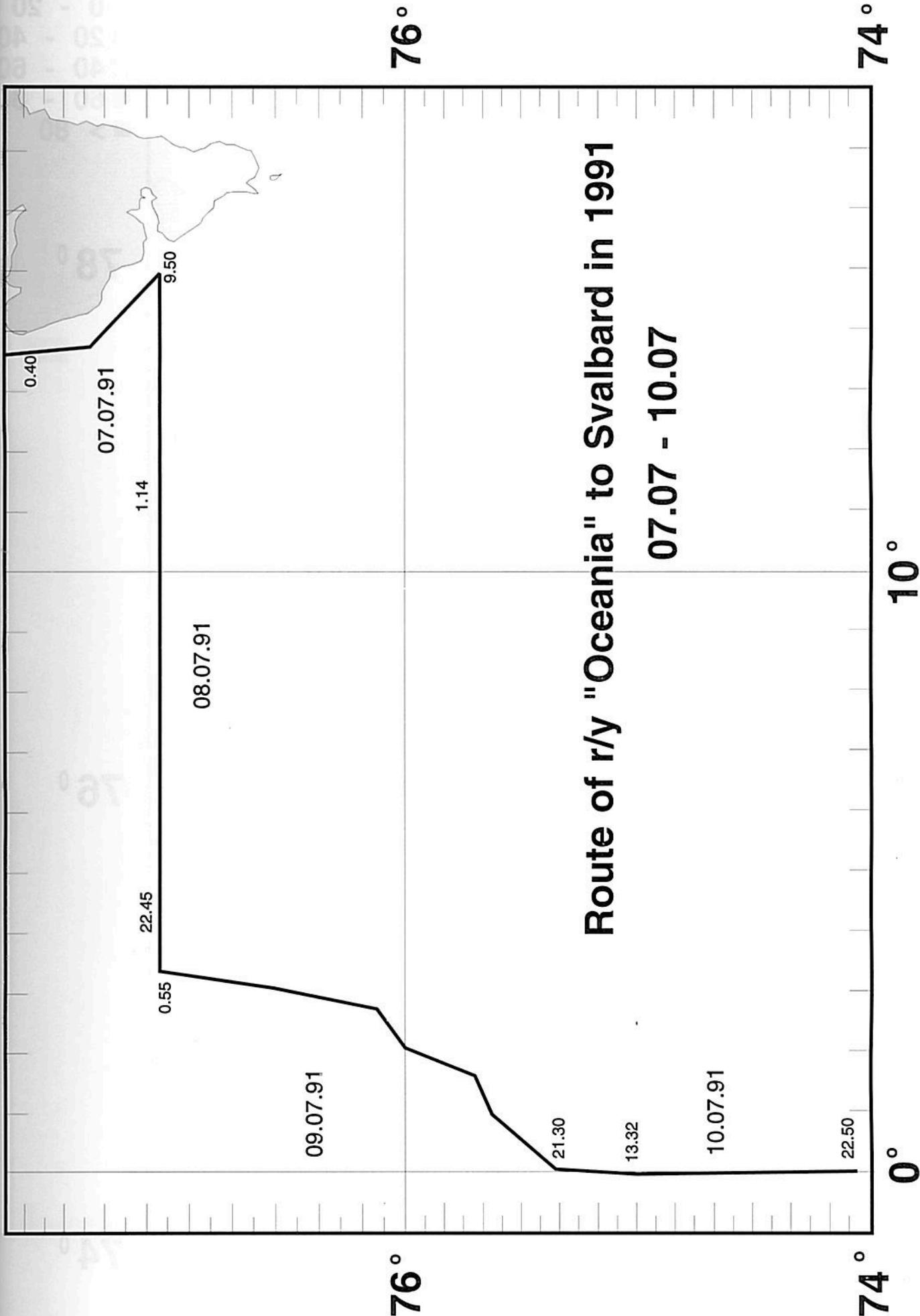
Observer: Theo Postma.

Time and route of the cruise

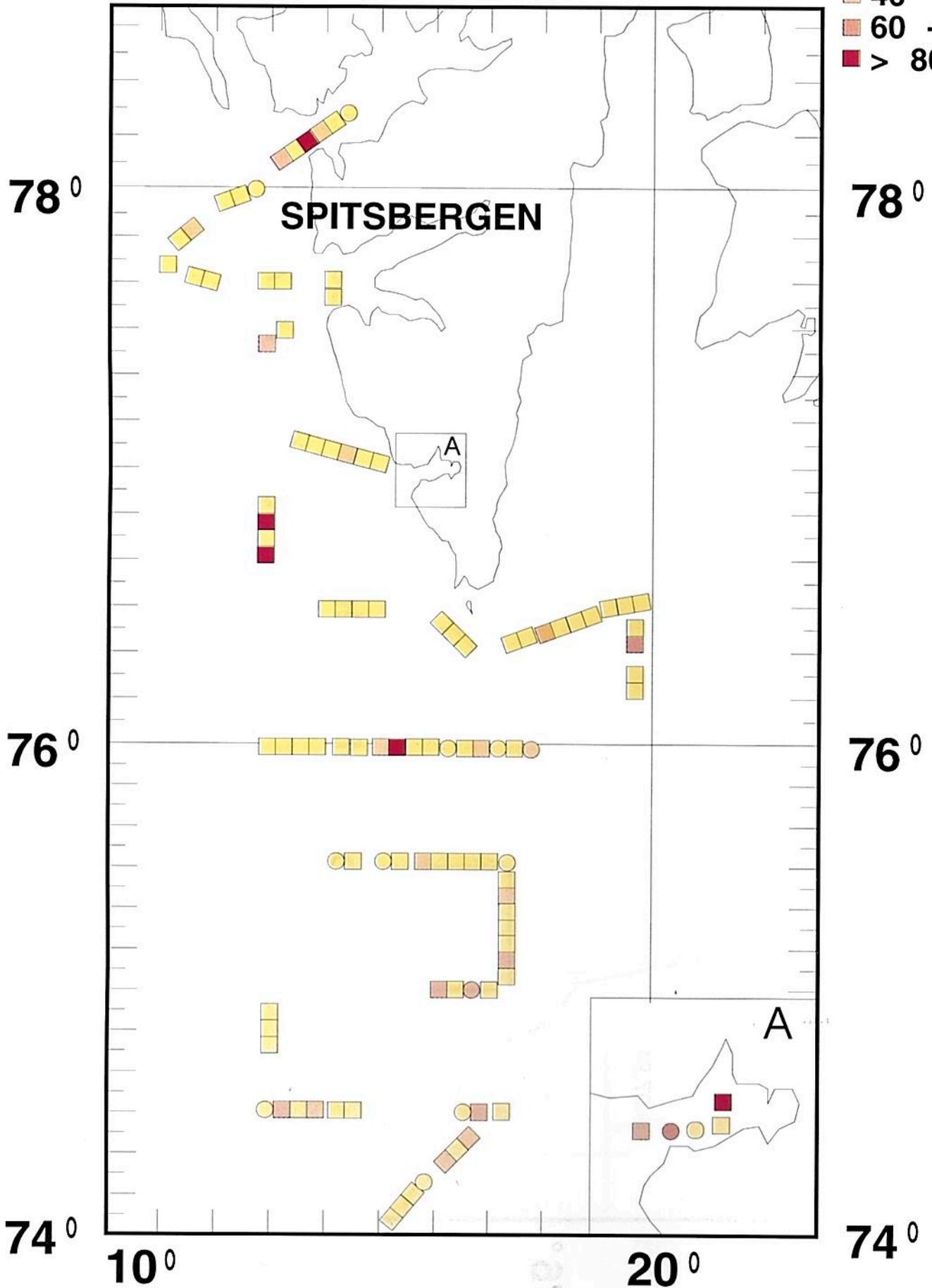
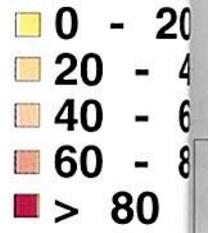
Seabird censuses started on 24 June (15^o00'E; 74^o19'N) and were conducted along the west coasts of Spitsbergen up to Adventfjord (06 July; 14^o20'E; 77^o36'N). On the return way the birds were counted from 7 July (13^o40'E , 77^o31'N) till 10 July (00^o00'E , 74^o06'N).

Route of r/y "Oceania" during cruise from Bear Isl. to Svalbard 24.06 - 06.07. 1991





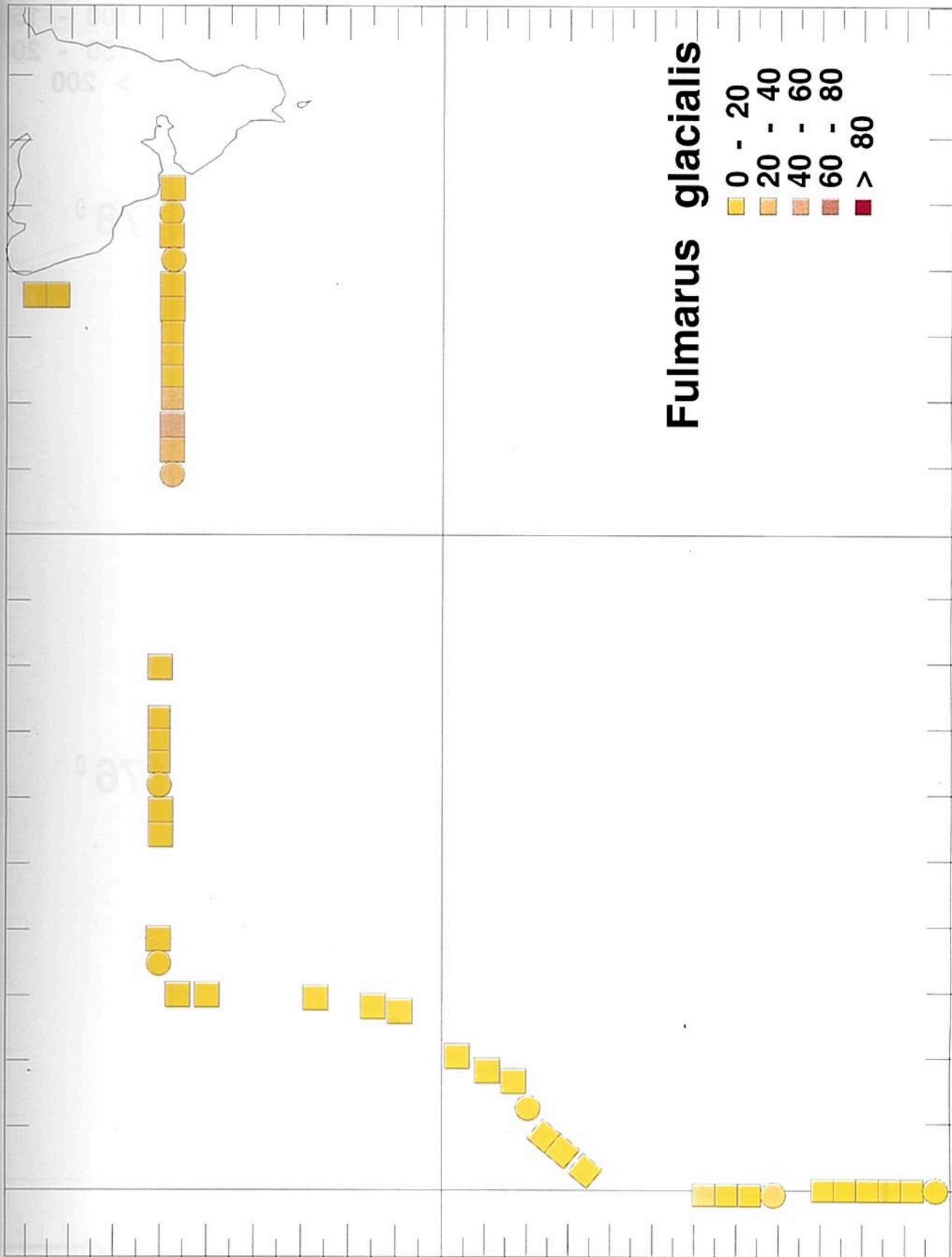
10° Fulmarus glacialis 20°



- 20
- 40
- 60
- 80
80

76°

74°



Fulmarus glacialis

- 0 - 20
- 20 - 40
- 40 - 60
- 60 - 80
- > 80

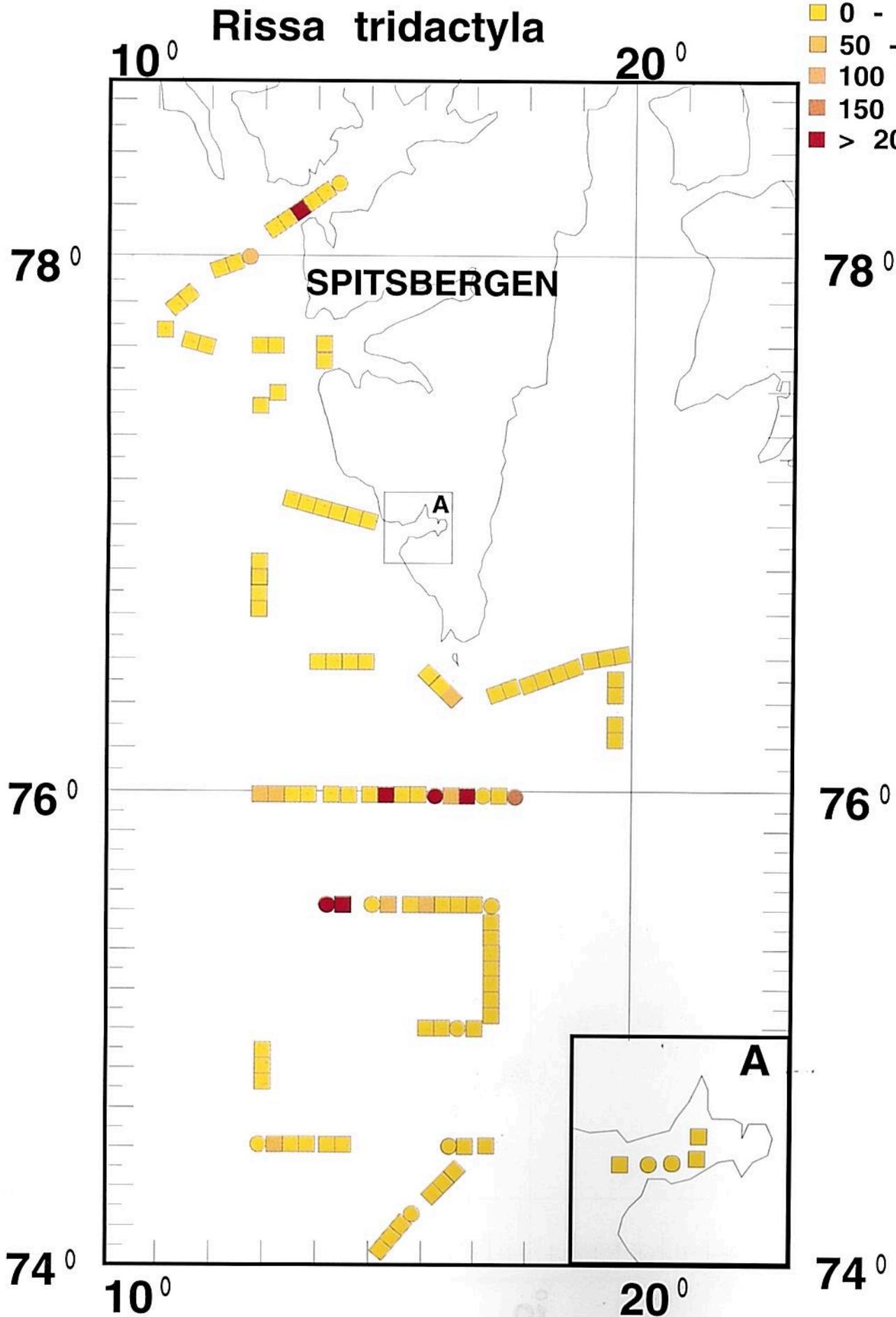
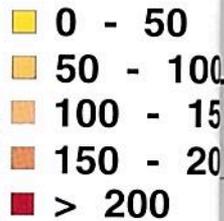
10°

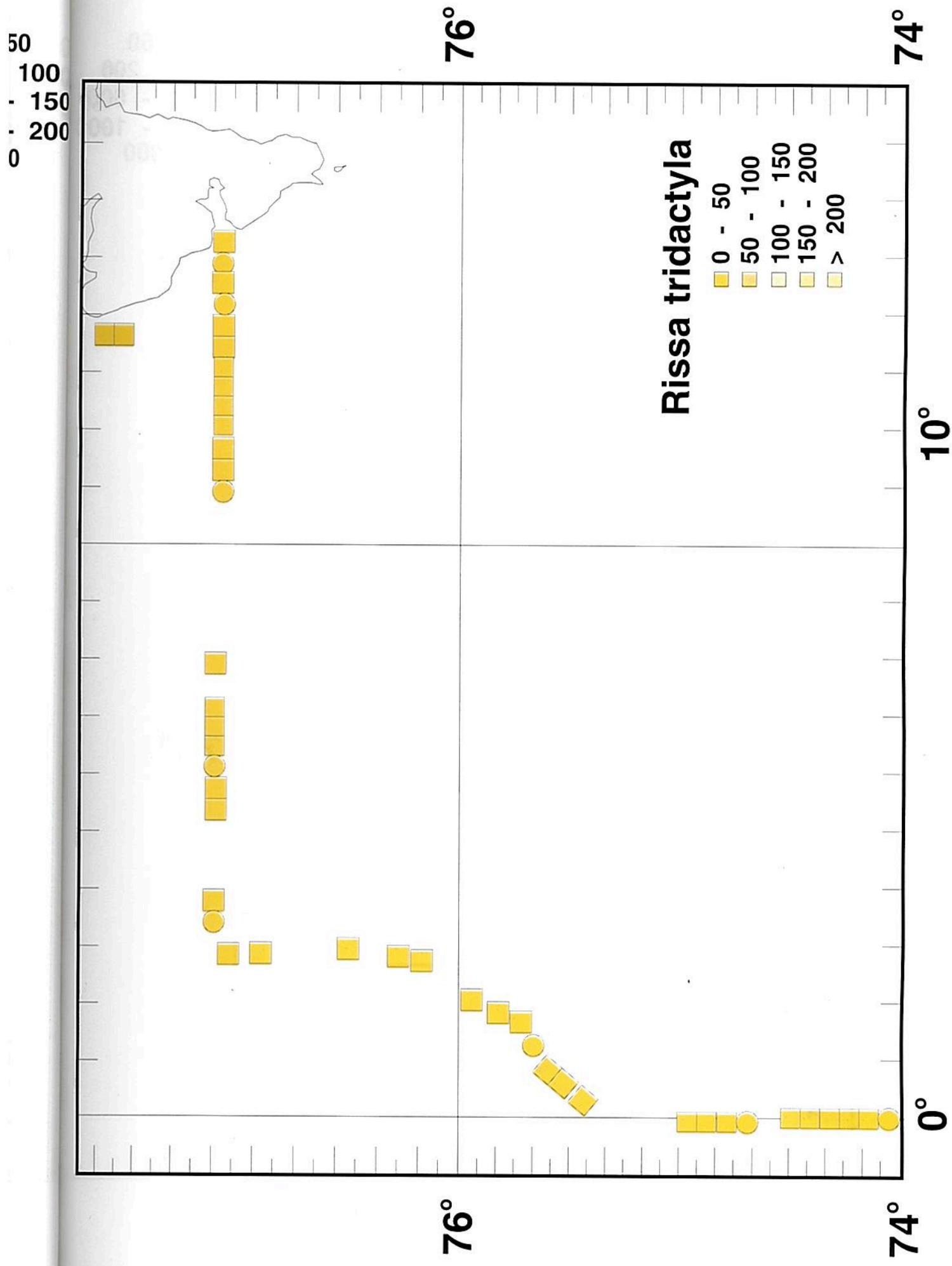
0°

76°

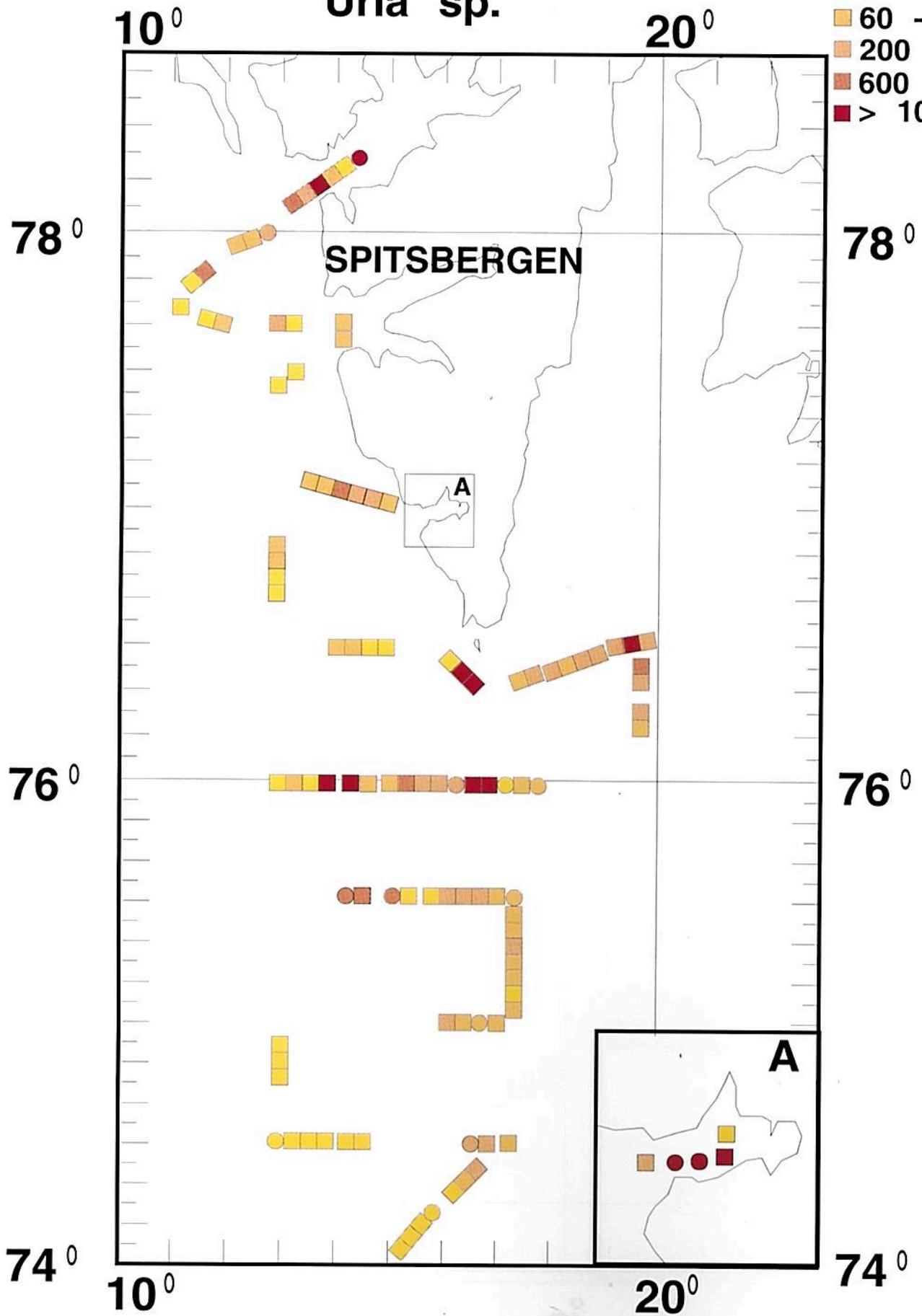
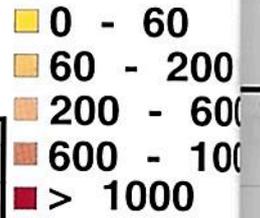
74°

Rissa tridactyla

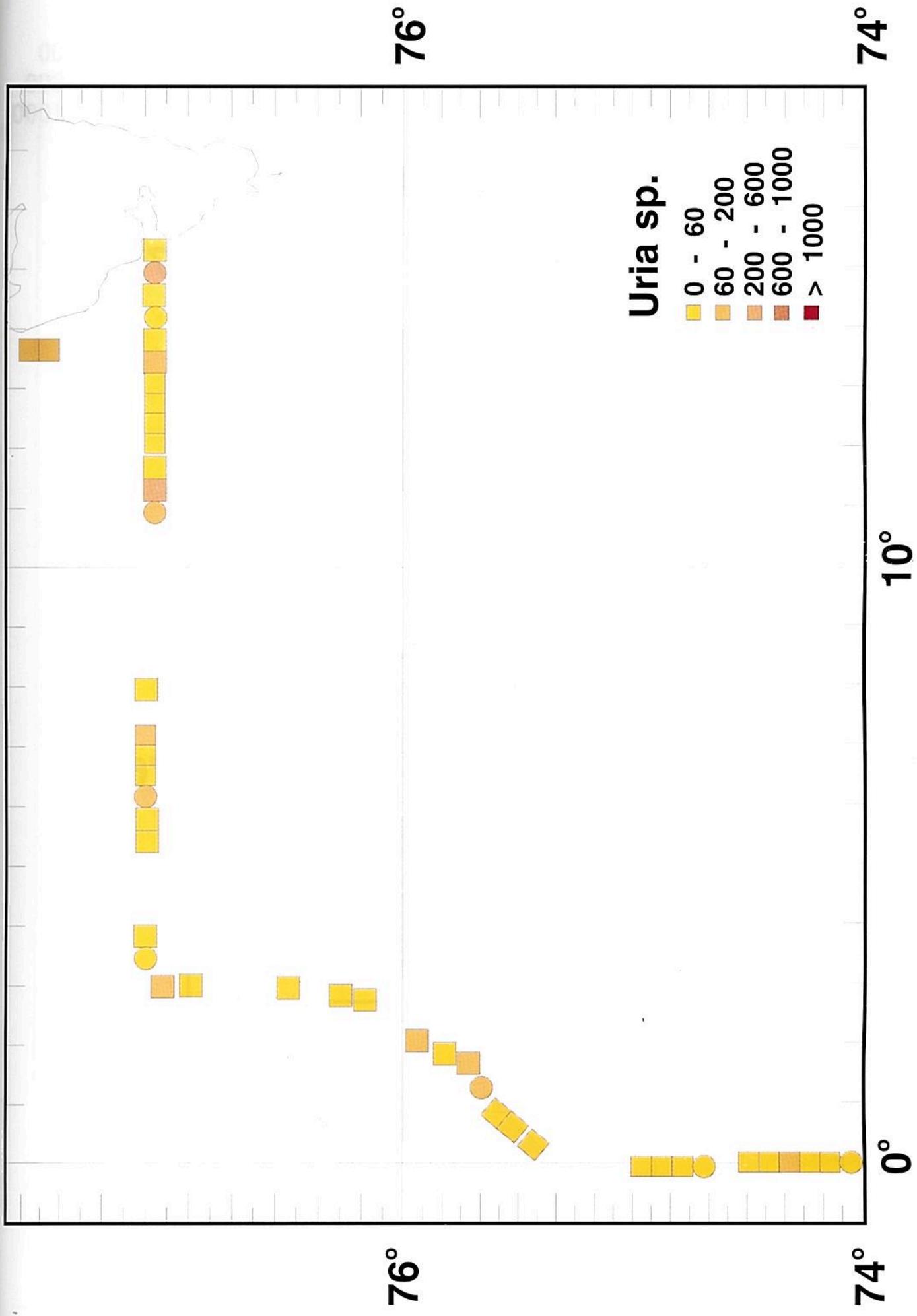




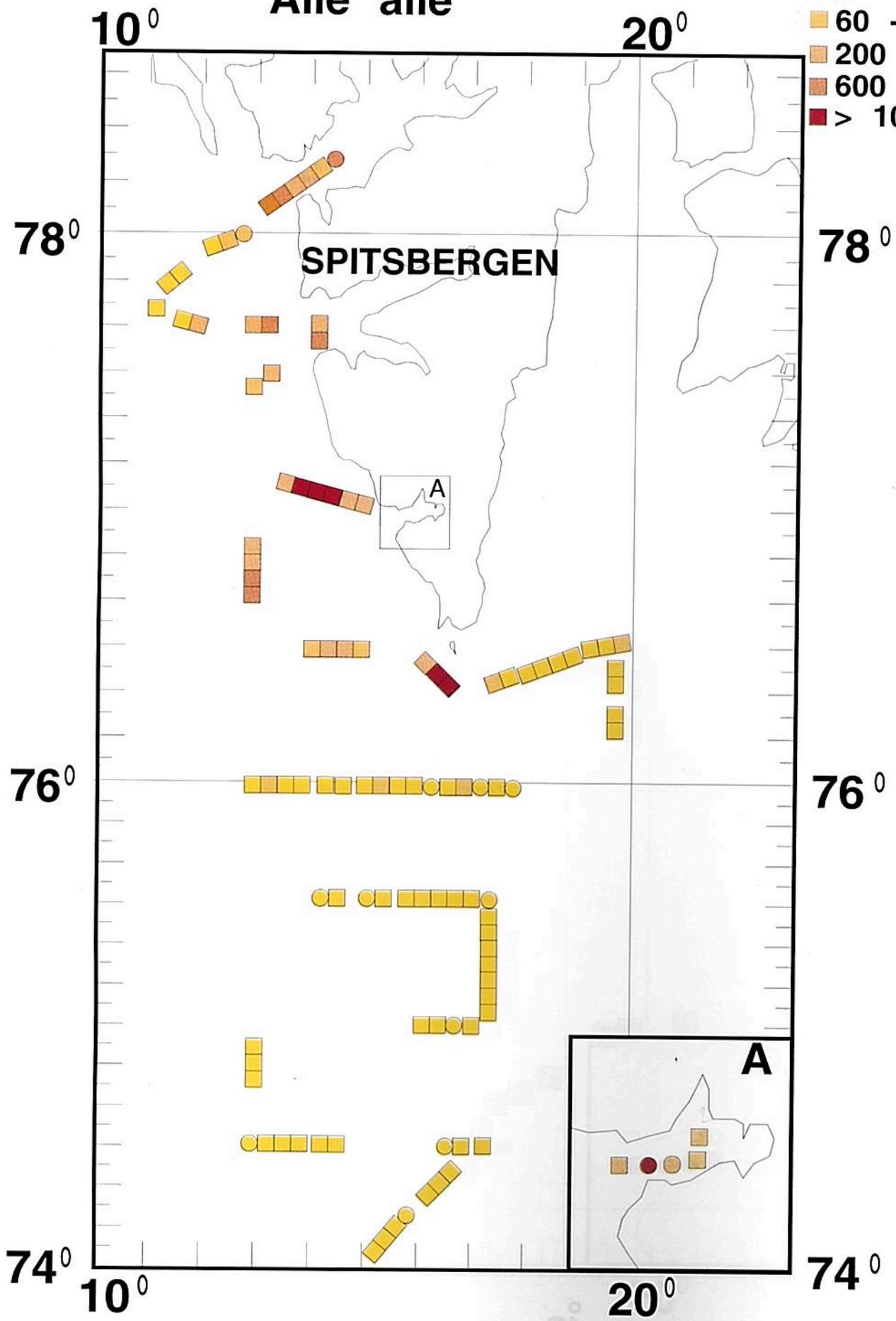
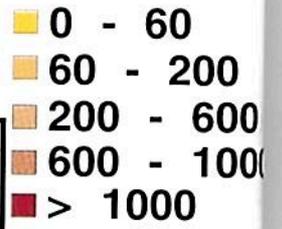
Uria sp.



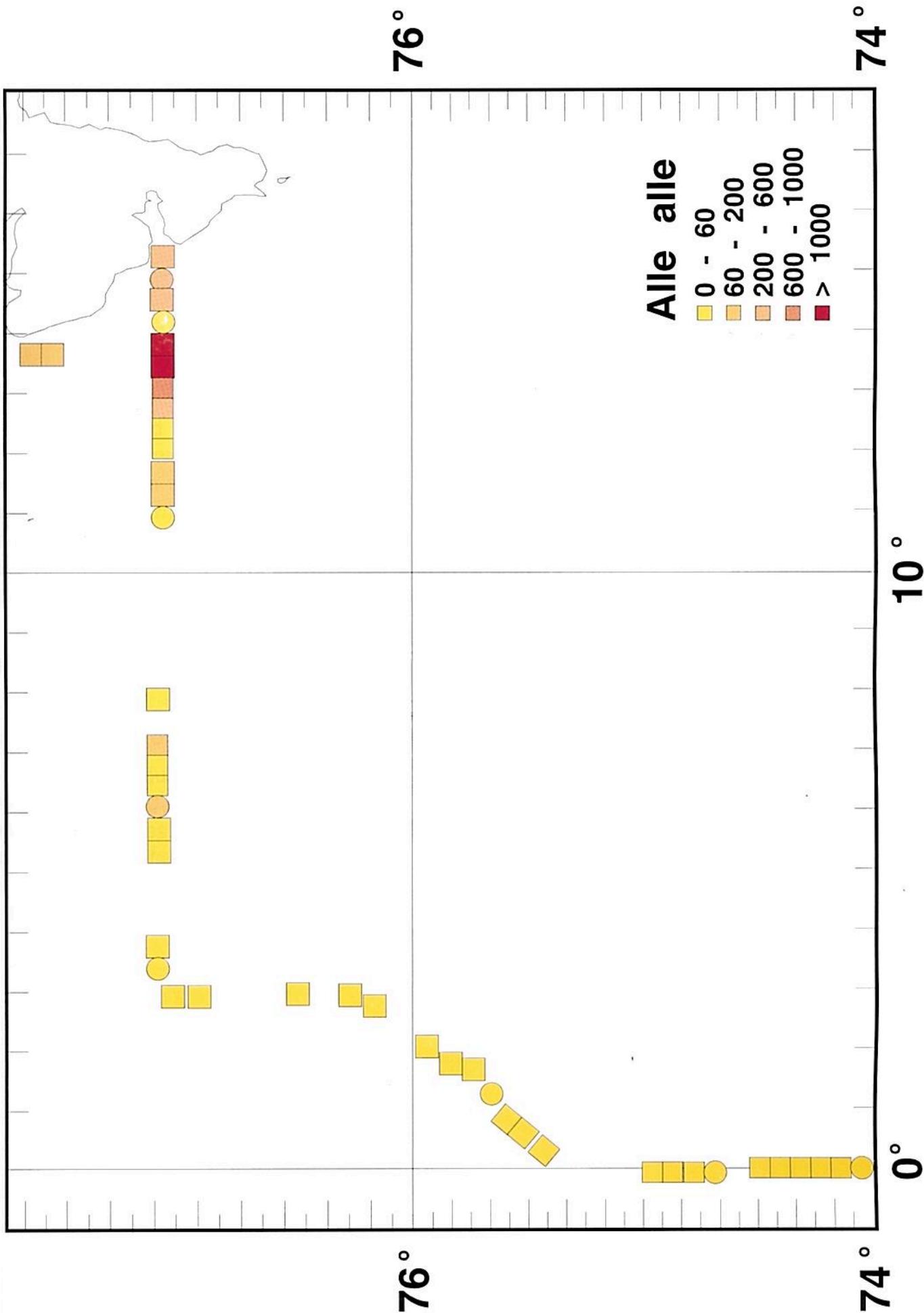
00
600
1000



Alle alle



100
10
1



**Seabird counting during the arctic cruise of s/y "Oceania"
from Bear Island to Spitsbergen (August 1992)
AREX'92**

**Michał Malinga, Lech Stempniewicz
Dept. of Vertebrate Ecology and Zoology, University of Gdansk
Legionow 9, 81-441 Gdansk**

Methods

Sea birds and mammals were counted within 300 m zone by the one side of the ship. The observation point was situated on the bridge deck, about 4 m above the sea level. Weather conditions such as visibility, ice cover, wind velocity were noted during the observations. The countings were carried out every 3 hours (8 counting sessions a day). Each session lasted at least 0.5 hour and was divided into 10 minute periods. In total 70 hours and 10 minutes of the observations were done. The ship's speed was 4-10 knots. Flying birds and those sitting on the water were counted separately except for guilemots *Uria* sp.

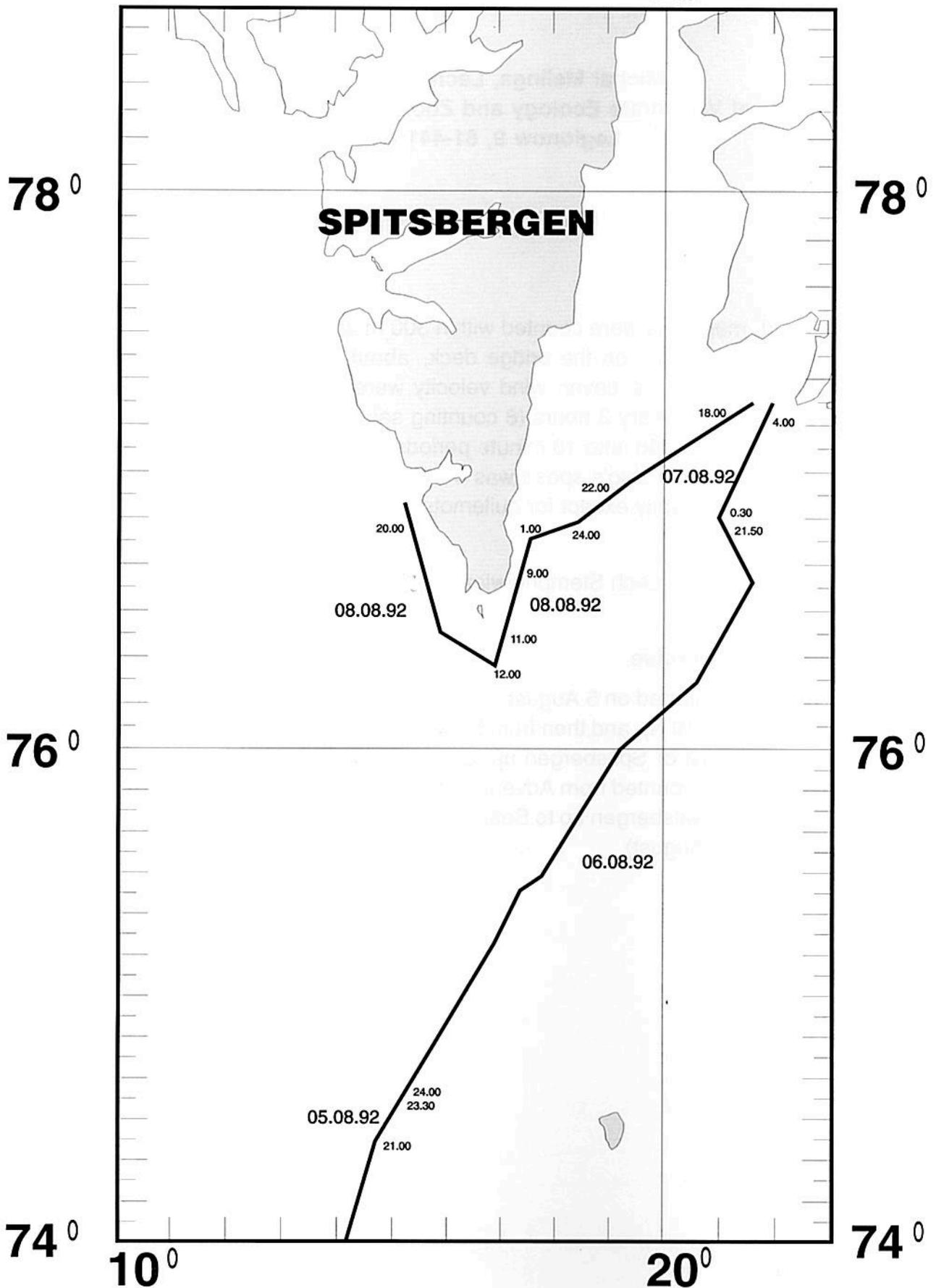
Observers: Michał Malinga, Lech Stempniewicz.

Time and route of the cruise

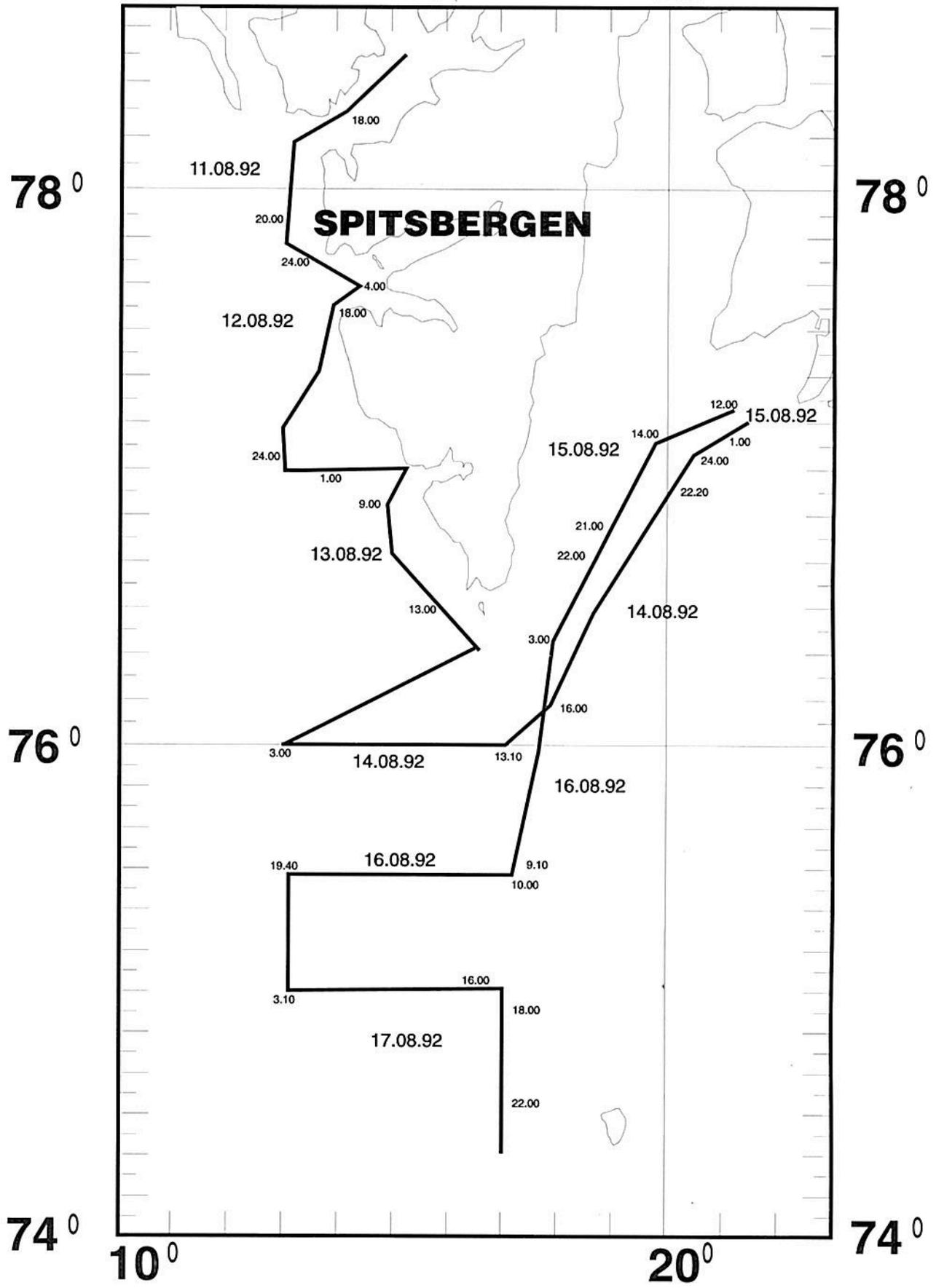
Seabird censuses started on 5 August (14°20'E; 74°20'N) and were conducted till 7 August (Bear Island, 20°40'E; 77°10'N), and then from Bear Island (7 August; 20°40'E; 77°10'N) along the south-east and west coast of Spitsbergen up to Horsund (8 August; 15°00'E; 76°50'N). On the return way the birds were counted from Adventfjord (11 August 15°00'E , 78°10'N) along the west and south-east coast of Spitsbergen up to Bear Island (15 August; 20°30'E , 77°06'N) and then up to 16°50'E , 74°30'N (17 August).

Route of r/y "Oceania" from Bear Isl. to Svalbard

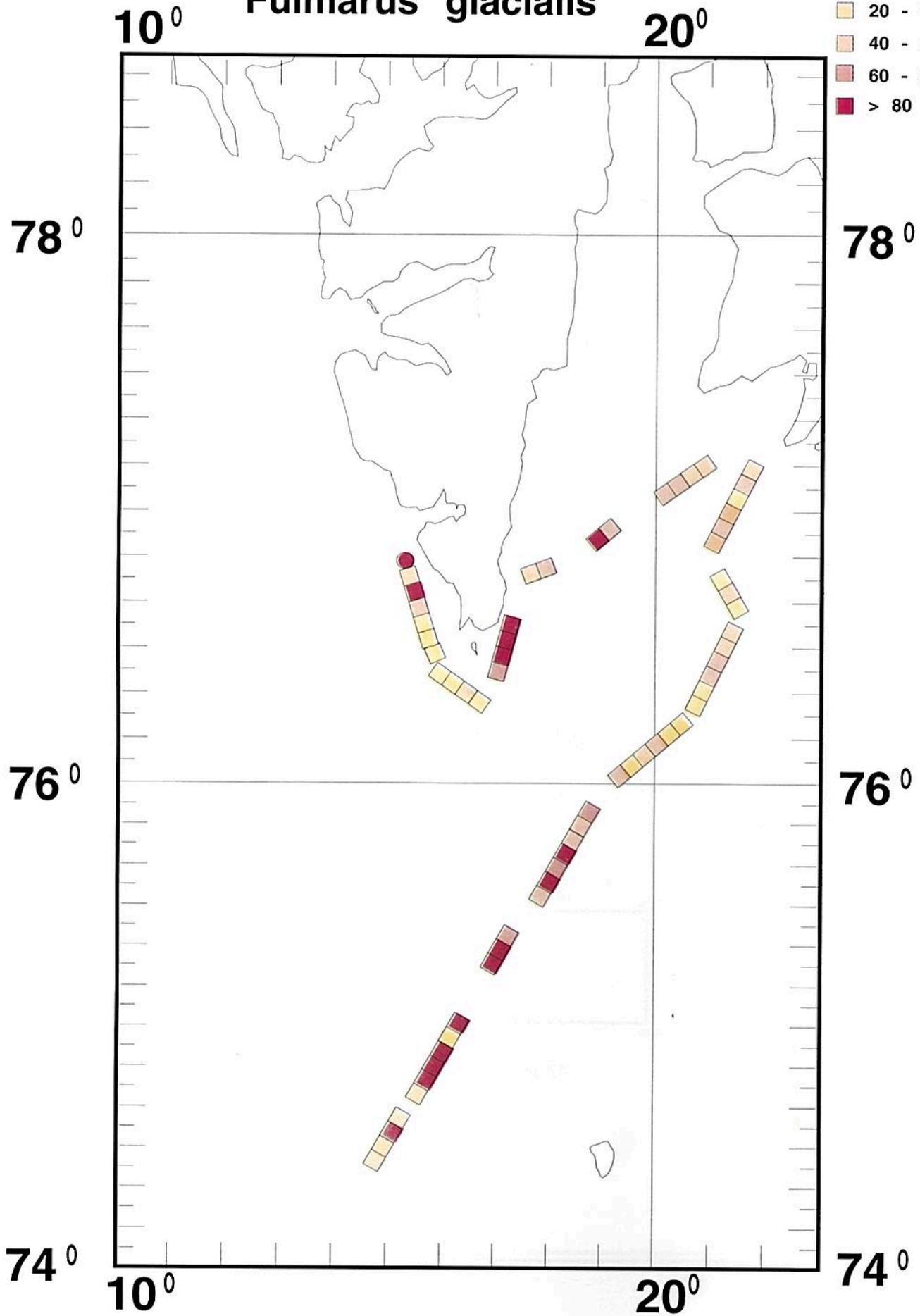
5 - 8.08. 1992



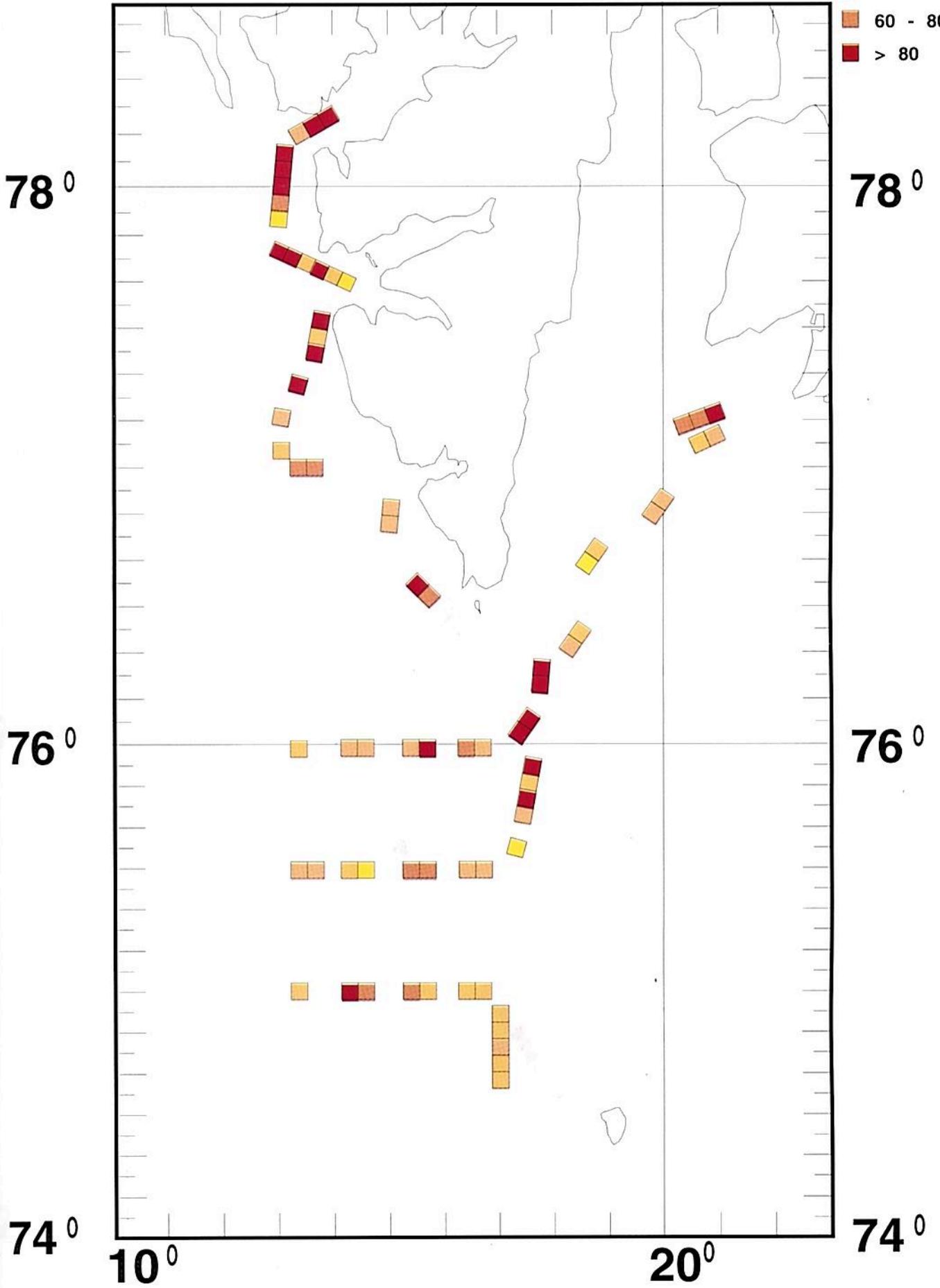
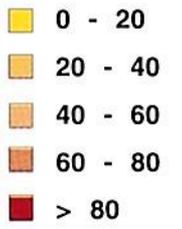
Route of r/y "Oceania" from Bear Isl. to Svalbard
 11 - 20.08. 1992



Fulmarus glacialis

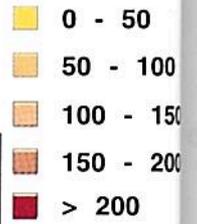


10⁰ Fulmarus glacialis 20⁰



10° Rissa tridactyla

20°



78°

78°

78

76°

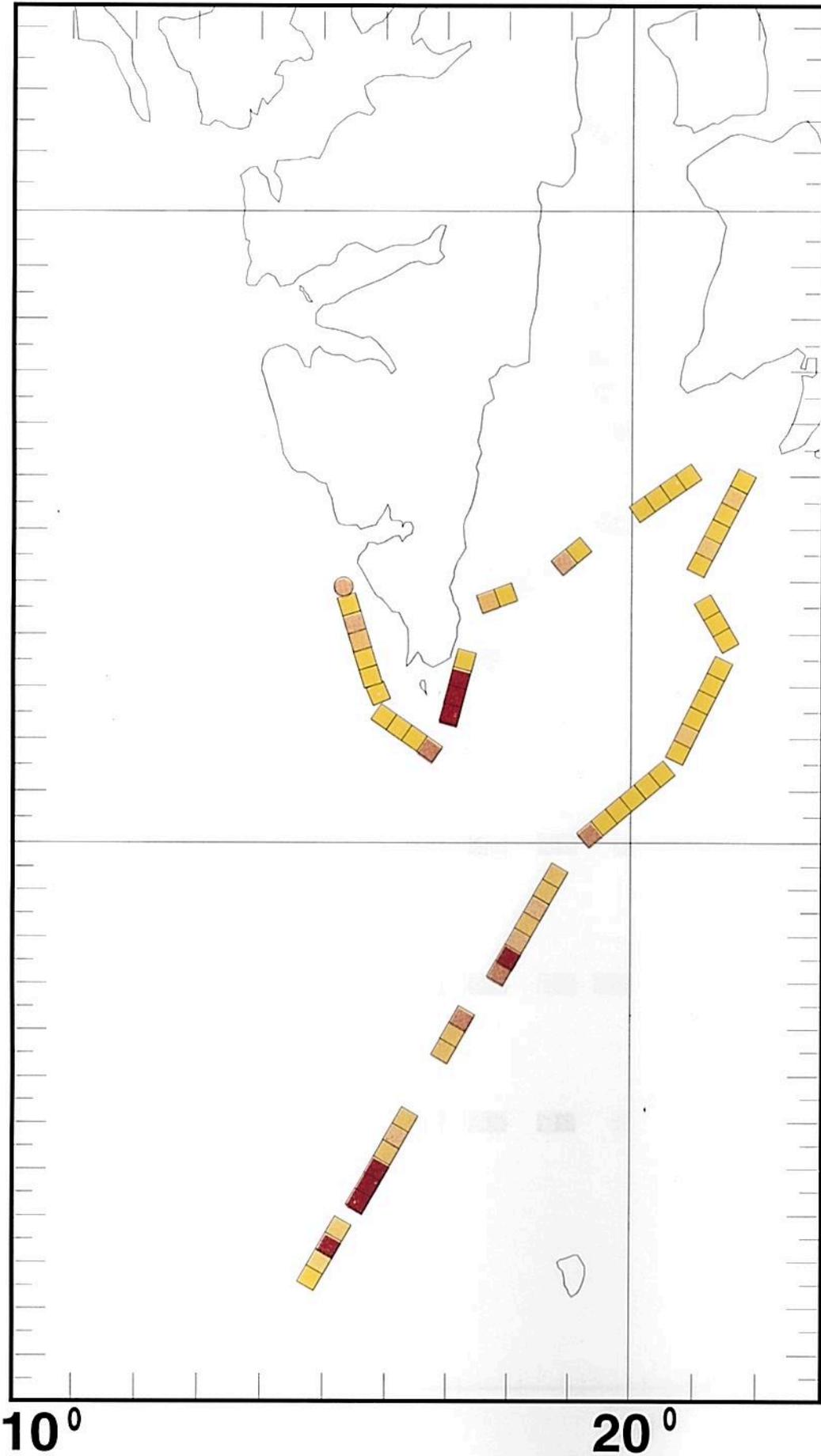
76°

76

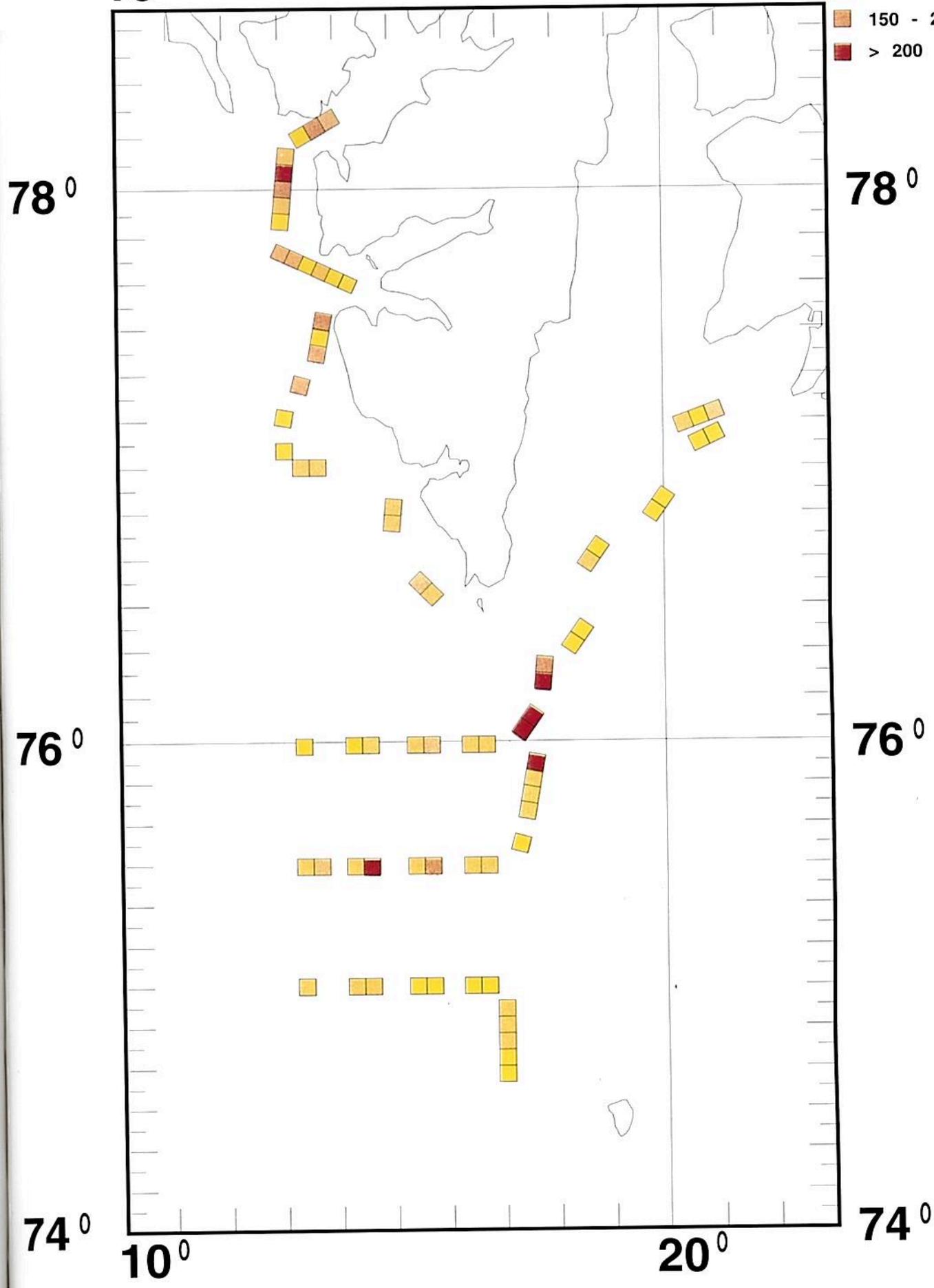
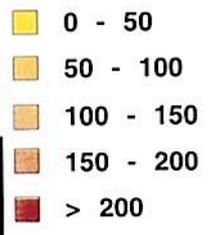
74°

74°

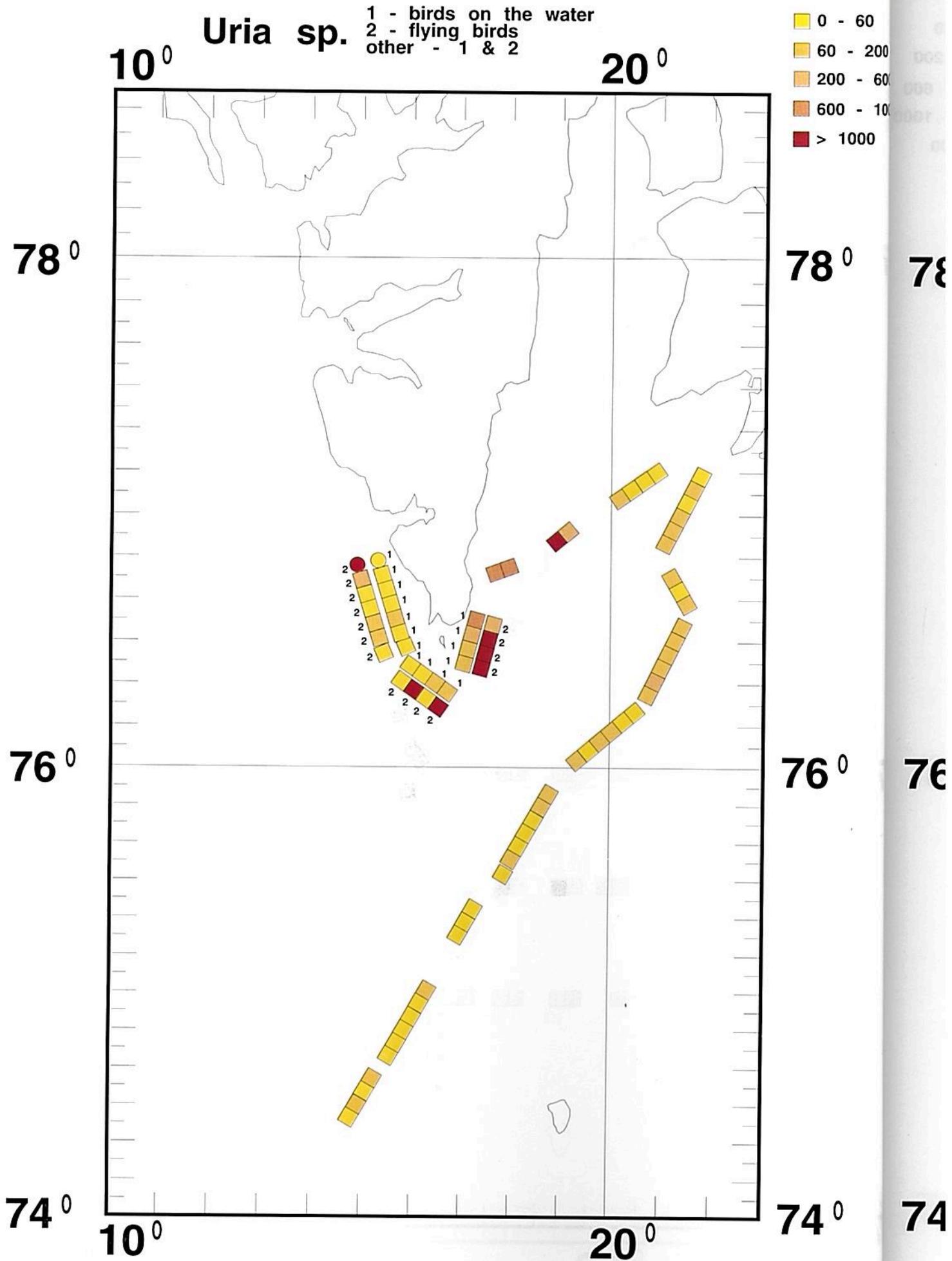
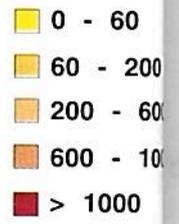
74



10° Rissa tridactyla 20°

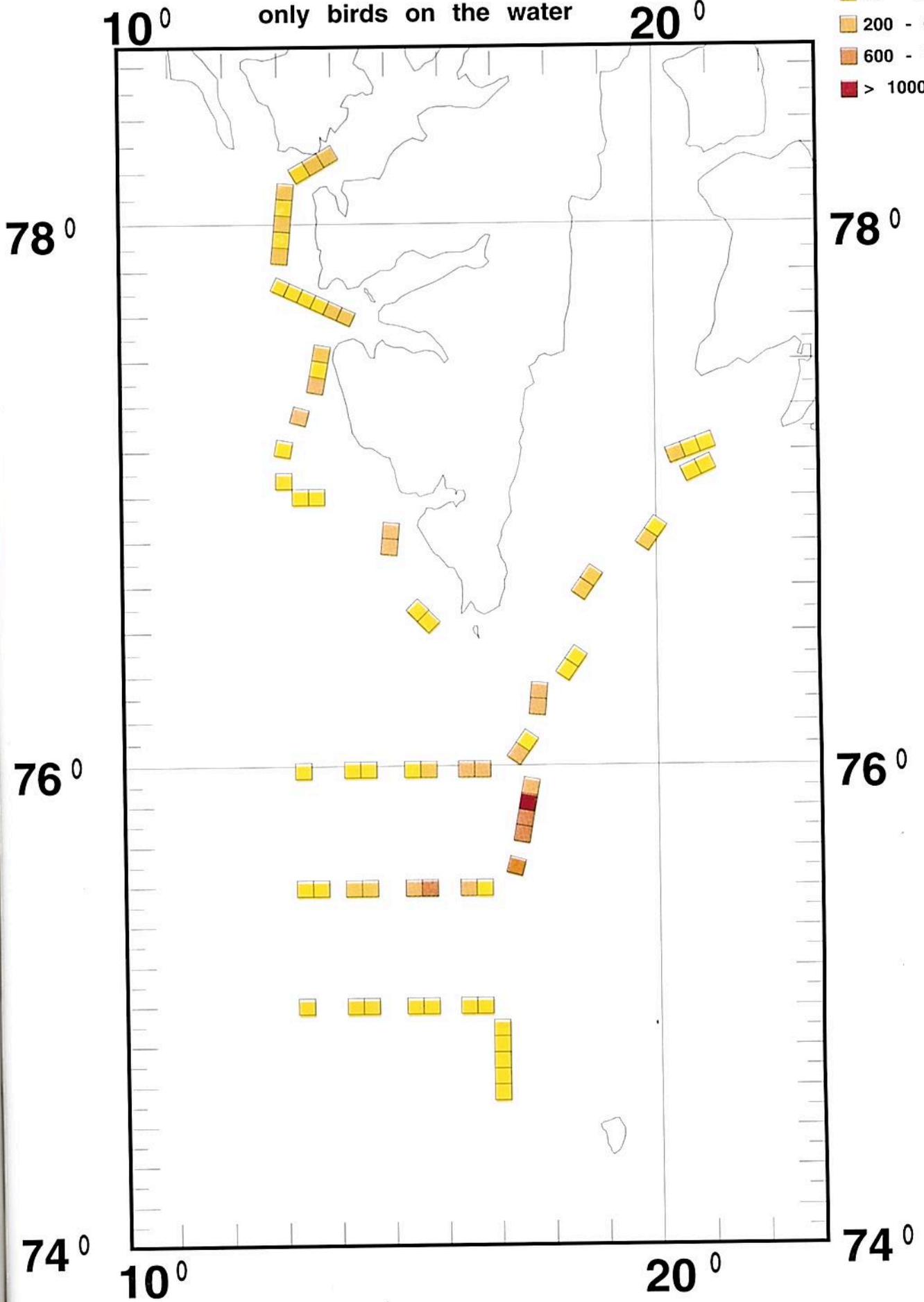


Uria sp.
 1 - birds on the water
 2 - flying birds
 other - 1 & 2

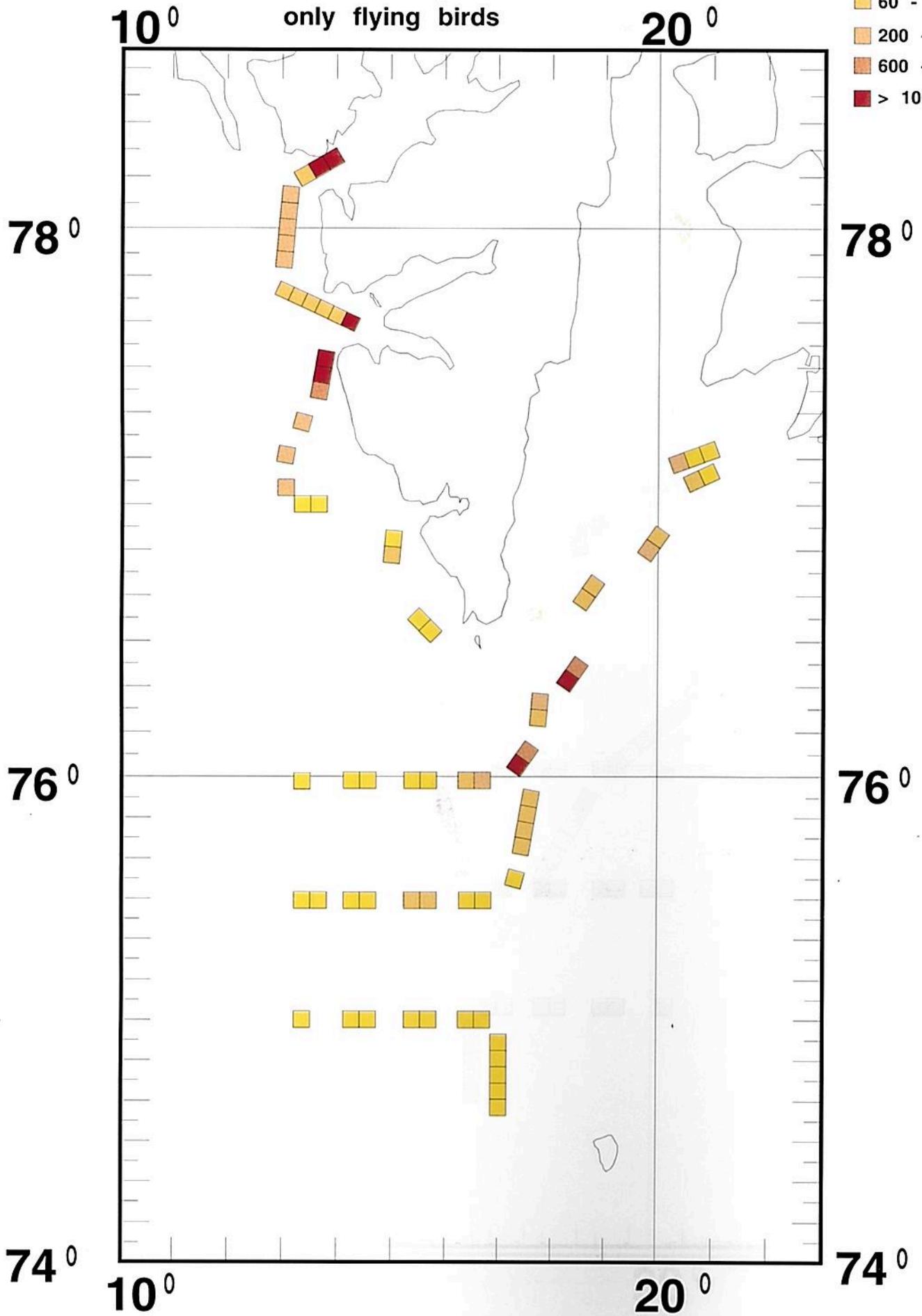
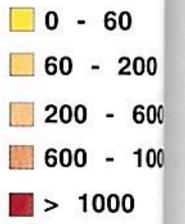


Uria sp.

only birds on the water



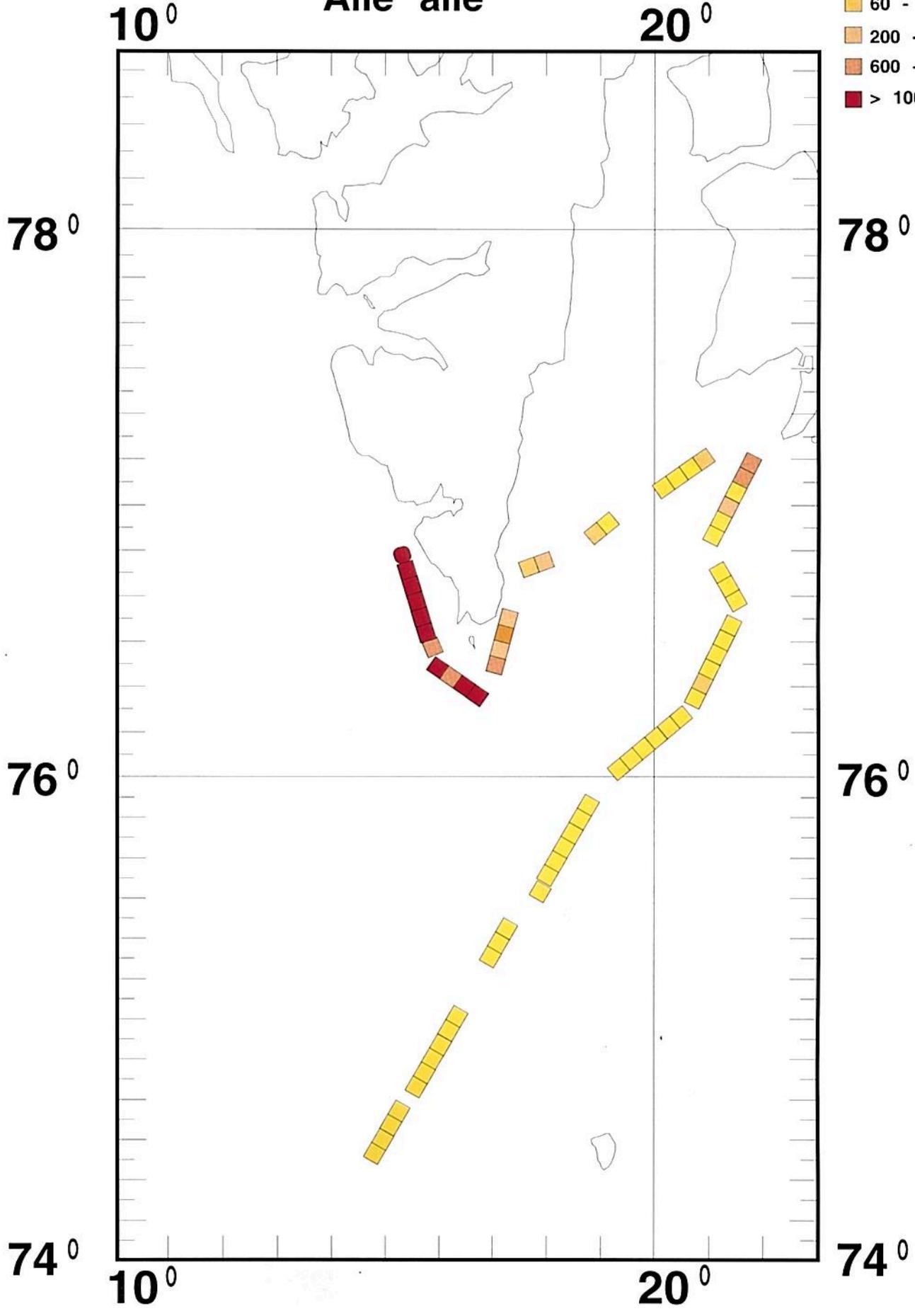
Uria sp.
only flying birds



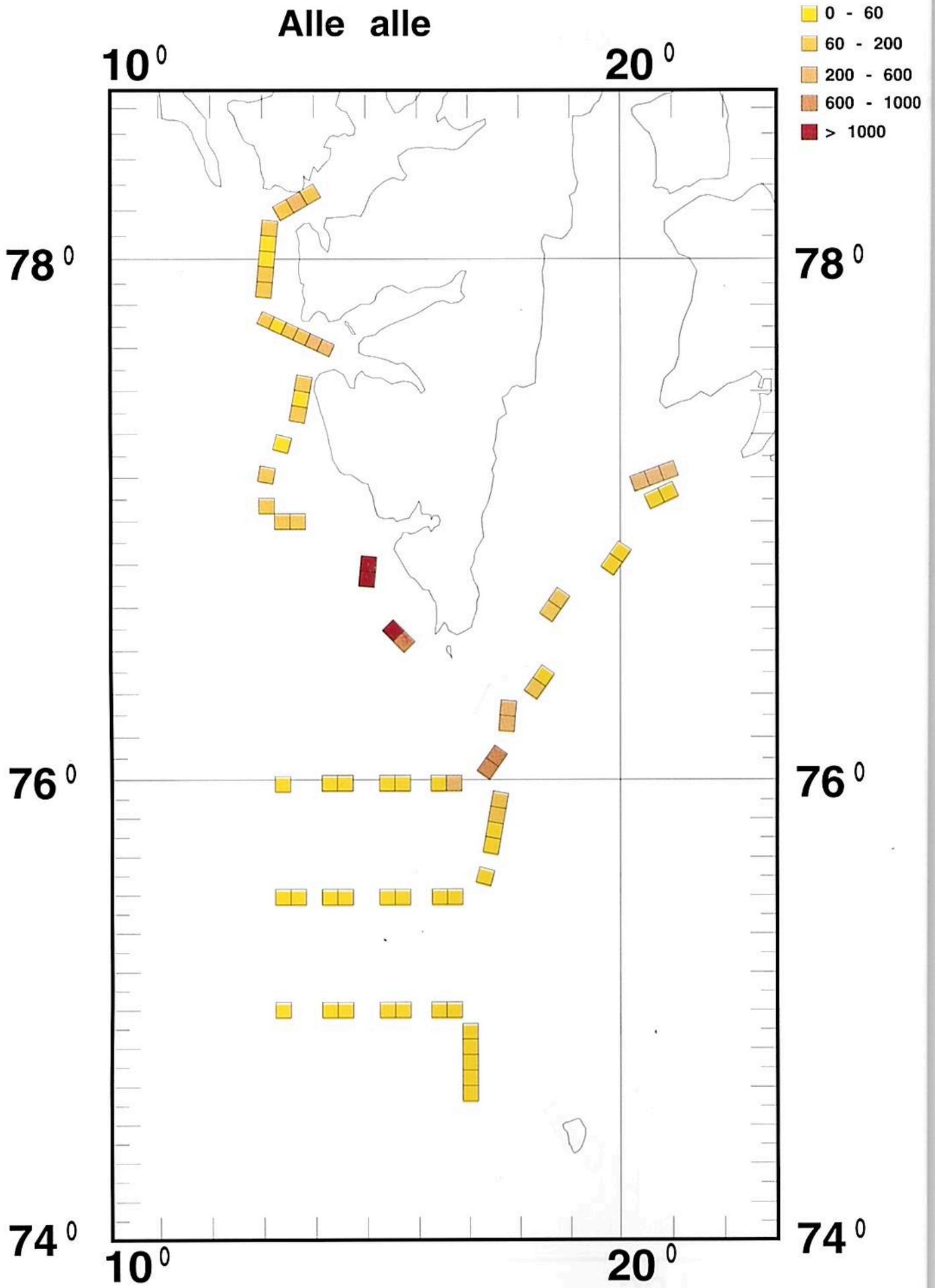
0
200
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Alle alle

- 0 - 60
- 60 - 200
- 200 - 600
- 600 - 1000
- > 1000



Alle alle



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**Seabird counting during the arctic cruise of r/v "Oceania"
from Bear Island to Spitsbergen (July 1993)
AREX' 93**

**Michał Malinga
Dept. of Vertebrate Ecology and Zoology, University of Gdańsk
Legionów 9, 81-441 Gdańsk**

Methods

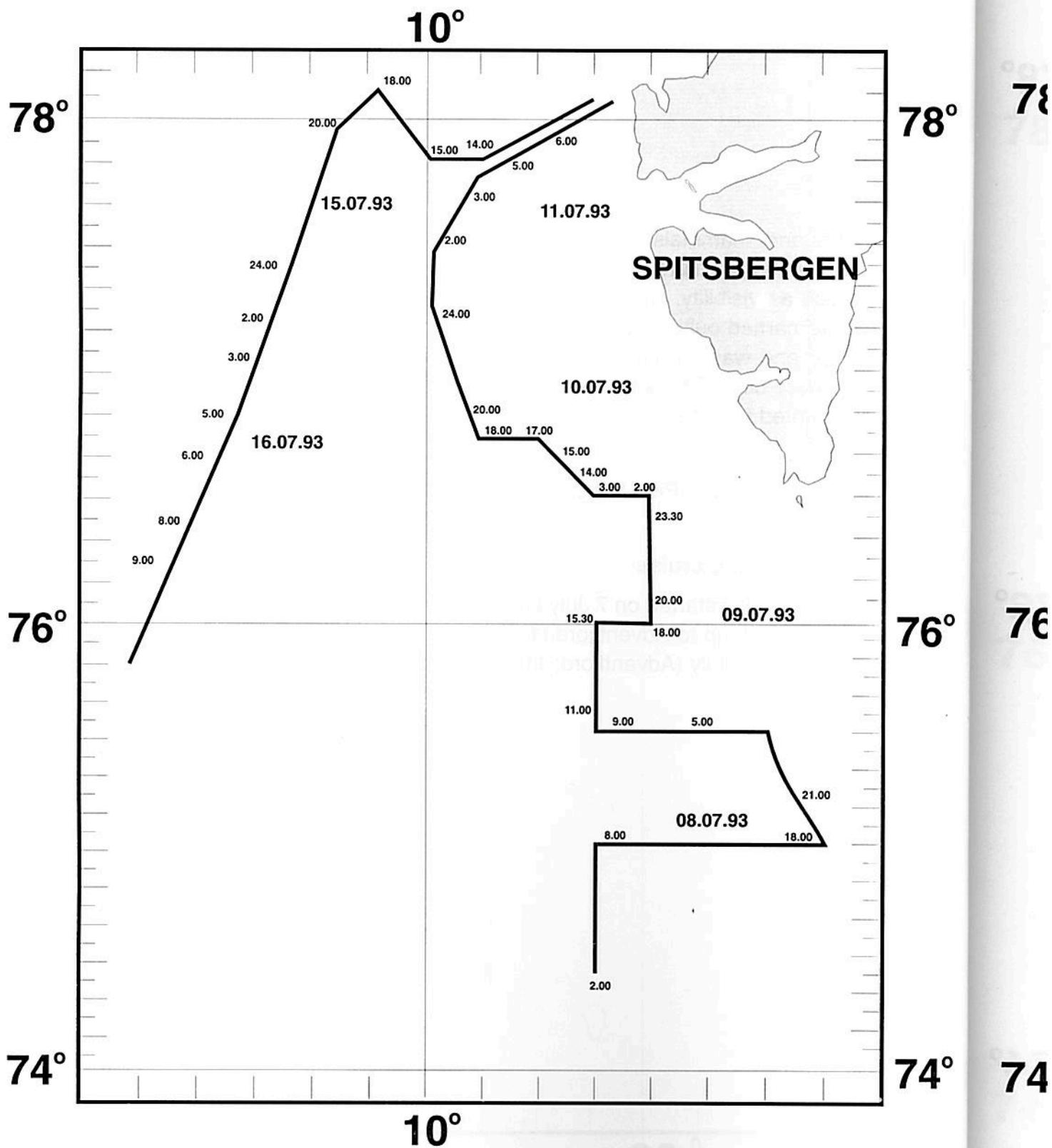
Sea birds and mammals were counted within 300 m zone by the one side of the ship. The observation point was situated on the bridge deck, about 4 m above the sea level. Weather conditions such as visibility, ice cover, wind velocity were noted during the observations. The countings were carried out every 3 hours (8 counting sessions a day). Each session lasted at least 0.5 hour and was divided into 10 minute periods. In total 28 hours and 50 minutes of observations were done. The ship's speed was 4-10 knots. Flying birds and those sitting on the water were counted together.

Observers: Lech Kotwicki, Piotr Wieczorek.

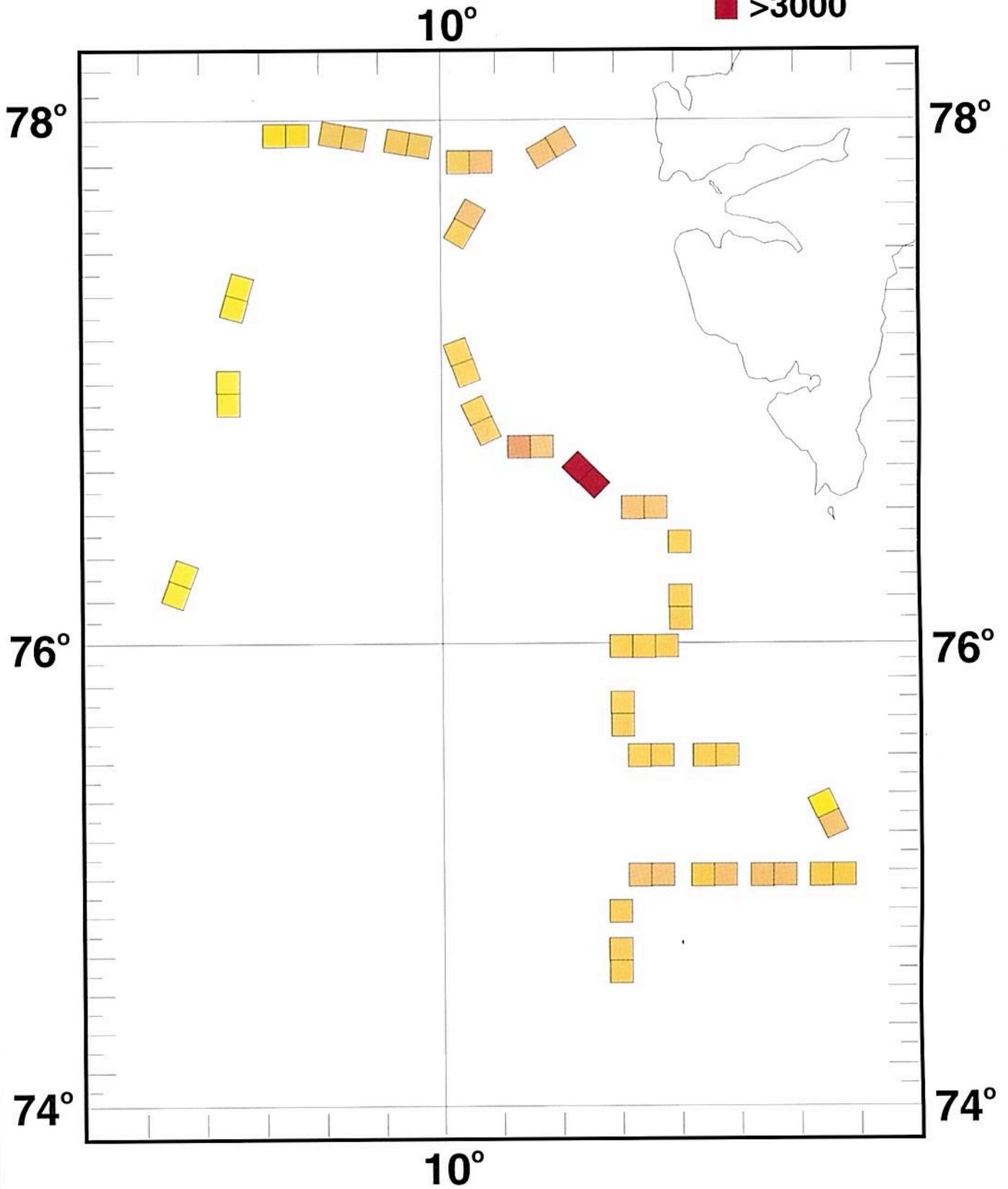
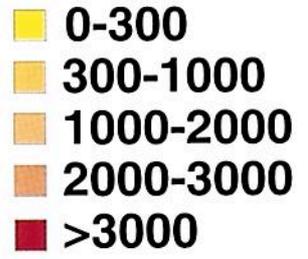
Time and route of the cruise

Seabird censuses started on 7 July (13°00'E; 74°30'N) and were conducted along the west coasts of Spitsbergen up to Adventfjord (11 July 13°10'E , 77°50'N). On the back way the birds were counted from 15 July (Adventfjord; 11°10'E , 77°50'N) till 16 July (5°30'E , 76°20'N).

Route of r/y "Oceania" during cruise from Bear Isl. to Svalbard 7 - 16.07. 1993

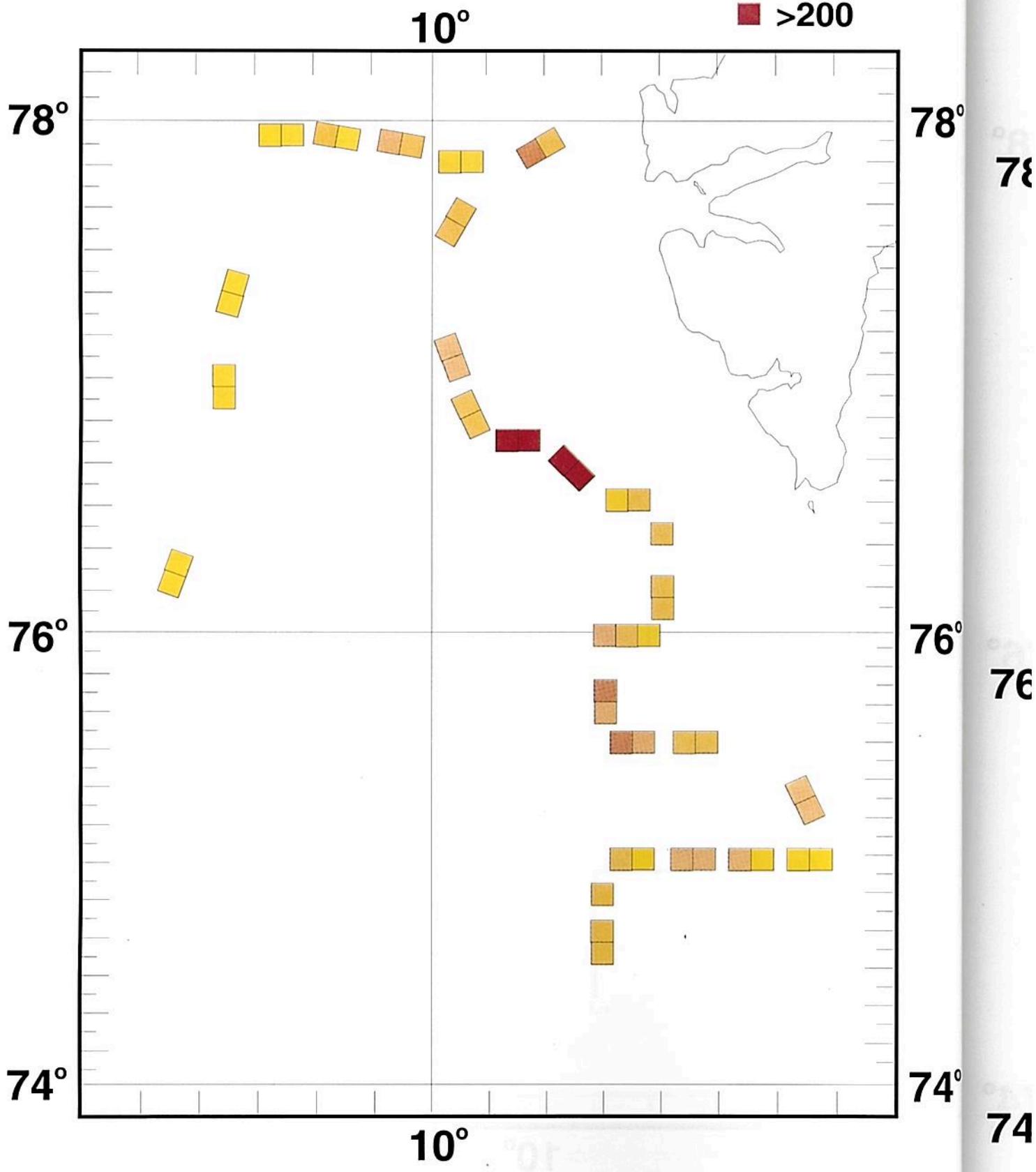


Fulmarus glacialis

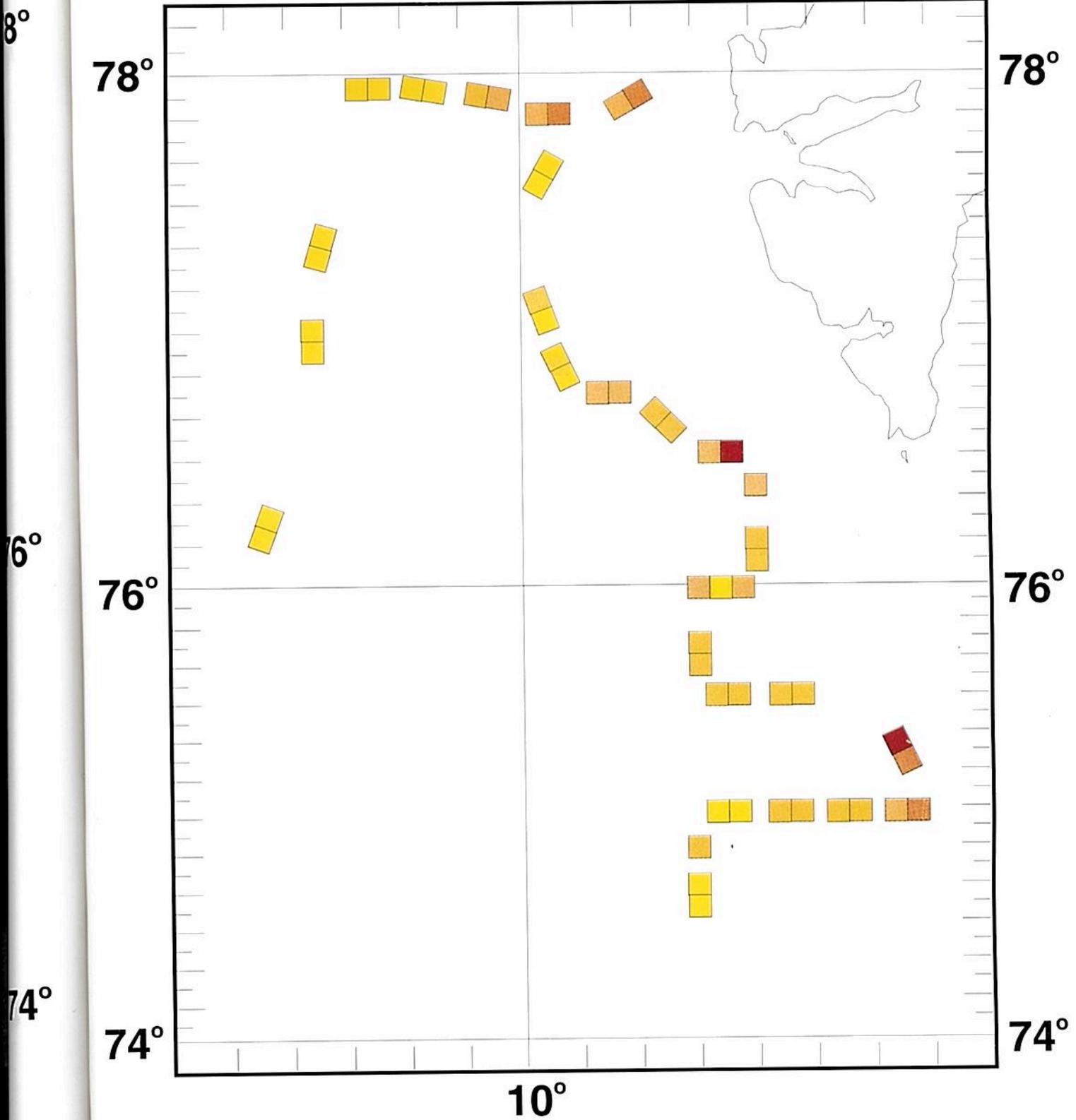
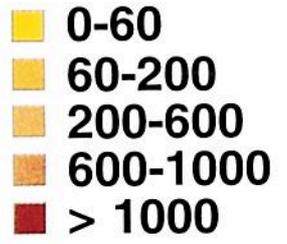


Rissa tridactyla

- 0-50
- 50-100
- 100-150
- 150-200
- >200

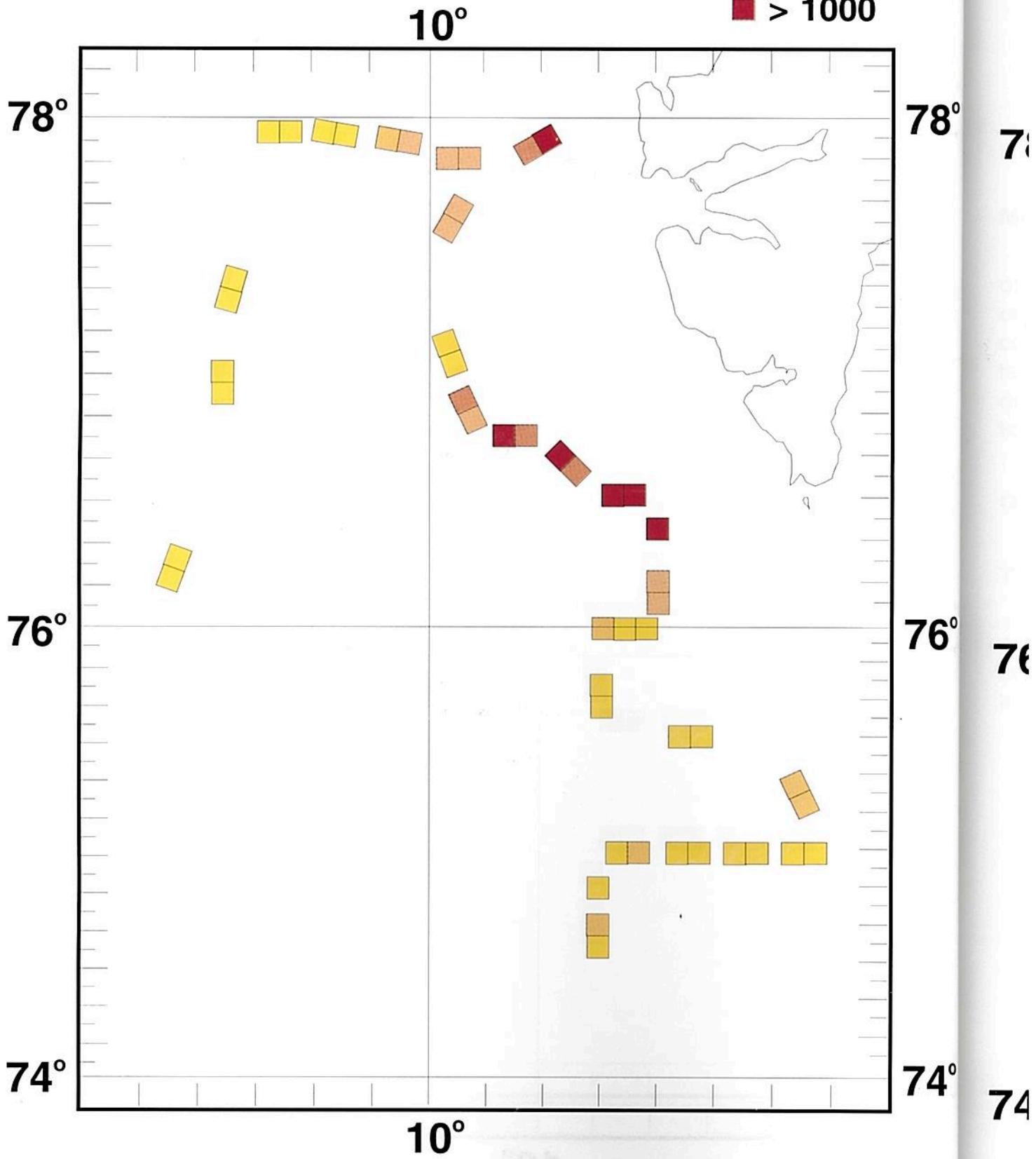


Uria sp.

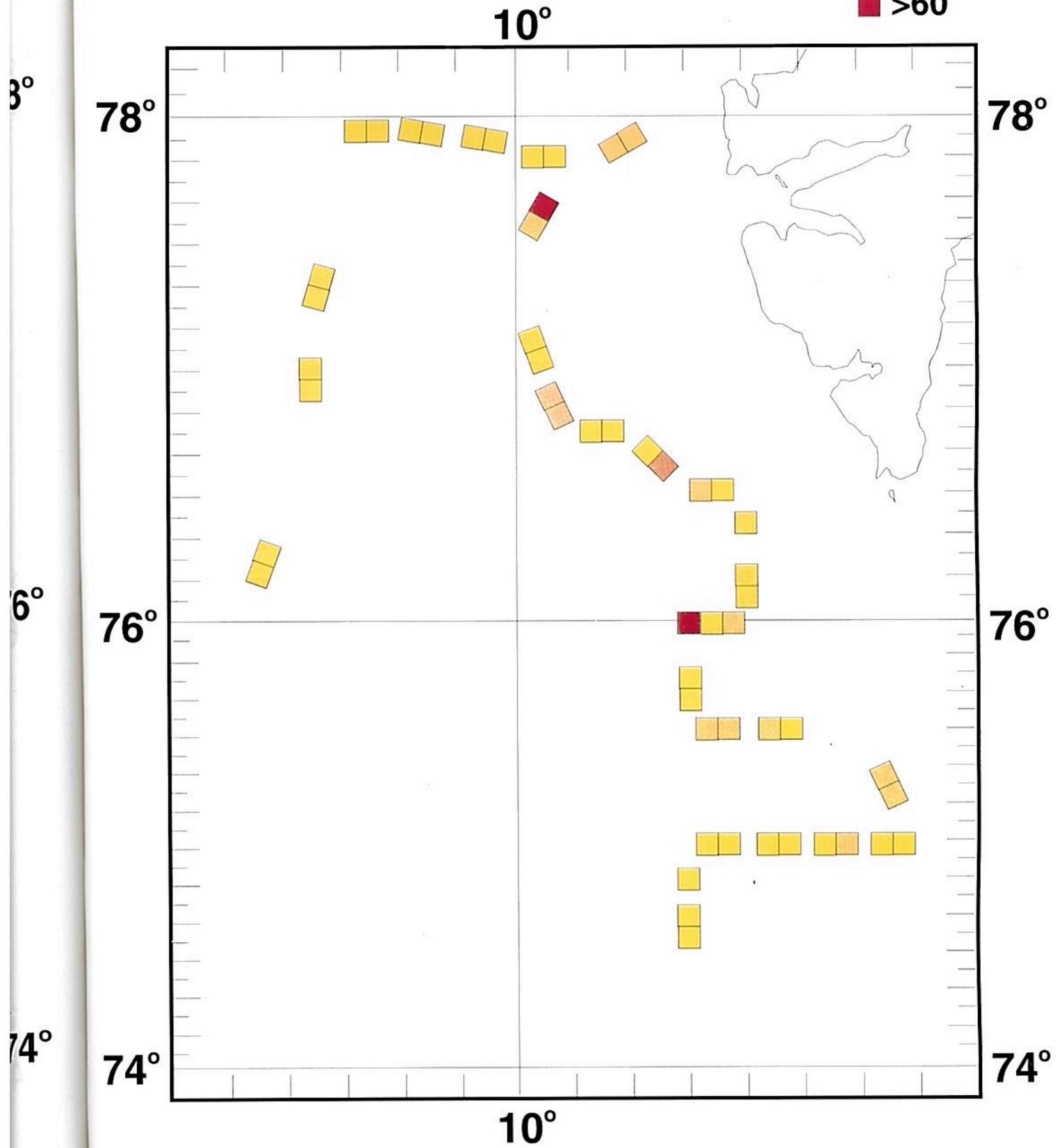
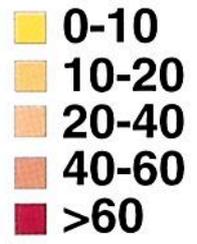


Alle alle

- 0-60
- 60-200
- 200-600
- 600-1000
- > 1000



Fratercula arctica



**Seabird counting during the arctic cruise of r/v "Oceania"
from Spitsbergen to Bear Island (July 1994)
AREX'94**

**Michał Malinga
Dept. of Vertebrate Ecology and Zoology, University of Gdańsk
Legionów 9, 81-441 Gdańsk**

Methods

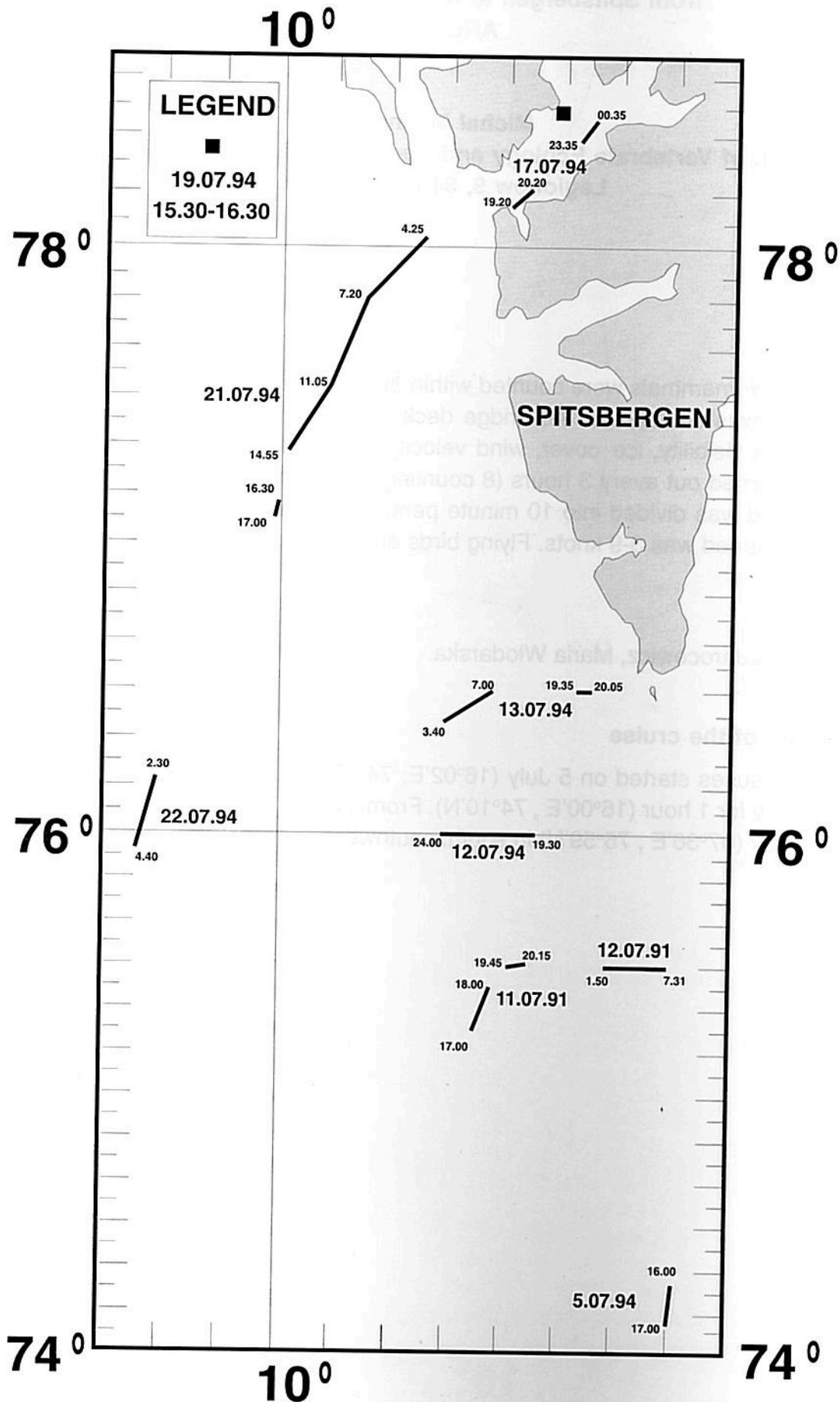
Sea birds and mammals were counted within 300 m zone by the one side of the ship. The observation point was situated on the bridge deck, about 4 m above the sea level. Weather conditions such as visibility, ice cover, wind velocity were noted during the observations. The countings were carried out every 3 hours (8 counting sessions a day). Each session lasted at least 0.5 hour and was divided into 10 minute periods. In total 16 hours of observations were done. The ship's speed was 3-9 knots. Flying birds and those sitting on the water were counted together.

Observers: Aneta Jarocewicz, Maria Włodarska.

Time and route of the cruise

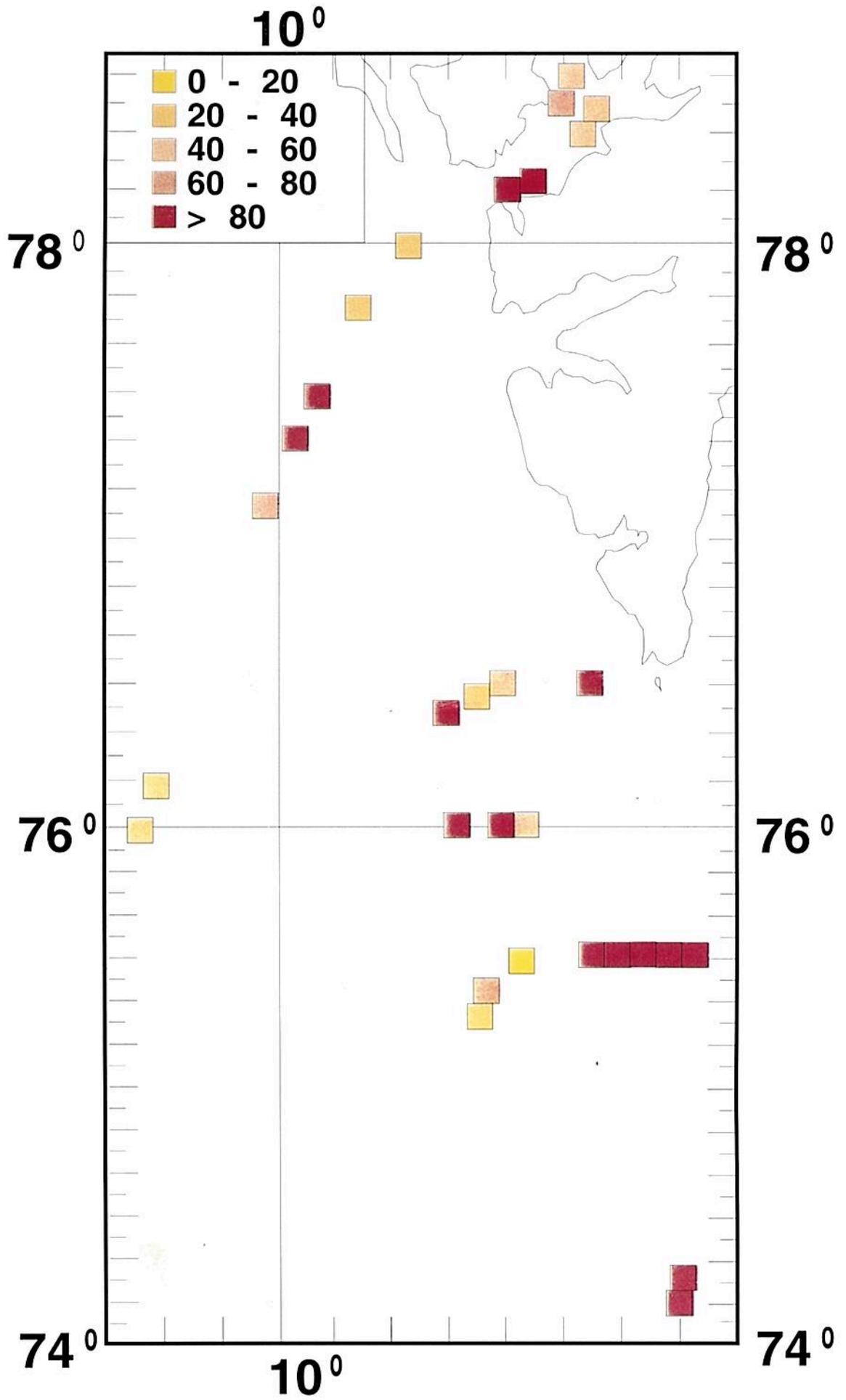
Seabird censuses started on 5 July (16°02'E; 74°17'N) and were conducted in the southwest direction only for 1 hour (16°00'E, 74°10'N). From 11 July (13°32'E, 75°16'N) the birds were counted till 22 July (07°36'E, 75°59'N) in south, southwest and west Spitsbergen waters (also in Istfjord area).

Route of r/y "Oceania" during cruise from Bear Isl. to Svalbard 5 - 22.07. 1994

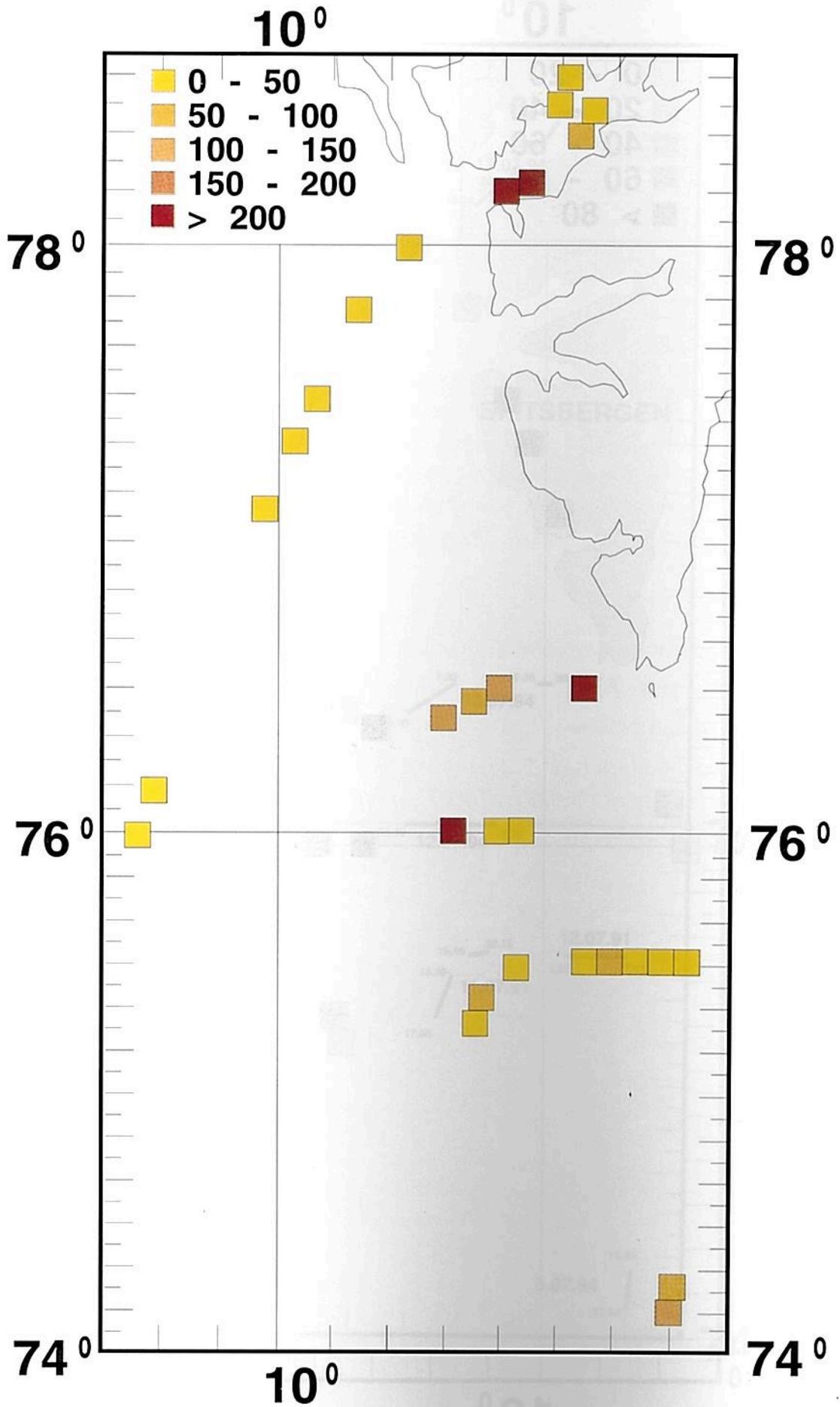


I.

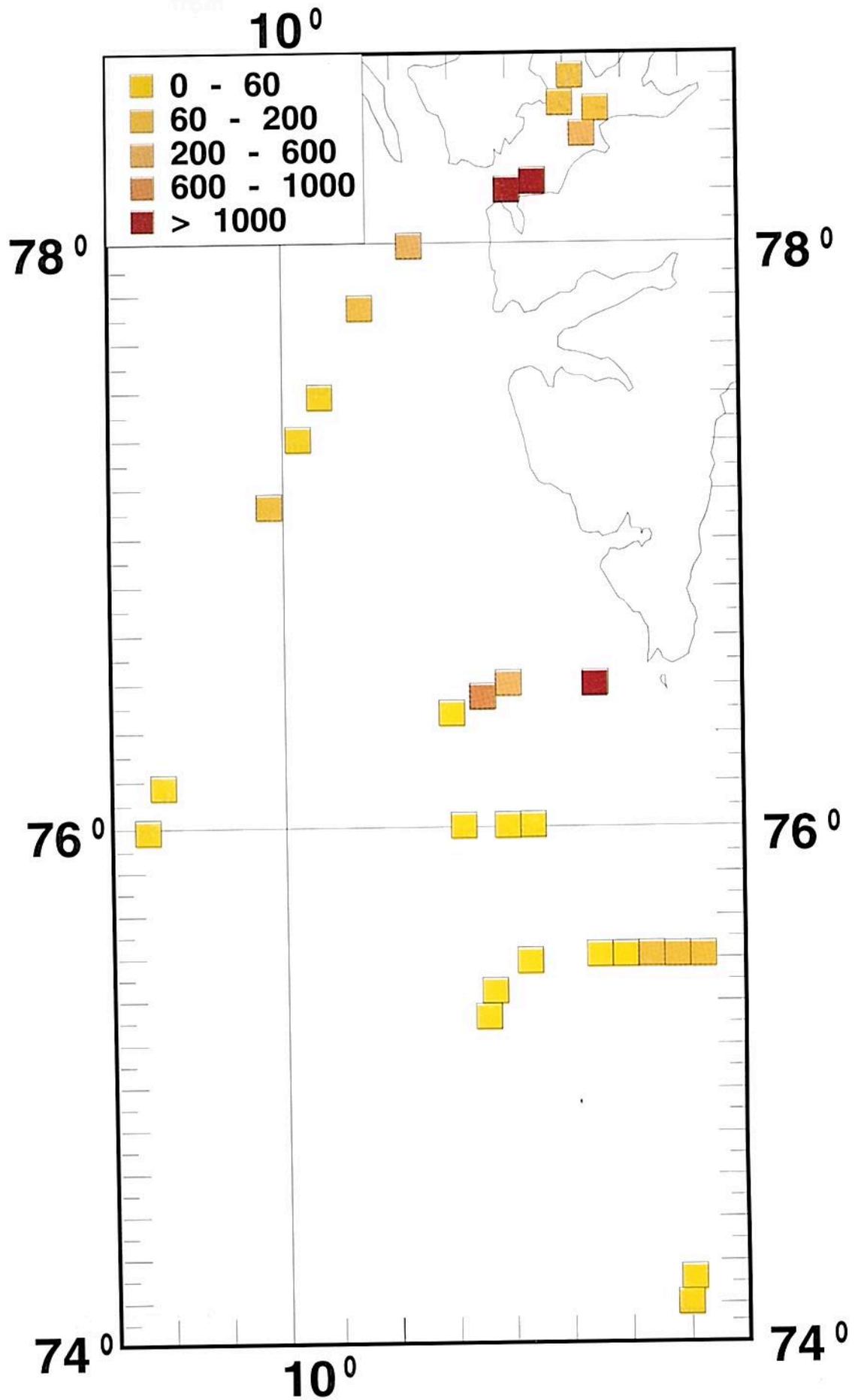
Fulmarus glacialis



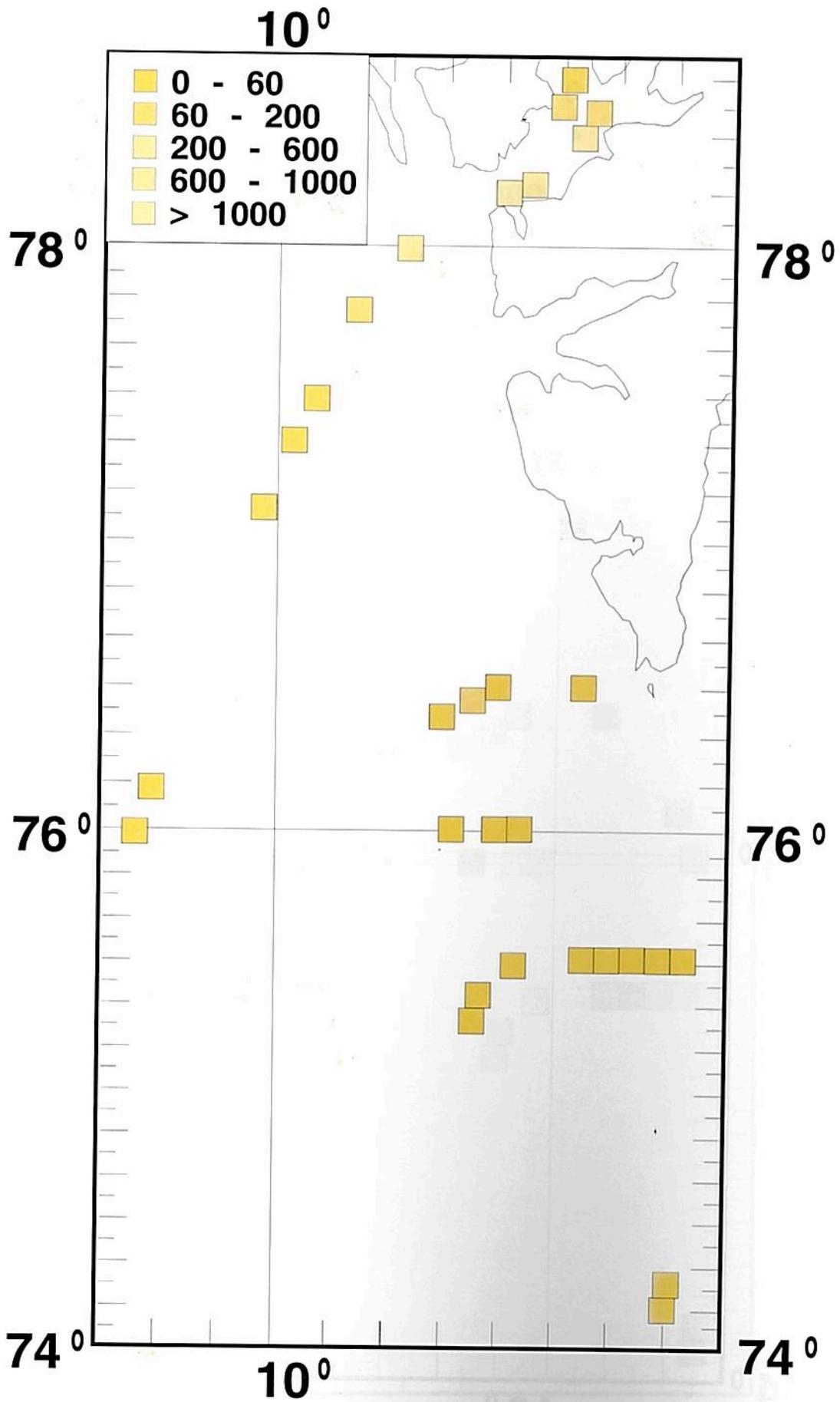
Rissa tridactyla



Uria sp.



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**Seabird counting during the arctic cruise of r/v "Oceania"
from Spitsbergen to Bear Island (July 1995)
AREX'95**

**Michał Malinga
Dept. of Vertebrate Ecology and Zoology, University of Gdańsk
Legionów 9, 81-441 Gdańsk**

Methods

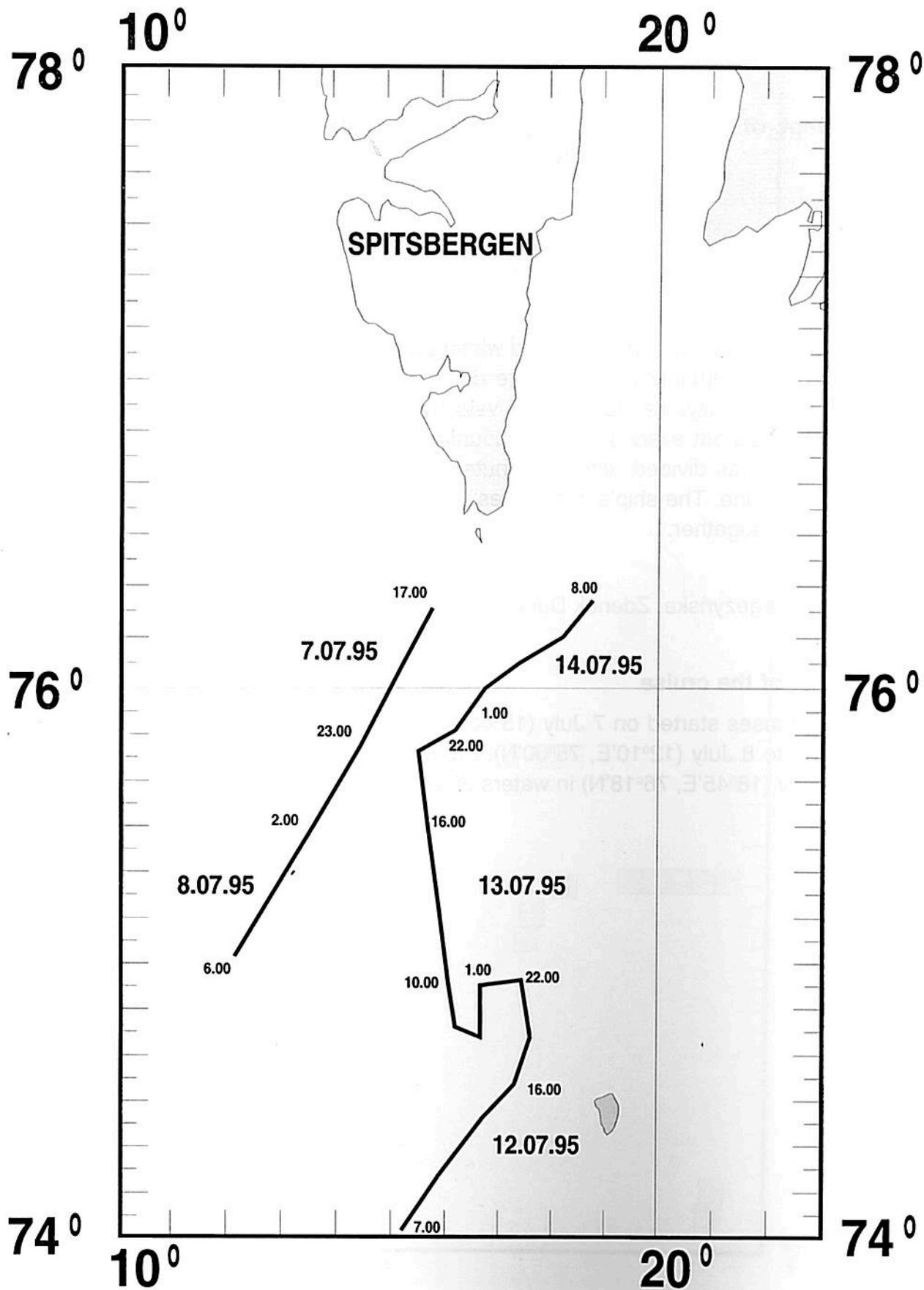
Sea birds and mammals were counted within 300 m zone by the one side of the ship. The observation point was situated on the bridge deck, about 4 m above the sea level. Weather conditions such as visibility, ice cover, wind velocity were noted during the observations. The countings were carried out every 3 hours (8 counting sessions a day). Each session lasted at least 0.5 hour and was divided into 10 minute periods. In total 21 hours and 10 minutes of observations were done. The ship's speed was 3-9 knots. Flying birds and those sitting on the water were counted together.

Observers: Asia Legeżyńska, Zdenek Duris, Piotr Wieczorek.

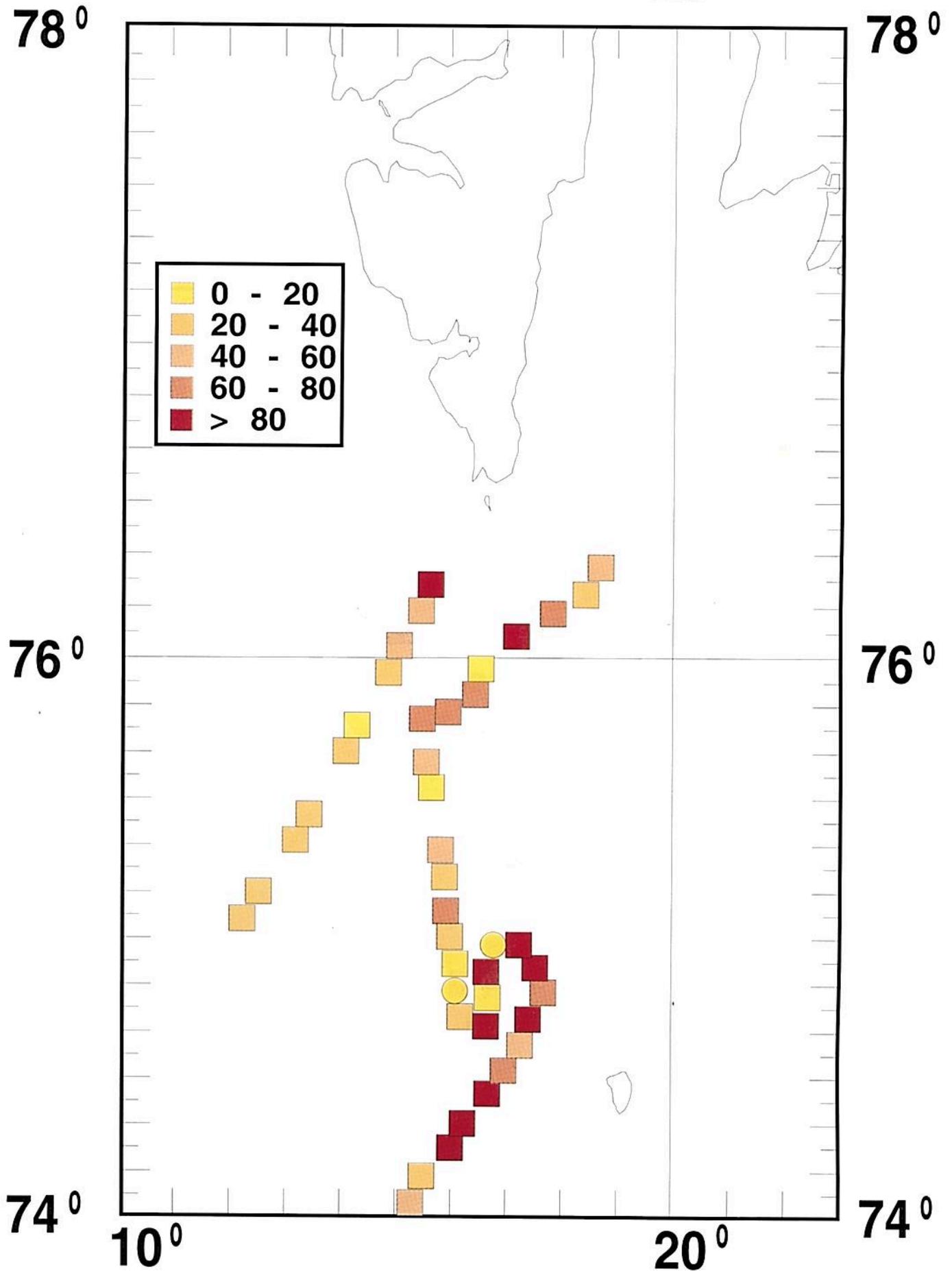
Time and route of the cruise

Seabird censuses started on 7 July (15°40'E; 75°16'N) and were conducted in the south-west direction up to 8 July (12°10'E, 75°00'N). From 12 July (15°05'E, 74°02'N) the birds were counted till 14 July (18°45'E, 76°18'N) in waters of south Spitsbergen.

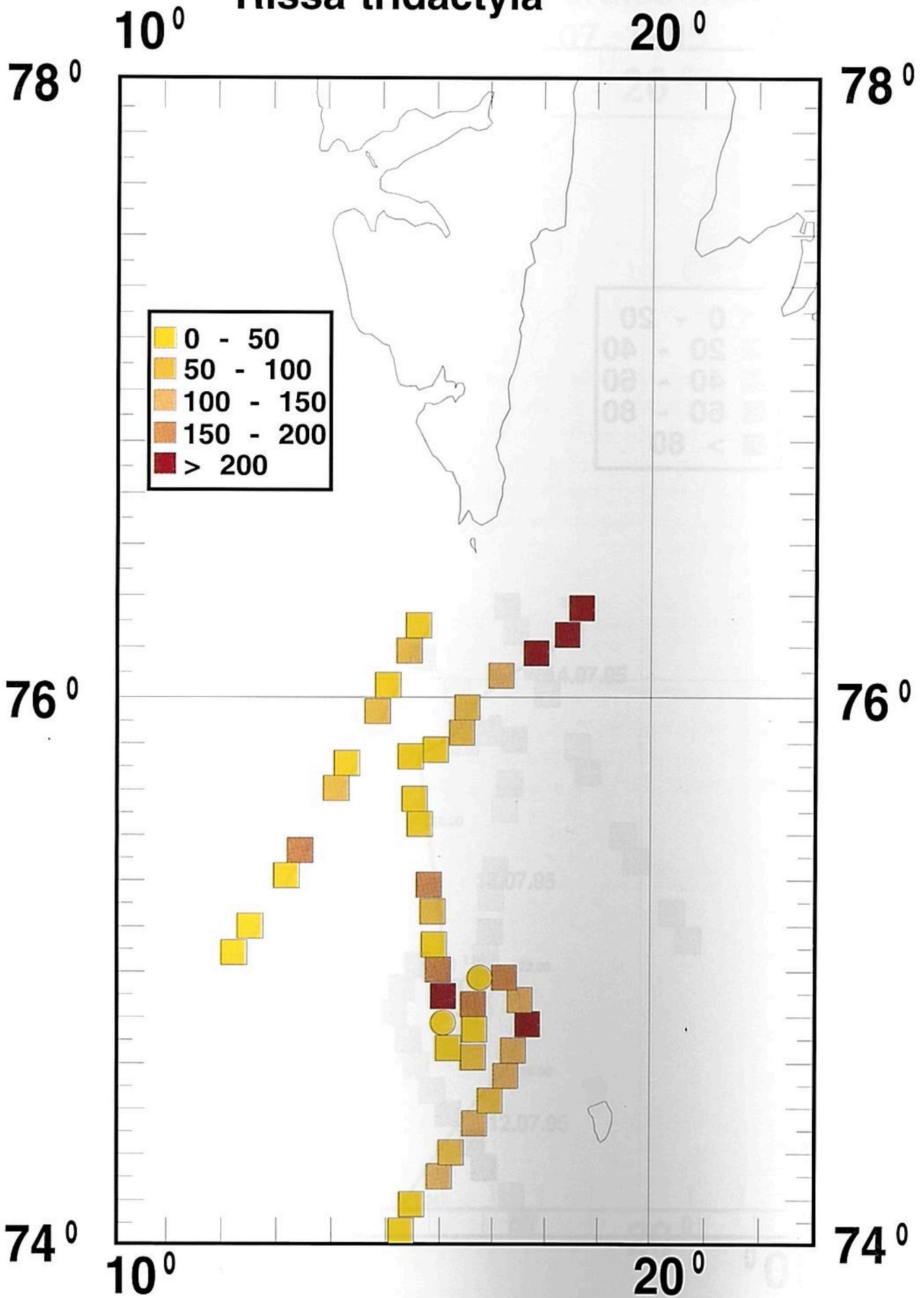
Route of r/y "Oceania" during cruise from Svalbard to Bear Isl. 7 - 14.07. 1995



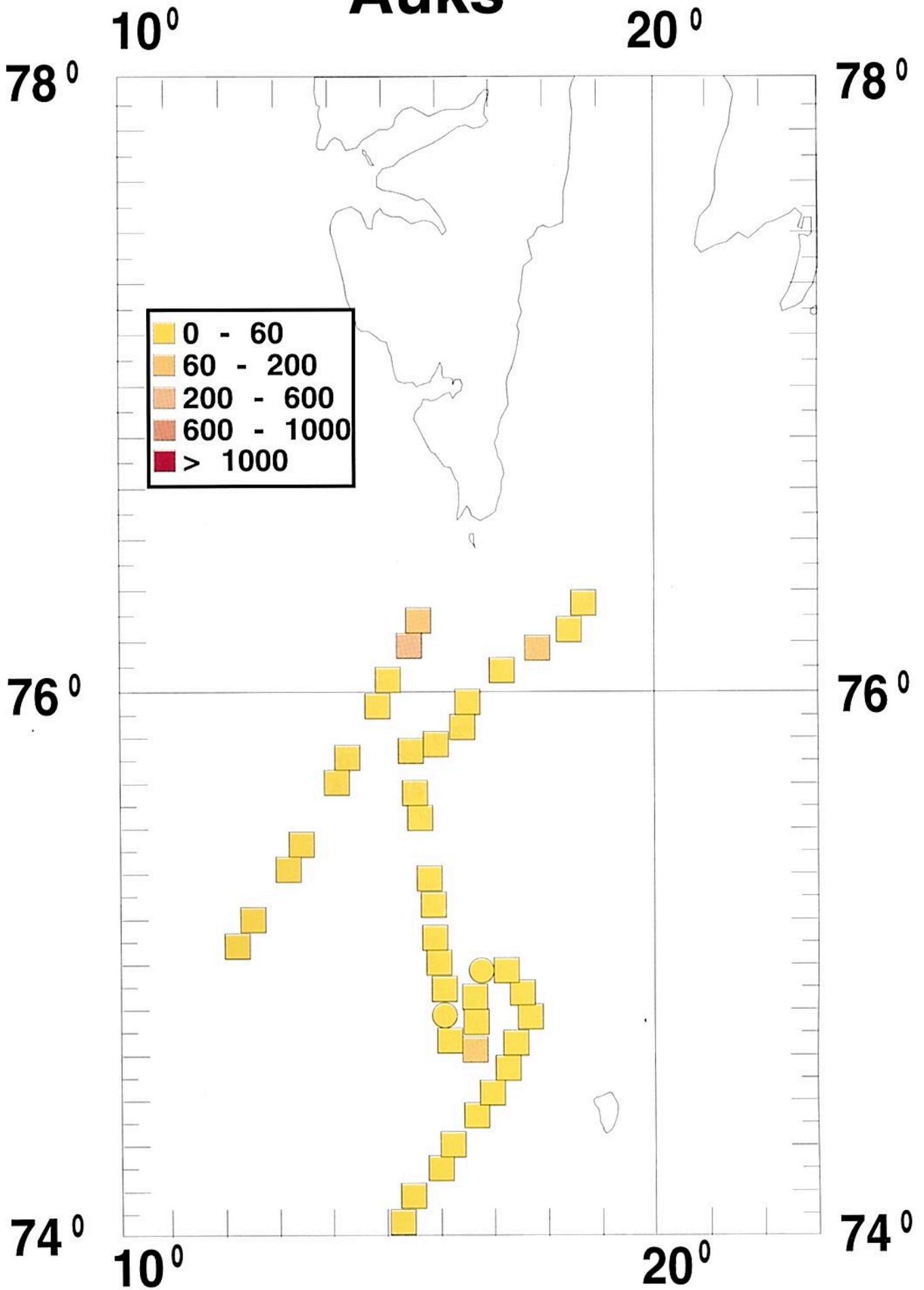
10° Fulmarus glacialis 20°



Rissa tridactyla



Auks



**Seabird counting during the arctic cruise of r/v "Pomor"
from Spitsbergen to Franz Joseph Land (August 1991)
FJL'91**

Michał Skakuj
Dept. of Vertebrate Ecology and Zoology, University of Gdańsk
Legionów 9, 81-441 Gdańsk

Methods

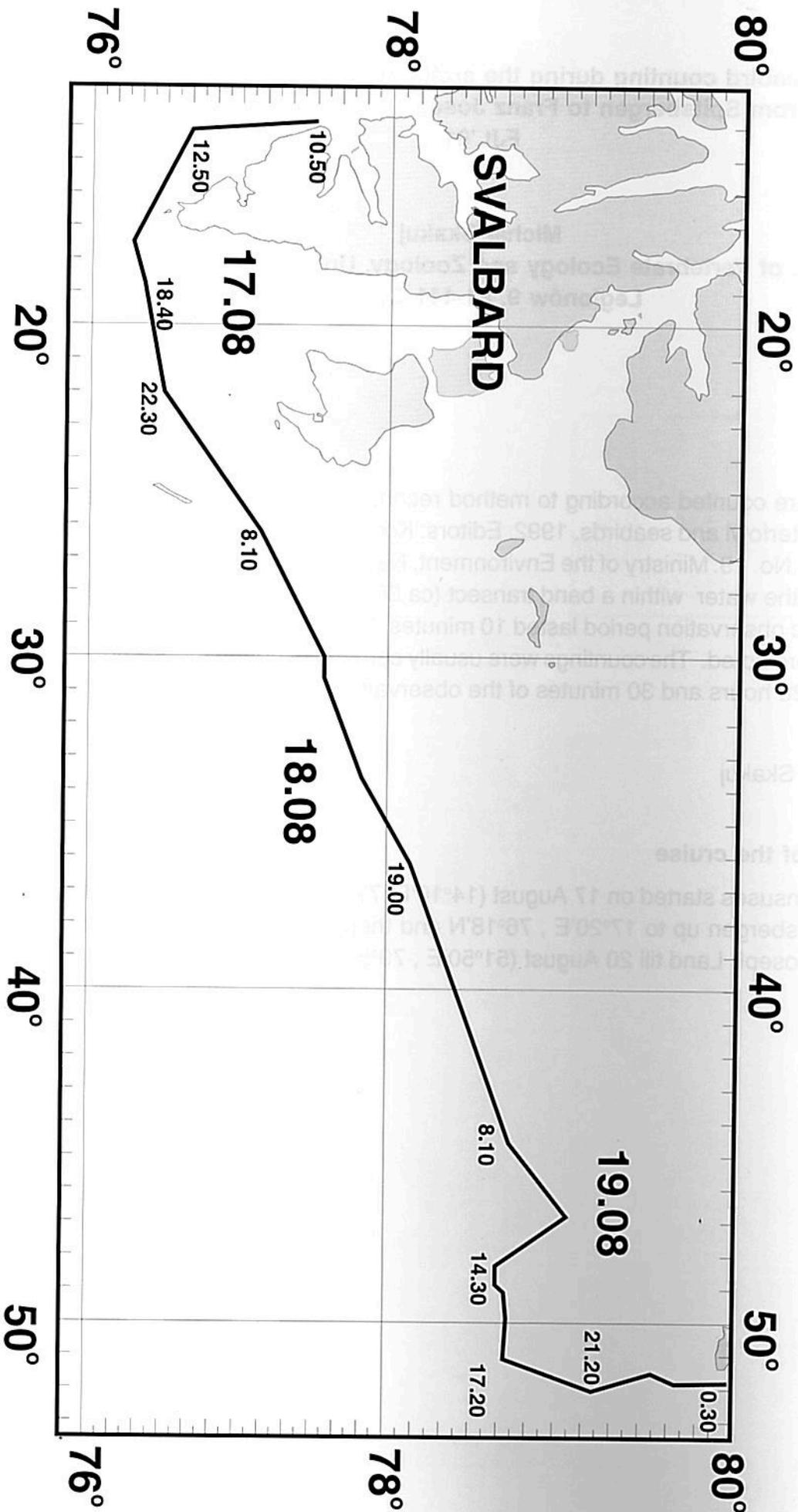
Sea birds were counted according to method recommended in "Manual for aeroplane and ship surveys of waterfowl and seabirds. 1992. Editors: Komdeur J., Bertelsen J., Cracknell. IWRB special publication No. 19. Ministry of the Environment, National Environment Research Institute". All birds sitting on the water within a band transect (ca 300 m wide) by one side of the ship were counted. The basic observation period lasted 10 minutes. During the last 2 minutes all birds flying around the ship were noted. The countings were usually carried out during the 1-3 hour observation sessions. In total 28 hours and 30 minutes of the observation were done.

Observer: Michał Skakuj

Time and route of the cruise

Sea birds censuses started on 17 August (14°10'E; 77°28'N) and were conducted along the west coast of Spitsbergen up to 17°20'E , 76°18'N and then were continued across the Barents Sea up to Franz Joseph Land till 20 August (51°50'E , 79°58'N).

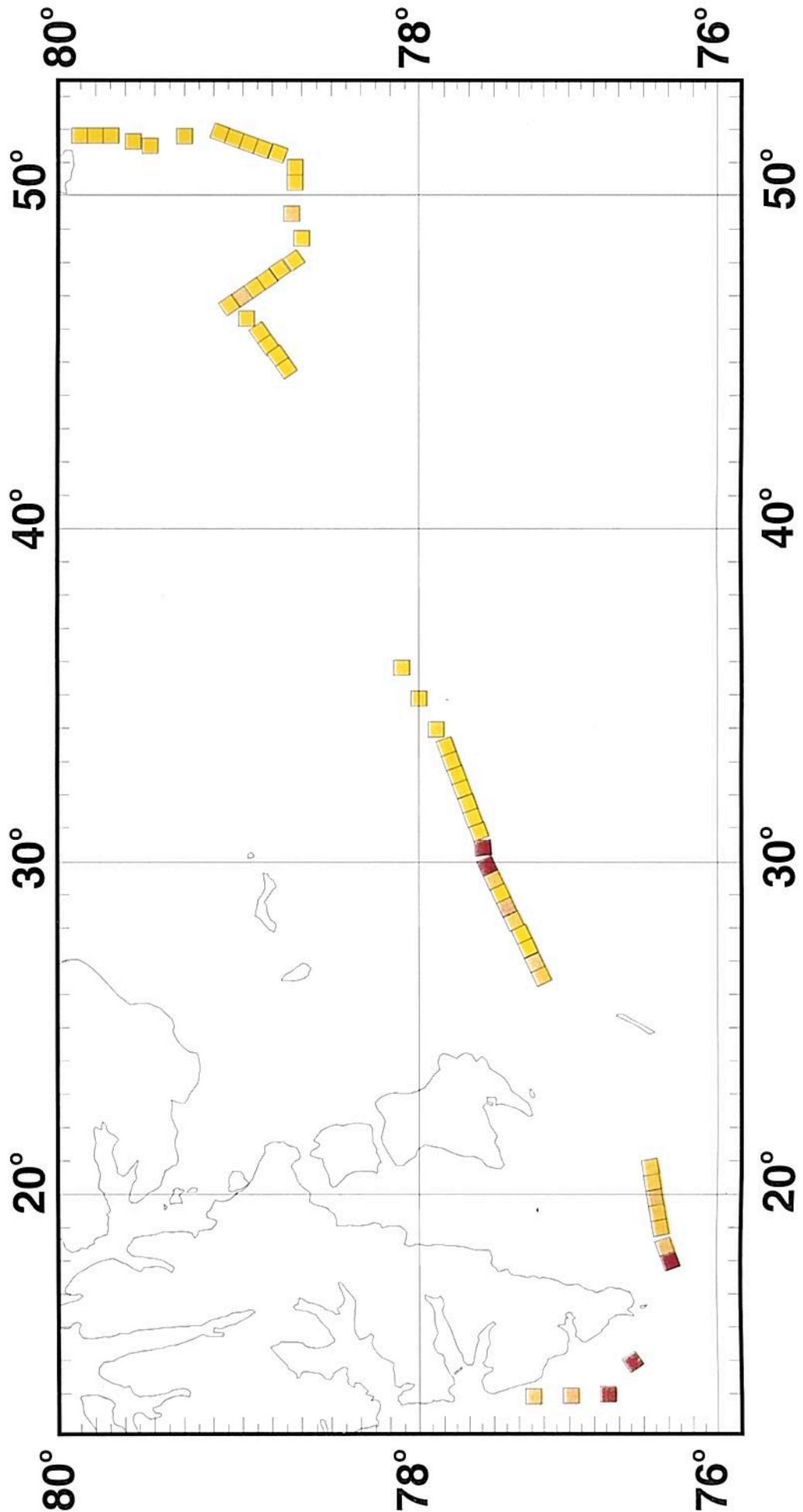
Route of r/v "Pomor" during cruise from Spitsbergen to Franz Josef Land
 17 - 20.08 1991



Fulmarus glacialis

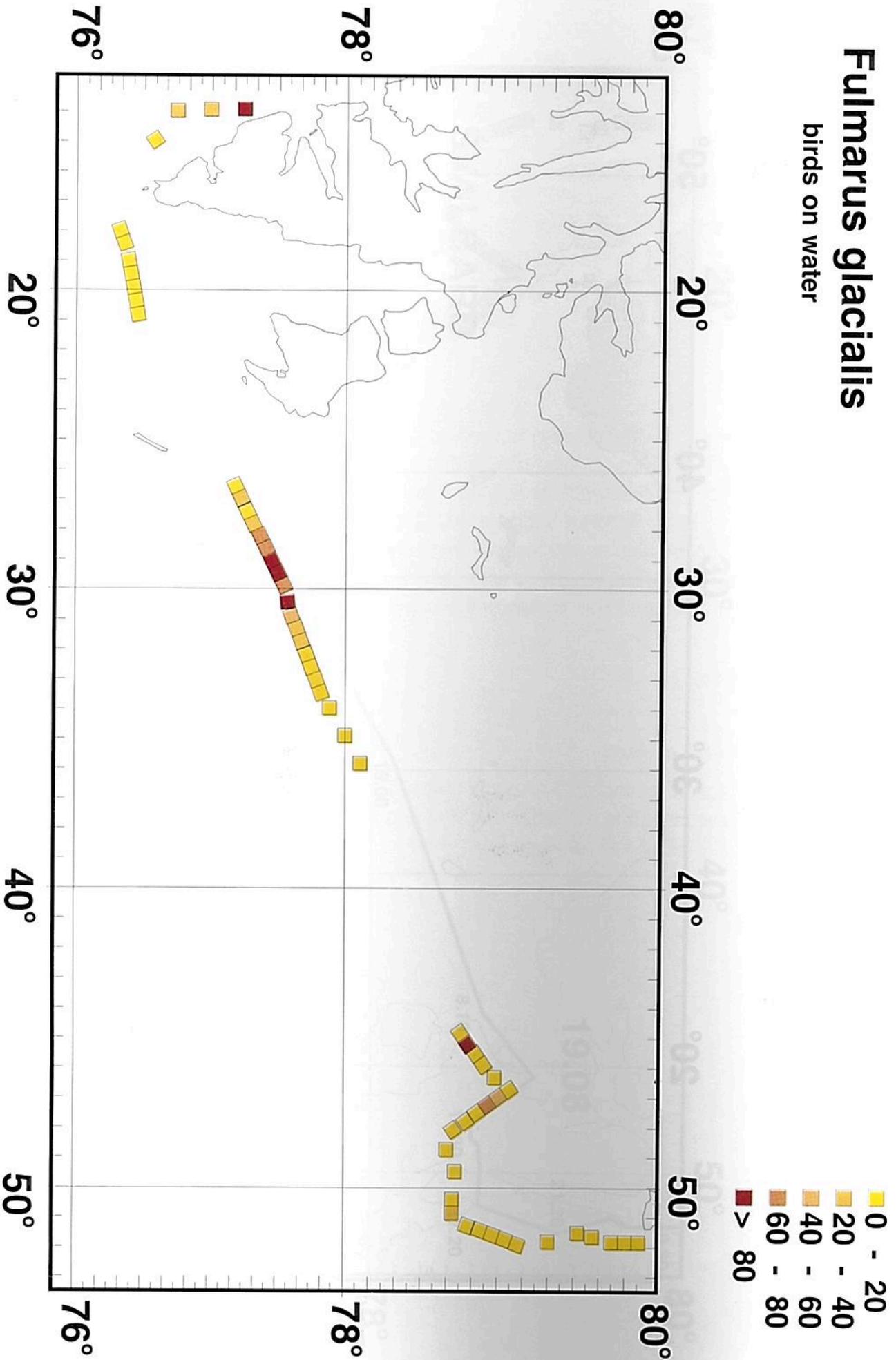
only flying birds

- 0 - 20
- 20 - 40
- 40 - 60
- 60 - 80
- > 80

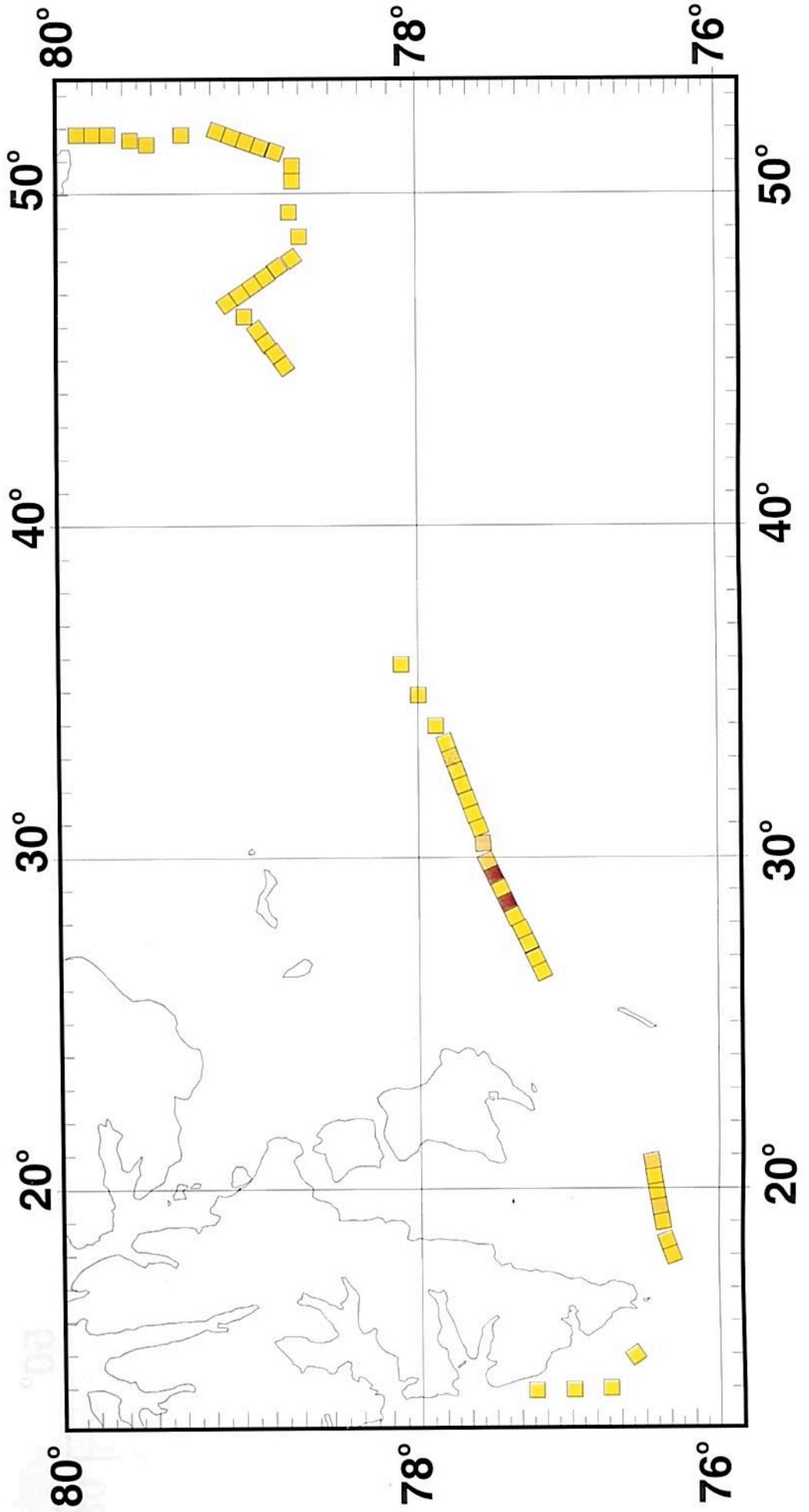
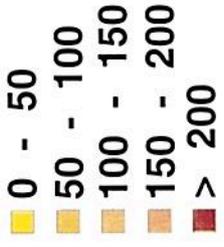


Fulmarus glacialis

birds on water

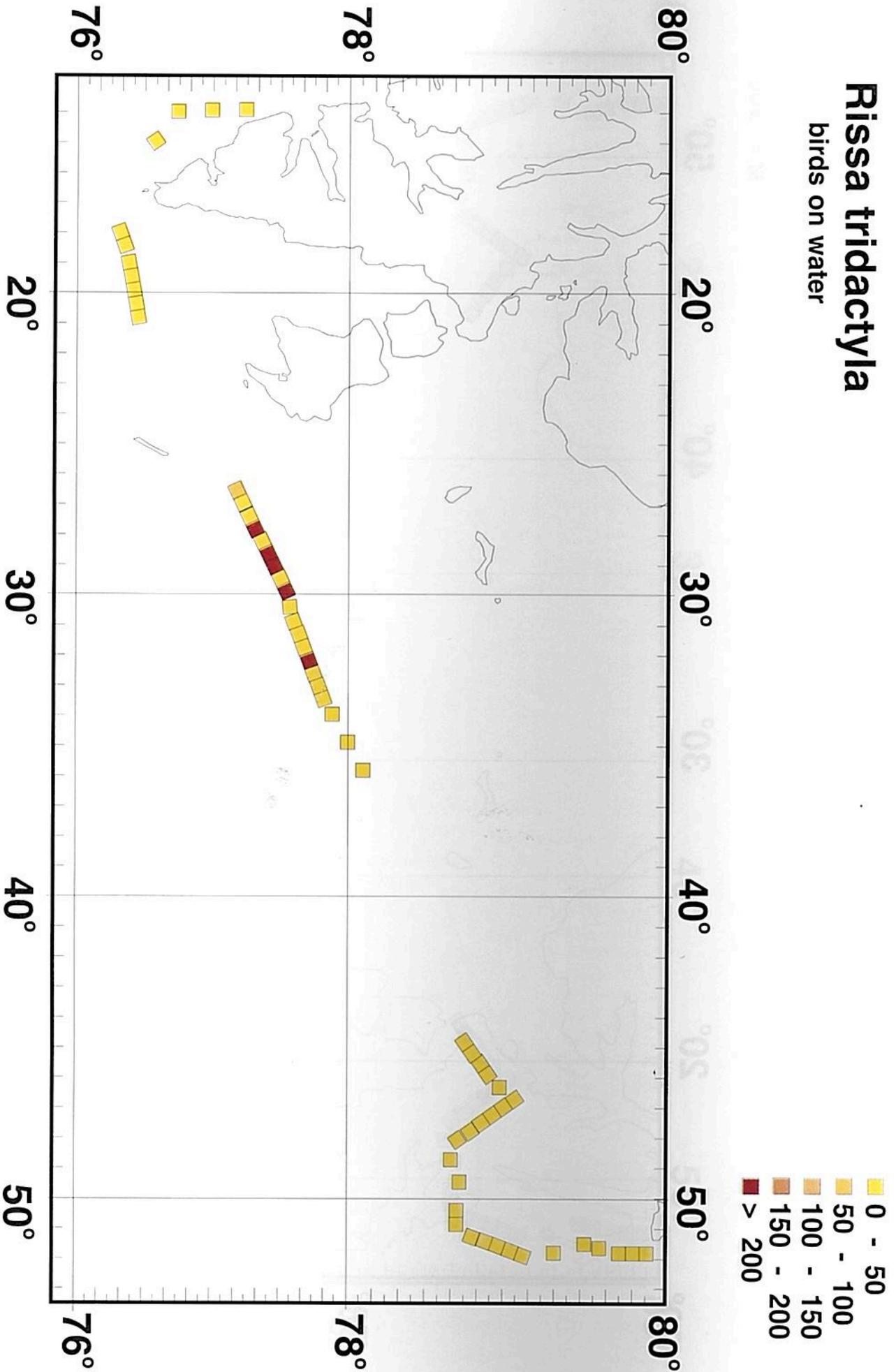


Rissa tridactyla only flying birds



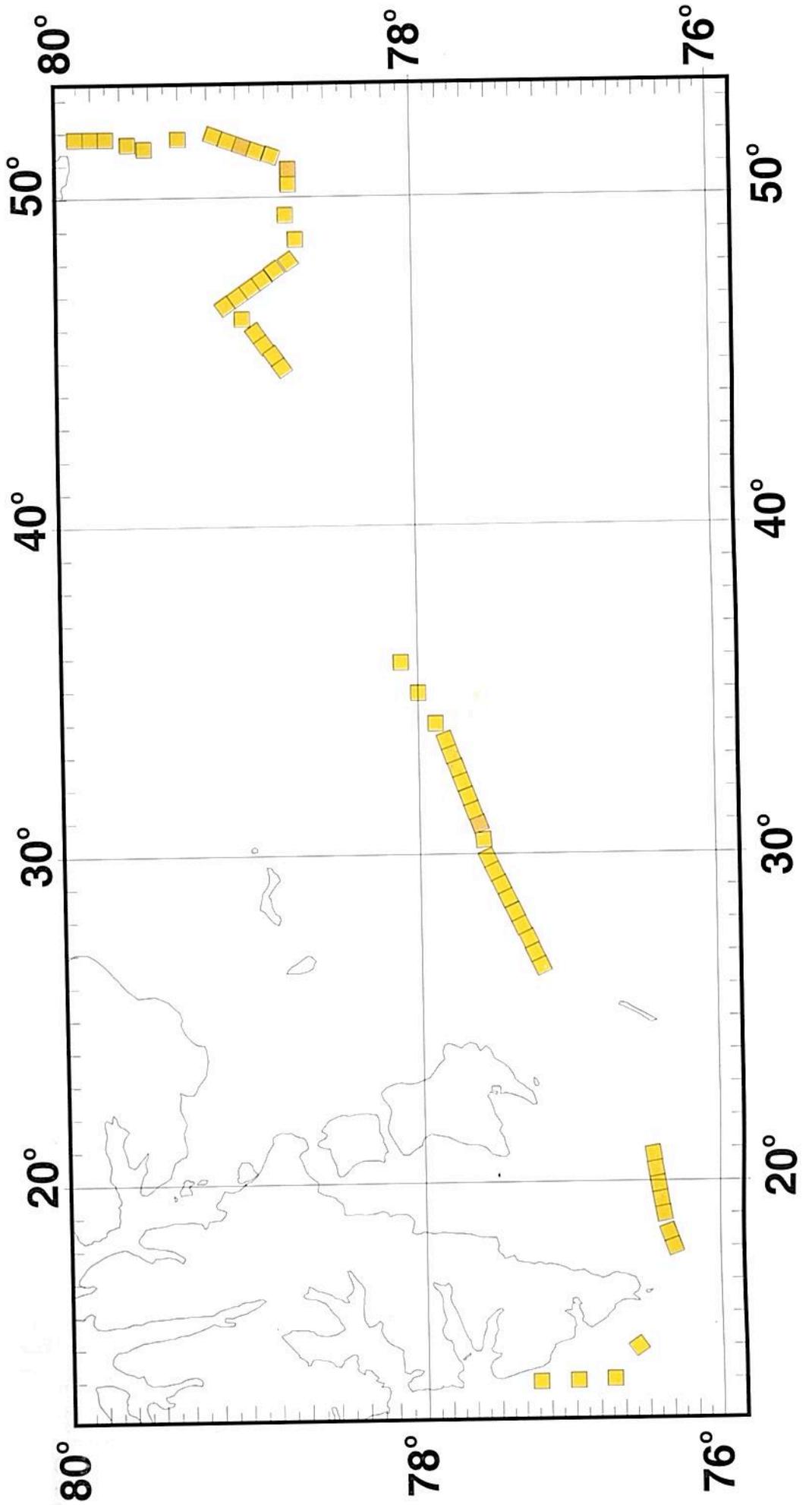
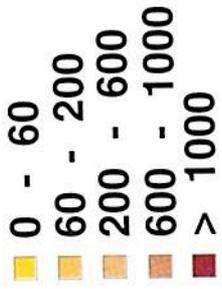
Rissa tridactyla

birds on water

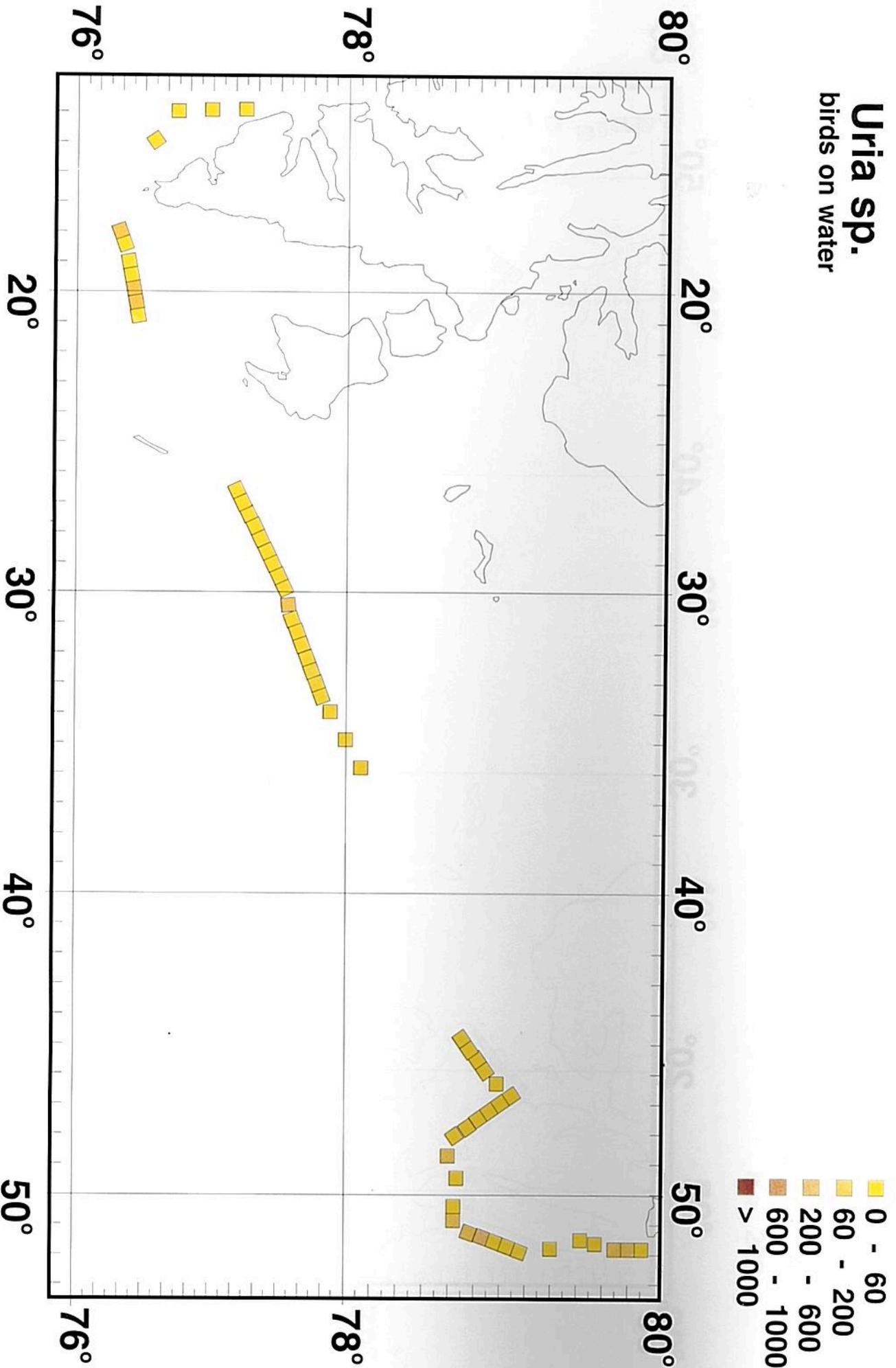


Uria sp.

only flying birds

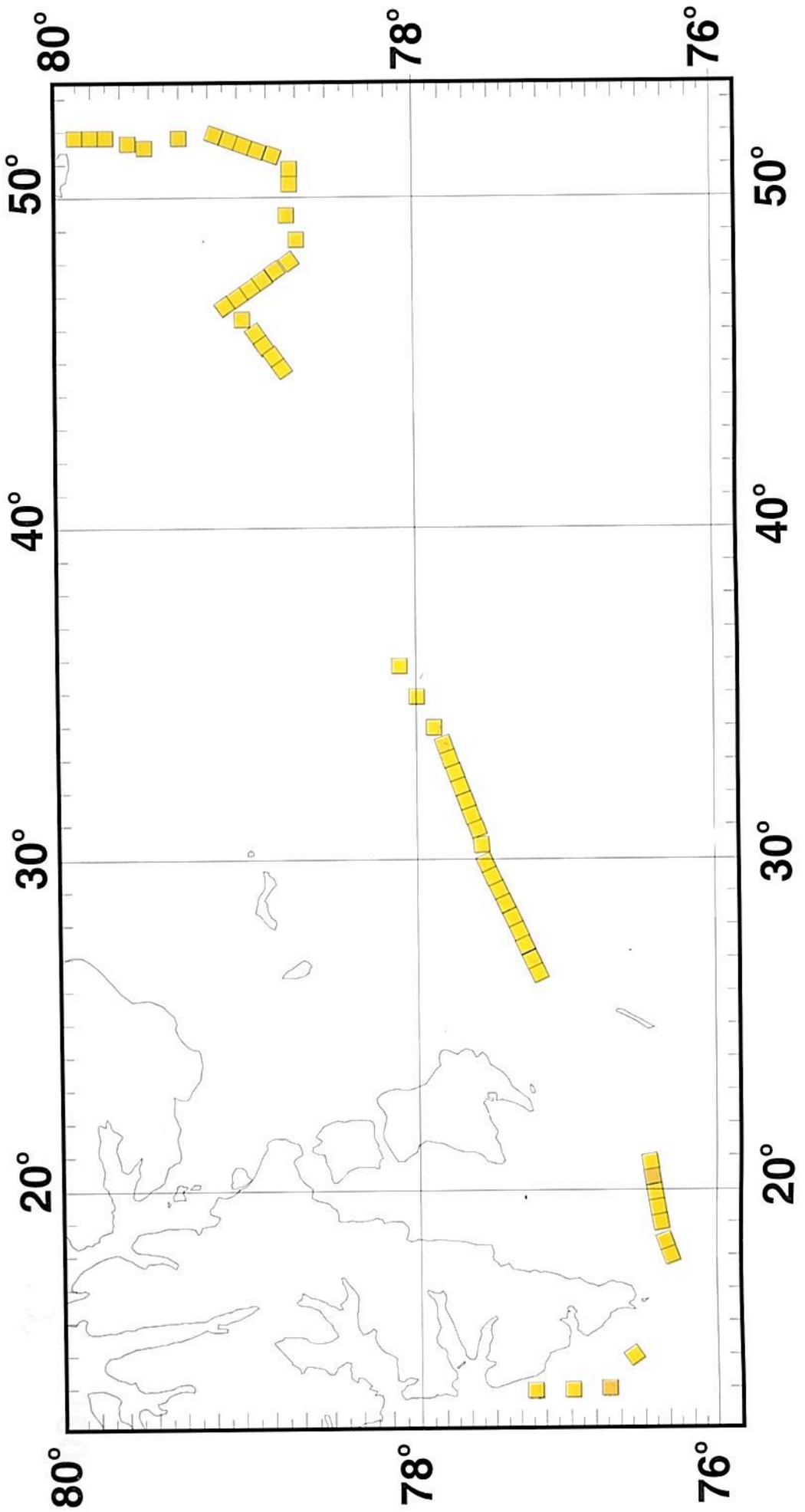


Uria sp.
birds on water

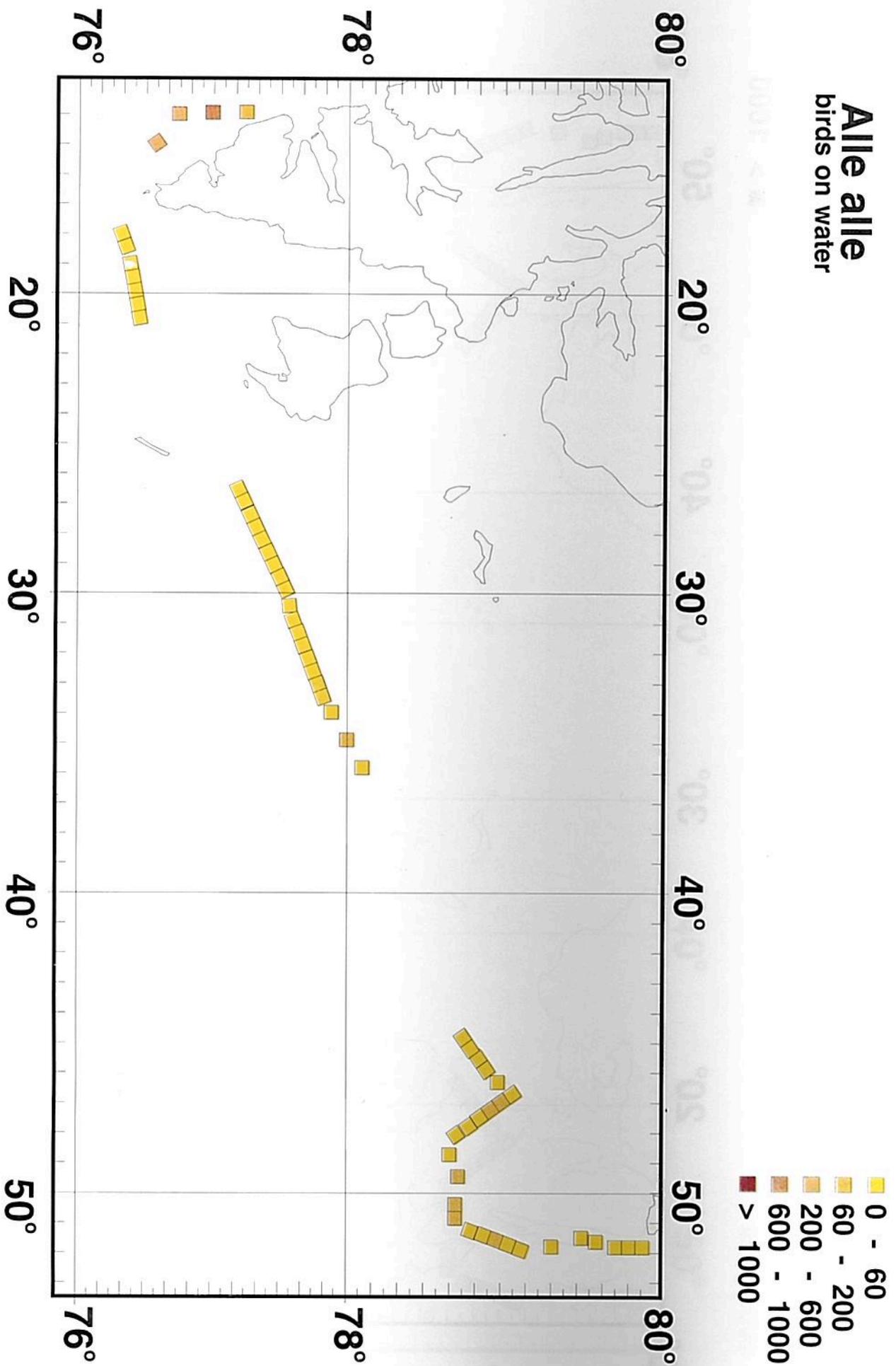


Alle alle
only flying birds

- 0 - 60
- 60 - 200
- 200 - 600
- 600 - 1000
- > 1000



Alle alle birds on water



**Seabird counting during the arctic cruise of r/v "Pomor"
from Franz Joseph Land to Spitsbergen (September 1992)
FJL'92**

Michał Malinga, Lech Stempniewicz
Dept. of Vertebrate Ecology and Zoology, University of Gdańsk,
Legionów 9, 81-441 Gdańsk

Methods

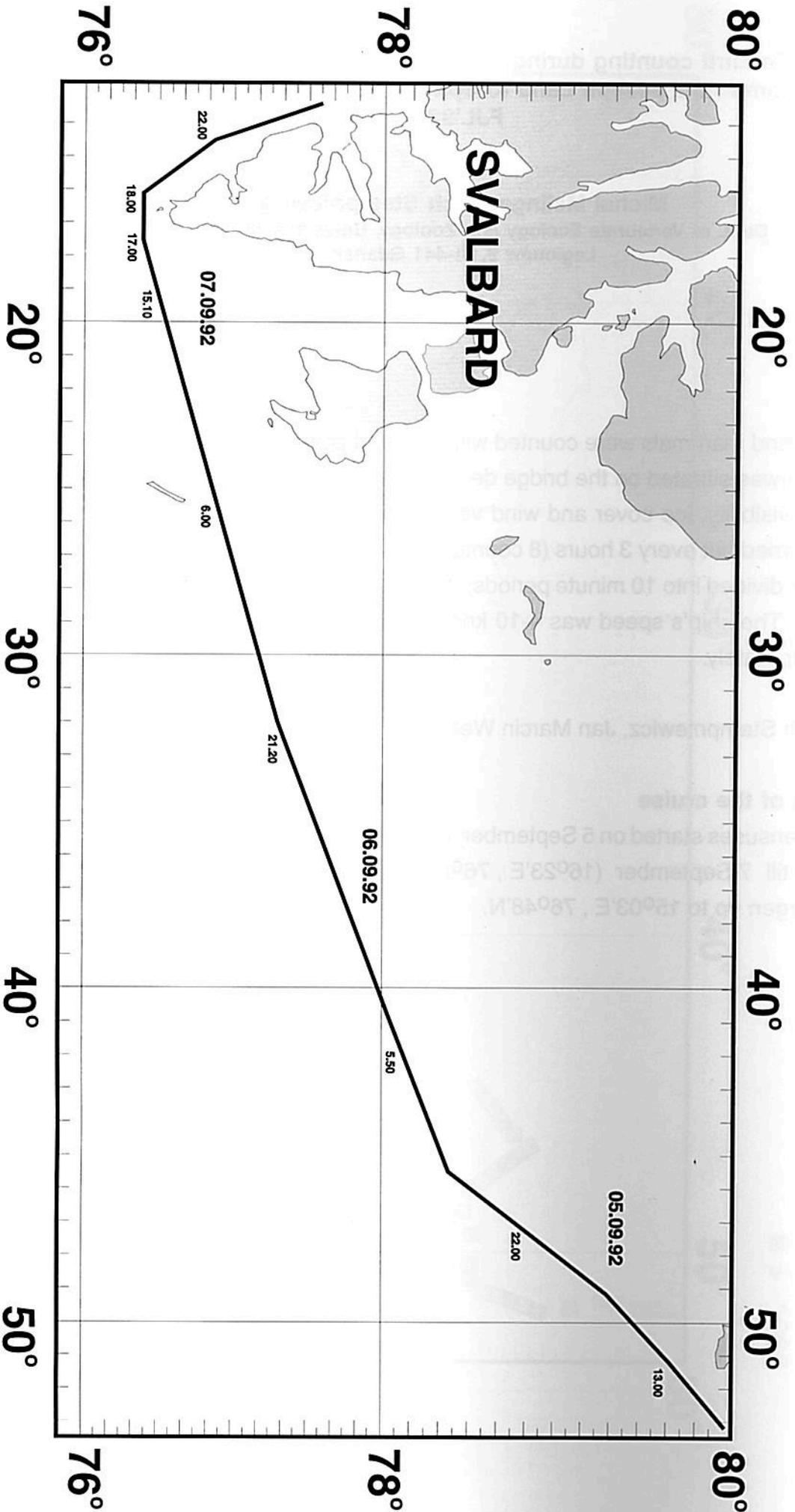
Sea birds and mammals were counted within 300 m zone by the one side of the ship. The observation point was situated on the bridge deck, about 5 m above the sea level. Weather conditions such as visibility, ice cover and wind velocity were noted during the observations. The counting were carried out every 3 hours (8 counting sessions a day). Each session lasted at least 0.5 hour and was divided into 10 minute periods. In total, 17 hours and 30 minutes of the observations were done. The ship's speed was 4-10 knots. Flying birds and those sitting on the water were counted separately.

Observers: Lech Stempniewicz, Jan Marcin Węśławski, Lars Øyvind Knutsen, Hallvard Strøm.

Time and route of the cruise

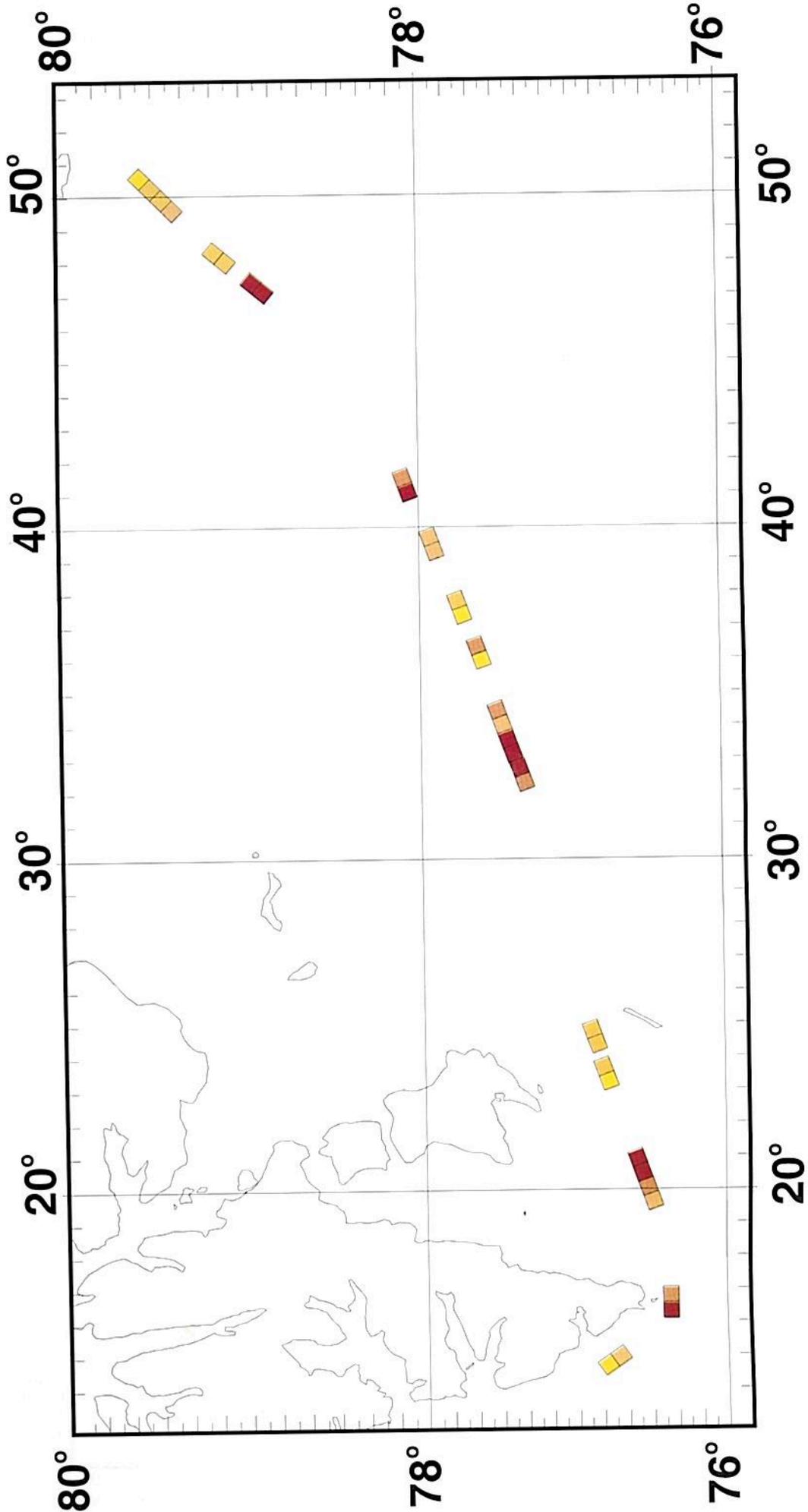
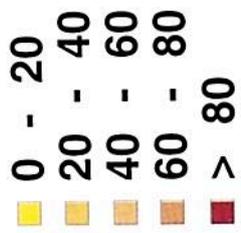
Seabird censuses started on 5 September (52°15'E; 79°40'N) and were conducted across the Barents Sea till 7 September (16°23'E, 76°22'N), and then were continued along the west coast of Spitsbergen up to 15°03'E, 76°48'N.

Route of r/v "Pomor" during cruise from Franz Josef Land to Spitsbergen
5 - 7.09 1992



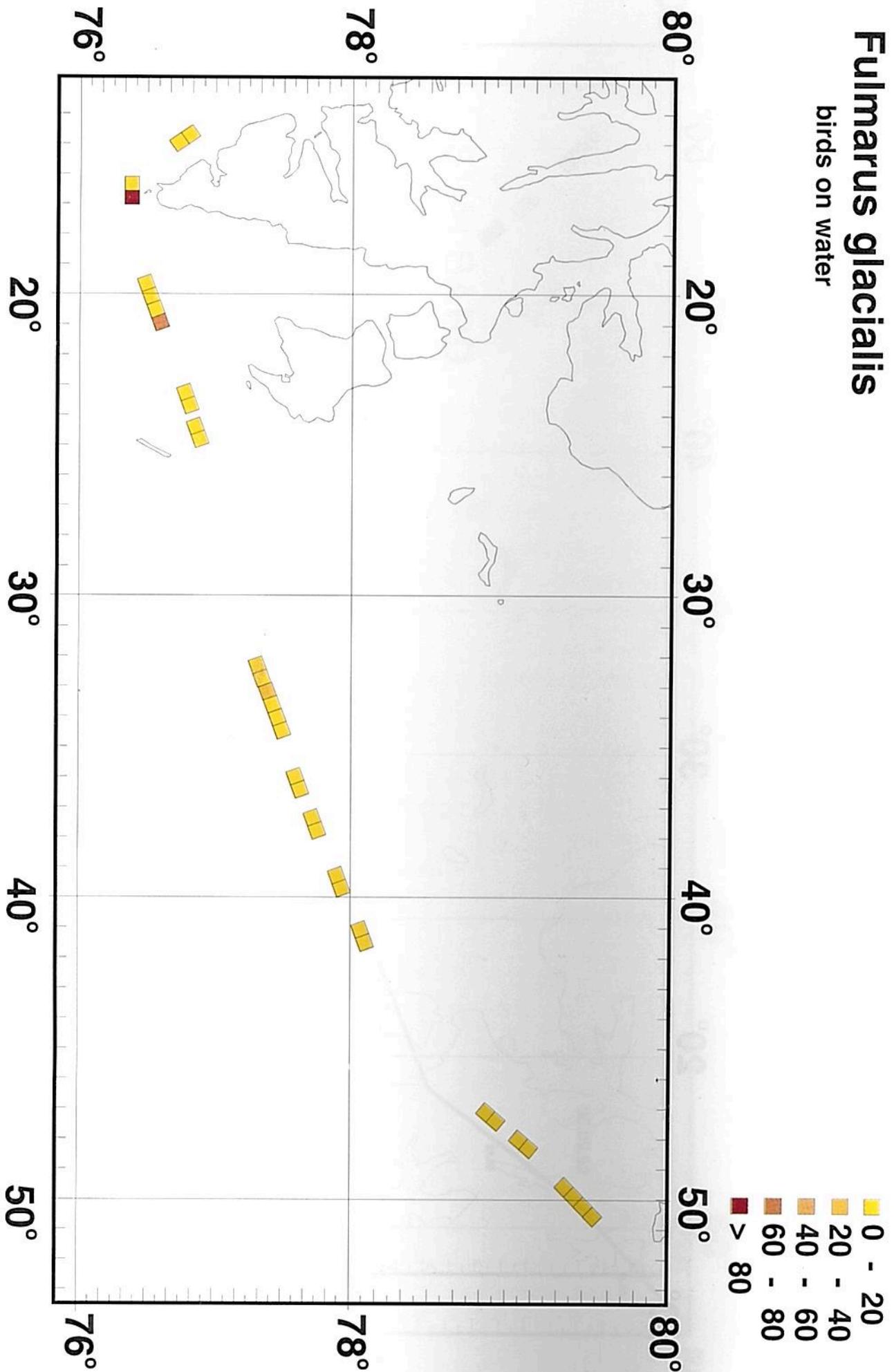
Fulmarus glacialis

only flying birds



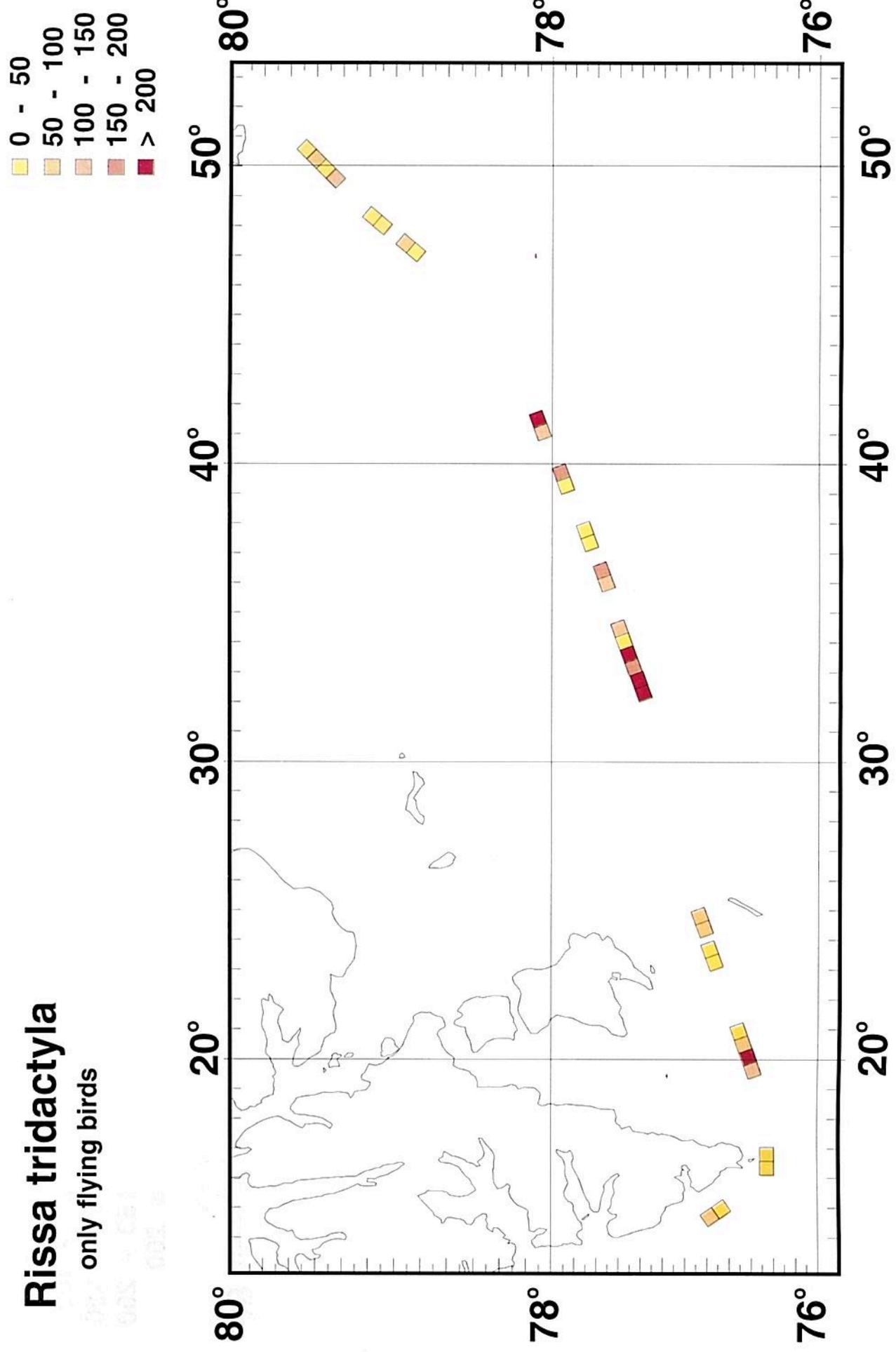
Fulmarus glacialis

birds on water



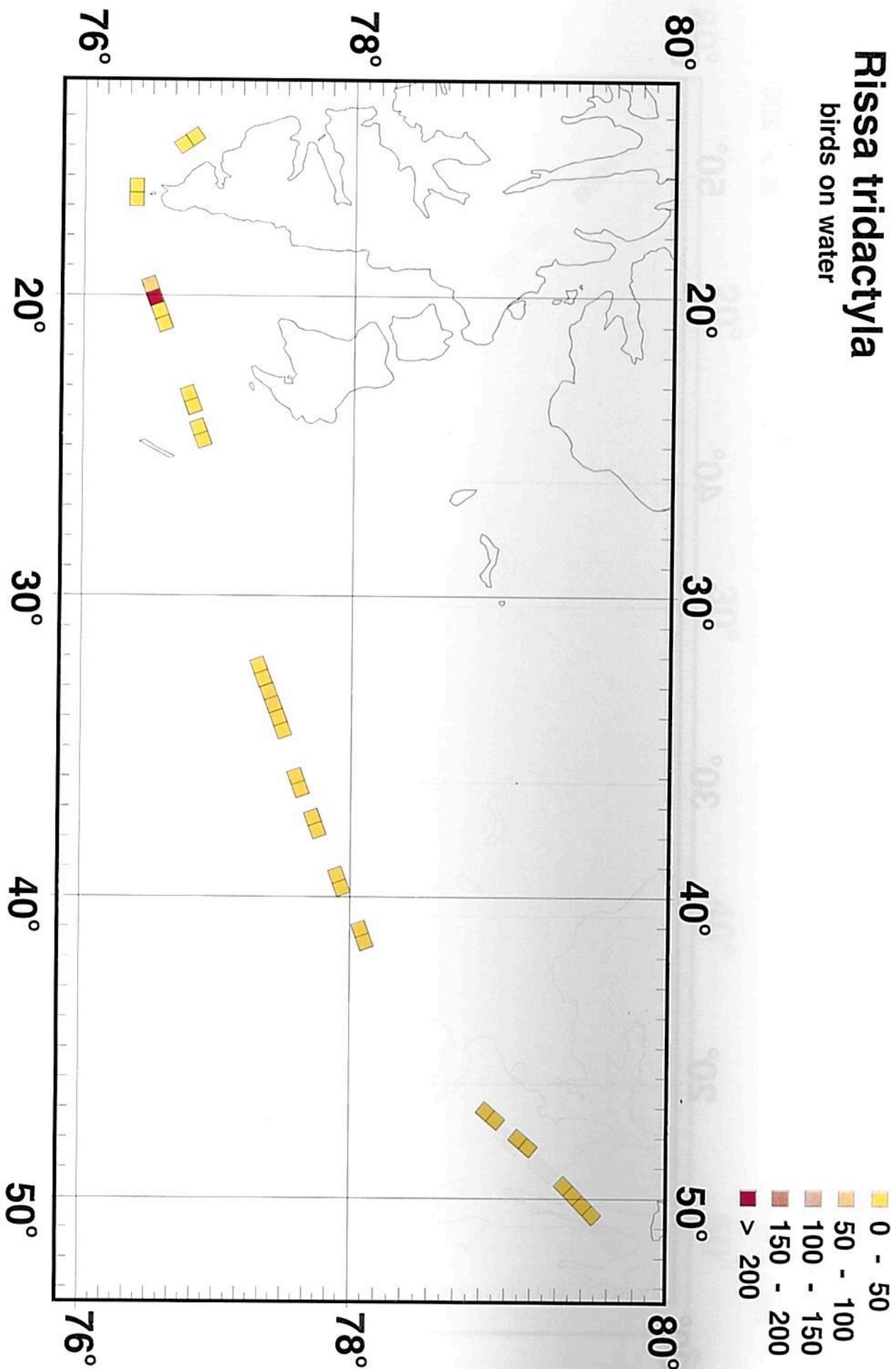
Rissa tridactyla

only flying birds



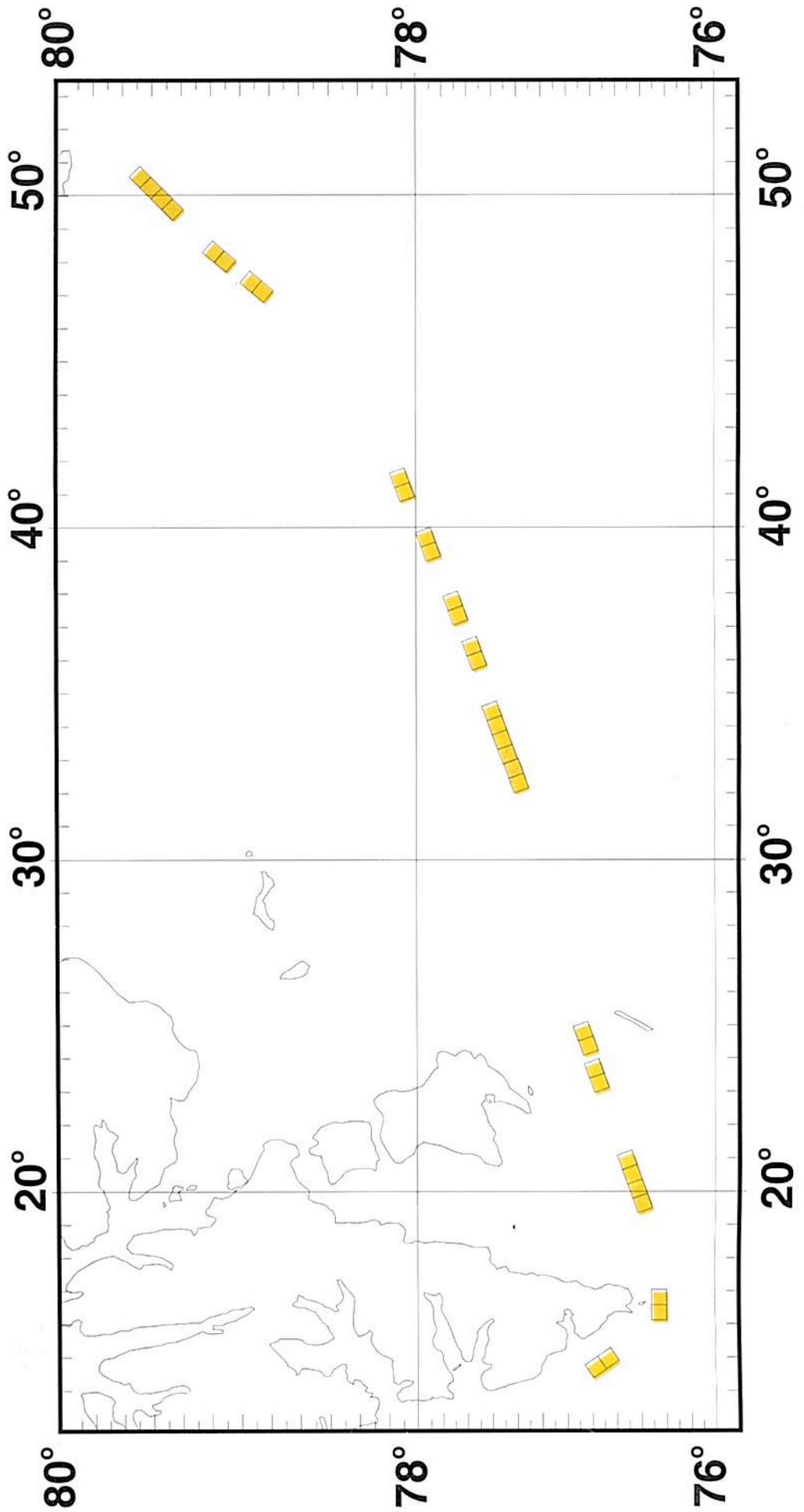
Rissa tridactyla

birds on water

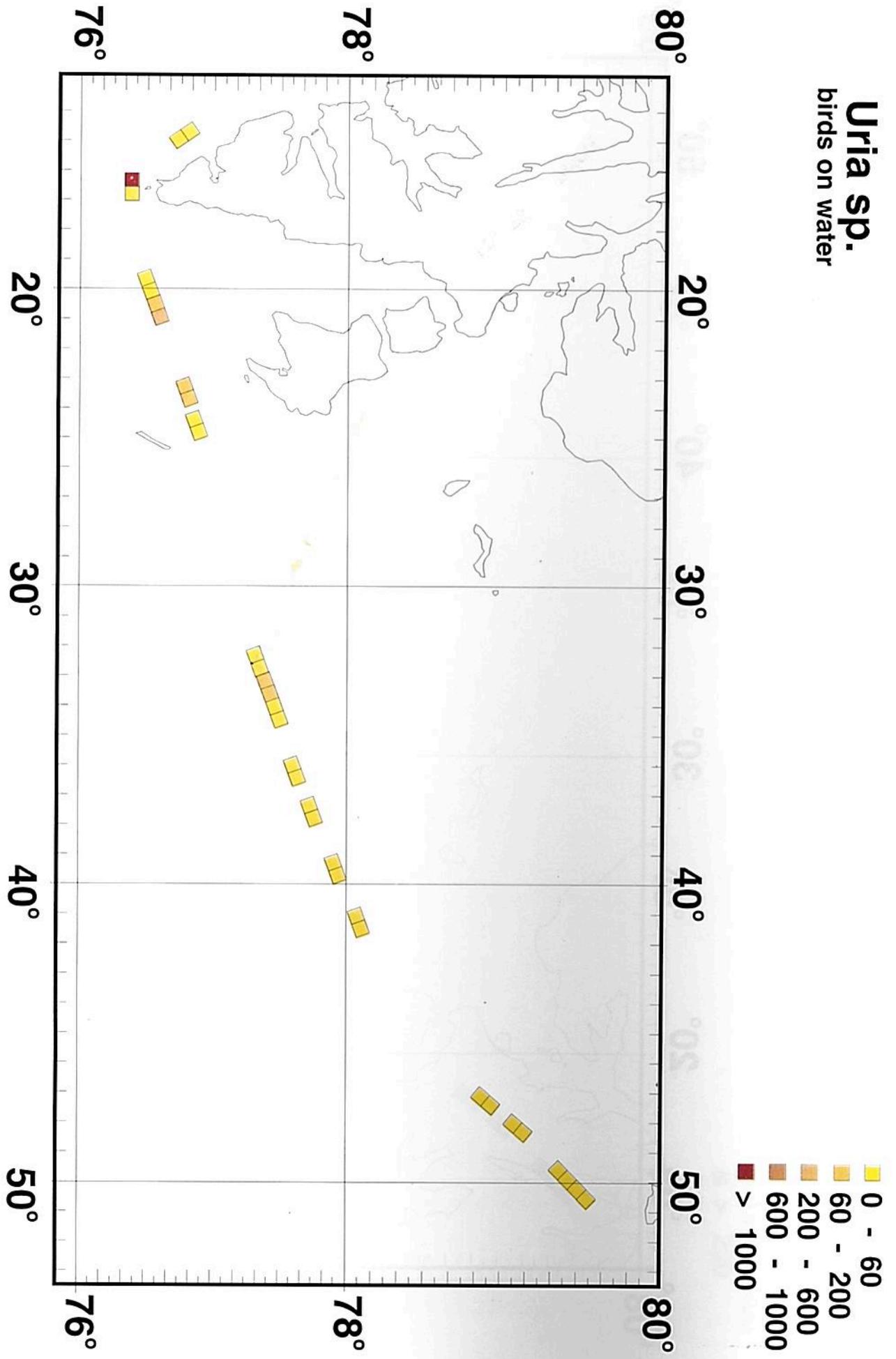


Uria sp.
only flying birds

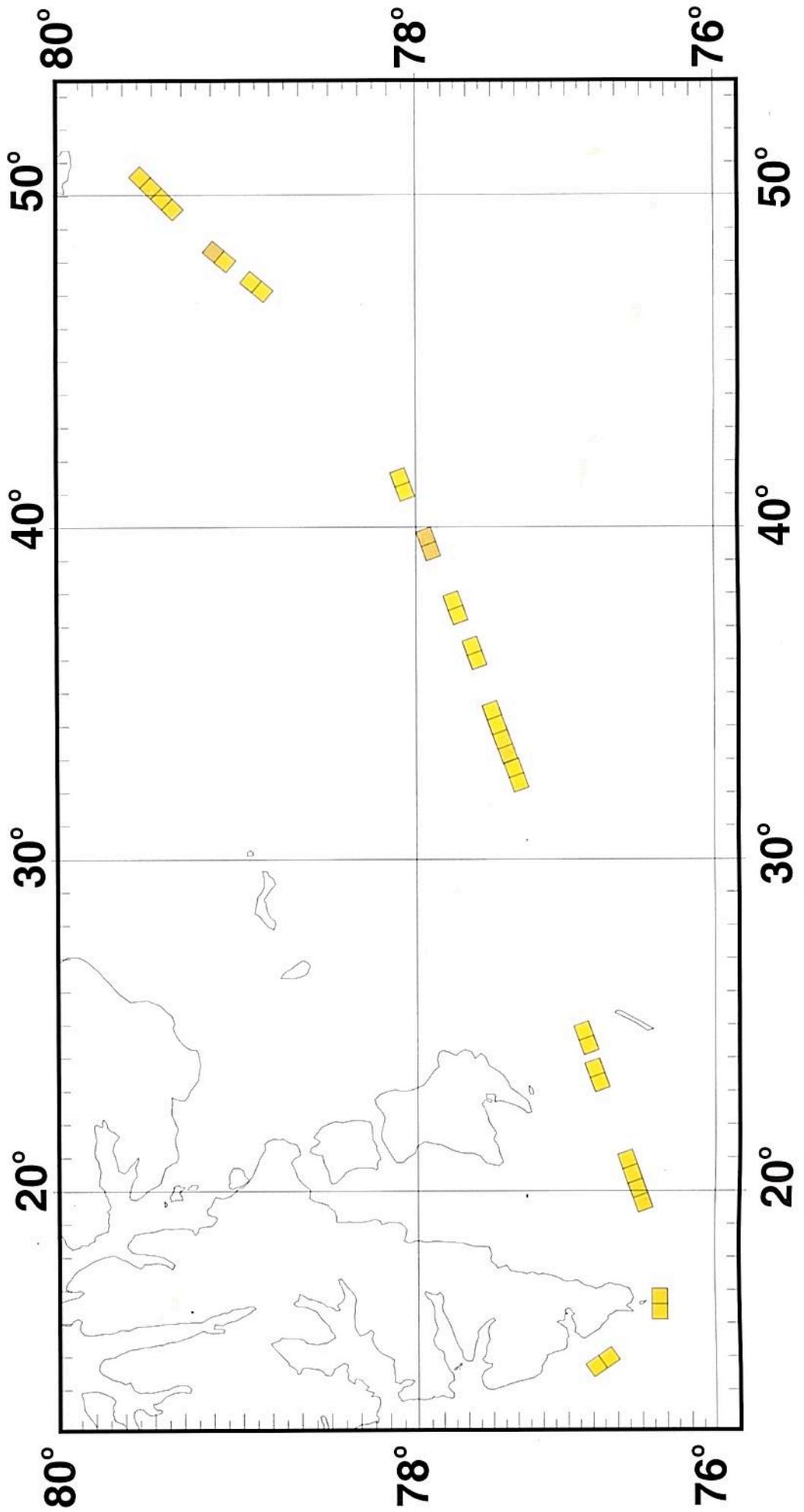
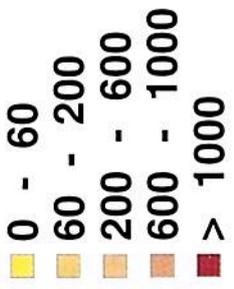
- 0 - 60
- 60 - 200
- 200 - 600
- 600 - 1000
- > 1000



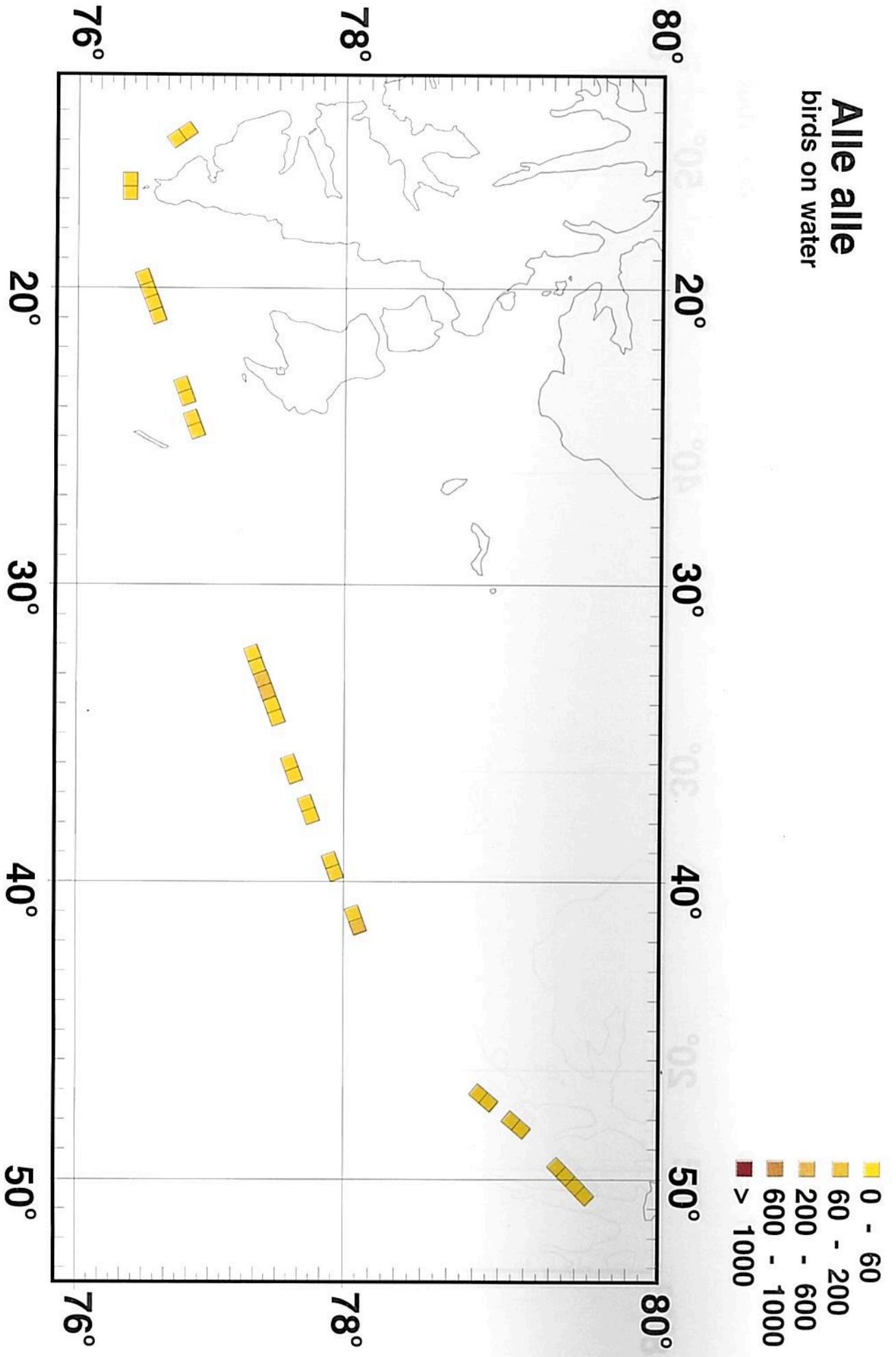
Uria sp. birds on water



Alle alle
only flying birds



Aile alle birds on water



**Seabird counting during the arctic cruise of r/v "Dalnye
Zelentzy" from Murmansk to Franz Joseph Land (August 1993)
FJL'93**

Lech Iliszko

Dept. of Vertebrate Ecology and Zoology, University of Gdańsk
Legionów 9, 80-441 Gdańsk, Poland

Methods

Sea birds and mammals were counted within 300 m zone by the one side of the ship. The observation point was situated on the frontal top deck, about 7 m above the sea level. Weather conditions such as visibility, ice cover and wind velocity were noted during the observations. The counting sessions lasted from 0,5 to 1 hour, and covered not less than 8 hours a day. During the back way they covered 15 to 22 hours a day depending on visibility. In total 93 hours of the observations were done. The ship's speed was 4-12 knots.

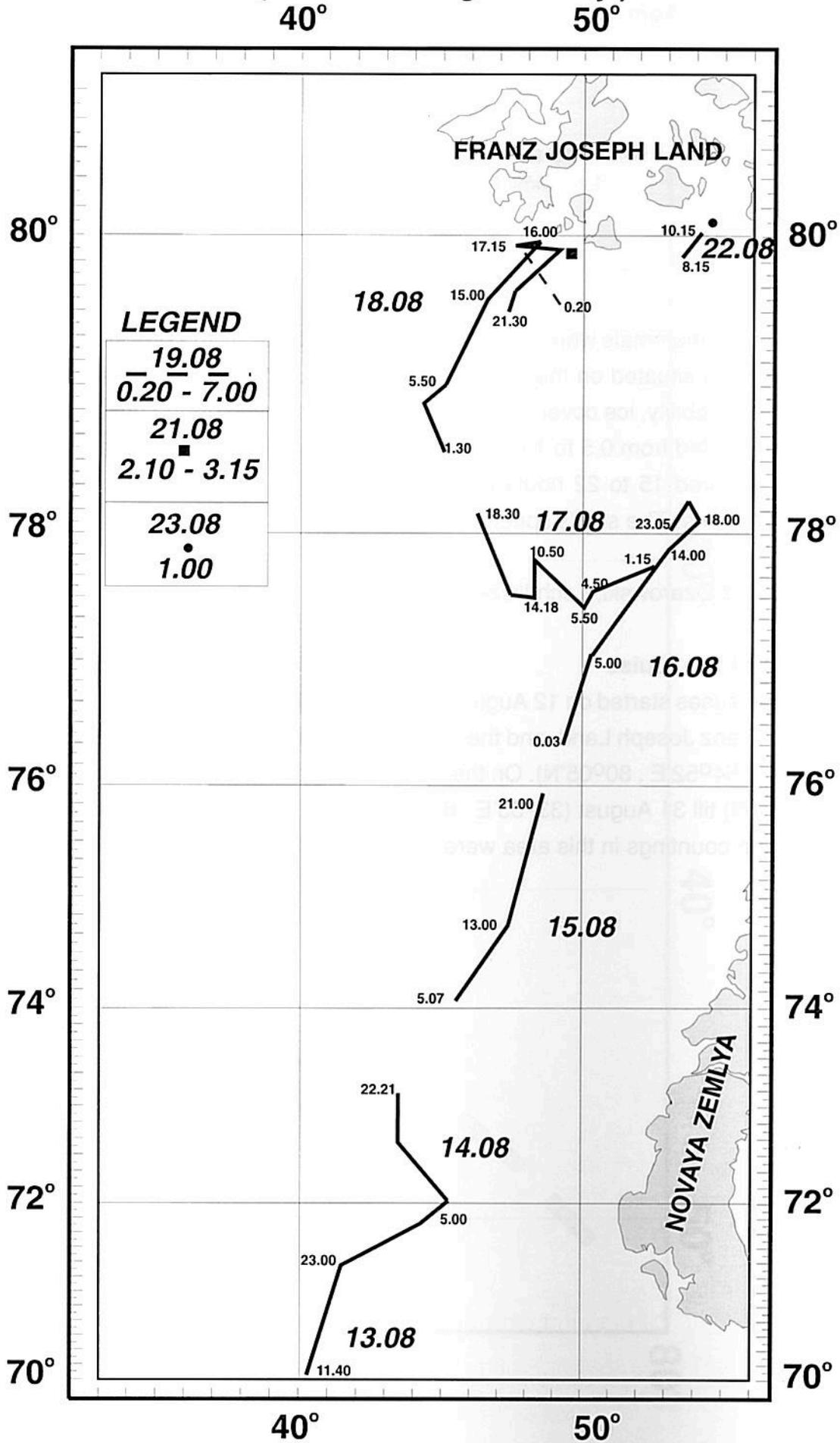
Observers: Dariusz Ożarowski, Lech Iliszko.

Time and route of the cruise

Seabird censuses started on 12 August near Kola Peninsula (38°31'E . 68°30'N) and were conducted up to Franz Joseph Land, and then along the south coasts of the archipelago to Brady Island (22 August; 54°52'E . 80°05'N). On the return way the birds were counted from 28 August (49°09'E , 78°53'N) till 31 August (33°33'E , 69°26'N) near Murmansk. Since pack ice occurred north of 77° N, the countings in this area were carried out close to or even among the pack ice.

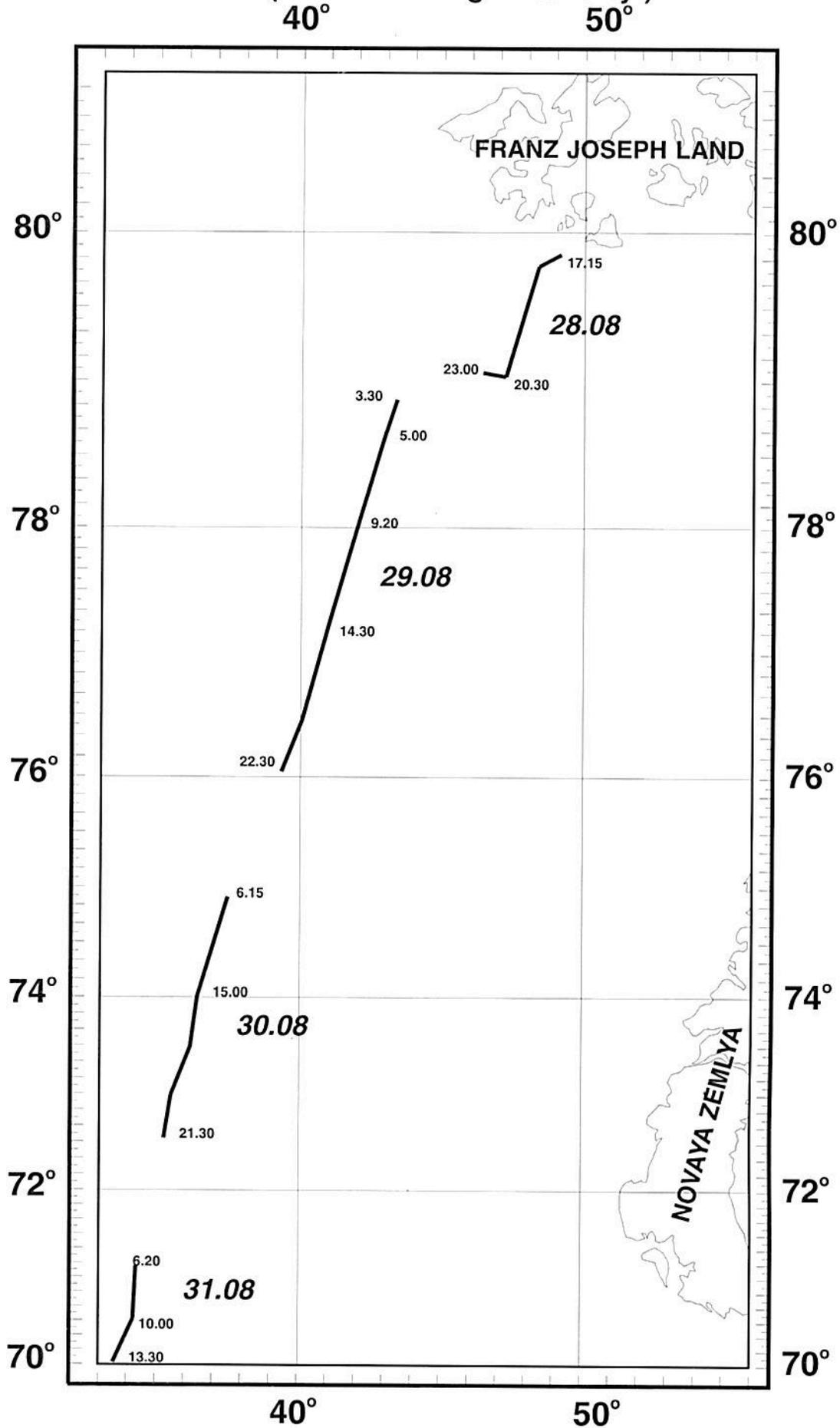
Route of r/v "Dalnye Zelency" during cruise from Murmansk to Franz Joseph Land 13-23.08. 1993

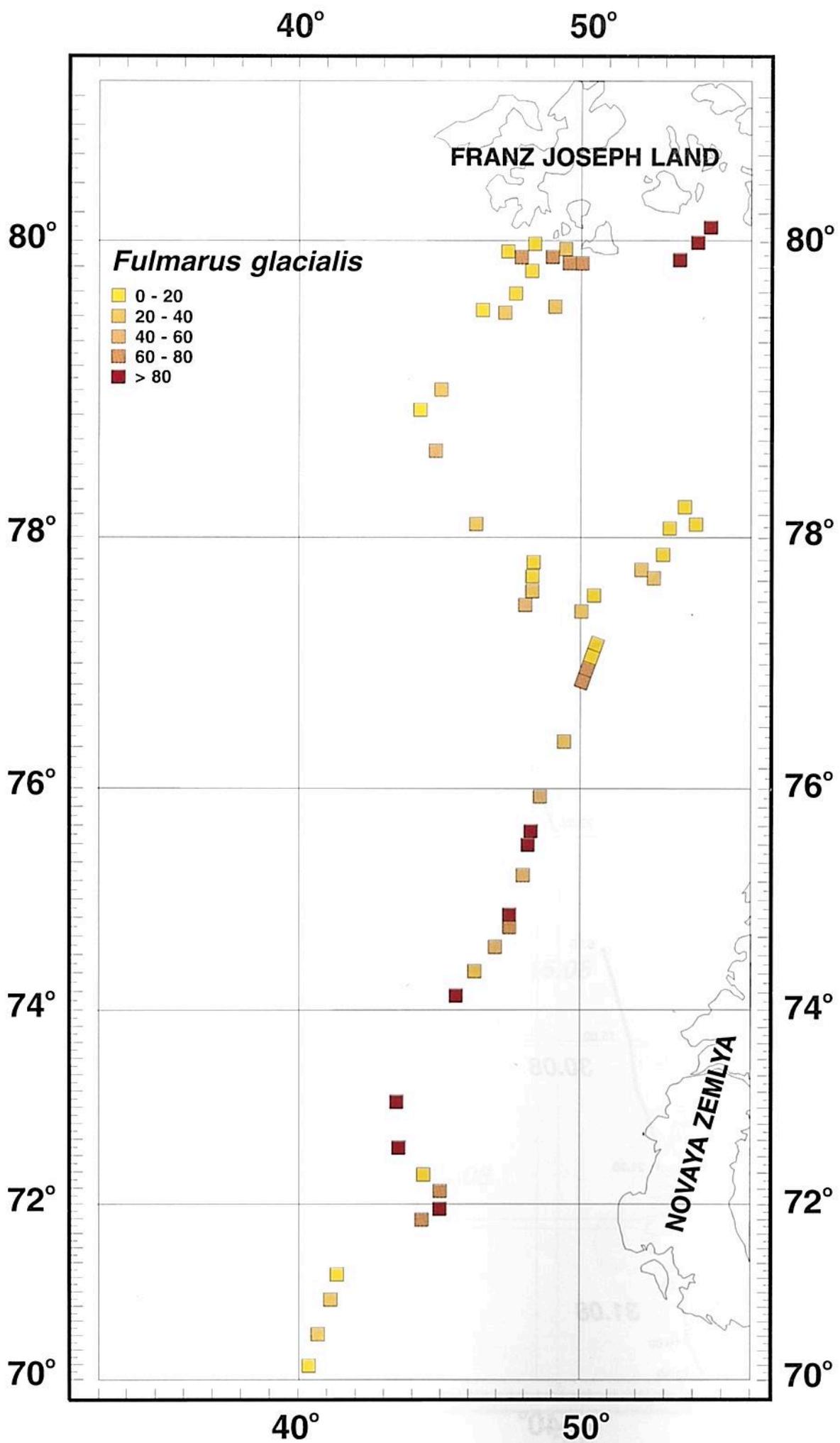
(birds counting area only)

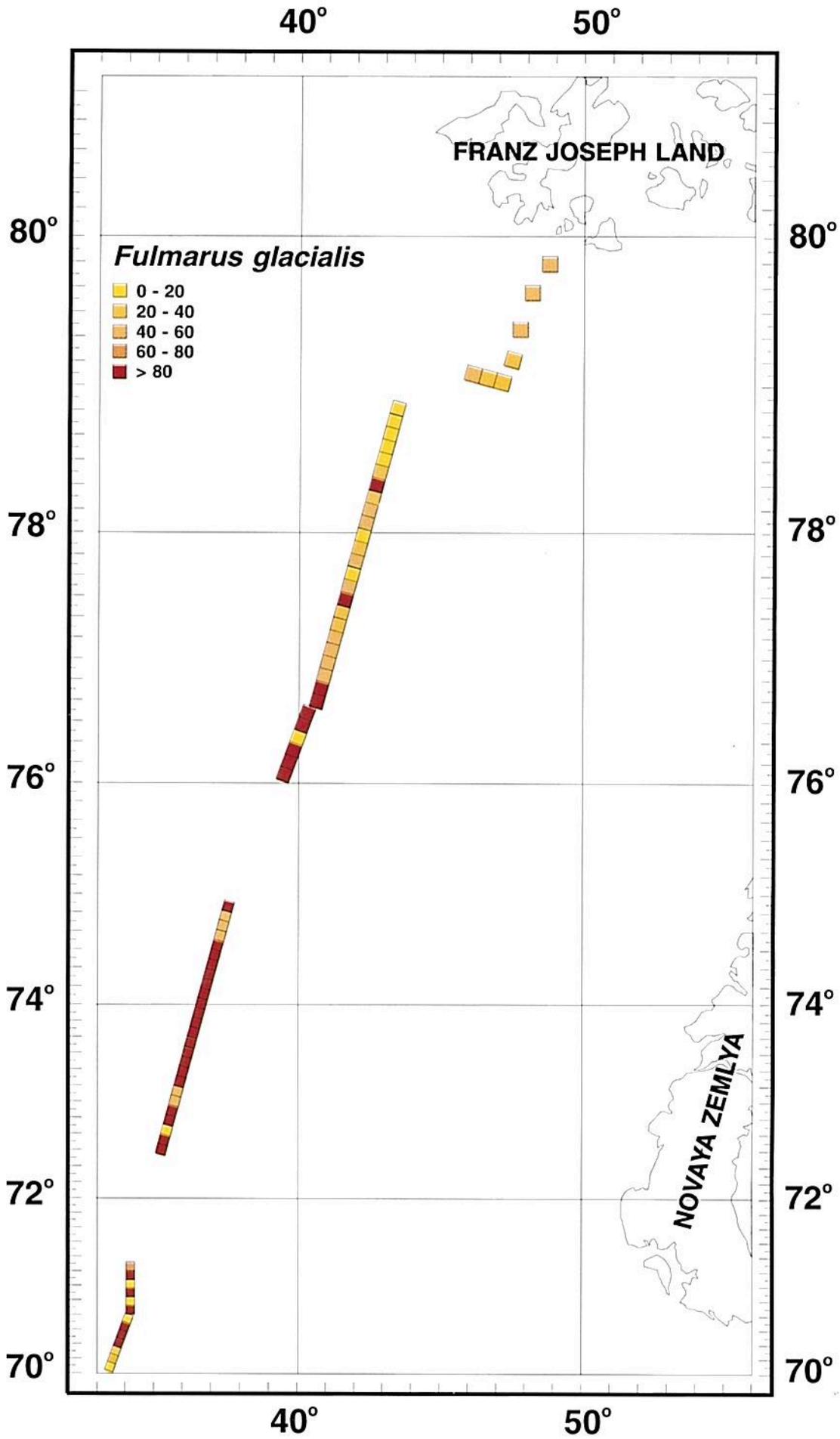


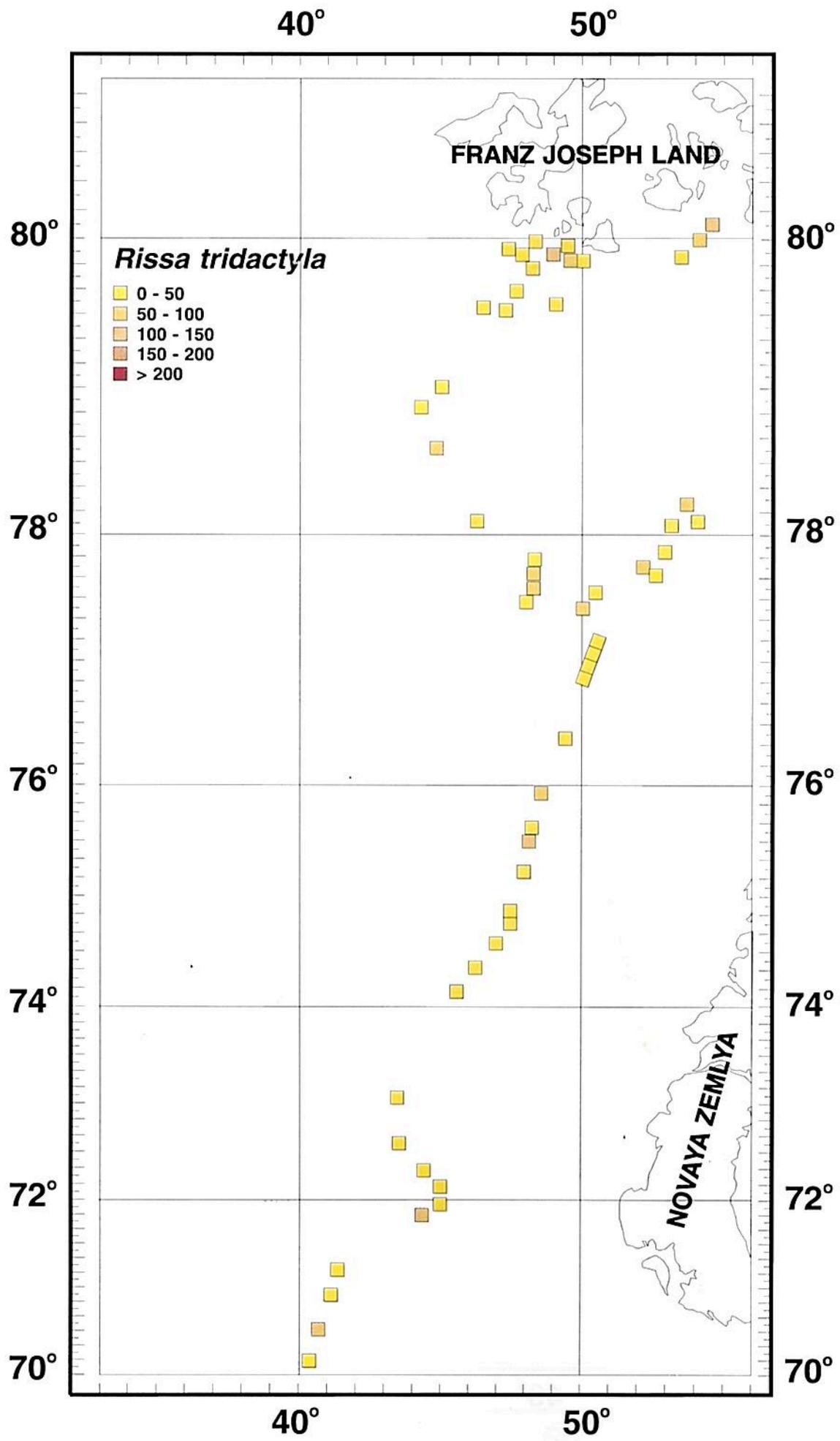
Route of r/v "Dalnye Zelency" during cruise from Murmansk to Franz Joseph Land 28-31.08. 1993

(birds countings area only)









40°

50°

FRANZ JOSEPH LAND

Rissa tridactyla

- 0 - 50
- 50 - 100
- 100 - 150
- 150 - 200
- > 200

80°

80°

78°

78°

76°

76°

74°

74°

72°

72°

70°

70°

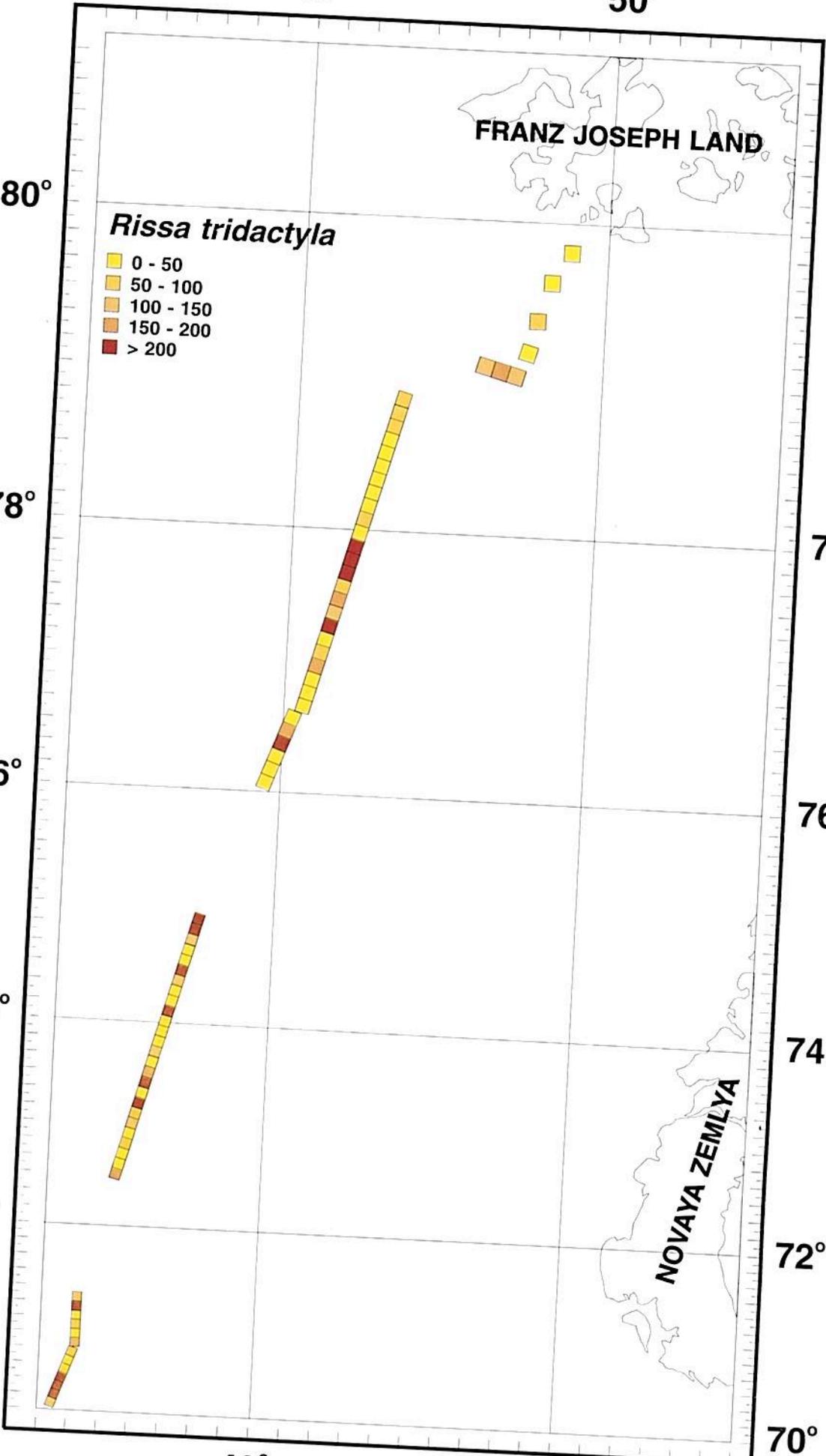
40°

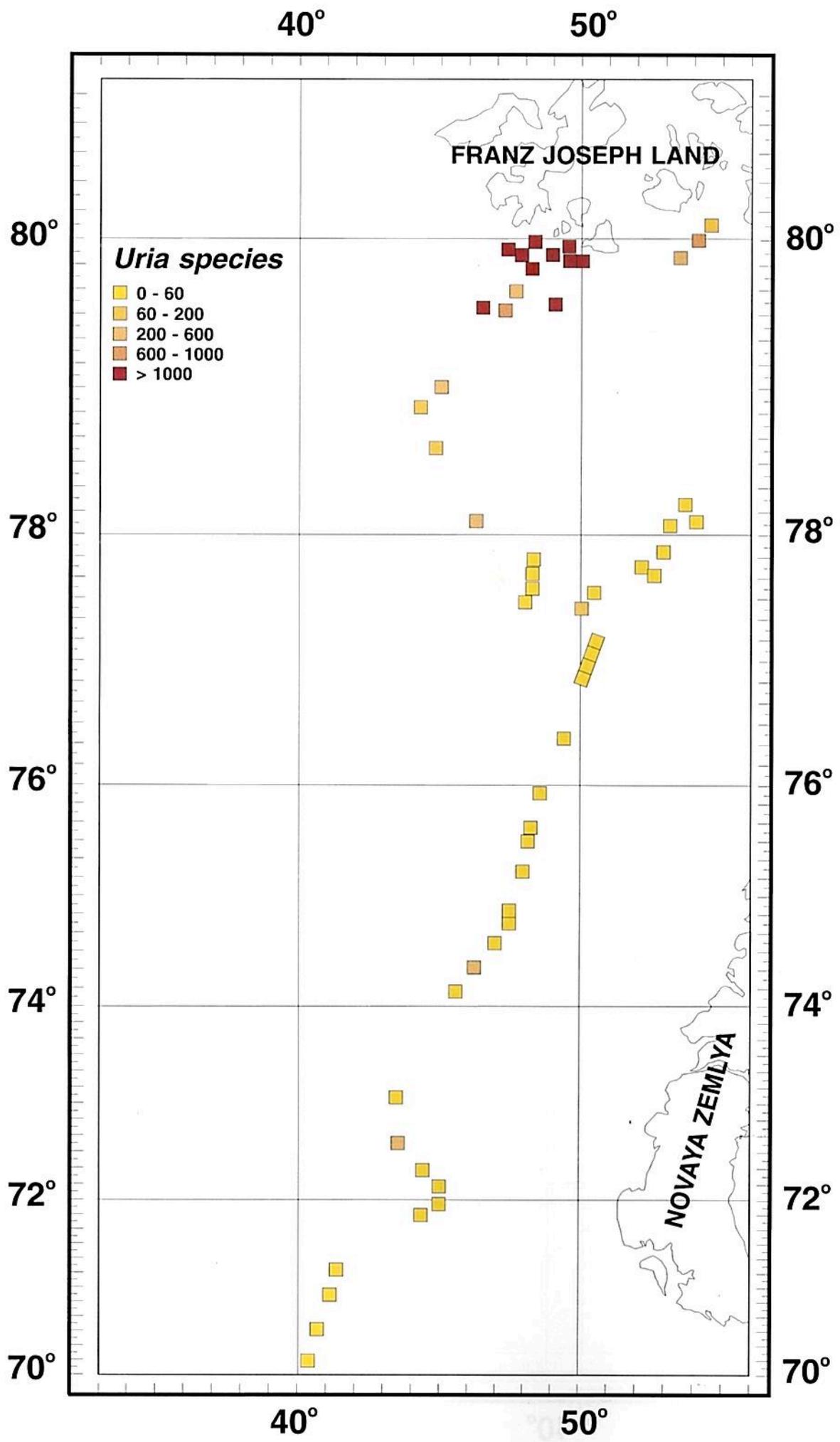
50°

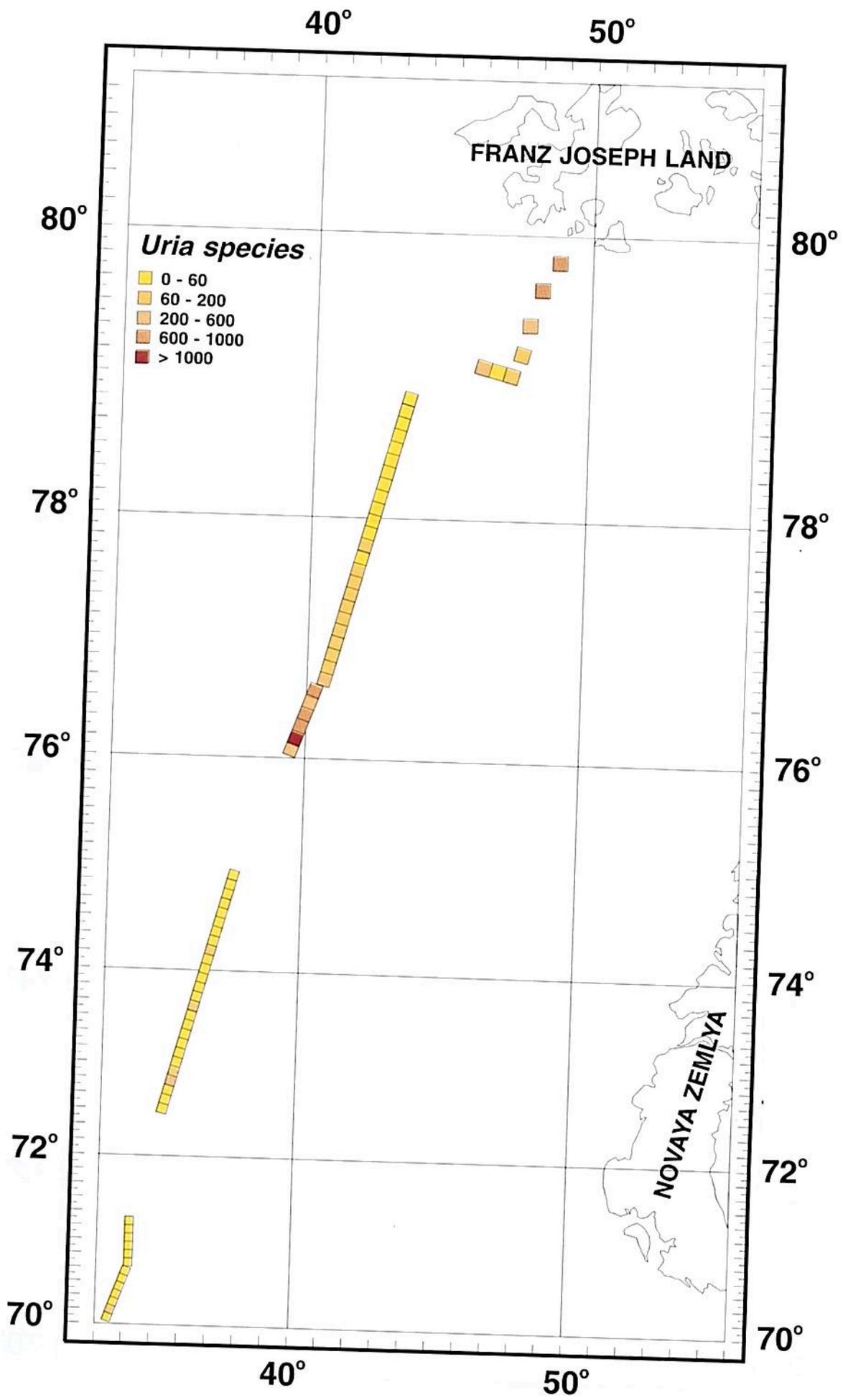
FJL '93

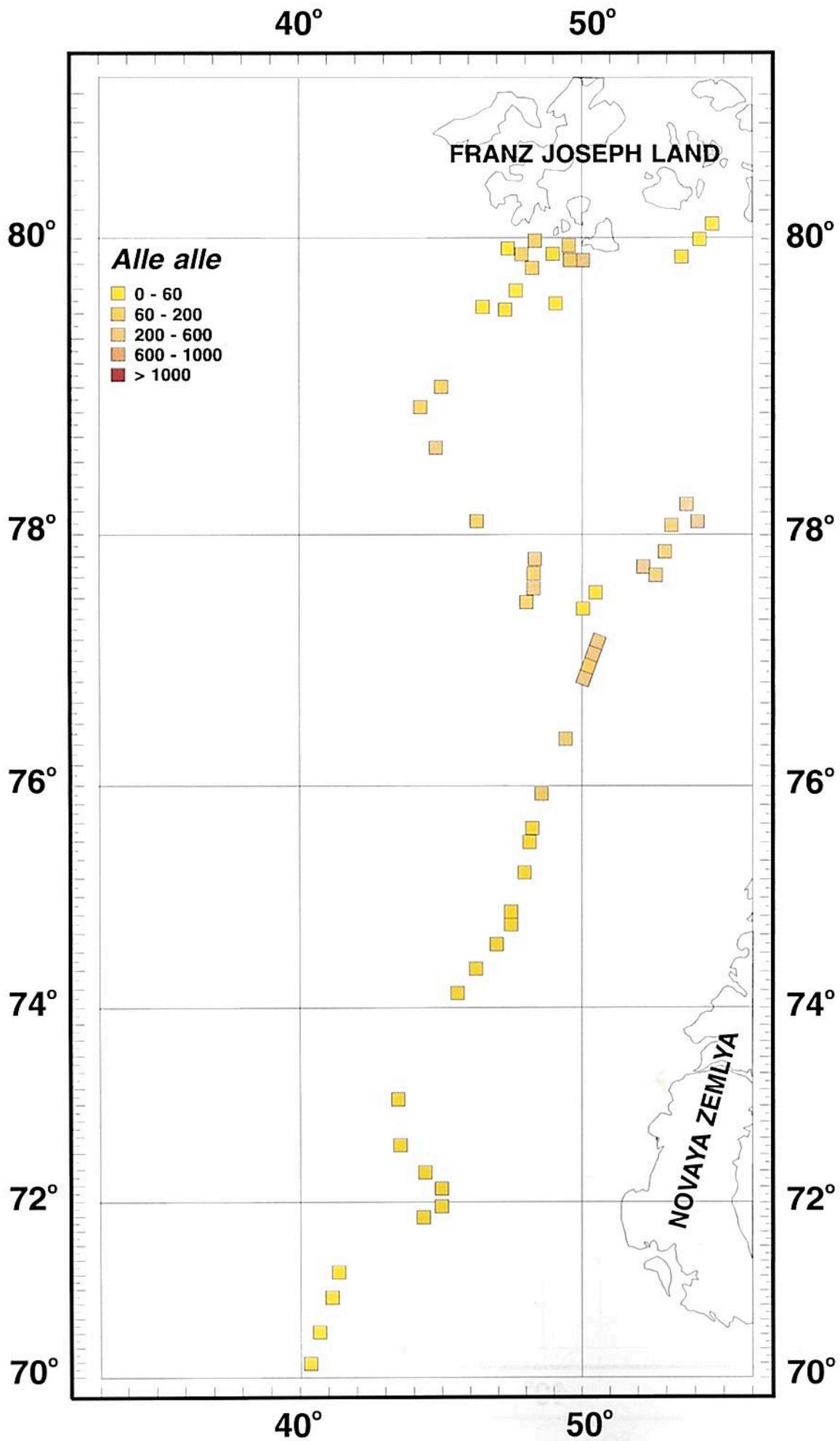
99

NOVAYA ZEMLYA



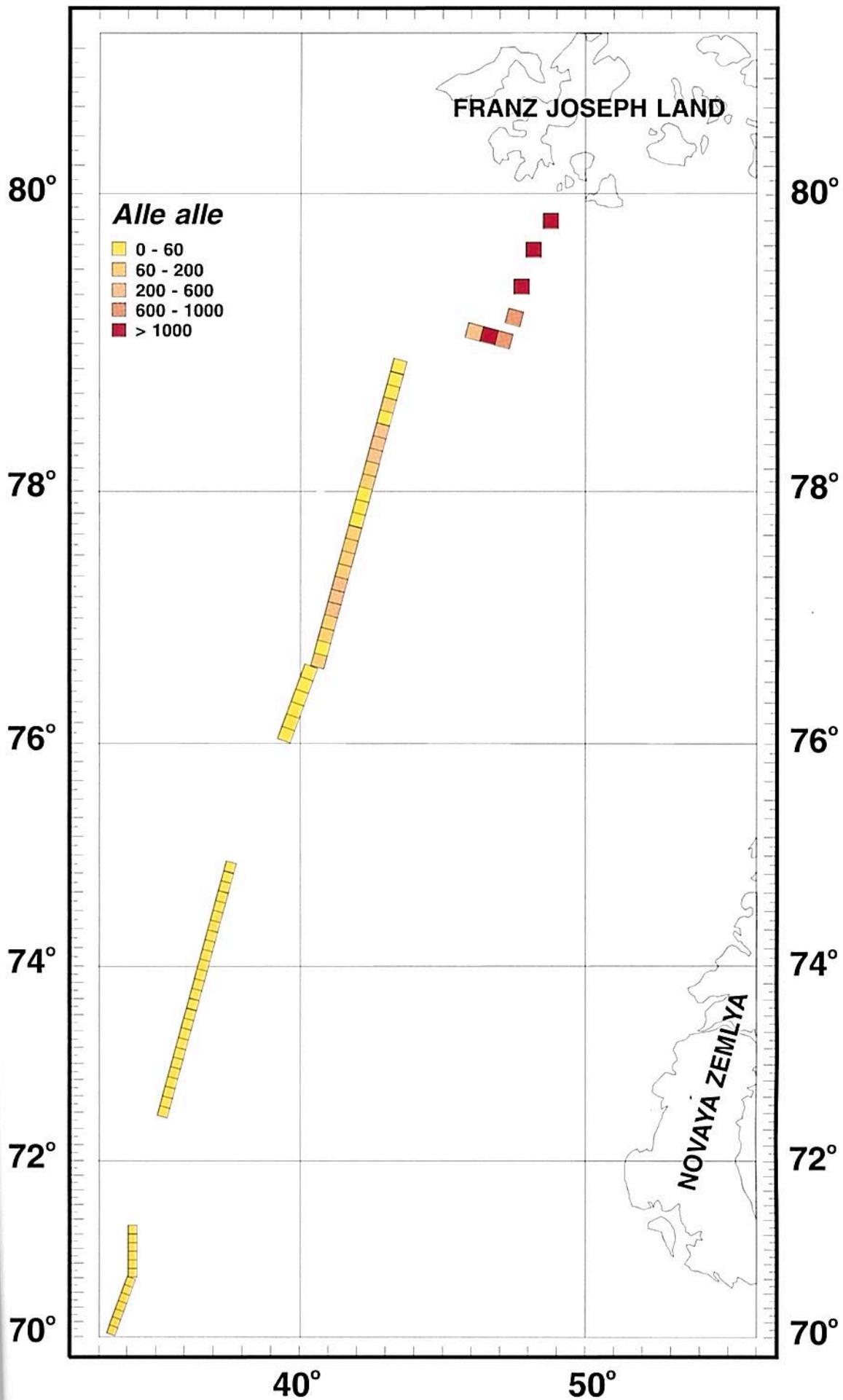






40°

50°



**Seabird counting during the arctic cruise of r/v "Ivan Kireyev"
to Novaya Zemlya and Franz Joseph Land
(July - August 1992)
NZEM'92**

Irina Pokrovskaya¹, Grigorij Tertitskii²

¹Institute of Nature Protection, Znamenskoe-Sadki,
113628 P.O. Vilar, Moscow, Russia

²Institute of Geography RAS, Laboratory of Biogeography,
Staromonetny Per. 29, Moscow, Russia

Methods

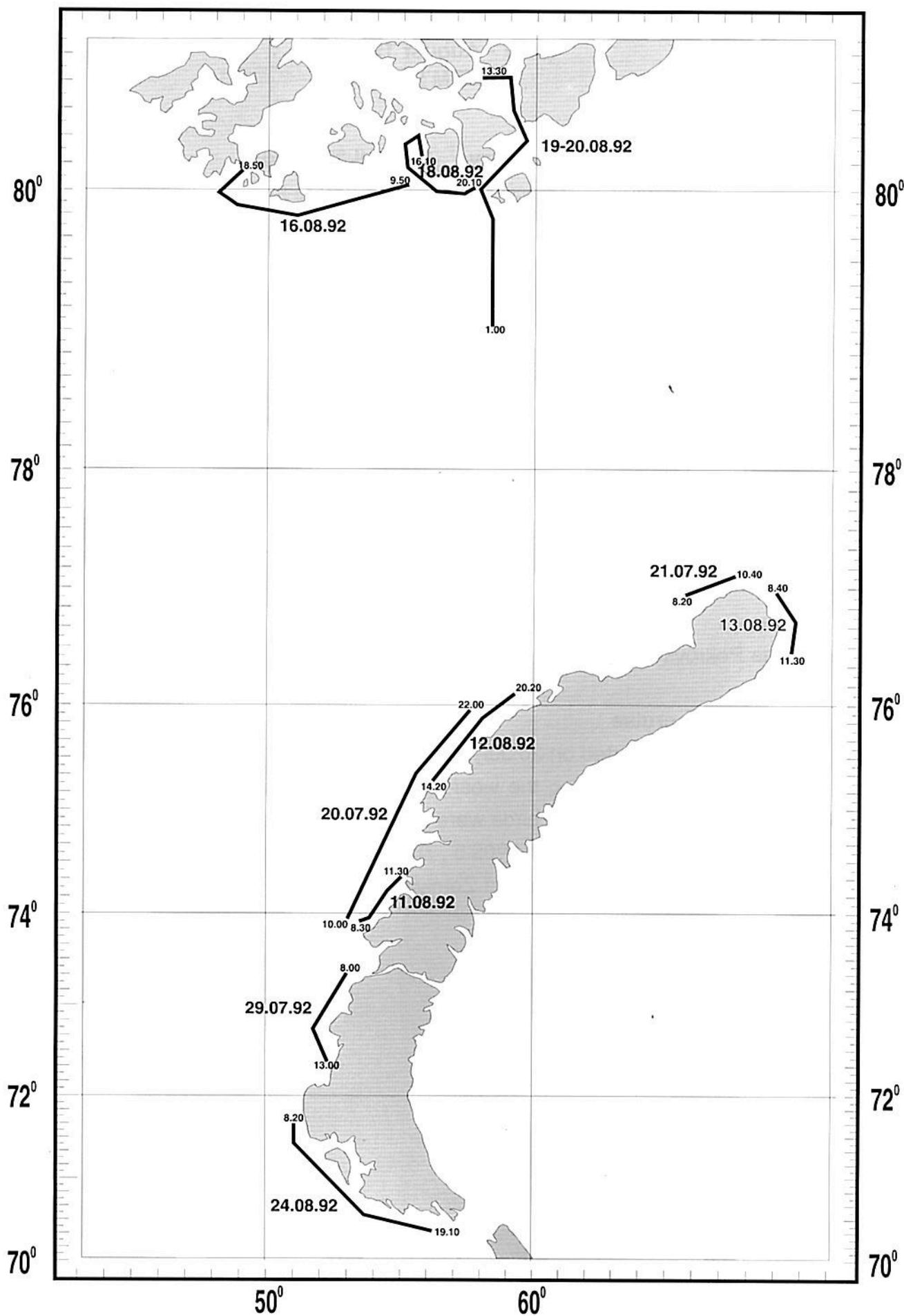
Sea birds and mammals were counted within 300 m zone by the one side of the ship. The observation point was situated on the frontal top deck, about 6 m above the sea level. Weather conditions such as visibility, ice cover and wind velocity were noted during the observations. The counting sessions lasted 0,5 hour. In total 64 hours and 40 minutes of the observations were done. The ship's speed was 10 knots. Flying birds and those sitting on the water were counted separately.

Observers: Irina Pokrovskaya, Grigorij Tertitskii.

Time and route of the cruise

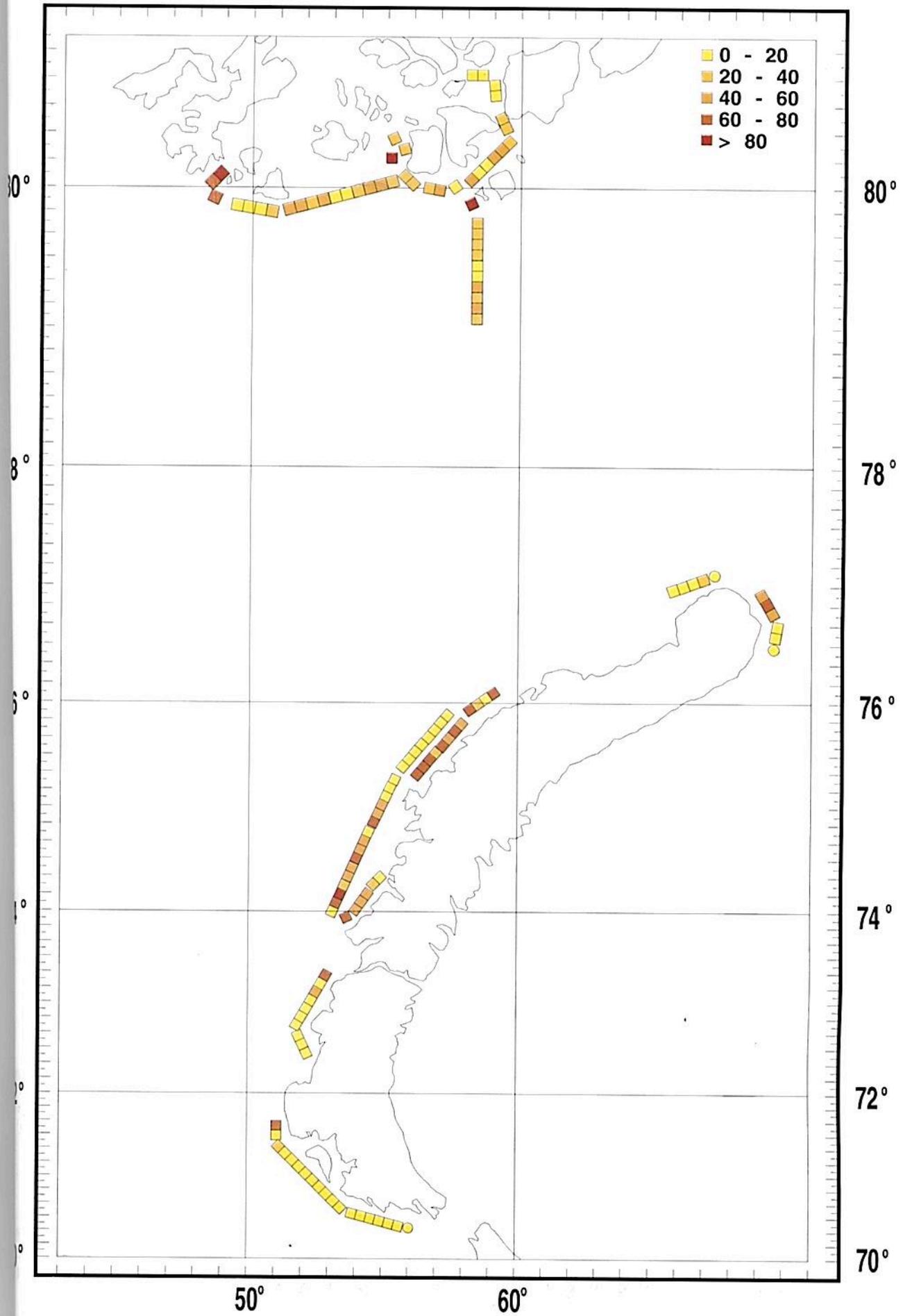
Sea birds censuses started on 20 July near the west coast of Novaya Zemlya (53°33'E . 73°55'N) and were conducted along the west and north-west coast of Novaya Zemlya till 13 August (69°01'E; 76°25'N). Then the birds were counted near Franz Joseph Land from 16 August (55°41'E , 80°03'N) till 20 August (58°05'E , 78°53'N). On 24 August sea birds counting was carried out near the south coast of Novaya Zemlya (between 51°14'E; 71°35'N and 55°05'E; 70°31'N).

**Route of r/v "Ivan Kireyev" to Novaya Zemlya and Franz Jozeph Land
20.07 - 24.08. 1992 - birds counting area only**



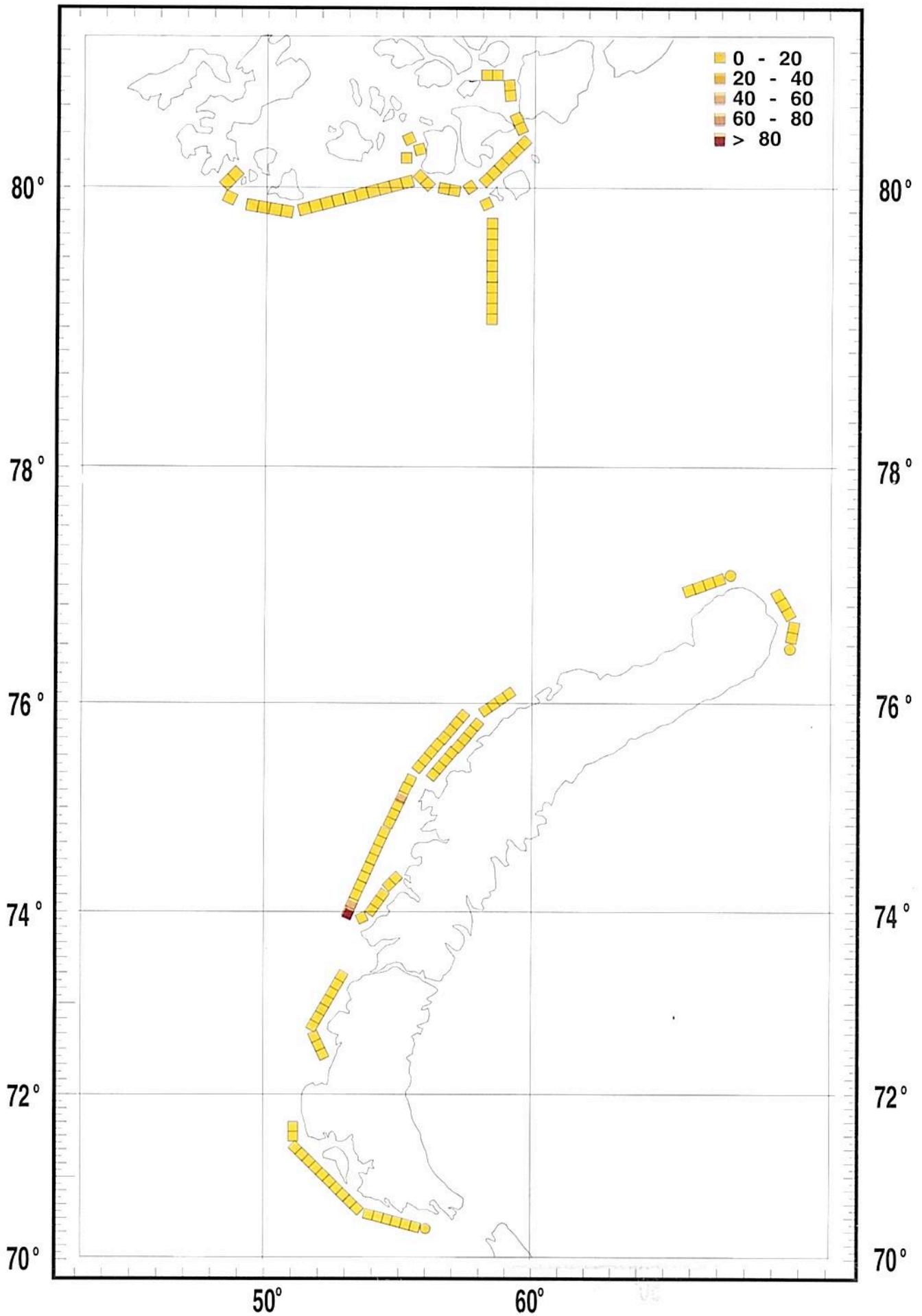
Fulmarus glacialis

only flying birds

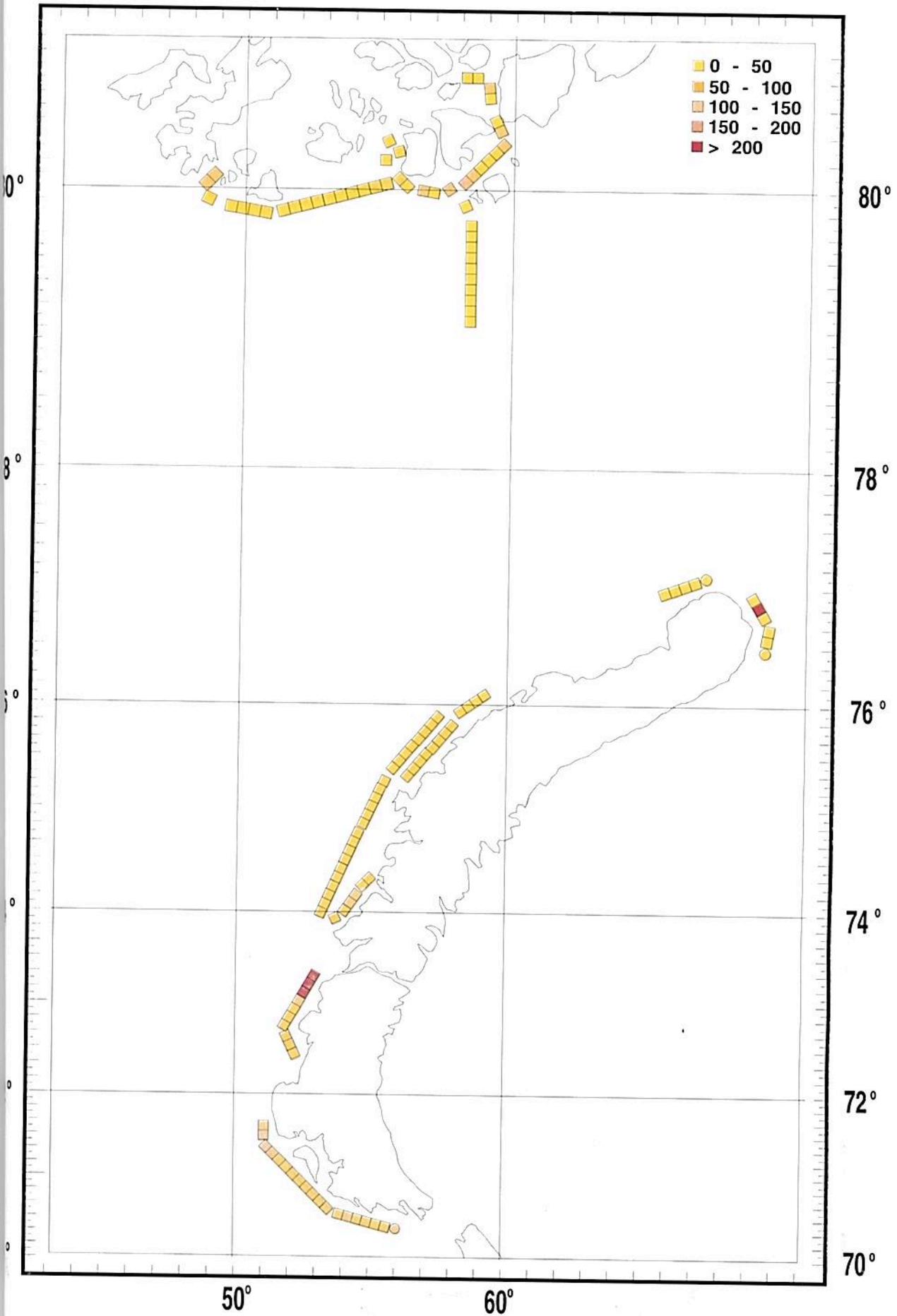


Fulmarus glacialis

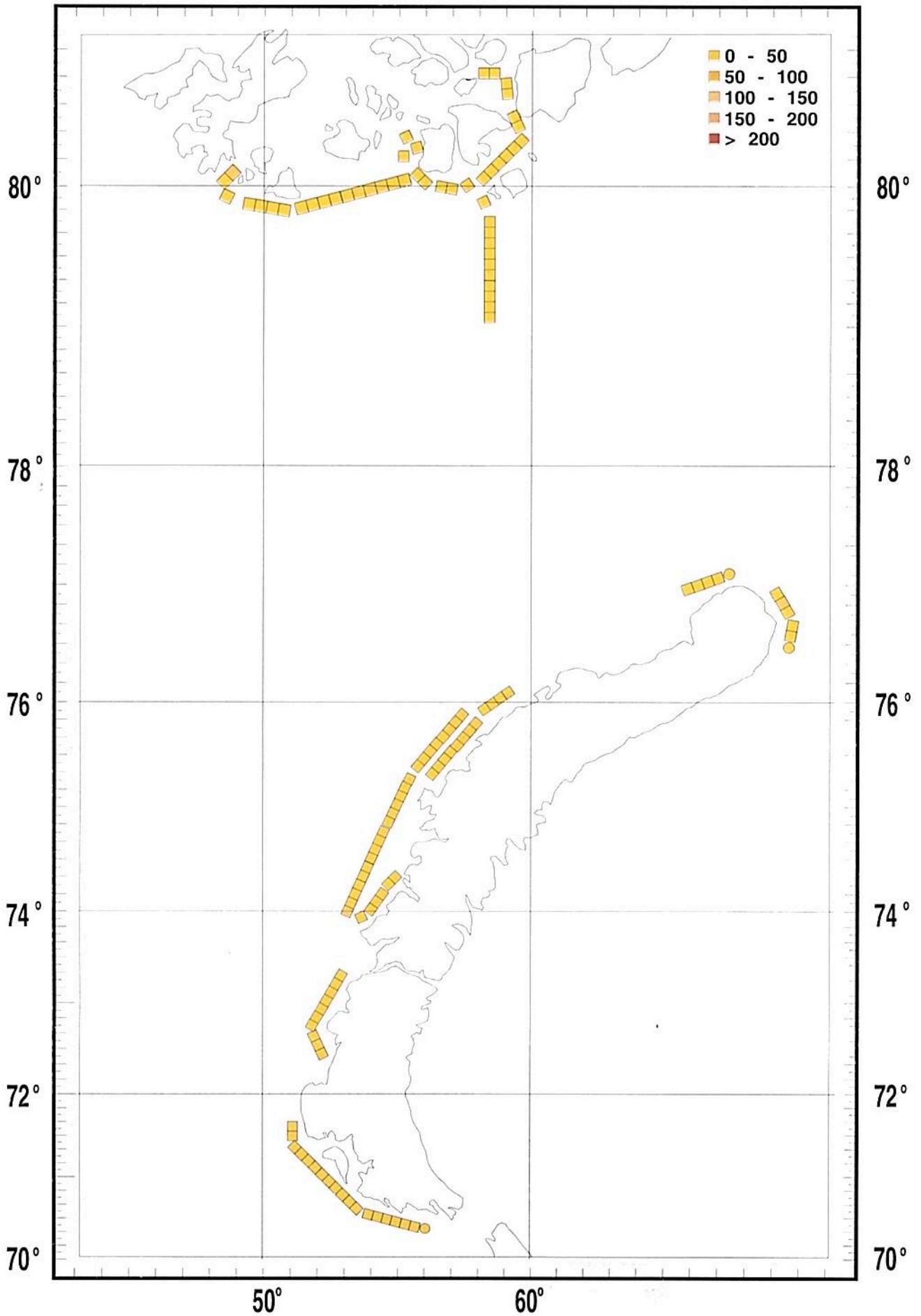
birds on water



Rissa tridactyla
only flying birds

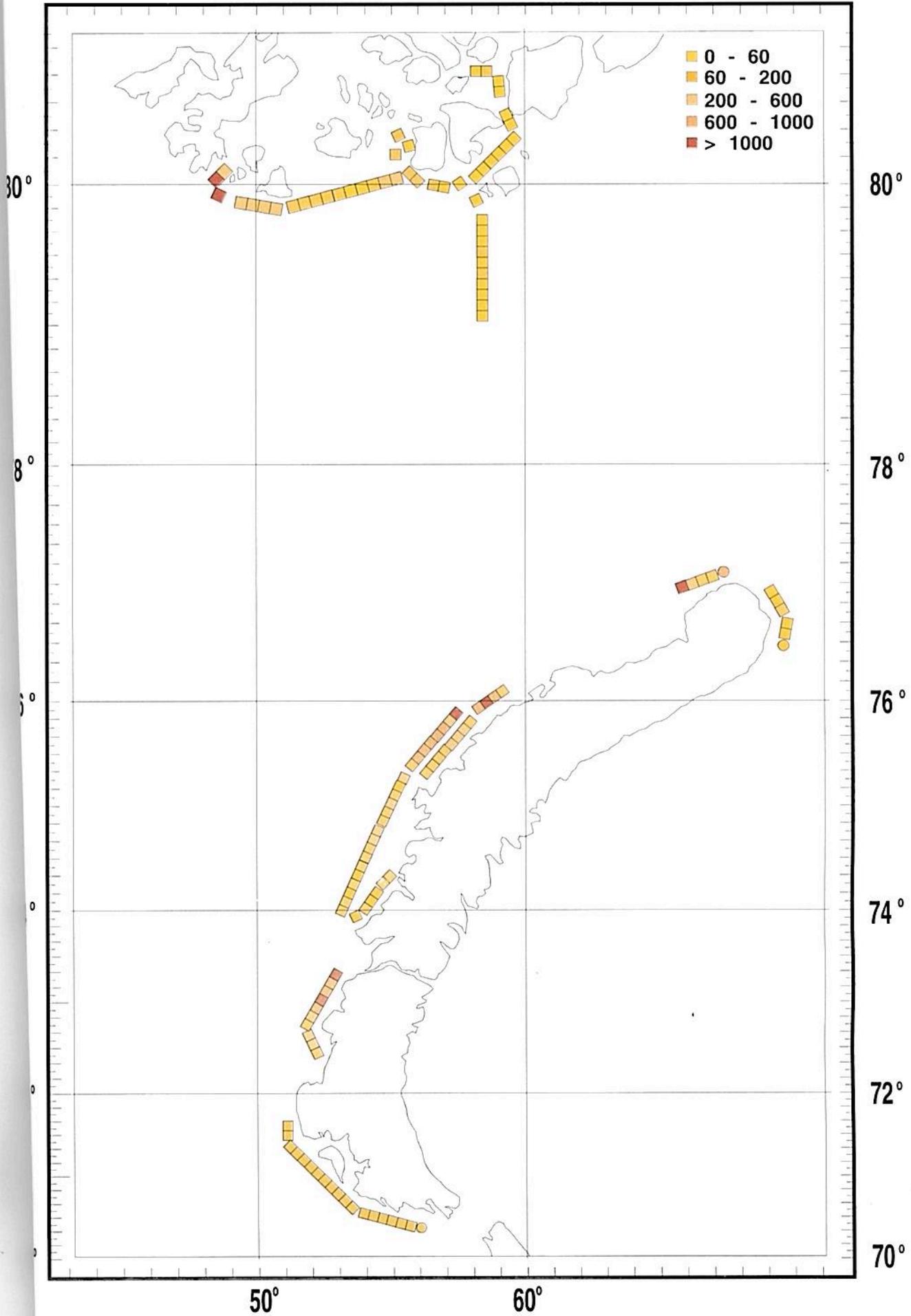


Rissa tridactyla
birds on water



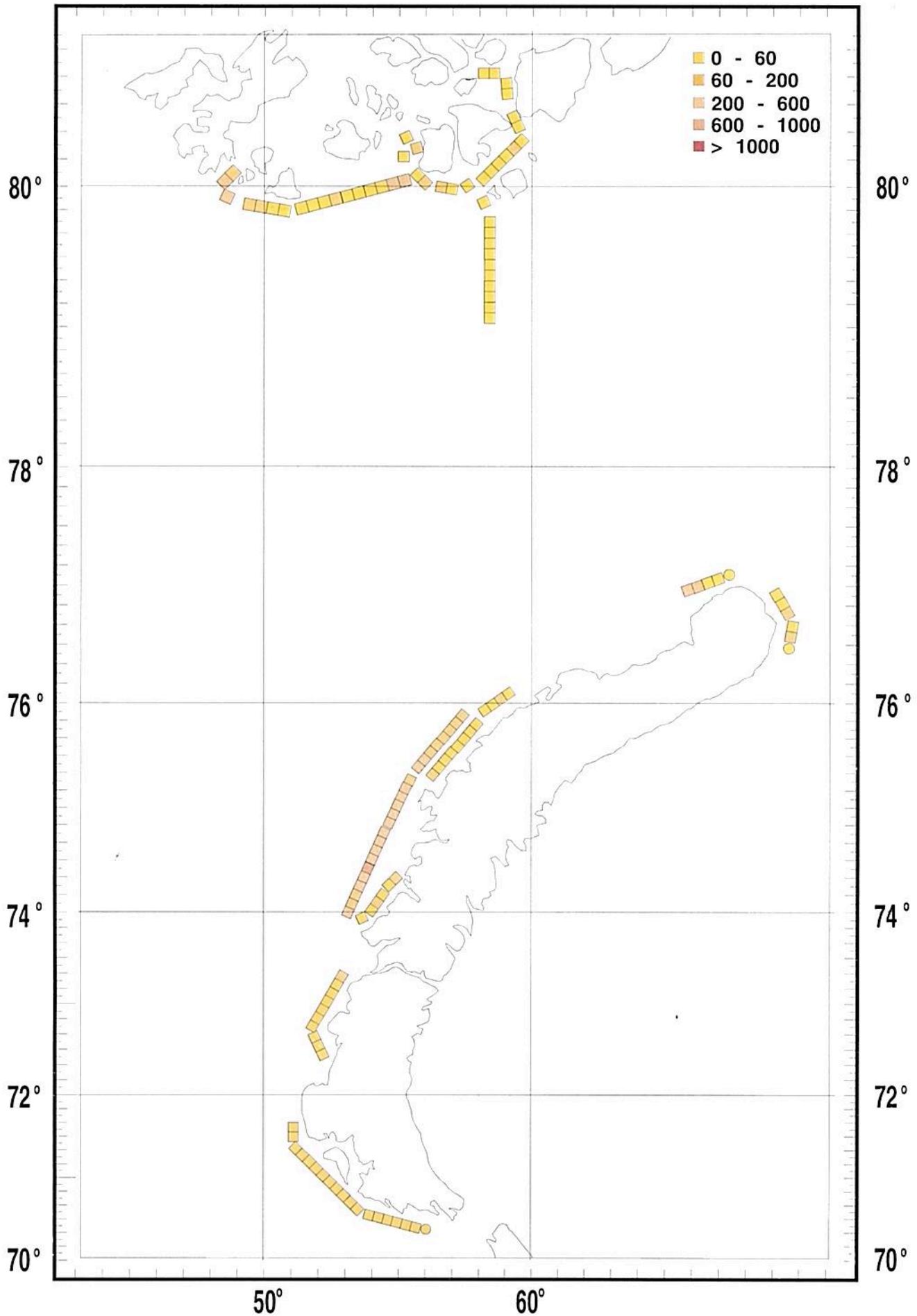
Uria lomvia

only flying birds

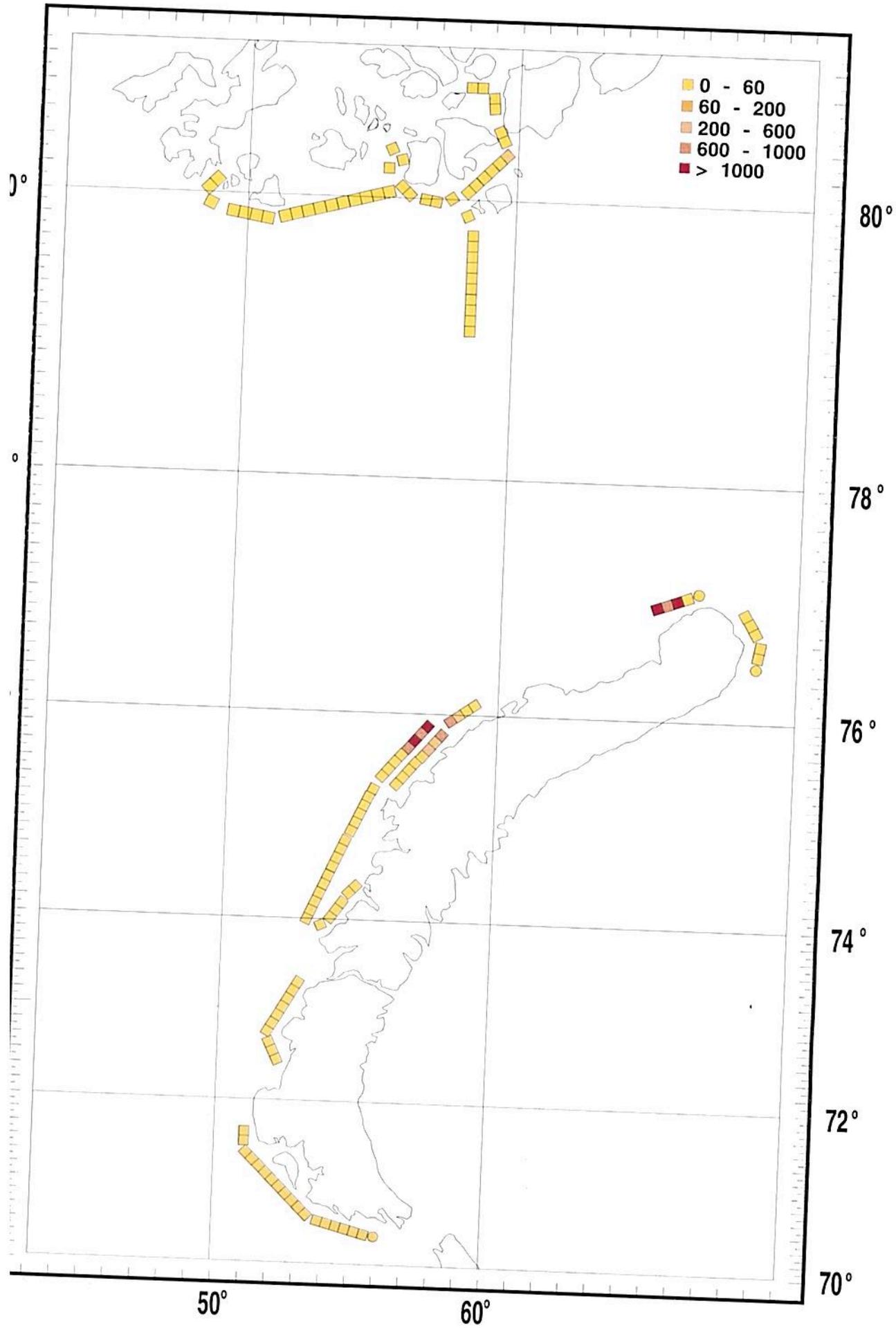


Uria lomvia

birds on water



Alle alle
only flying birds



Alle alle
birds on water

