SEASONAL FREQUENCY of PELAGIC FISH SPECIES in SOME MICROREGIONS of the SOUTH-WEST OKHOTSK SEA

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## Space view on surface of the Sea of Okhotsk in Late March 2003 (ice covered northern and western parts of the Sea)



## Sea surface temperature of the Sea of Okhotsk in different seasons of 1999 (1- April; 2 – June; 3 – August; 4 –October)









#### Some comparative characteristics of trawl and net surveys conducted in the Okhotsk Sea in 1999-2003

Fisheries Research Institute	Vessel	Year	Gear (trawl or net)	Part of the Okhotsk Sea	Duration of survey (days)	Size of research area (×10 <sup>3</sup> km <sup>2</sup> )
SakhNIRO	4 commercial vessels ("Grant" et al)	1999	Bottom net	South- western	131	1.65
TINRO- centre	R/V "Professor Kaganovskiy"	1999	Pelagic trawl	Southern	20	359.3
	_"_	1999	Pelagic trawl	Northern	37	821.5
TINRO- centre	R/V "TINRO"	2000	Pelagic trawl	Southern	16	292.6
_**_	R/V "Professor Kaganovskiy"	2000	Pelagic trawl	Northern	37	839.0
SakhNIRO	R/V "Dmitriy Peskov"	2001	Bottom trawl	South- western	57	21.6
SakhNIRO	R/V "Dmitriy Peskov"	2002	Pelagic trawl	South- western	30	26.8
SakhNIRO	R/V "Dmitriy Peskov"	2003	Pelagic trawl	South- western	50	18.8

Location of three microregions in the south-west Okhotsk Sea in July-November1999



Characteristics of microregions and types of scientific observations conducted in a zone of deep waters of the south-west Okhotsk Sea in 1999 (+,observations; -,no observations)

Micro- region	Latitude, N	Longitude, E	Square, km <sup>2</sup>	Period of obser-	Types of observations			S
				vations	Number of temperature mea- surements	Fish species	Sea birds	Marine mammals
SW	46°32′-	143°51′-	191.0	July21-	57	+	+	+
	46°39′	143°59′		Nov.10				
NW	46°46′-	143°49′-	780.0	<b>July18-</b>	87	+	+	+
	47°05′	144°01′		Nov.07				
NE	47°34′-	144°34′-	677.0	July03-	6	+	_	_
	47°52′	145°45′		Oct.27				

#### List of pelagic fish species caught in three microregions of the south-west Okhotsk Sea in 1999

Species (English name)	Species (Latin name)	Number of days with fish catches
Japanese anchovy	Engraulis japonicus	30
Walleye pollock	Theragra chalcogramma	25
Pink salmon	Oncorhynchus gorbuscha	21
Pacific saury	Cololabis saira	16
Deep-sea smelt	Leuroglossus schmidti	9
Arabesque greenling	Pleurogrammus azonus	7
Threespine stickleback	Gasterosteus aculeatus	4
Longnose lancetfish	Alepisaurus ferox	1

#### List of sea birds and marine mammals observed in a zone of deep waters in the south-west Okhotsk Sea in 1999 (photos taken from World Wide Web)

English name	Latin name	
SEA I		
Fulmar	Puffinus sp.	
Kittiwake	Risa tridactyla	
Glaucous-winged gull	Larus glaucencens	
Slaty-backed gull	Larus schistisagus	1
MARINE	MAMMALS	
Pacific white-sided dolphin	Phocoenoides dalli	424
Northern fur seal	Callorhinus ursinus	7
Ringed seal	Phoca hispida	and the second
Killer whale	Orcinus orca	
		2 Pr

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#### Characteristics of catches and biological parameters of pelagic fishes in a zone of deep waters of the south-west Okhotsk Sea in July – October 1999

Paramet ers	Walleye pollock	Pink salmon	Japanese anchovy	Paci- fic saury	Long- nose lancet- fish	Arabe- sque greenlin g	Three- spine stickle- back	Deep-sea smelt
Catch per unit (ind./40 nets)	1-67	1-12	1-40	1	1	3-51	1	1-2
Time of lifting catches aboard (hours)	06-20	02-24	21-08, 12-17	21-06	10- 11.30	20-06	23- 06	03-20
Duration of fish occurren ce in nets (hours)	<b>≤ 2</b>	≥ 165	≤1	≤1	≤1	≤1	≤1	≤2
Water temperat ure, °C	11-15	11-18	10.2- 18	13.8- 17.6	15	11.2- 17.2	7.4- 12.2	7-18
Length of fishes, cm	45-56	43-54	14-16	23-29	134	18-23	3.5- 6.5	12-15
Ontogen etic stages	Adult	Adult	Adult	Adult	Adult	Juveni le	Juveni le	Adult
Seasonal biologica l status of fishes	Fee- ding	Prespa w- ning	Fee- ding	Fee- ding	Feedin g	Feedin g	Feedin g (or winter 's migrat ion)	Fee- Ding

# **Walleye pollock**

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• Frequency (%) and time of occurrence of walleye pollock in three microregions

Region	Walleye pollock
SW	8.0
	07.31- 10.14
NW	80.0
	07.27- 10.15
NE	12.0
	07.08- 10.11

- This fish occurred in the study region for more than 3 months.
- Walleye pollock was the most frequent in the first decade (10-day period) of August and first decade of October.
  - The maximum frequency and duration of occurrence for walleye pollock was recorded in the northwestern region (NW).
  - During July of 1999 postspawning walleye pollock
    migrated from the
    northeastern site toward the
    southwestern area.

## **Pink salmon**

• Frequency (%) and time of occurrence of pink salmon in three microregions

Region	Pink salmon
SW	38.1
	07.22-09.02
NW	38.1
	07.20- 09.10
NE	23.8
	07.15- 08.07

- This fish occurred in the study region for almost two months.
- A total of three peaks (three waves) were recorded in pink salmon migration to a zone of depth slope near southeastern Sakhalin.
- From July through August of 1999, a dynamics of pink salmon catches in the coastal zone by means of trap nets was well agreed with the temporary variability of frequency of this fish from net catches in a zone of depth slope, being 5 days late.
- A frequency of this fish at the western sites (NW and SW) was almost two time higher than in the northeastern microregion.
- We can see a trend of later appearance of the pink salmon in net catches from north-east toward southwest.

#### Dynamics of anadromous pink salmon migration near the south-east Sakhalin in July –September, 1999



#### Japanese anchovy

 Frequency (%) and time of occurrence of anchovy in three microregions

Region	Japanese anchovy	
SW	26.7	
	08.08- 10.10	
NW	56.7	
	08.19- 10.13	
NE	16.6	
	08.24-09.29	

- This species was being found in the study region for more than 2 months.
- In the direction from southwestern to northeastern site, anchovy was observed to appear in the late time period.
- This fish species was the most frequent in the northeastern region (NW) and the least frequent in the northeastern region (NE).
- A seasonal dynamics of anchovy's frequency was also characterized by the polymodal curve, but with a trend of frequency rising by early October.
- This fish appeared in the study region when a temperature of the sea surface layer reached 15 °C and more. With the beginning of sharp decrease in the sea surface water temperature, its aggregations migrated to other regions.

Distribution of anchovy catches (thousand ind./sq. km) in the Sea of Okhotsk in summer-autumn 1999 (from Merzlyakov, Temnykh, 2002)



Dynamics of Japanese anchovy frequency and water surface temperature (B – south-western microregion, C – north-western microregion) in a zone of deep waters near the south-eastern Sakhalin in 1999



# **Pacific saury**

• Frequency (%) and time of occurrence of saury in three microregions

Region	Pacific saury
SW	68.8
	08.22-09.26
NW	31.2
	09.12-09.22
NE	0.0
	_

- In 1999 this fish was being found in the study region during a little more than one month.
- Its earliest appearance, longest occurrence, and maximum frequency were observed at the very southern site.
- In August and September 1999 saury was very abundant in the southeastern Sakhalin region.
- Dynamics of saury seasonal frequency was characterized by the curve with two peaks.
- Saury began to run to a zone of depth slope of the southeastern Sakhalin
  Island when the temperature of surface waters reached high values.

Distribution of saury catches (thousand ind./sq. km) in the Sea of Okhotsk in summer-autumn 1999 (from Merzlyakov, Temnykh, 2002)



Dynamics of Pacific saury frequency and water surface temperature (B – south-western microregion, C – north-western microregion) in a zone of deep waters near the south-eastern Sakhalin in 1999



## **Longnose lancetfish**

- Frequency (%) and time of occurrence of longnose lancetfish in three microregions
- This pelagic predator • inhabits, mainly, the northwestern part of the Pacific ocean.

fish

Region	Longnose lancetfish	<ul> <li>During our survey this fish species was caught only once in early September in the very southern</li> </ul>
SW	100.0	microregion (SW) under the surface sea temperature
	09.02	15 °C.
NW	0.0	Absolute length of this fish was 140 cm, fork length 130 cm and body weight 4.7 kg.
	_	
NE	0.0	This fish species was caught in the period when
	_	appearance of saury was recorded and anchovy was abundant in this region too.

## **Deep-sea smelt**

• Frequency (%) and time of occurrence of deep-sea smelt in three microregions.

Region	Deep-sea smelt
SW	44.4
	08.10-10.11
NW	55.6
	07.28-10.28
NE	0.0
	_

- In the study region this species was being found during all the observation period, more than three months.
- It was found only in the western microregions (NW and SW).
- Its earlier appearance and longer occurrence was recorded at the northwestern site.
- Like for majority of pelagic
  fish species considered
  before, maximum frequency
  of a deep sea smelt was
  recorded in the
  northwestern microregion
  (NW).

#### Frequency (%) and time of occurrence (month, day) of pelagic fish species in three microregions of the southwest Okhotsk Sea in 1999

		영영과 전문 영양		영양(영화) 영화				
Regio n	Walle ye polloc k	Pink salmo n	Japan ese ancho vy	Pacif ic saury	Longn ose lancetfi sh	Arabes que greenlin g	Threespin e sticklebac k	Deep-sea smelt
SW	8.0	38.1	26.7	68.8	100.0	28.6	0.0	44.4
	07.31- 10.14	07.22 - 09.02	08.08- 10.10	08.22 - 09.26	09.02	10.09- 10.10	_	08.10-10.11
NW	80.0	38.1	56.7	31.2	0.0	71.4	100.0	55.6
	07.27- 10.15	07.20 - 09.10	08.19- 10.13	09.12 - 09.22	_	09.08- 10.14	10.11- 10.21	07.28-10.28
NE	12.0	23.8	16.6	0.0	0.0	0.0	0.0	0.0
	07.08- 10.11	07.15 - 08.07	08.24- 09.29	_	_	_	_	_

Distribution of phytoplankton biomass (mg/ m3) in the Okhotsk Sea in summer (left: from Markina, Chernyavskiy, 1984; right: from Gorbatenko,1997)



Distribution of zooplankton biomass (mg/m3) in the Okhotsk Sea in June – August 1988 (left: large sized zooplankton; right: total biomass, from Shuntov, 2001)



#### *Time of occurrence of pelagic fish species near the south-east Sakhalin in July – October 1999*



#### Frequency dynamics of pelagic fish species, sea birds, and marine mammals near the south-east Sakhalin in July – October 1999

# (KW- killer whale, D –dolphin, NFS – northern fur seal, S – ringed seal)

Object	Month, decade											
	July			August			September			October		
	1	2	3	1	2	3	1	2	3	1	2	3
Walleye pollock	4	-	12. 0	20. 0	4. 0	12. 0	16.0	20.0	-	-	12. 0	-
Pink salmon	-	9.5	33. 3	23. 8	-	19. 1	14.3	-	-	-	-	-
Anchovy	-	-	-	6.6	3. 3	10. 0	16.7	16.7	10. 0	26. 7	10. 0	-
Saury	-	-	-	-	-	12. 5	18.7	43.8	25. 0	-	-	-
Arabesq ue greenlin g	-	-	-	-	-	-	14.3	-	-	28. 6	57. 1	-
Sea birds	No dat a	No dat a	11. 0	-	-	1.1	7.7	8.7	7.7	20. 9	26. 4	16. 5
Marine mammal s	No dat a	No dat a	-	-	-	9.1 K W	18.2 KW ; NFS	36.4 KW;NF S; D	9.1 D	18. 2 NF S	-	9.1 S

#### Conclusion

- From July through October of 1999, a total of 8 pelagic fish species have been found from bottom net catches in a zone of depth slope of southeastern Sakhalin Island.
- We have observed a distinctly expressed seasonal priority of appearance of different pelagic fishes in the study region. It is caused both by ecological peculiarities and dates of migrations for individual species, and peculiarities of formation of the environmental conditions on areas of their feeding.
- All three microregions (northwestern, southwestern and northeastern) where observations took place, differed by species abundance of pelagic fishes, dates of their appearance, duration of their occurrence, and intensity of their frequency. 7 fish species were found at the very southern site, and 3 species at the very northern site.
- The maximum frequency and maximum duration of pelagic fish occurrence have been recorded in the northwestern microregion (NW), which is characterized by the higher biological productivity of waters.