Change in the biodiversity of the demersal fish community in the northern Bering and Chukchi Seas

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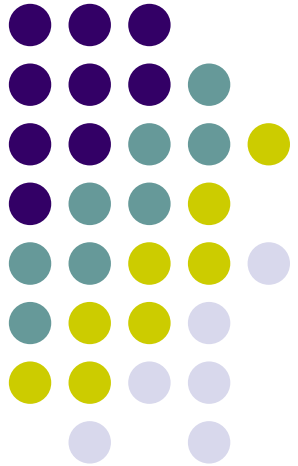
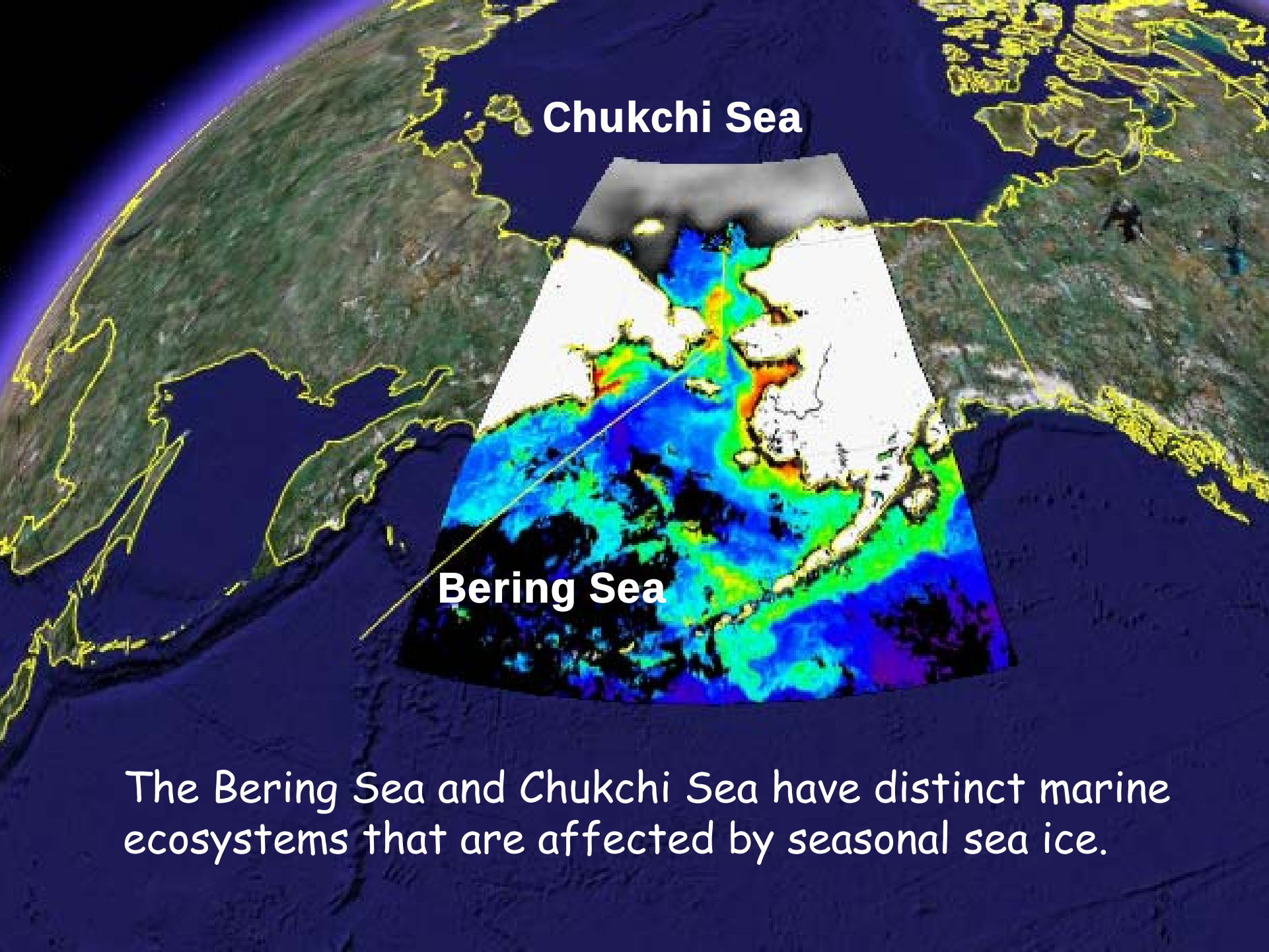


PICES-17 MONITOR/ESSAS Workshop (W3) October 24, 2008

Outline

- Background
- Objective
- Study area
- Data (Oceanographic and fish sampling) and Methods
- Results and Discussion
- Summary



The Bering Sea and Chukchi Sea have distinct marine ecosystems that are affected by seasonal sea ice.

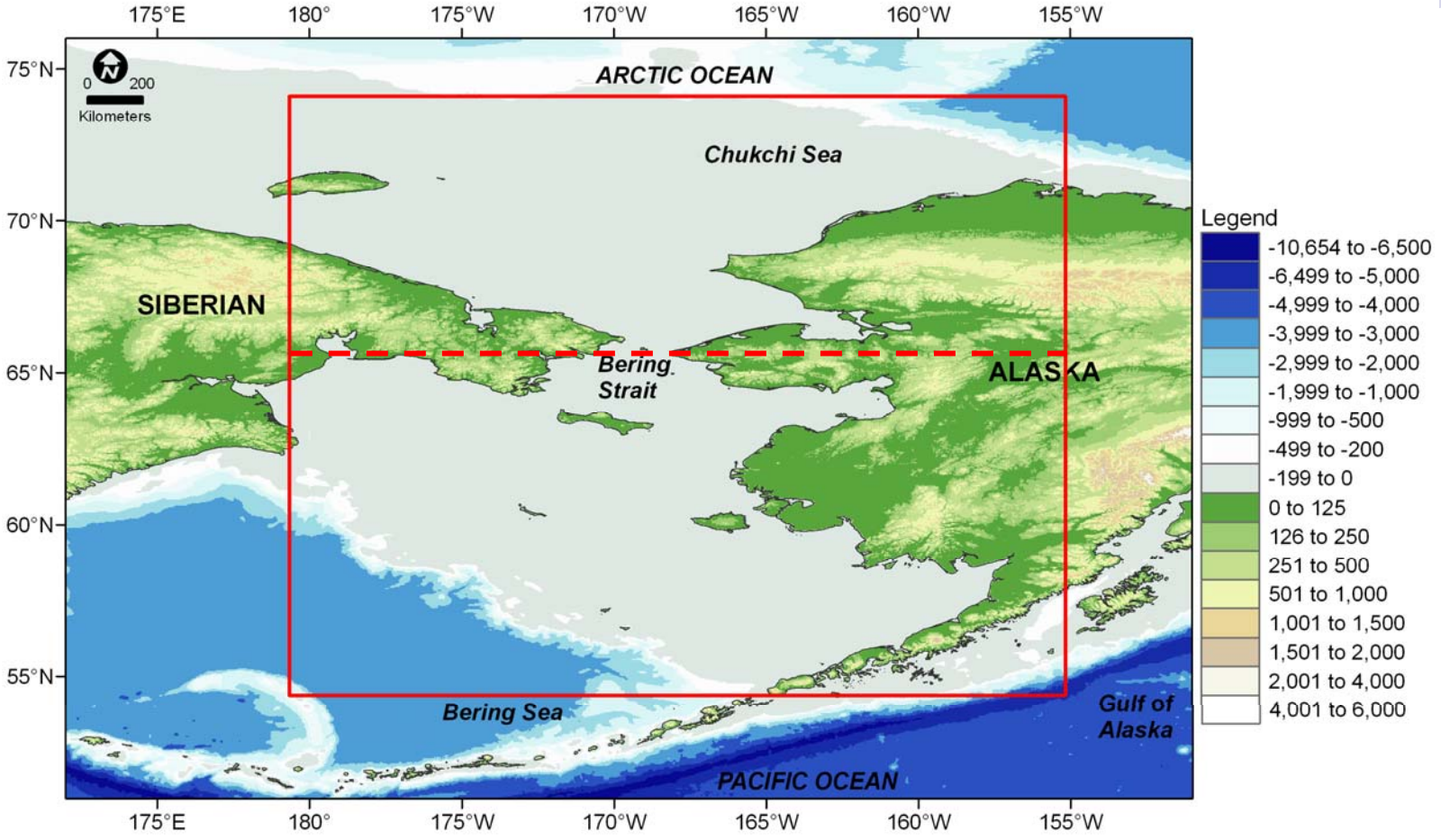
T/S Oshoro-Maru

Bottom Trawling

Objective

- To examine the change on biodiversity of demarsal fish community between 1991, 1992 and 2007, 2008

Study Area



Red polygon indicates area focused for this study

Dashed red line indicates border for Chukchi Sea and Bering Sea

Methodology

- Sampling conducted in three different years

Bering Sea:
- 21-22 July 1991
- 18-22 July 1992
- 25-31 July 2007

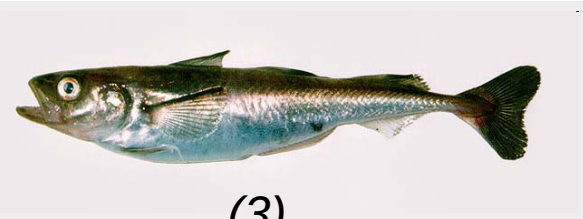
Chukchi Sea:
- 25-31 July 1991
- 26-31 July 1992
- 7-11 August 2007

- Data collected:
  - Demersal fish using bottom trawl
  - Oceanographic parameter

- The analysis only focused on three Gadidae fish species:
  1. Pacific cod (*Gadus macrocephalus*)
  2. Walleye pollock (*Theragra chalcogramma*)
  3. Arctic cod (*Boreogadus saida*)

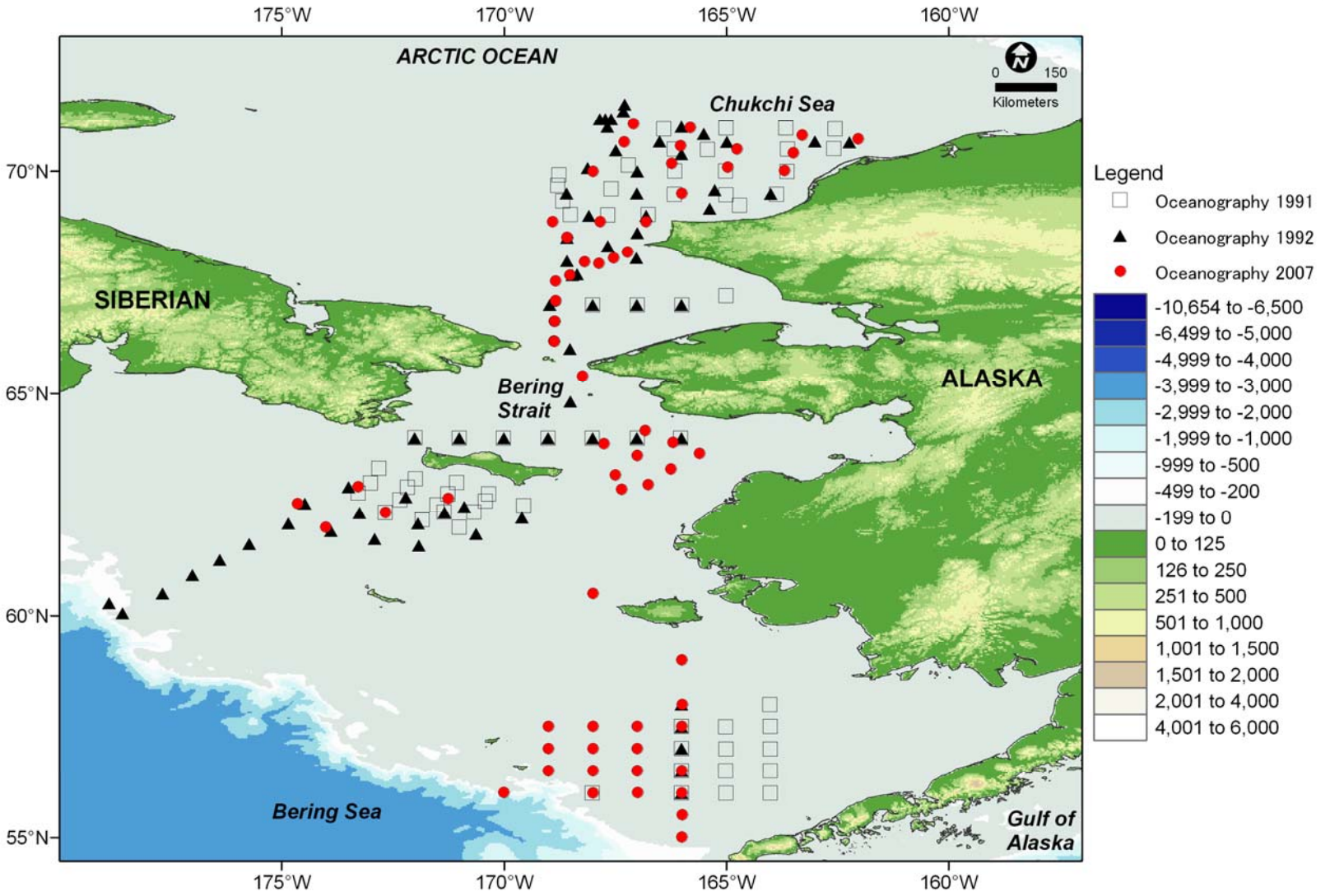
(1)

(2)

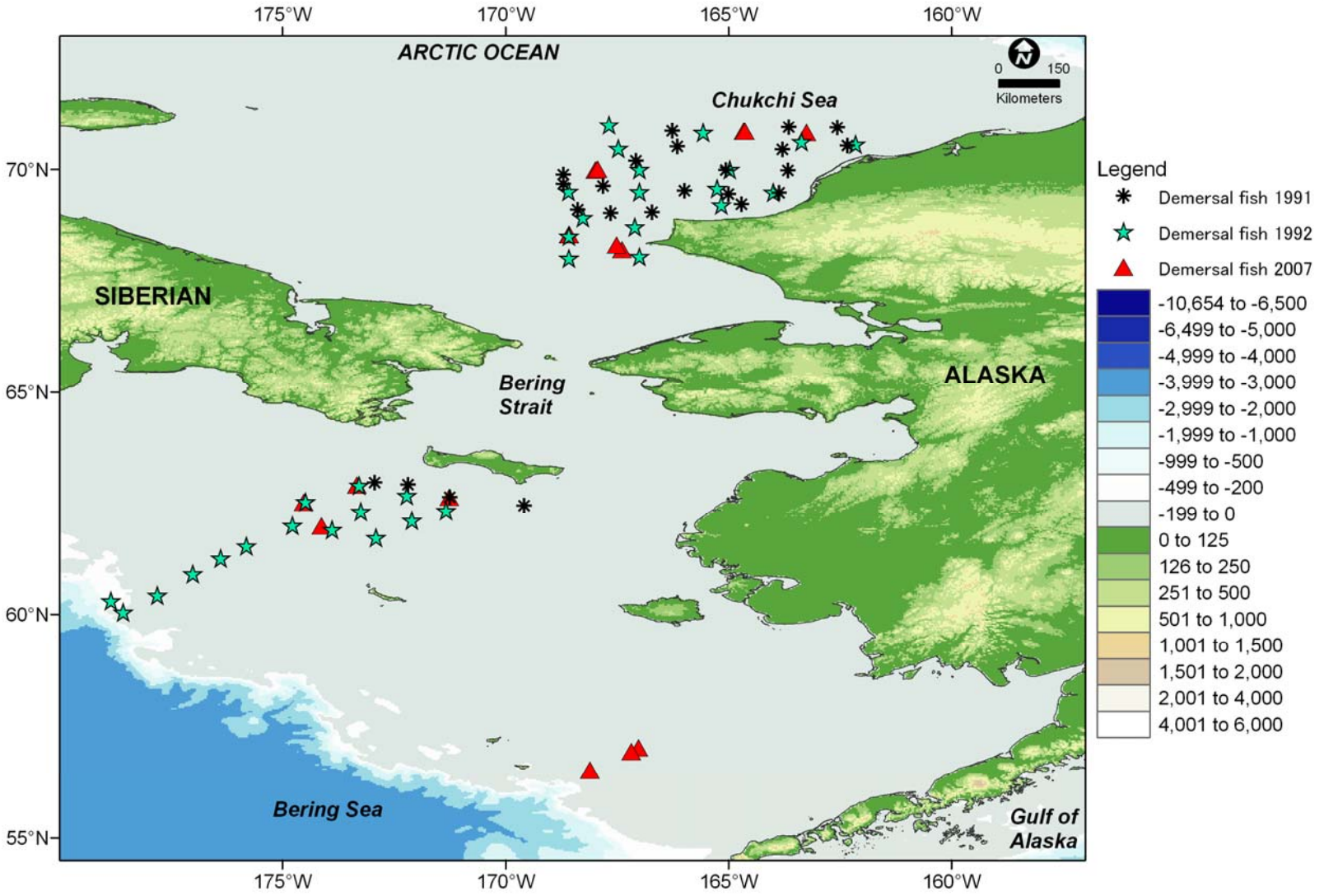


(3)

Oceanographic sampling



Demersal fish sampling



Data analysis

- Standardize of fish biomass
  - ✓ Using speed, trawling time and distance → **standardize weight**
- Mapping bottom temperature
- Mapping bottom fish biomass (standardize weight) distributions
- Biodiversity indices based on biomass

  (Jin and Tang, 1996) :
  - ✓ Margalef richness index (R)
  - ✓ Simpson's index (D)
  - ✓ Shannon-Wiener index (H)
  - ✓ Evenness index (E)

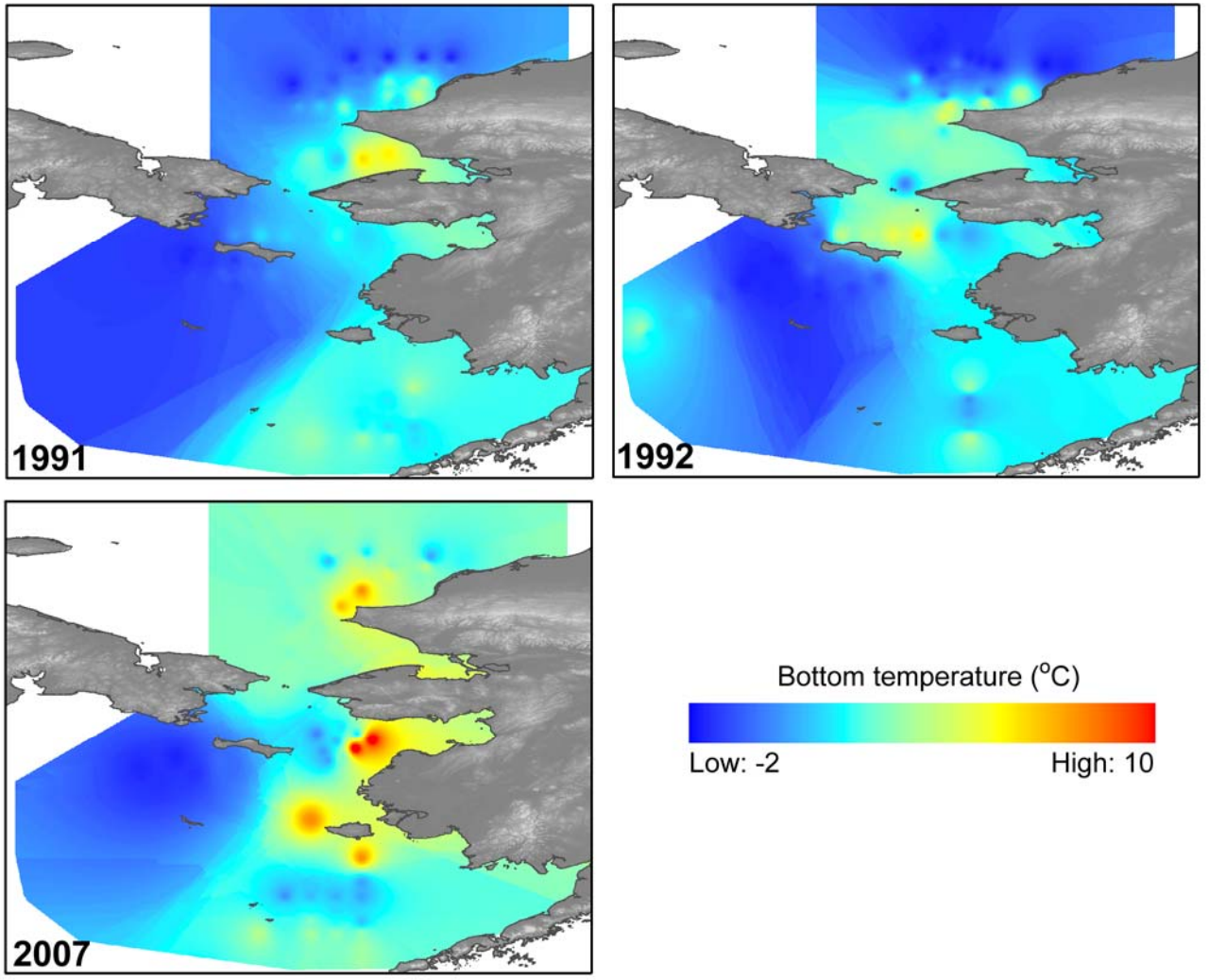
Results and Discussion

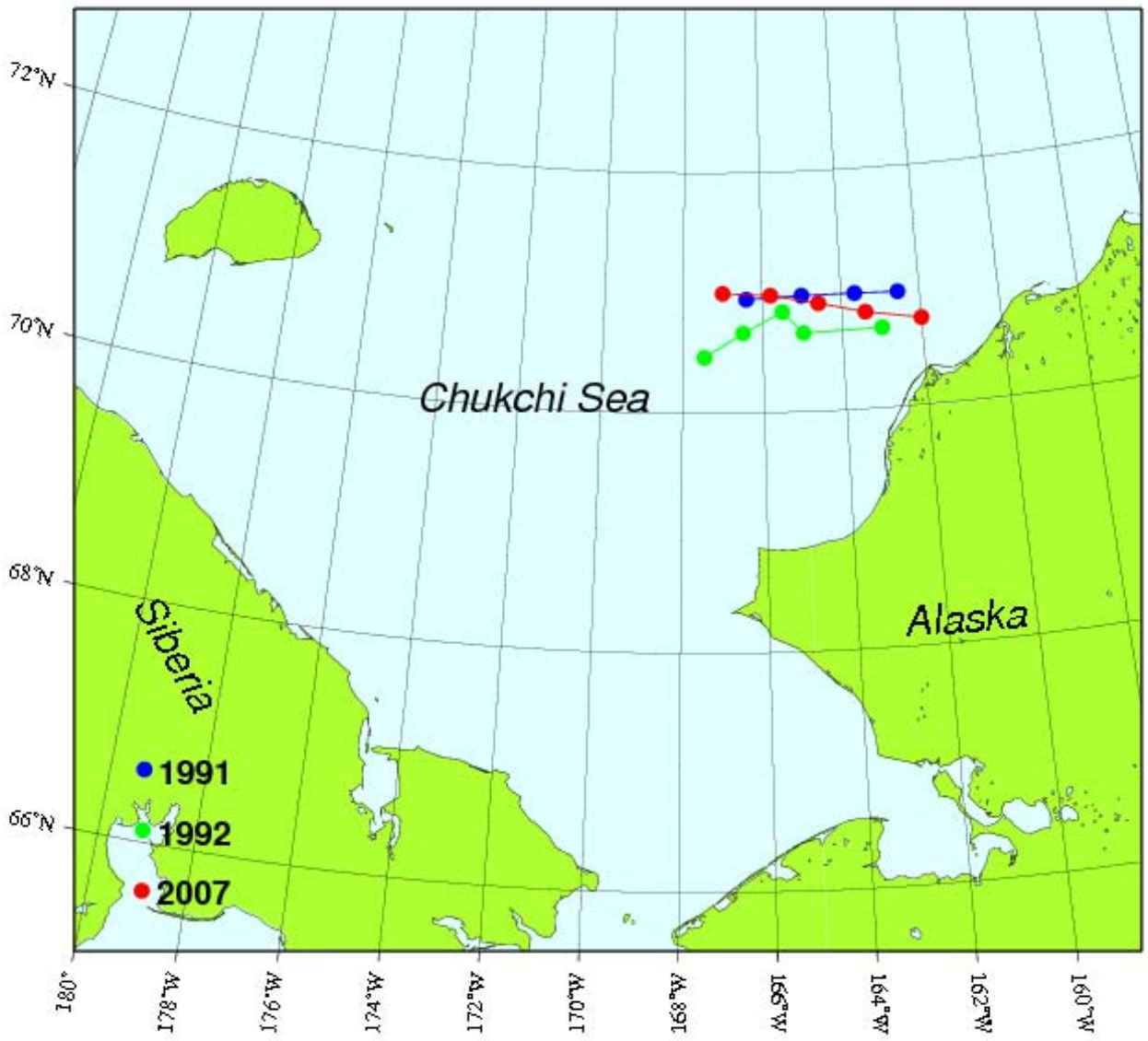
Standardized fish biomass

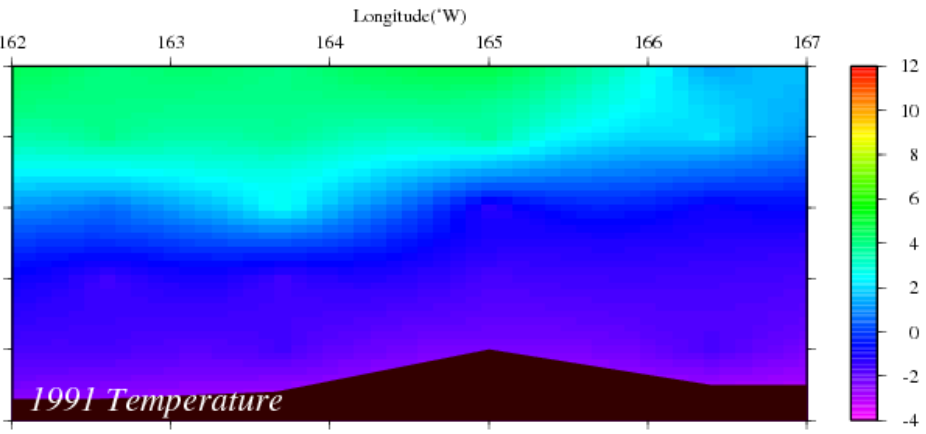
Year	Items	Bering Sea			Chukchi Sea		
		Pacific cod	Walleye pollock	Arctic cod	Pacific cod	Walleye pollock	Arctic cod
1991	Date	21-22 July			25-31 July		
	N(T)	2(23)	2(23)	2(23)	1(23)	1(23)	12(23)
	Weight	0.97	3.04	0.07	0.001	0.001	0.09
1992	Date	18-22 July			26-31 July		
	N(T)	7(32)	5(32)	9(32)	0(32)	0(32)	17(32)
	Weight	6.31	205.01	0.58	0	0	2.62
2007	Date	25-31 July			7-11 August		
	N(T)	3(16)	5(16)	2(16)	0(16)	0(16)	9(16)
	Weight	5.22	234.49	0.03	0	0	0.86

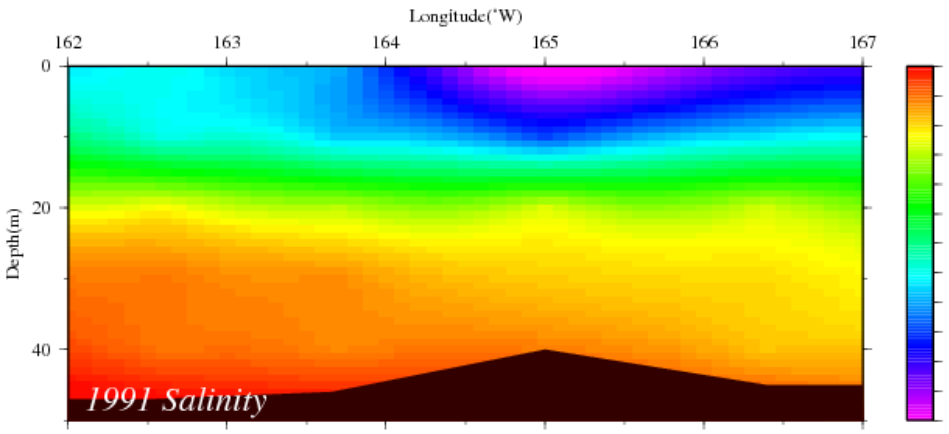
N(T) = No. of station (Total stations)
Weight: standardize weight

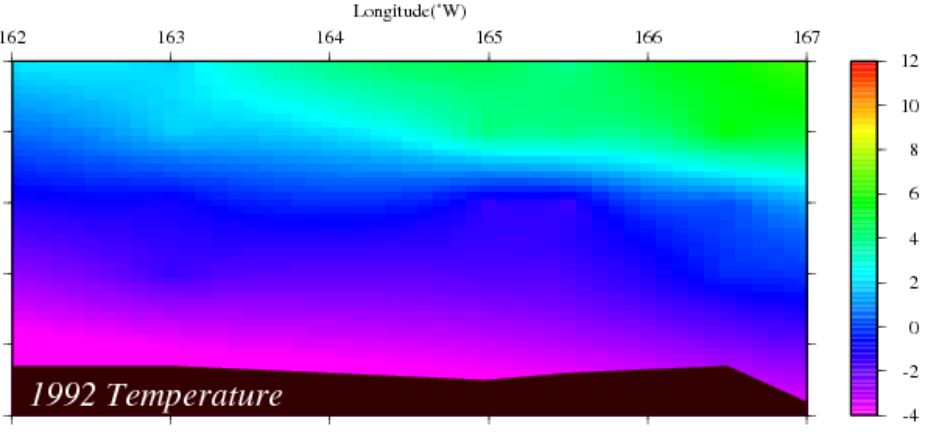
Bottom temperature




72°N
70°N
68°N
66°N
180°
178°W
176°W
174°W
172°W
170°W
168°W
166°W
164°W
162°W
160°W
Chukchi Sea
Alaska
Siberia
1991
1992
2007


Longitude(°W)
162
163
164
165
166
167
12
10
8
6
4
2
0
-2
-4
1991 Temperature


Longitude(°W)
162
163
164
165
166
167
Depth(m)
0
20
40
1991 Salinity


Longitude(°W)
162
163
164
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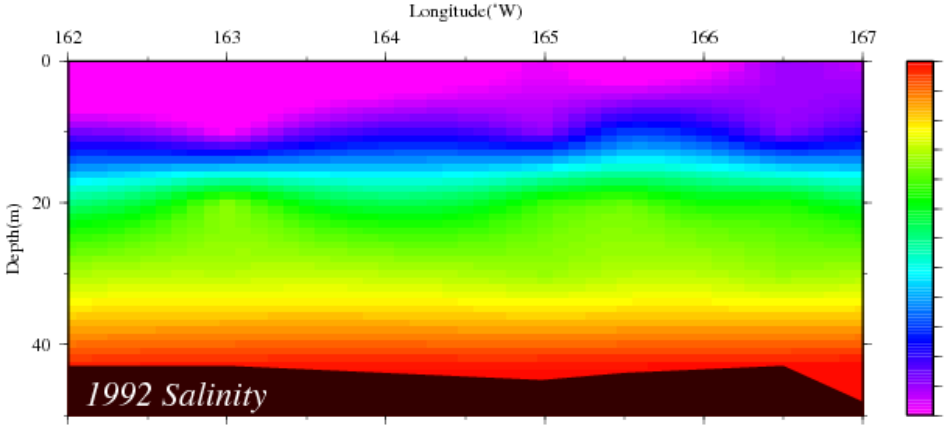
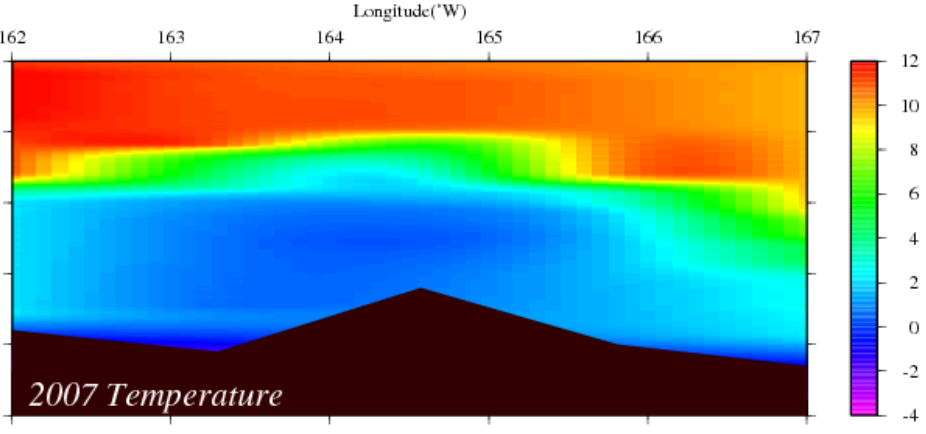
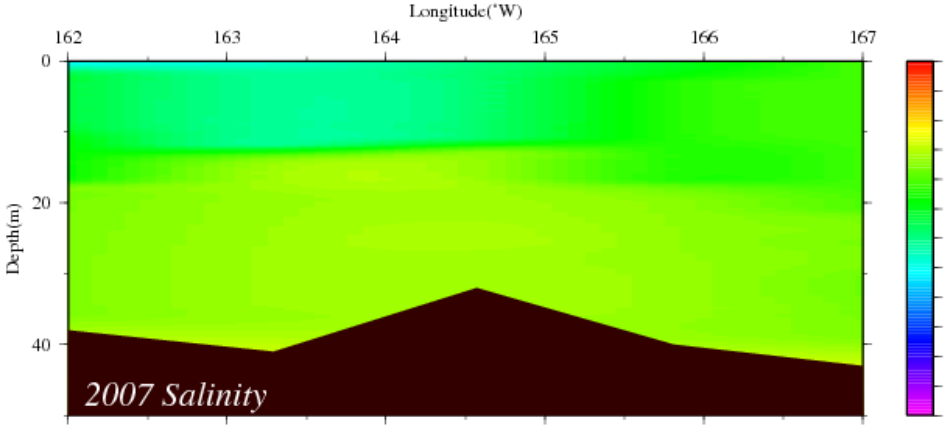
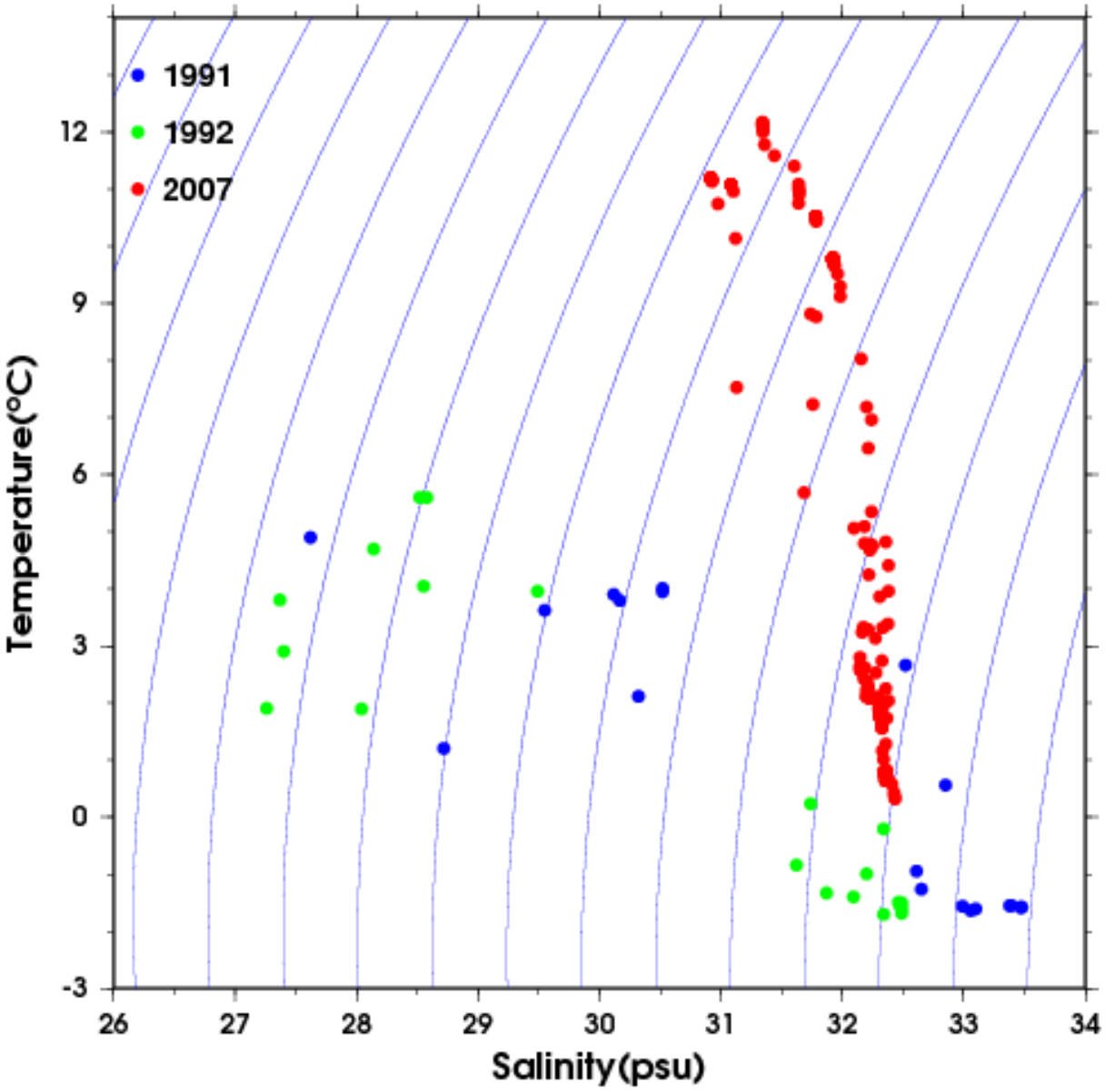
167
12
10
8
6
4
2
0
-2
-4
1992 Temperature

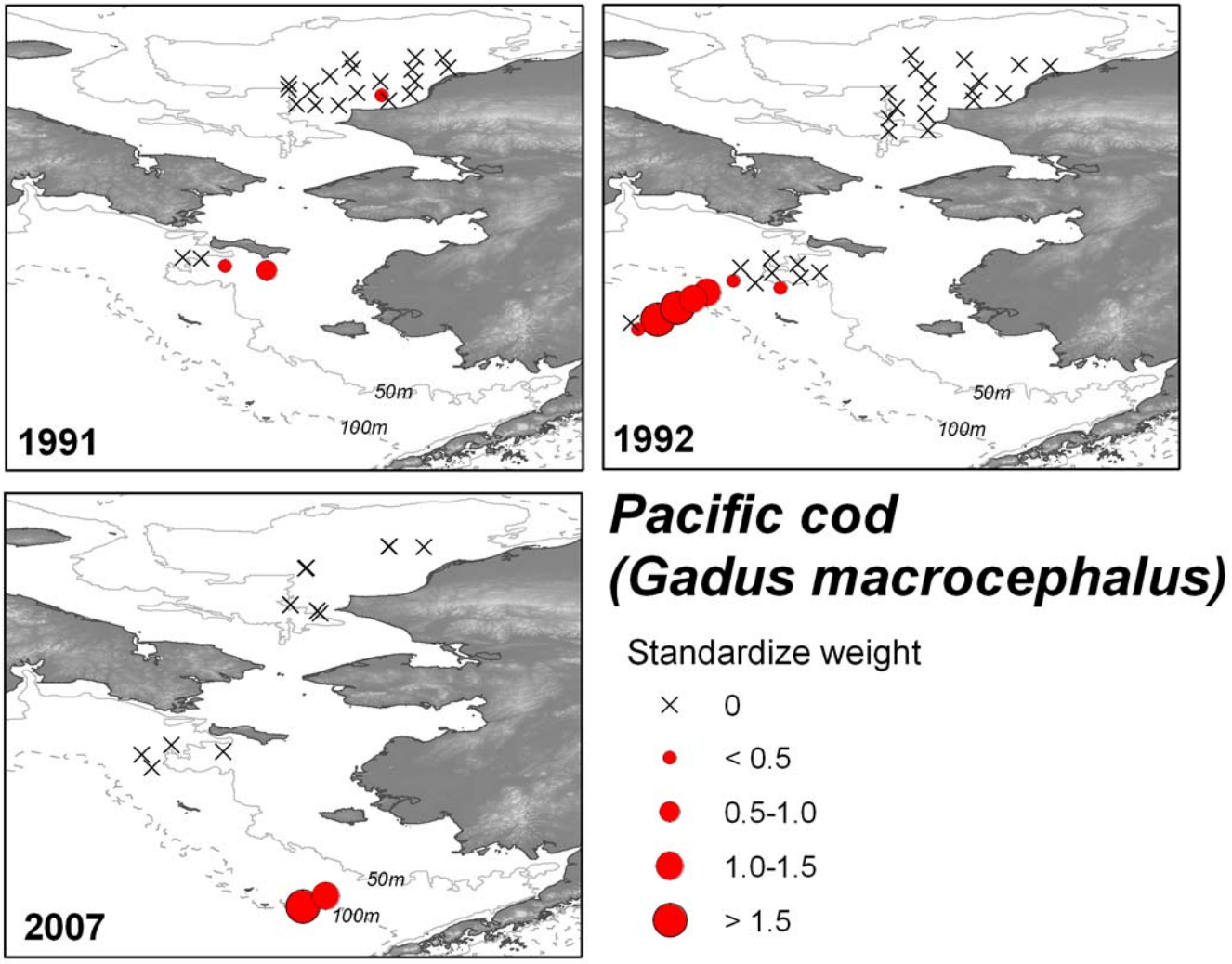

Longitude(°W)
162
163
164
165
166
167
Depth(m)
0
20
40
1992 Salinity


Longitude(°W)
162
163
164
165
166
167
12
10
8
6
4
2
0
-2
-4
2007 Temperature

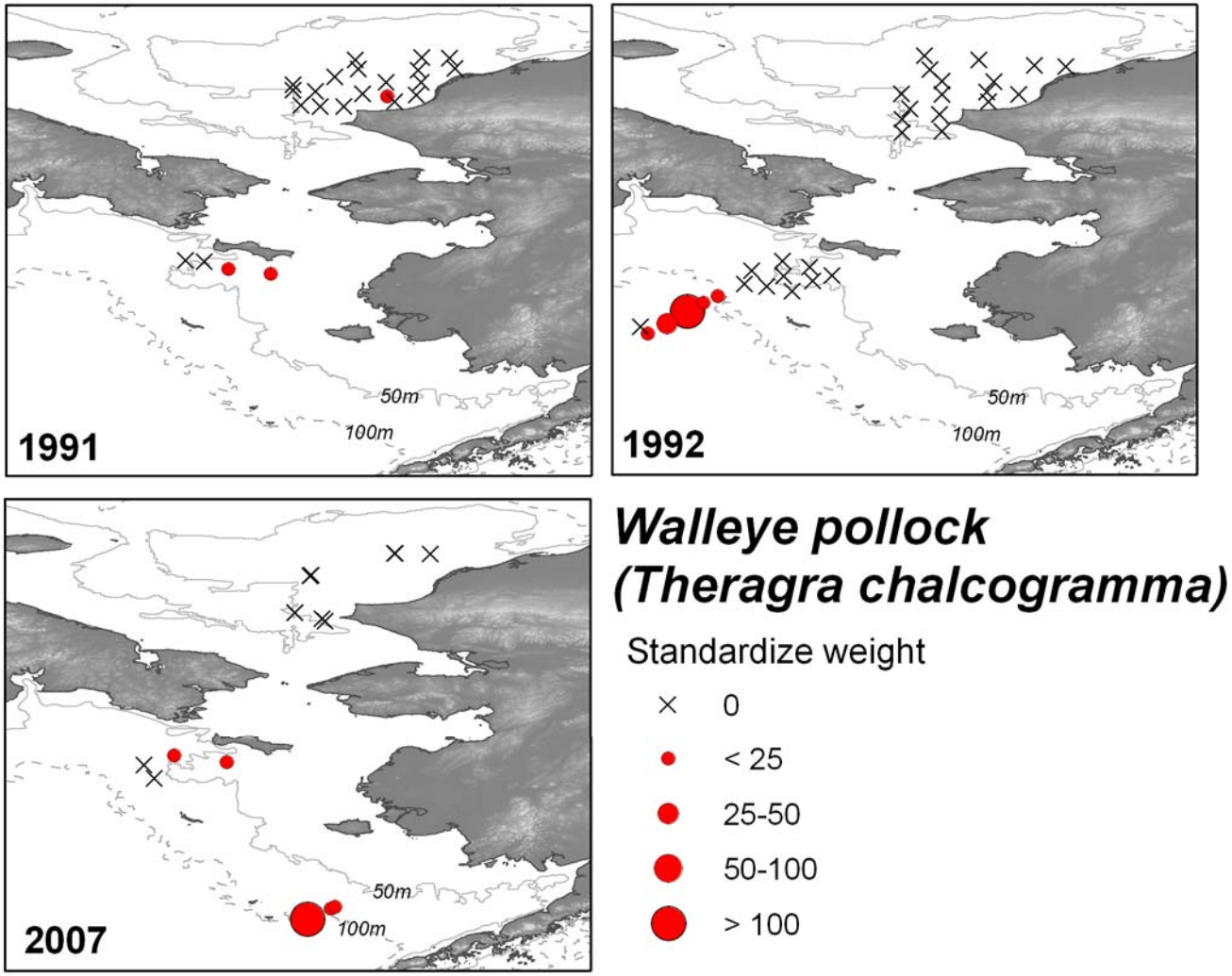

Longitude(°W)
162
163
164
165
166
167
Depth(m)
0
20
40
2007 Salinity


1991
1992
2007
Temperature(°C)
12
9
6
3
0
-3
26
27
28
29
30
31
32
33
34
Salinity(psu)

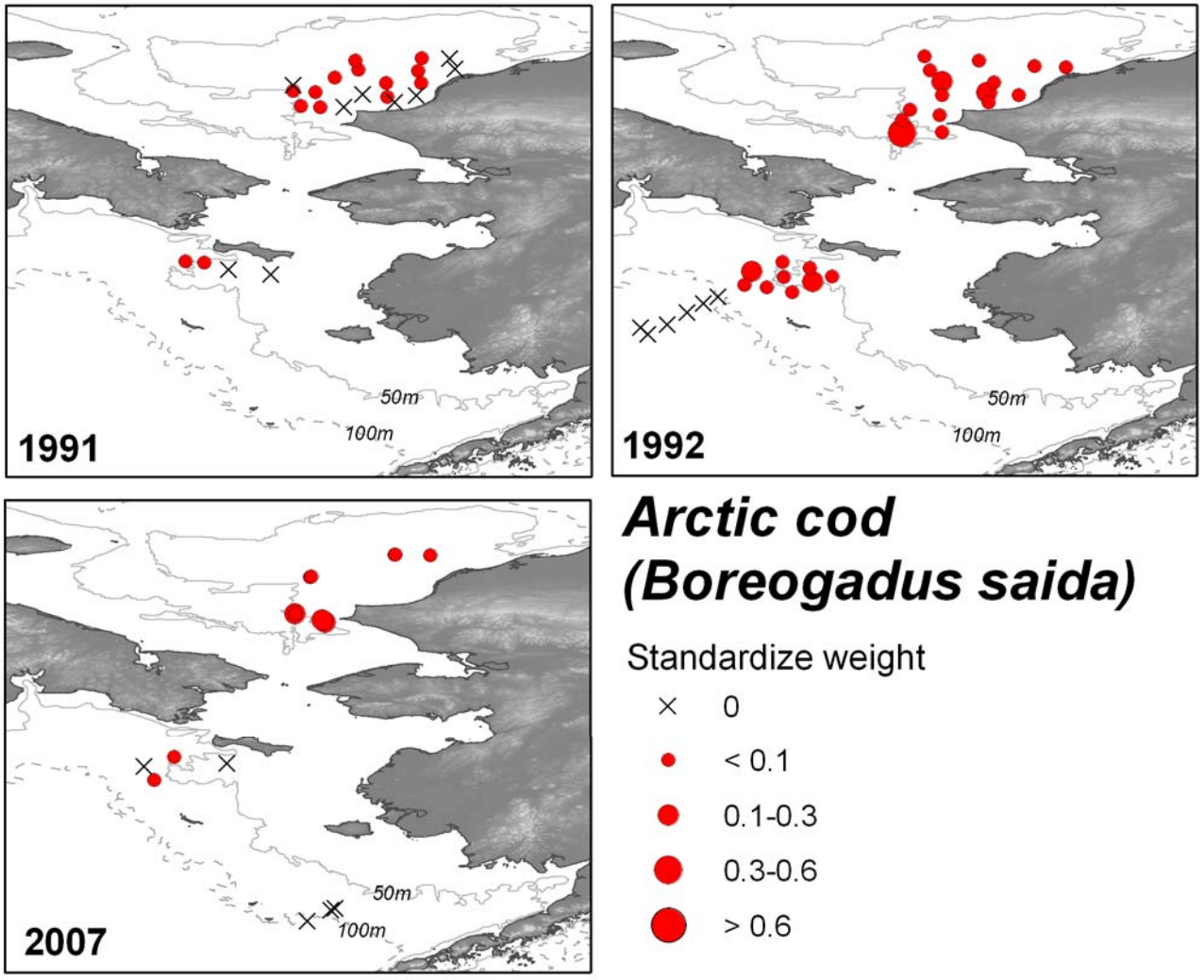
Demersal fish abundance (1)



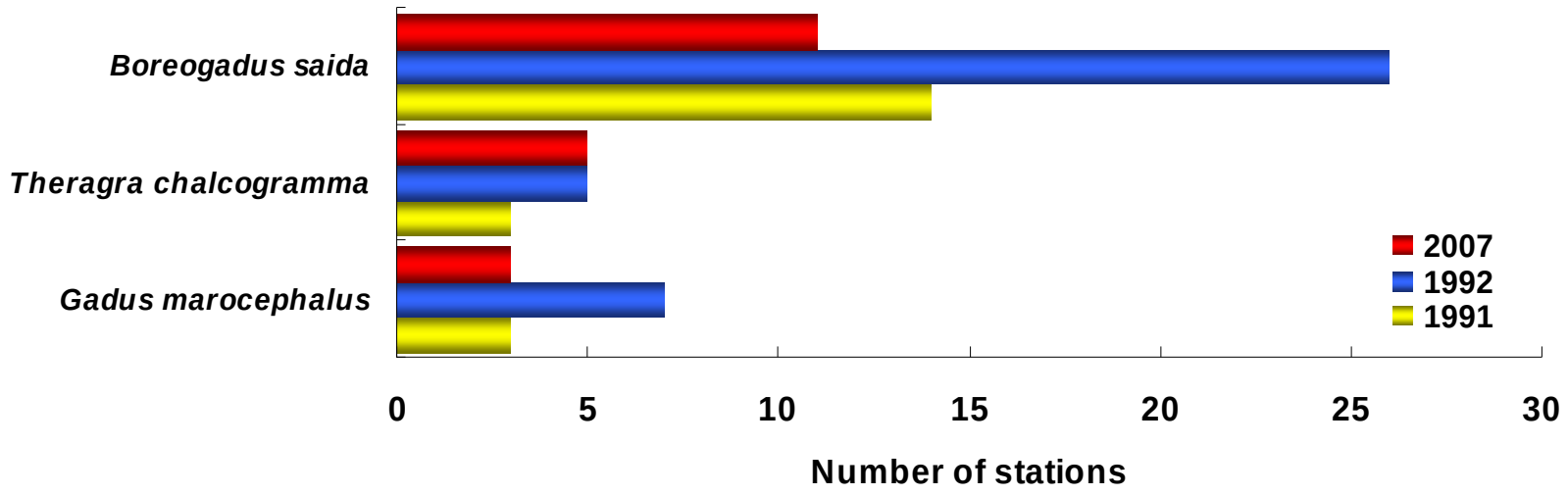
Demersal fish abundance (2)



Demersal fish abundance (3)



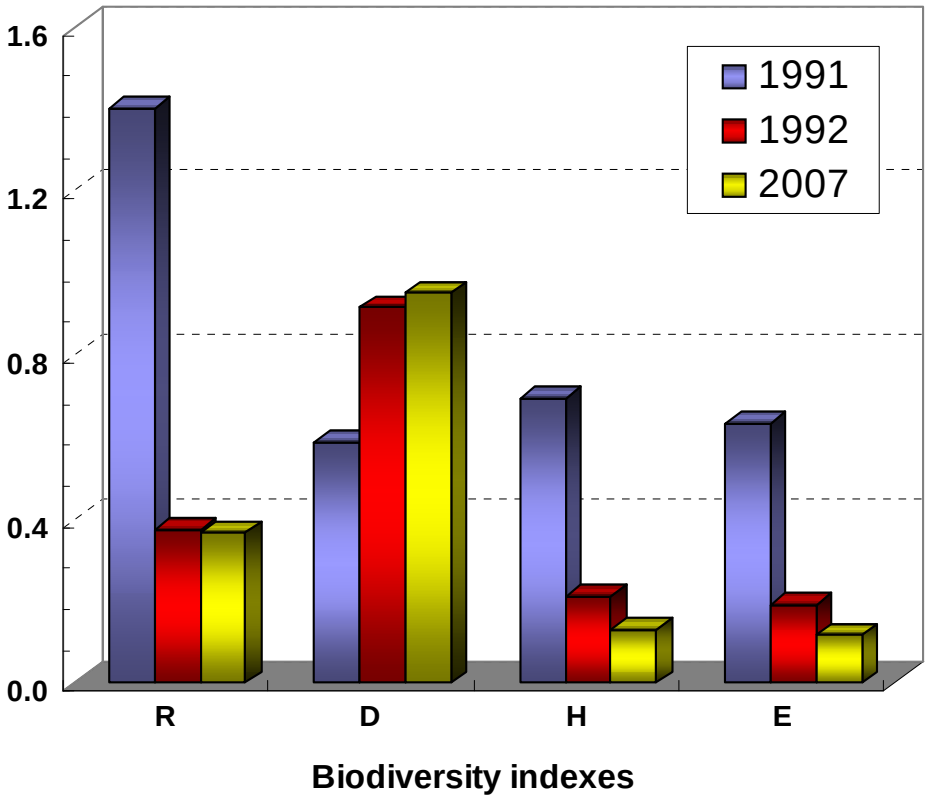
Distribution of the demersal fish occurrences



Biodiversity indexes

Year	Biodiversity index			
	R	D	H	E
1991	1.40	0.59	0.69	0.63
1992	0.37	0.91	0.21	0.19
2007	0.36	0.95	0.13	0.12

R: Margalef richness index
D: Simpson's index
H: Shannon-Wiener index
E: Evenness index



Summary

- We compare abundance and distribution of arctic cod and the other Gadidae fishes between in summer 1991/1992 and in summer 2007/2008
- Arctic cod might be an index species to understand the biodiversity change in the bottom fish community