Okhotsk Sea ecosystem overview

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Map of the Sea of Okhotsk

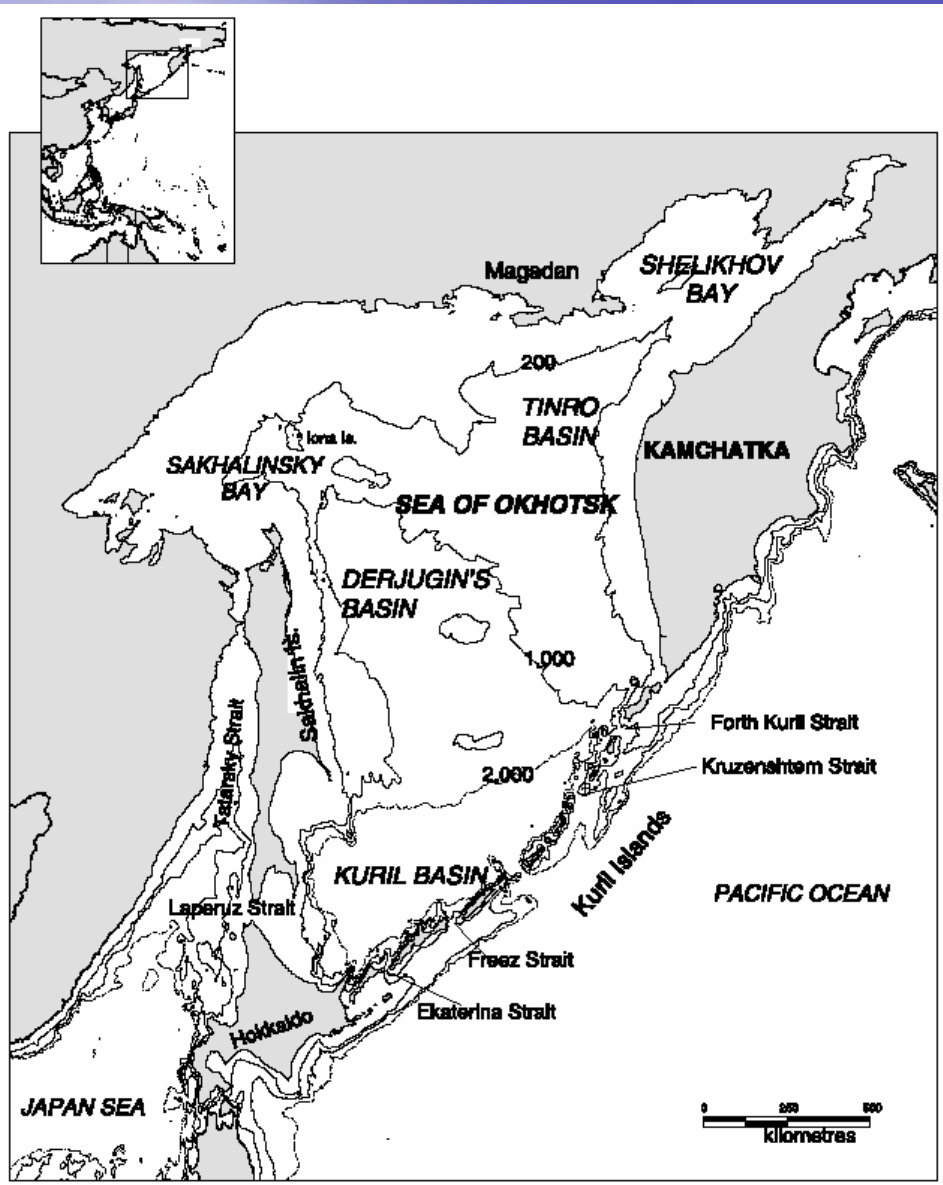


Fig. 1 Map of the Sea of Okhotsk (Udintsev, 1957, simplified).

- Area – about 1.53 million km^2
- Max depth – 3916 m
- Average depth – 821 m
- 50 Kuril straits (30 large) about 500 km wide in total
- The deepest straits:

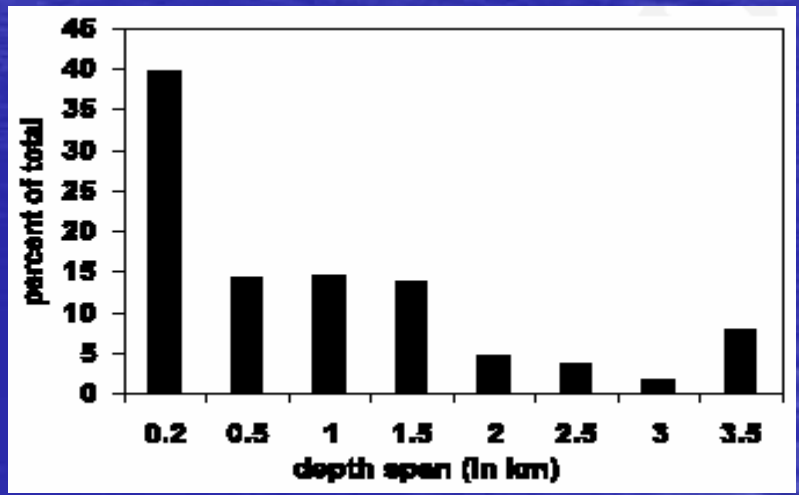
4th Kuril Strait 1700 m

Kruzenshtern's Strait 1400-1900 m

Bussol Strait 2500-3000 m

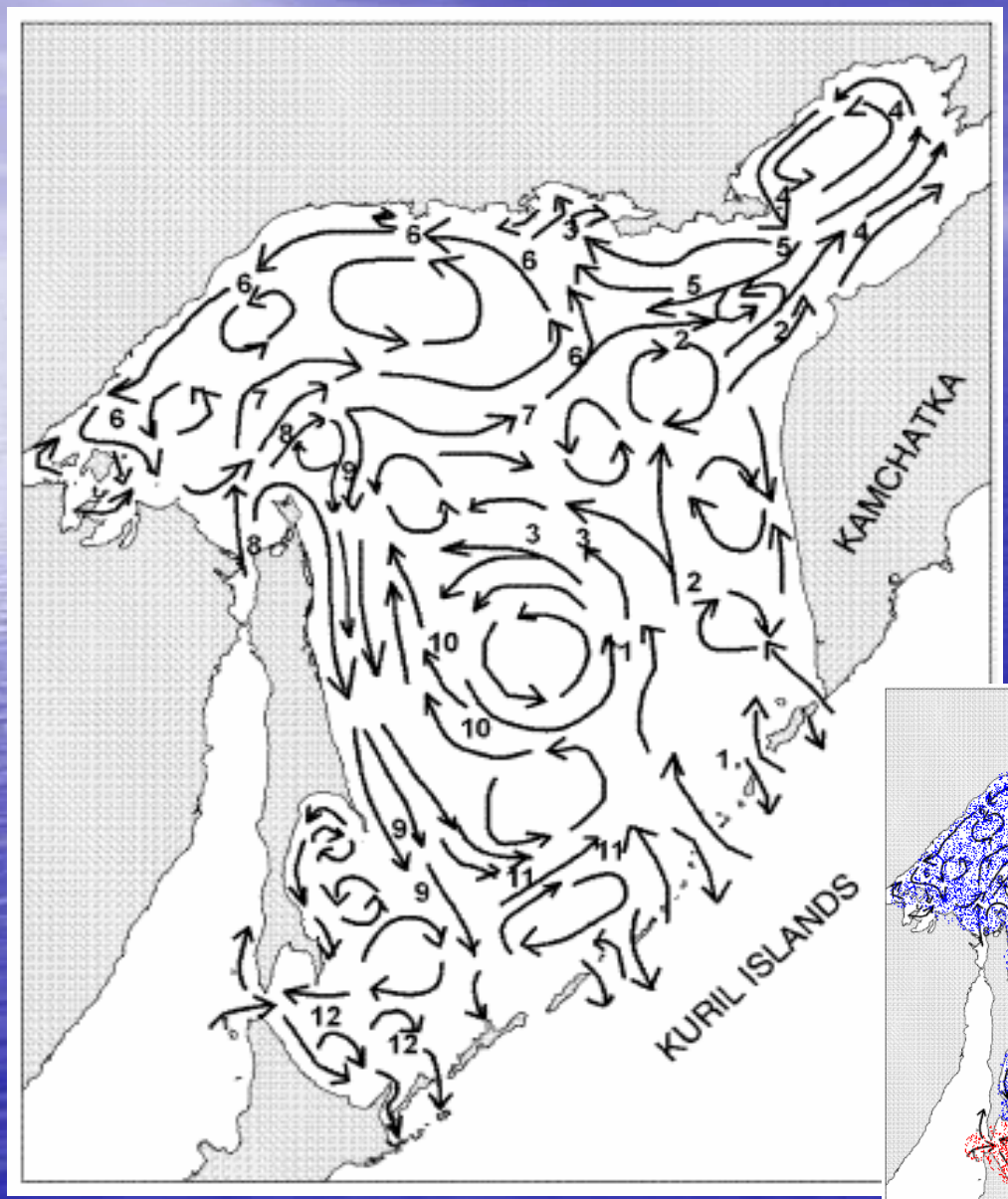
Freez's Strait 800 m

Ekaterina's Strait 437 m



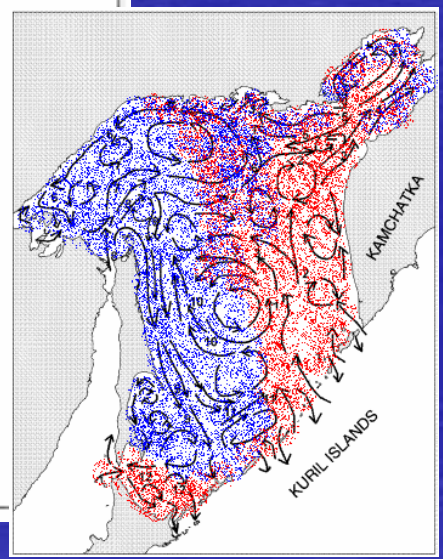
Share of the total area of the Sea of Okhotsk at different depths

Scheme of general water circulation in the Sea of Okhotsk in summer

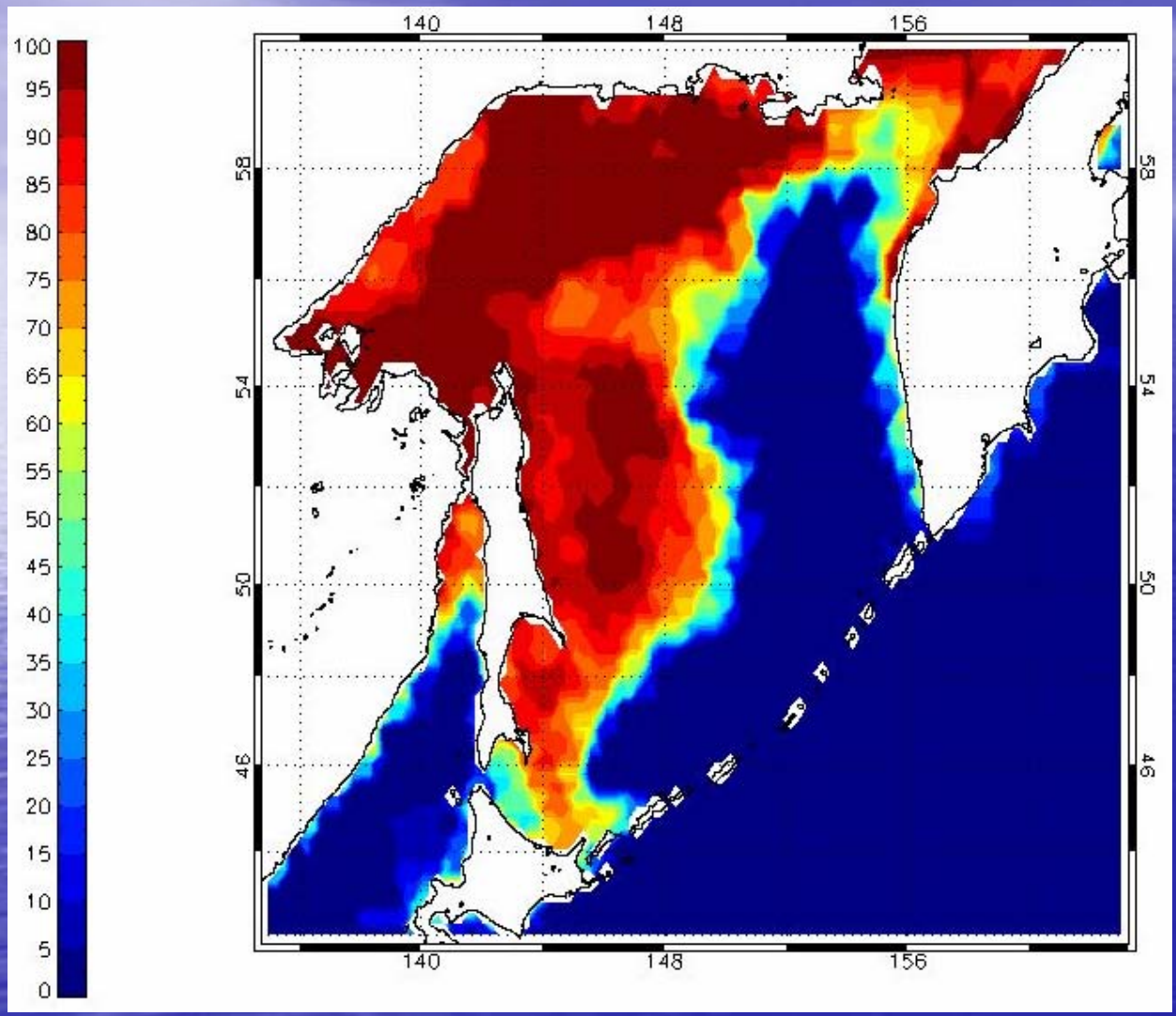


Currents:

1 West Kamchatkan
2 Northern branch
3 Middle
4 Penzhinskoe
5 Yamskoe
6 Northern Okhotsk's
7 Northern Okhotsk's concurrent
8 Amurskoe
9 East Sakhalin's
10 East Sakhalin's concurrent
11 Northeastern
12 Soya

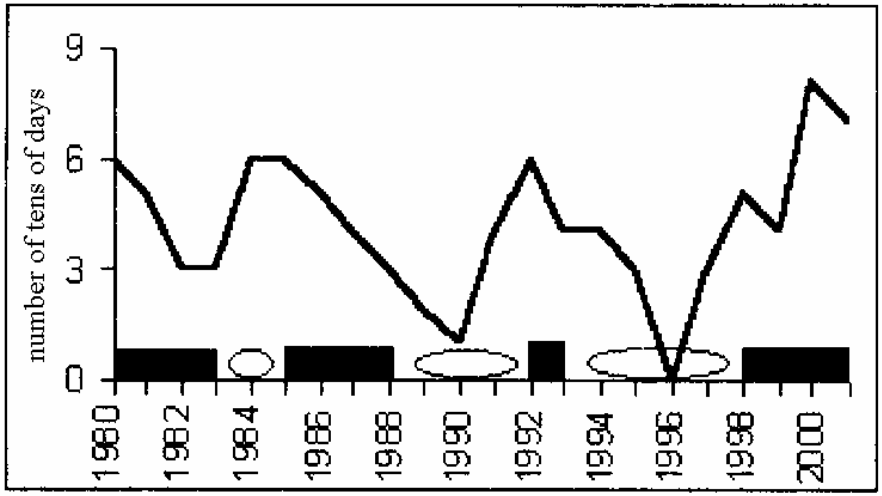


Warm pacific waters flow in, cool down cyclonically circulating over northern shelf and flow out

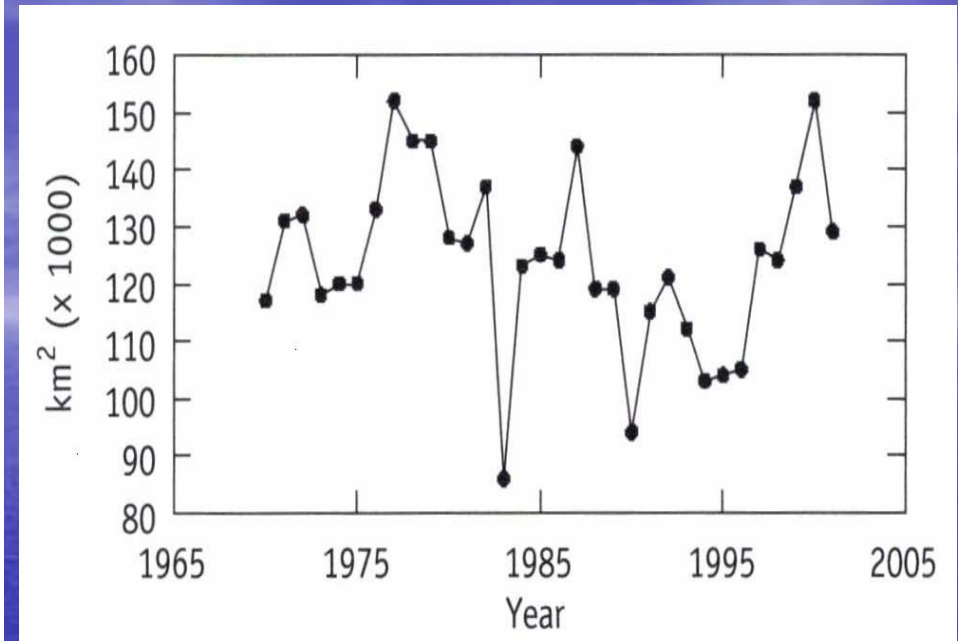


Ice distribution in the Sea of Okhotsk in March 10, 2004

(share (%) of area covered by ice in each section of ¼ degree lat * ¼ degree long)



Interannual variability of recurrence of “cold” atmospheric circulation synoptic types (line) and nature of ice conditions in the Sea of Okhotsk (bars and ovals) (Glebova, 2002).

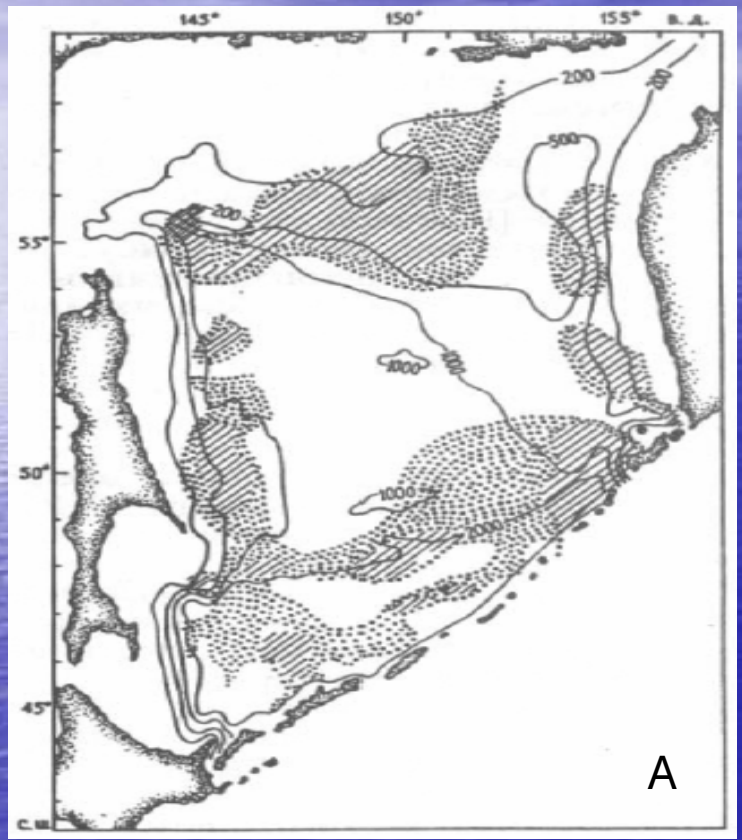


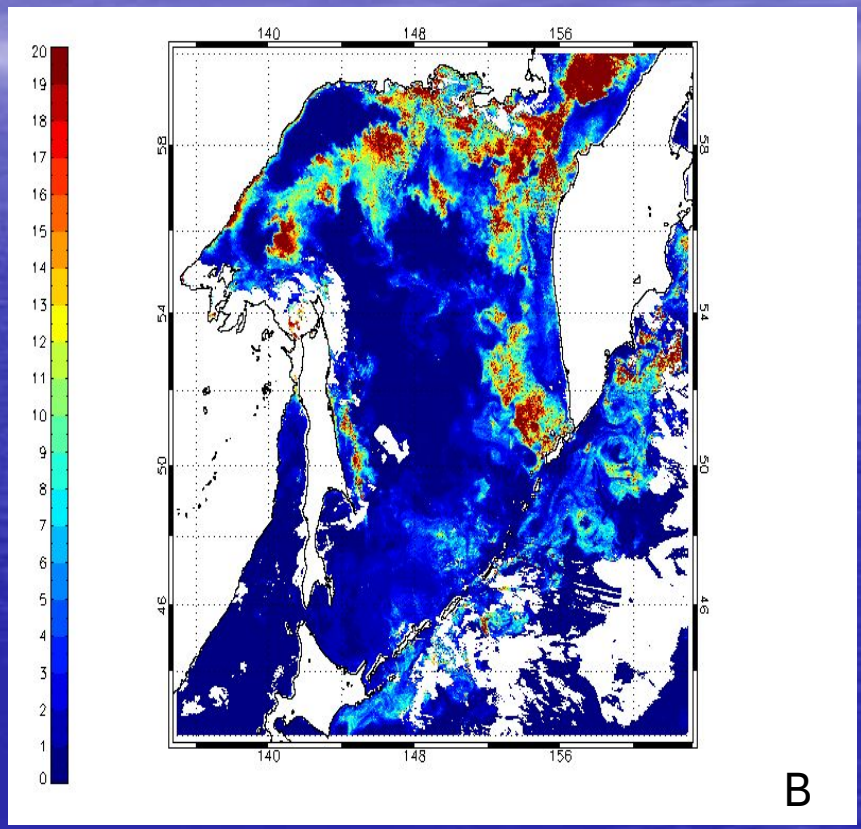
Annual maximum ice cover in the Sea of Okhotsk

Area	1996	1997	1998	1999	2000
Western Kamchatka shelf (April)	0.40	1.13	0.01	-0.25	-0.28
North-western part (May-June)	-0.45	-0.12	-0.72	-0.94	-0.98

Average water temperature in 50-200 m layer in the two areas of the Sea of Okhotsk (Ustinova et al., 2002).

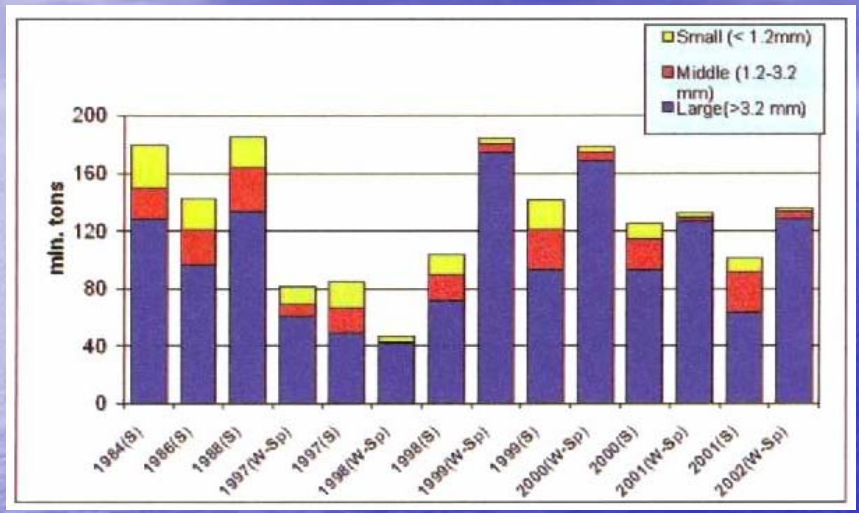
Regions of high potential primary productivity selected by the higher nutrients concentration in early spring (After Arzhanova and Zubarevich, 1997) (A) and chlorophyll distribution on the surface in the late May 2002 (B)

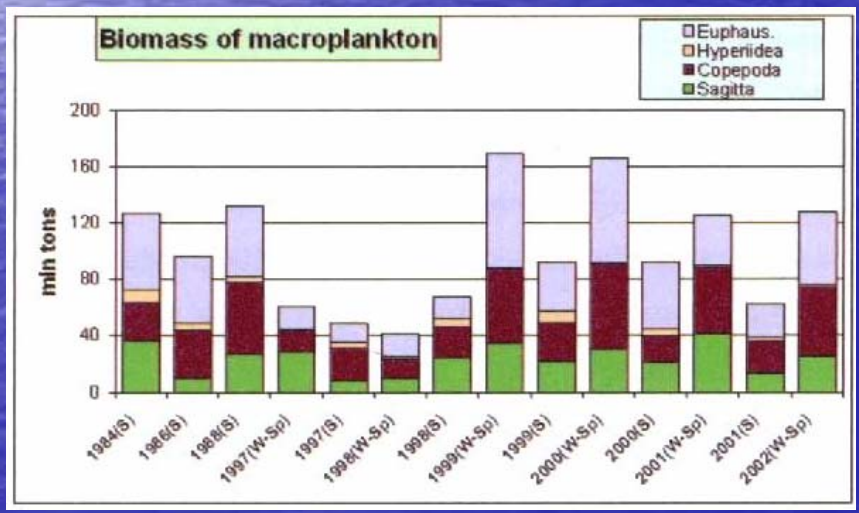




Primary production: 450 gC m^{-2} including phythobenthos or 14.4*109 t or 720 million tC for the entire Sea (Shuntov, Dulepova, 1997).
That's the highest estimation in the northwestern Pacific in terms of the level of primary production per unit of area.

Time series data on size (A) and taxonomic (B) groups of zooplankton in the northern part of Okhotsk Sea





Euphausiids:
Thysanoessa longipes
Th.raschii
Euphausia pacifica

Copepods:
Neocalanus plumchrus
N. cristatus
Metridia okhotensis
M. pacifica
Pseudocalanus. minutus
Calanus glacialis
Eucalanus bungii

Amphipods:
Themisto japonica
Th.libellula

Chaethognaths:
Parasagitta elegans
Eukrohnia hamata

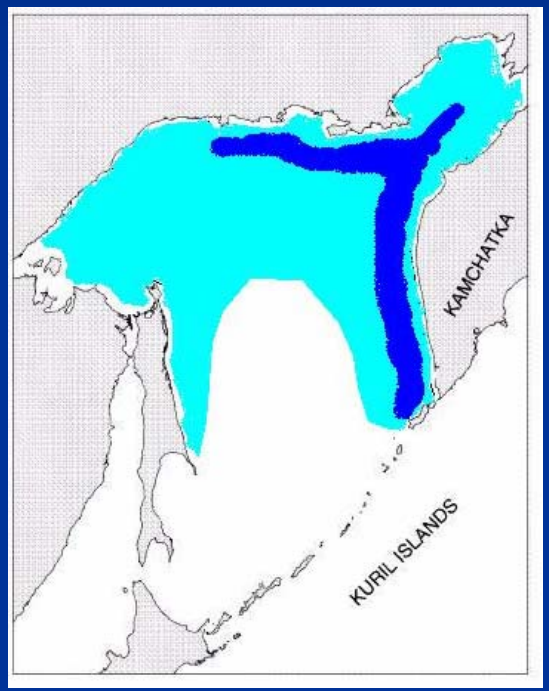
Fish community

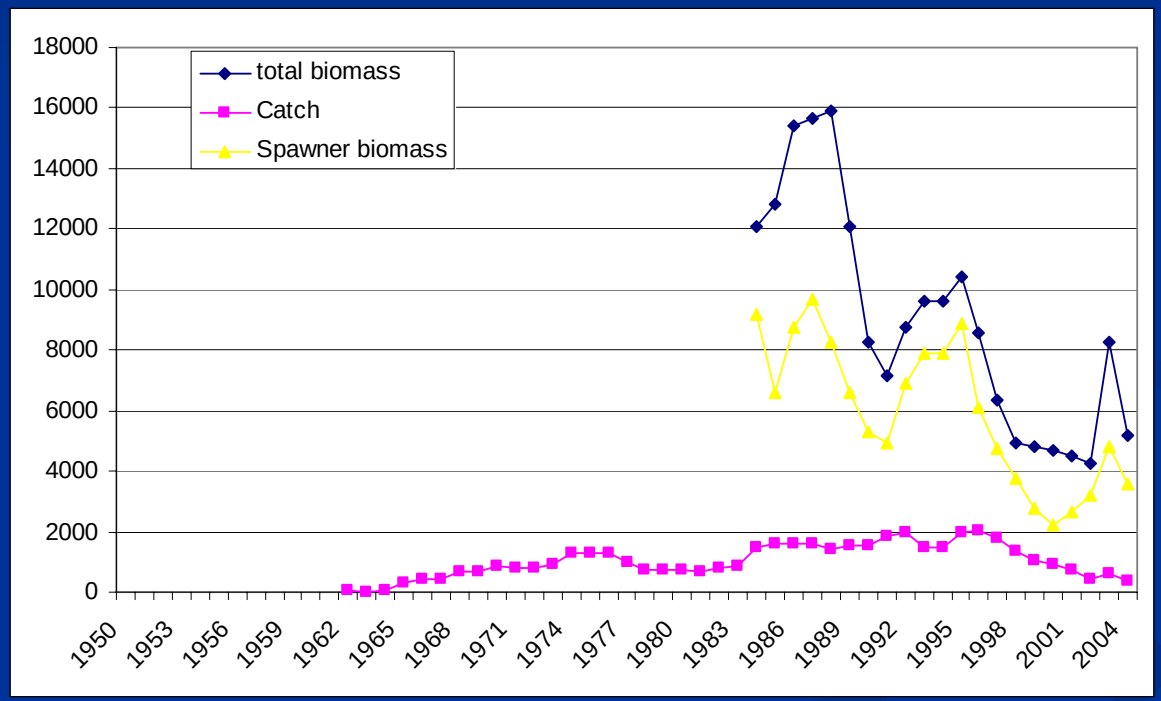
Species	1985	1986	1988	1998	1999	2000	2001	2002
Pollock	83.9	89.5	93.8	78.5	78.1	86.6	84.1	81.2
Herring	14.8	10.0	5.3	17.3	14.8	10.9	10.4	10.7
Capelin	0.9	0.2	0.1	0.4	0.8	0.6	1.8	1.8
Deep sea smelt	<0.1	<0.1	<0.1	1.5	3.5	0.6	1.1	3.5
Cyclopteriids	<0.1	<0.1	<0.1	3.0	0.1	0.1	0.1	0.2
Sakhalin plaice	<0.1	<0.1	<0.1	0.3	1.3	0.4	0.5	0.3
Other fishes	0.3	0.4	0.8	1.7	1.4	0.8	2.0	2.4
Total fish biomass	8.9	8.5	9.4	7.8	6.5	5.5	5.4	5.2

Composition (%) of epipelagic fish community in the northern Sea of Okhotsk in spring 1985, 1986, 1988 and 1998-2002 and total fish biomass (millions tonnes).

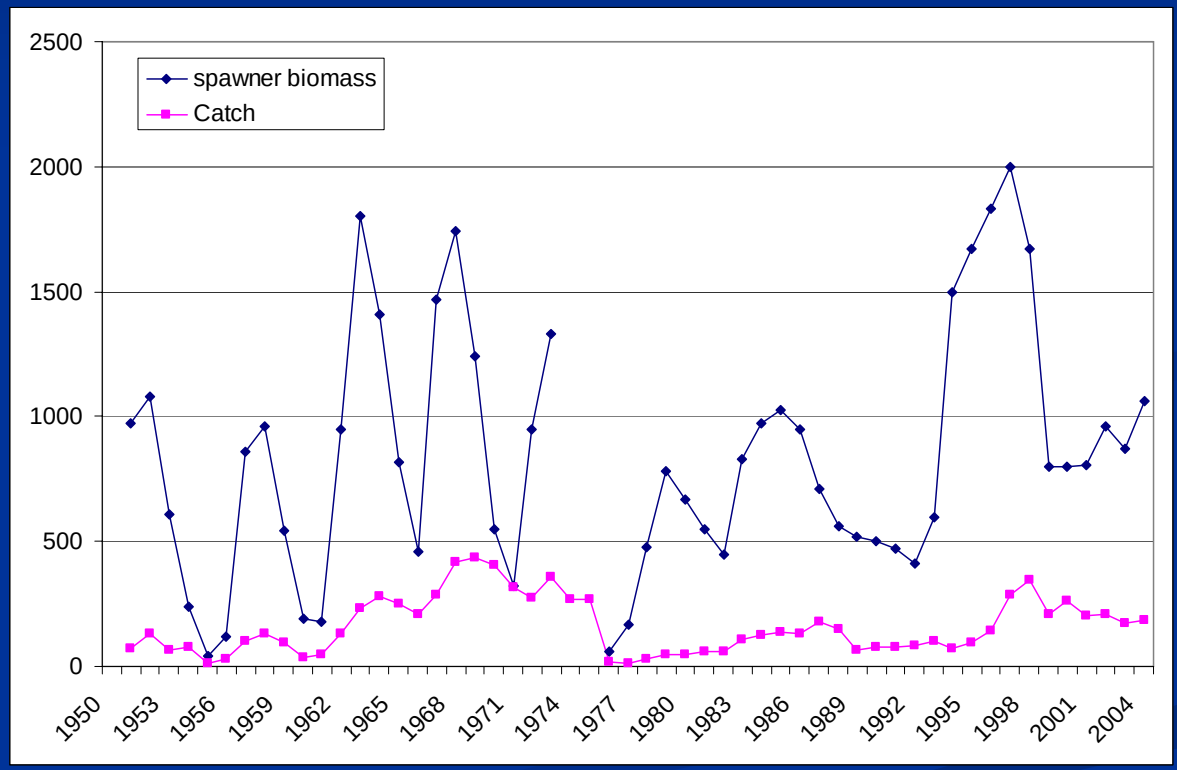
- Pollock, herring, pacific salmon, cod and flatfishes are the main target species.
- In 1980s total fish biomass was estimated as 35 mmt, annual fish production – 17.5 mmt (walleye pollock – 10–15 mmt, groundfish – 3.5 mmt, and other pelagic fish – 2–3 mmt).

Time series data on pollock

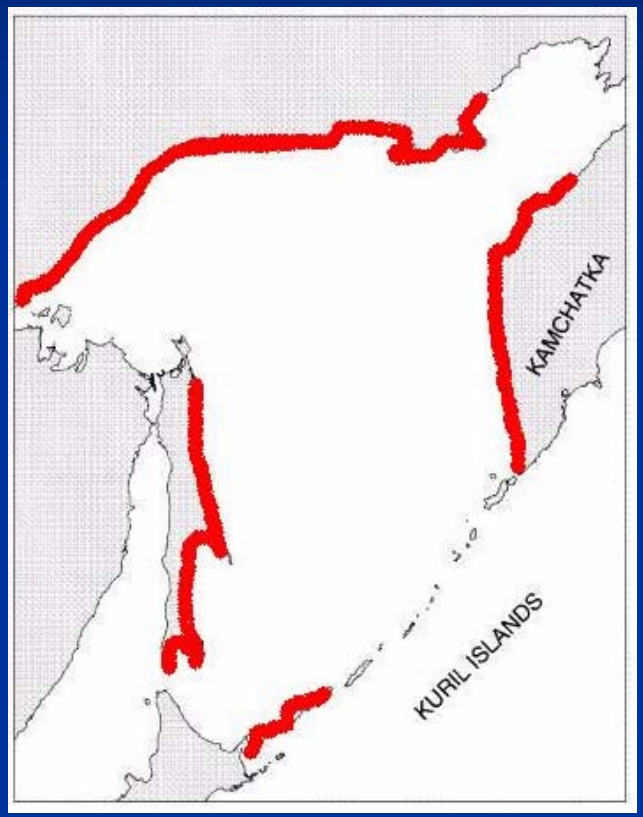


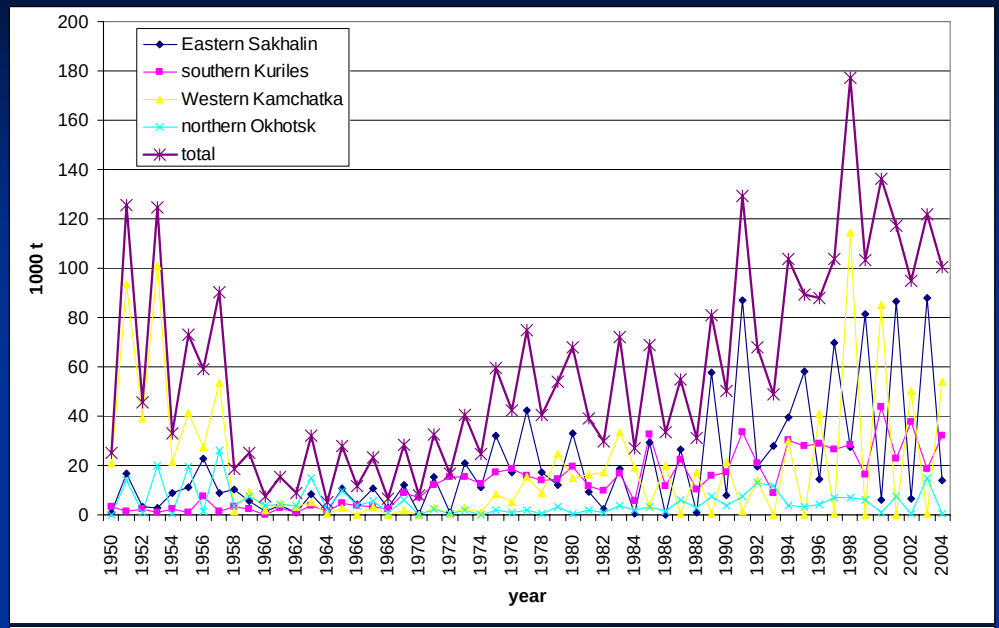


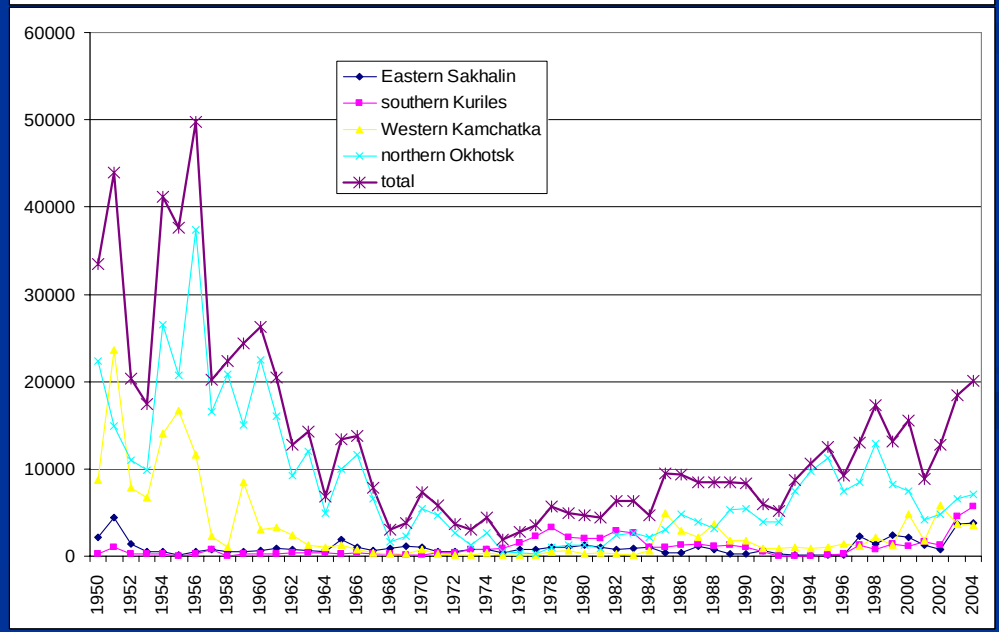
Time series data on herring



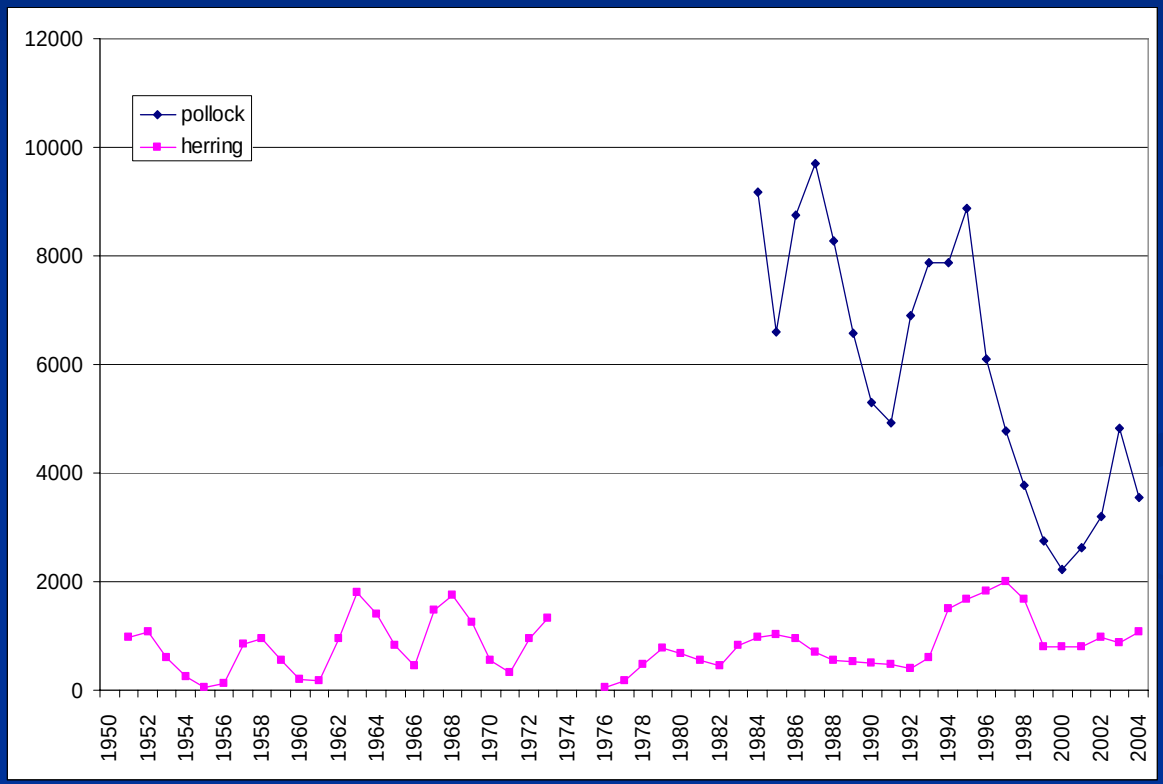
Time series data on pink (above) and chum (below) salmon







Comparison between pollock and herring spawner stocks



- Trends of both species abundances appear as generally not opposite
- Food habits of both species are similar that could be considered as an index of possible competition. However a surplus of planktonic resources in the area of joint distribution indicates an absence of food limitation for both stocks.

Biomass and production in Okhotsk Sea ecosystem in 1980s – early 1990s (Shuntov, Dulepova, 1997)

Groups	Biomass ($\times 10^6$ t)	Production ($\times 10^6$ t)
Phytoplankton	-	15100
Bacteria	-	5200
Protozoa	-	2100
Herbivorous zooplankton	314	2520
Predatory zooplankton	115	480
Nonpredarory zoobenthos	208.6	318
Predatory zoobenthos	21.4	22.1
Pelagic fishes	31.5	15.7
Demersal fishes	3.5	1.7
Demersal invertebrates	1.5	0.5
Squids*	3.5	12.5
Seabirds	0.012	0.004
Marine mammals	0.5	0.1