Federal Agency for Fisheries of the Russian Federation

SOME RESULTS OF BOTTOM AND MIDWATER TRAWL SURVEY FOR WALLEYE POLLOCK (*THERAGRA CHALCOGRAMMA*) IN THE WESTERN BERING SEA IN OCTOBER-NOVEMBER 2003 ABOARD THE SHIP *"BAGRATION"*

(document submitted for IX Bering Sea Pollock Conference, Kushiro, Japan, 2004)

By

A.V.Chodakov, G.V.Norvillo, A.V.Buslov

2004

This cruise was a continuation of a multiannual study of the northwest Bering Sea pollock conducted under the "Program of comprehensive study of the population structure, status of stocks of the northwest Bering Sea pollock, and its role for the current ecosystems in 2001-2005".

The major cruise objectives were:

- conduct a comprehensive trawl survey in the Karagin subarea of the East Kamchatka Area;
- collect data to assess the size of the fishing stock, and find out the main pattern of abundance dynamics and distribution in the main fishing species of the region;
- collect and analyze biological and statistical data on the specific composition of catches; size/age/sex composition of the most abundant fish species; qualitative assessment of the feeding intensity in pollock, and its trophic relationship with the other fish species.

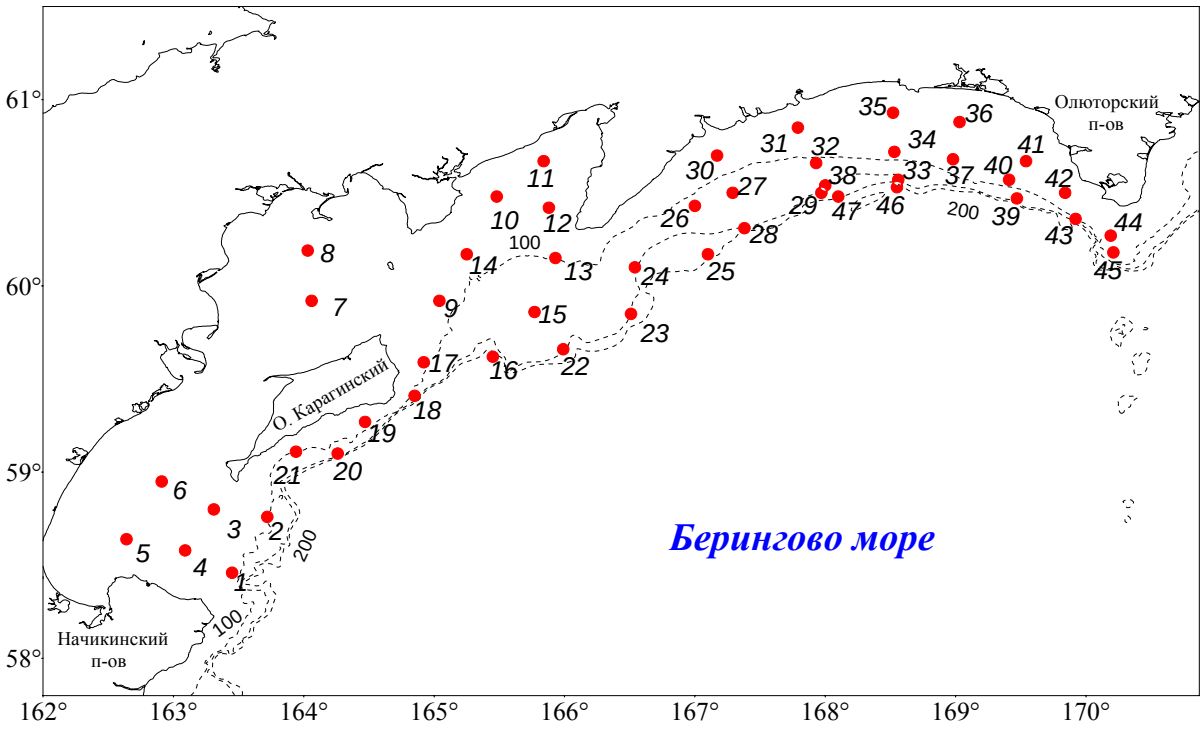


Figure 1. Bottom and midwater trawl survey from RTMS "Bagration". Grid of stations (31.10.03-12.11.03).

The bottom and midwater trawl survey was conducted between October 31 and November 12, 2003 along the grid of stations shown in Figure 1. Each tow went on for 30 minutes. The speed of trawl was 4 knots.

The biomass of hydrobionts was assessed, and the spatial distribution chart was fitted by spline-approximation using program MAPDESIGNER.

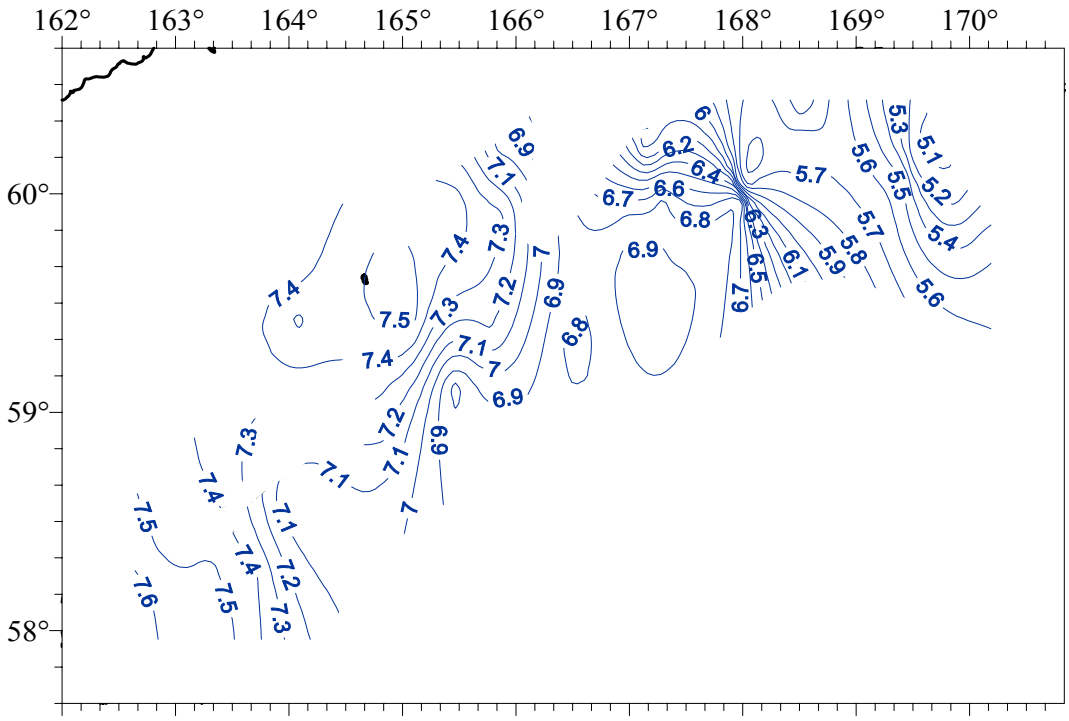


Figure 2. Distribution of surface water temperature in Karagin-Olutor area in November 2003.

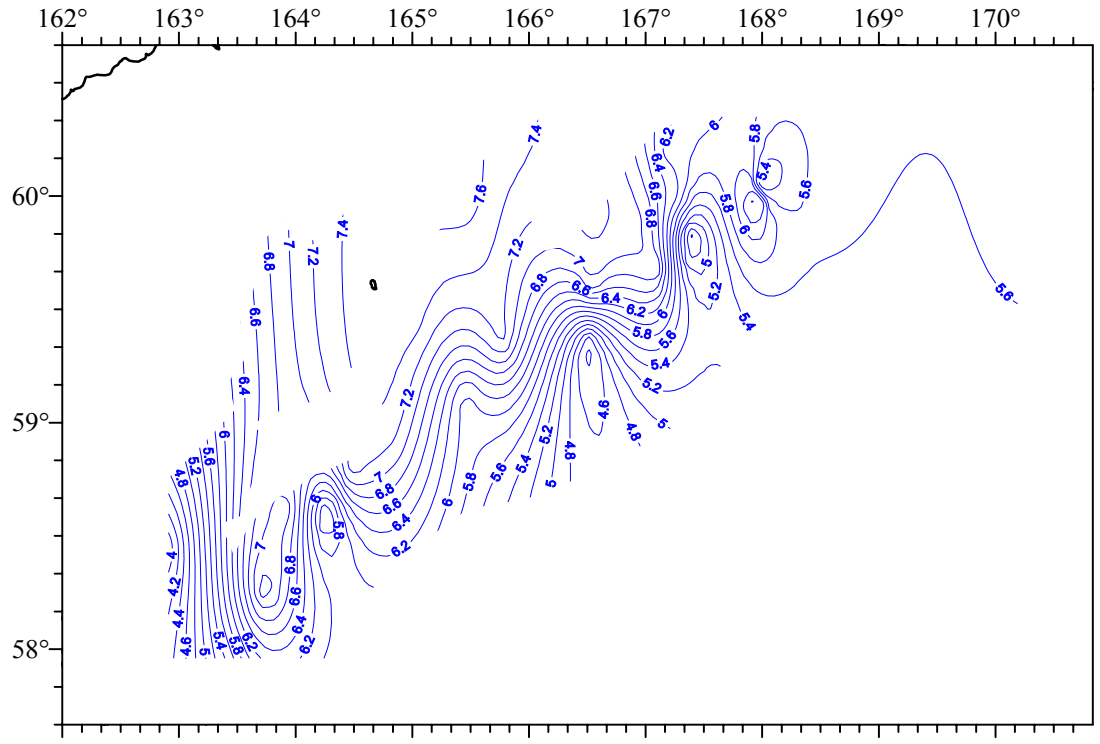


Figure 3. Distribution of water temperatures within 50 m in Karagin-Olutor area in November 2003.

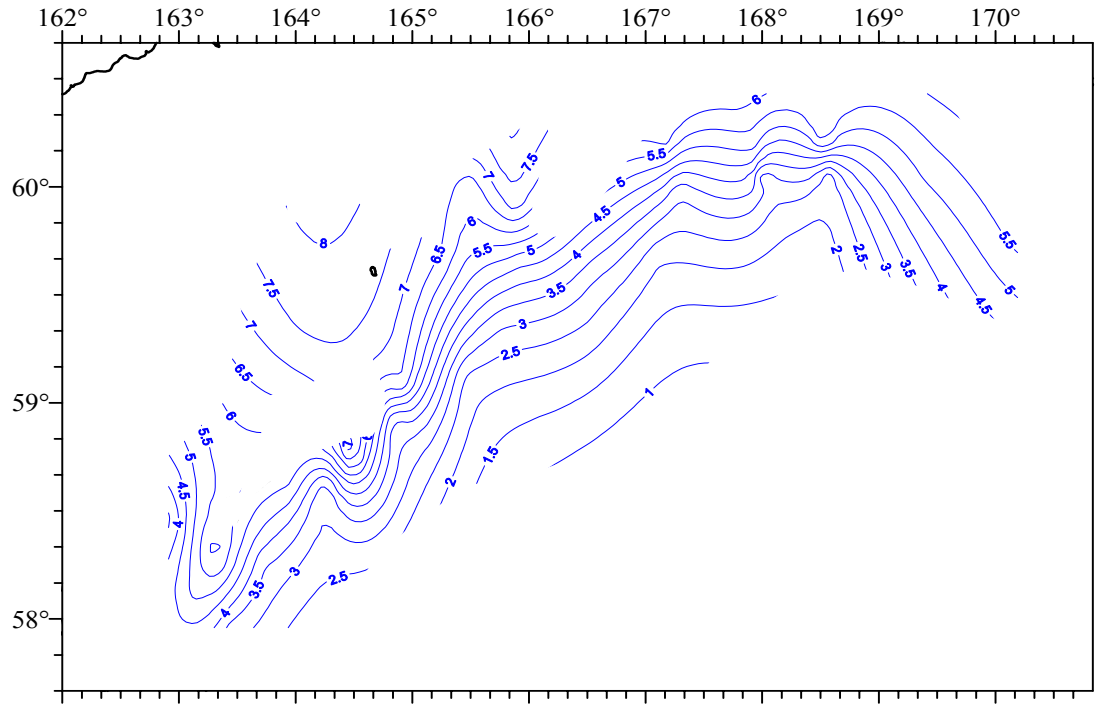


Figure 4. Distribution of water temperatures near bottom in Karagin-Olutor area in November 2003.

Hydrological conditions.

The average values of surface temperatures recorded during the survey (Fig. 2) were 2,5-2,7°C higher than the multiannual values; on the average it was + 6,89° C. The highest temperatures were recorded off Nachikin peninsula (southern part of the region surveyed). In Olutor Bay which is in the northeast of the area surveyed the surface water temperature was 1,8-2,1° C below the multiannual level.

The maximum near-bottom temperatures of up to +7,5° C were recorded in coastal areas (Fig. 4). At deepwater places of over 200m the near-bottom water temperature was 1,2-1,7° C which exceeds the average multiannual November indicators by 0,3-0,5° C.

This means that the year 2003 may be regarded as a warm year.

Species composition.

Eighty seven fish species of twenty five families were represented in catches (Table 1), and ten species of invertebrates (sea urchins, sea cucumbers, Commander squid, octopus, two species of shrimp, blue crab, tanner crab, etc.).

Most species belonged to Cottidae family (15), Pleuronectidae (12) and Agonidae (9). However, these species occurred in catches only individually. The most numerous species were pollock, cod and Pacific herring.

Table 1. Species composition and frequency of occurrence of fish in catches, November 2003.

	Species	%	Average catch Ind/hour	Kg/hour
	Fam. Petromyzontidae			
1	Pacific three-toothed lamprey - *Entosphenus tridentatus* (Gairdner)	2.13	0.17	0.046
	Fam. Dalatidae			
2	Pacific sleeper shark - *Somniosus pacificus* (Bigelow et Schroeder)	4.26	0.09	8.51
	Fam. Rajidae			

3	Aleutian skate - *Bathyraja aleutica* (Gilbert)	2.13	0.47	1.13
4	Smallthorn skate - *B. minispinosa* (Ishiyama et Ishihara)	2.13	0.09	0.03
5	Threadnose skate - *B. parmifera* (Ishiyama)	17.02	1.32	3.20
6	Okhotsk skate - *B. violacea* (Suvorov)	8.51	0.34	0.37
	Fam. Clupeidae			
7	Pacific herring - *Clupea pallasi pallasi* (Valenciennes)	63.83	317.3	62.03
	Fam. Salmonidae			
8	Chum salmon - *Oncorhynchus keta* (Walbaum)	4.26	0.09	0.01
9	Chinook salmon - *O. tshawytscha* (Walbaum)	6.38	0.13	0.42
	Fam. Osmeridae			
10	Pacific capelin - *Mallotus villosus catervarius* (Pallas)	48.94	25.19	0.41
11	Arctic rainbow smelt - *Osmerus mordax dentex* (Steindachner)	21.28	5.19	0.52
	Fam. Bathylagidae			
12	Northen smoothtongue - *Leuroglossus schmidti* (Rass)	2.13	0.04	0.01
13	Eared blacksmelt - *Lipolagus ochotensis* (Schmidt)	2.13	0.09	0.01
	Fam. Myctophidae			
14	Northern lumpfish - *Stenobrachius leucopsarus* (Eigenmann)	2.13	0.21	0.02
	Fam. Gadidae			
15	Saffron cod - *Eleginus gracilis* (Tilesius)	51.06	109.7	17.93
16	Pacific cod - *Gadus macrocephalus* (Tilesius)	76.60	53.19	87.59
17	Alaska pollock - *Theragra chalcogramma* (Pallas)	100.0 0	4550.6	1332.4
	Fam. Macrouridae			
18	Giant grenadier - *Albatrossia pectoralis* (Gilbert)	4.26	5.02	12.51
19	Popeye grenadier - *Coryphaenoides cinereus* (Gilbert)	2.13	0.04	0.01
	Fam. Scorpaenidae			
20	Pacific ocean perch - *Sebastes alutus* (Gilbert)	6.38	0.43	0.05
21	Shortraker rockfish - *S. borealis* (Barsukov)	2.13	0.04	0.29
22	Blue rockfish - *S. glaucus* (Hilgendorf)	10.64	4.98	5.8
23	Rockfish - *Sebastes sp*.	2.13	0.04	0.0002
	Fam. Anoplopomatidae			
24	Sablefish - *Anaplopoma fimbria* (Pallas)	8.51	0.26	0.02
	Fam. Hexagrammidae			
25	Rock greenling - *Hexagrammos lagocephalus* (Pallas)	8.51	0.26	0.31
26	Whitespotted greenling - *H. stelleri* (Tillesius)	21.28	0.94	0.13
27	Atka mackerel - *Pleurogrammus monopterygius*	44.68	2.89	1.45

	(Pallas)			
	Fam. Cottidae			
28	Sculpin - *Artediellus sp.*	2.13	0.04	0.0004
29	Antlered sculpin - *Enophrys diceraus* (Pallas)	2.13	0.04	0.01
30	Grey purple sculpin - *Gymnacanthus detrisus* (Gilbert et Burke)	14.89	2.47	0.35
31	Armorhead sculpin - *G. galeatus* (Bean)	8.51	0.22	0.04
32	Threaded sculpin - *G. pistilliger* (Pallas)	17.02	8.51	0.42
33	Japanese Irish lord - *Hemilepidotus gilberti* (Jordan et Starks)	27.66	14.34	5.81
34	Yellow Irish lord - *H. jordani* (Bean)	61.70	24.64	12.81
35	Thorny sculpin – *Icelus spiniger* (Gilbert)	21.28	5.49	0.23
36	Butterfly sculpin - *Melletes papilio* (Bean)	36.17	12.68	2.88
37	Plain sculpin - *Myoxocephalus jaok* (Cuvier)	17.02	1.19	1.34
38	Great sculpin - *M. polyacanthocephalus* (Pallas)	46.81	8.43	16.12
39	Warty sculpin - *M. verrucosus* (Bean)	2.13	0.043	0.07
40	Scissortail sculpin - *Triglops forficata* (Schmidt)	6.38	0.13	0.01
41	Ribbed sculpin - *T. pingeli* (Reinhardt)	8.51	0.34	0.01
42	Spectacled sculpin - *T. scepticus* (Gilbert)	19.15	8.64	0.50
	Fam. Hemitripteridae			
43	Crested sculpin - *Blepsias bilobus* (Cuvier)	31.91	3.83	0.41
44	Shaggy sea raven- *Hemitripterus villosus* (Pallas)	25.53	0.94	1.46
45	Eyeshade sculpin - *Nautichthys pribilovius* (Jordan et Gilbert)	4.26	0.09	0.0006
	Fam. Agonidae			
46	Alleutian alligatorfish - *Aspidophoroides monopterygius* (Bloch)	12.77	0.3	0.01
47	Black fin poacher- *Bathyagonus nigripinnis* (Jordan et Gilbert)	8.51	0.17	0.01
48	Fourhorn poacher - *Hypsagonus quadricornis* (Cuvier)	4.26	0.09	0.0006
49	Bering poacher - *Occella dodecaedron* (Block et Schneider)	2.13	0.05	0.0009
50	Northern-tubenose poacher - *Pallasina aix Starks*	6.38	0.94	0.0047
51	Drogon poacher - *Percis japonica* (Pallas)	27.66	3.19	0.41
52	Sturgeon poacher - *Podothecus accipenserinus* (Pallas)	21.28	3.62	0.2
53	Sawback poacher - *Sarritor frenatus* (Gilbert)	29.79	1.66	0.07
54	Longnose poacher - *S. leptorhynchus* (Bloch)	8.51	0.17	0.02
	Fam. Psychrolutidae			
55	Spinyhead sculpin - *Dasycottus setiger* (Bean)	12.77	0.43	0.17
56	Darkfin sculpin - *Malacocottus zonurus* (Bean)	21.28	9.06	2.03
	Fam. Cyclopteridae			
57	Smooth lumpsucker - *Aptocyclus ventricosus* (Pallas)	8.51	0.17	0.29

58	Siberian lumpsucker - *Eumicrotremus asperrimus* (Tanaka)	8.51	0.3	0.03
59	Pacific spiny lumpsucker - *E. orbis* (Gunther)	6.38	0.3	0.02
60	Lumpsucker (unidentified) - *Eumicrotremus sp.*	4.26	0.17	0.01
	Fam. Liparidae			
61	Forktail snailfish - *Careproctus furcellus* (Gilbert et Burke)	14.89	2.21	1.44
62	Pink snailfish - *C. rastrinus* (Gilbert et Burke)	14.89	1.40	0.71
63	Proboscis snailfish - *C. simus* (Kido)	2.13	0.04	0.0004
64	Blotched snailfish - *Crystallichthys mirabilis* (Jordan et Snyder)	6.38	0.3	0.19
65	Dimdisc snailfish - *Elassodiscus tremebundus* (Gilbert et Burke)	4.26	3.11	0.6
66	Snailfish (unidentified) - *Liparis sp.*	21.28	0.09	0.0017
67	Slander snailfish - *Paraliparis grandis* (Schmidt)	2.13	0.34	0.08
	Fam. Bathymasteridae			
68	Searcher - *Bathymaster signatus* (Cope)	8.51	0.3	0.04
	Fam. Zoarcidae			
69	Wattled eelpout - *Lycodes palearis* (Toyoshima)	25.53	9.32	1.28
70	Marbled eelpout - *L. brevicaudus* (Taranetz et Andriashev)	12.77	1.79	1.23
	Fam. Stichaeidae			
71	Fourline snakeblenny - *Eumisogrammus praecisus* (Kroyer)	2.13	0.04	0.003
72	Longsnout prickleback - *Lumpenella longirostris* (Evermann et Goldsbourg)	4.26	0.43	0.03
73	Blenny (unidentified) - *Lumpenus sp.*	4.26	0.09	0.0017
	Fam. Zaproridae			
74	Prowfish - *Zaprora silenus* (Jordan)	31.91	2	0.24
	Fam. Ammodytidae			
75	Pacific sandlance - *Ammodytes hexapterus* (Pallas)	8.51	0.77	0.09
	Fam. Pleuronectidae			
76	Kamchatka flounder - *Atheresthes evermanni* (Jordan et Starks)	6.38	1.57	2.69
77	Arrowtooth flounder - *A. stomias* (Jordan et Gilbert)	19.15	1.40	1.98
78	Flathead sole - *Hippoglossoides elassodon* (Jordan et Gilbert)	8.51	0.6	0.16
79	Bering flounder - *H. robustus* (Gill et Townsend)	36.17	52.6	8.67
80	Pacific halibut - *Hippoglossus stenolepis* (Schmidt)	23.40	0.72	5
81	Northern rock sole - *Lepidopsetta polyxystra* (Gill)	17.02	0.94	0.66
82	Longhead dab - *Pleuronectes proboscidea* (Gilbert)	10.64	0.64	0.6
83	Yellowfin sole - *Limanda aspera* (Pallas)	38.30	14.94	4.96

84	Sakhalin dab - *L. sakhalinensis* (Pallas)	53.19	92.04	7.01
85	Starry flounder - *Platichthys stellatus* (Pallas)	8.51	0.64	0.57
86	Alaska plaice - *Pleuronectes quadrituberculatus* (Pallas)	27.66	2.3	2.05
87	Pacific black halibut - *Reinhardtius hippoglossoides matsuurae* (Walbaum)	36.17	2.55	1.37

Such a rich specific diversity can most likely be attributed to the unusually high water temperatures in November 2003. Most of the fish species recorded in catches belong to the boreal or south-boreal fauna complex.

The average weighted catch per one hour haul of the trawl survey was 5779 ind., or 1648.9 kg in terms of weight. Pollock was found in catches taken in all 47 hauls. Its share was 84,5% in number (82,1% by biomass). Herring, saffron cod, Sakhalin dab and cod were much less frequent in catches. The occurrence of the other species was less than 1% (Table 3).

Table 3. The shares of the most abundant species (number/weight), November 2003.

Species	Number, %	Weight, %
Theragra chalcogramma	84,49	82,07
Clupea pallasii	5,89	3,82
Eleginus gracilis	2,04	1,1
Limanda sakhalinensis	1,71	0,43
Gadus macrocephalus	0,99	5,39
Hippoglossoides robustus	0,98	0,53
Hemilepidotus jordani	0,46	0,79
Myoxocephalus polyacanthocephalus	0,16	0,99

The composition of catches in Olutor and Karagin Bays virtually did not differ either in quality or quantity. Over 88% of catches by biomass taken in the two areas consisted of species of Gadidae family, chiefly pollock.

As for differences, we could make the following points. The most numerous fish besides cod in Karagin Bay were sculpins where great sculpin and yellow Irish lord prevailed; flounders were the second where the Bering flounders and Pacific halibut predominated; finally, clupeids were represented by one species: Pacific herring.

In Olutor Bay the second ranking species was Pacific herring followed by sculpins where great sculpin and yellow Irish lord were the leading species; next were flounders among which the major species were Sakhalin dab and Bering flounder. The relative abundance of the other species in Olutor Bay was nearly twice as high as in Karagin Bay.

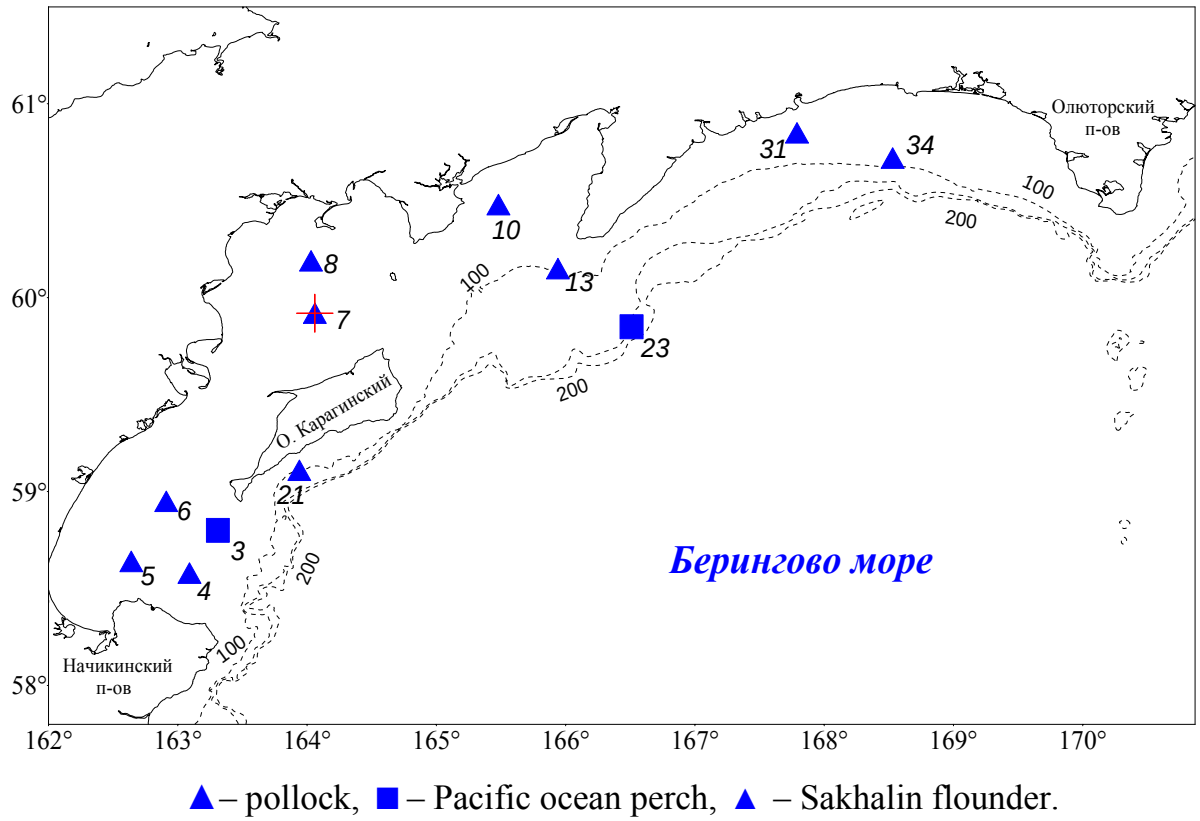


Figure 5. Fish (0+) capture sites, November 2003.

Fish of the year of three species were found in catches: pollock, Pacific ocean perch, and Sakhalin flounder (Fig. 5.) Pollock of the year was 8,5-22,3 cm long. The modal group was 9,2 cm.

Distribution and number of pollock.

The trawl survey area was 13141 miles². The average density estimates of pollock concentrations at this area were 16017 kg or 57868 fish per square mile. The biomass was **210315** tons; abundance was 760478000 fish. There was a decline in biomass by 21,9% against 2002.

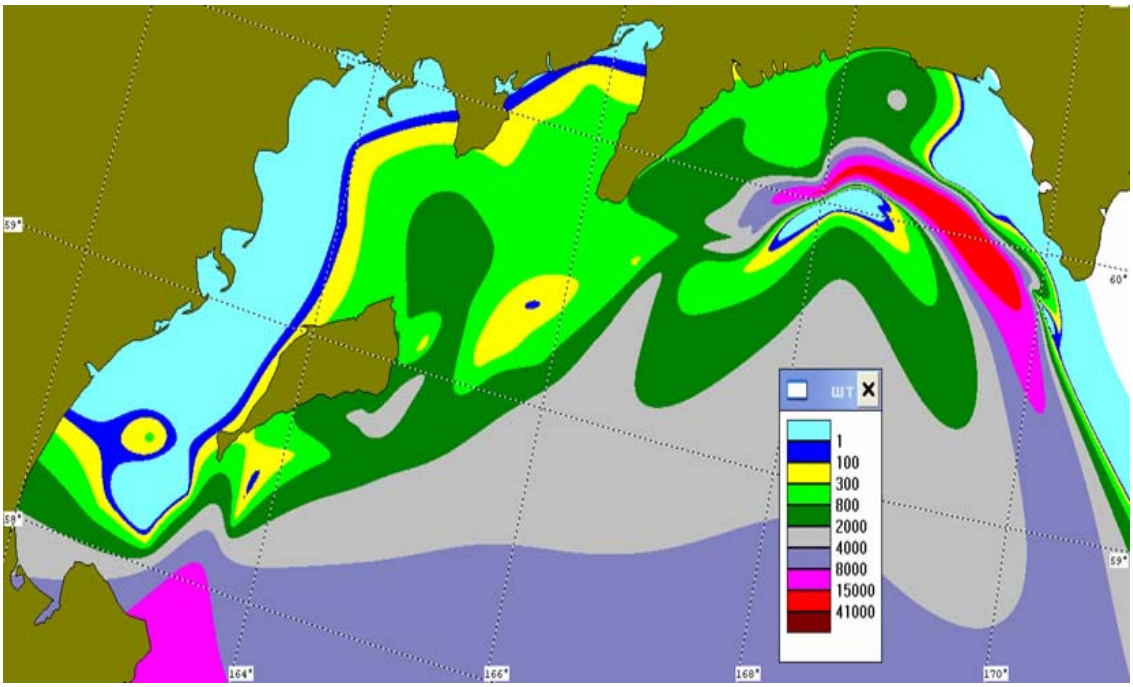


Figure 6. Plot of walleye pollock distribution in Karagin subzone of the Bering sea in accordance with trawl survey data, November 2003.

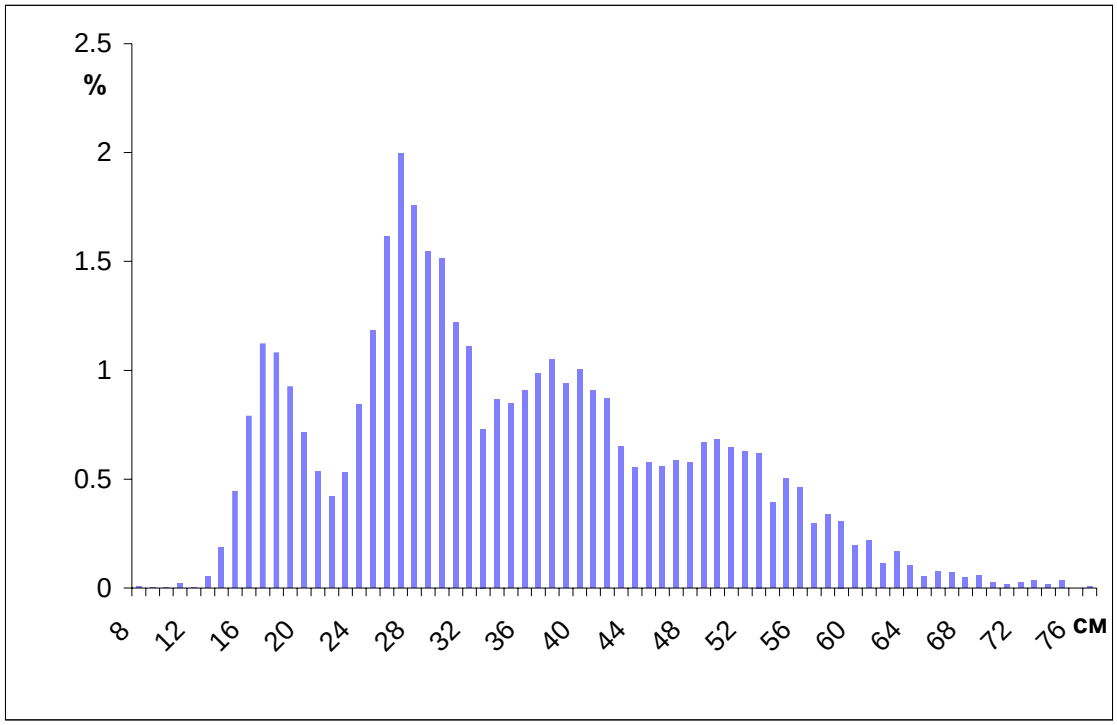
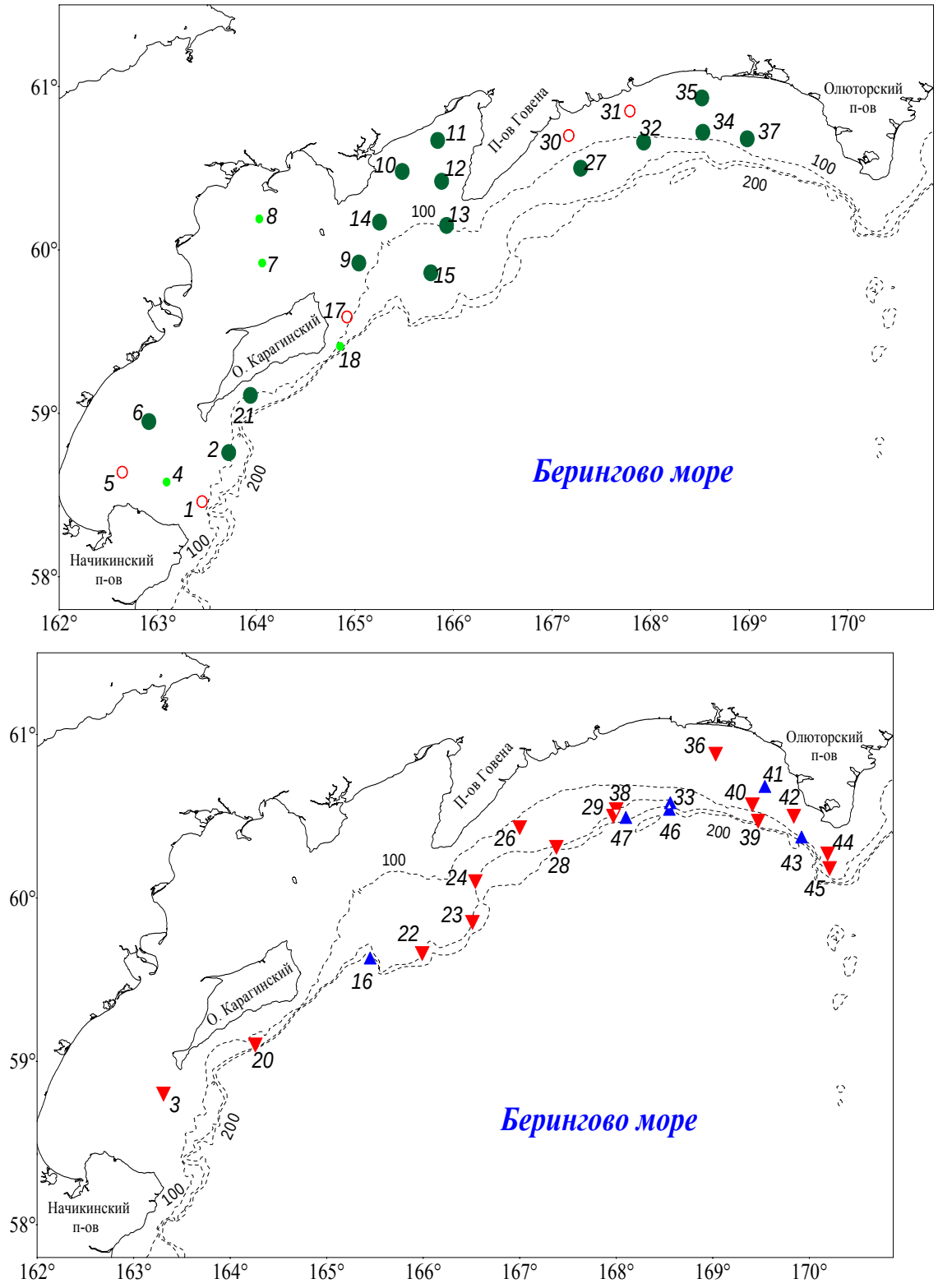


Figure 7. Length frequency of walleye pollock (n=11073) in Karagin subzone, November 2003.

Individuals of 8,5-77 cm (average 31,9 cm) were found in catches. The length frequencies had two peaks: 18-22 cm; 28-32 cm; 37-41 cm (Fig. 7).

Young fish 10-20 cm long of the 2001 year-class prevailed in the shallow areas of Karagin Bay and Ukin Inlet. The average length of pollock there was 13,6 cm (Fig. 8).

Fish of 25-30 cm were more frequent in Korf and Olutor Bays.



● – pollock up to 20cm – pollock 20-25 cm – pollock 25-30 cm

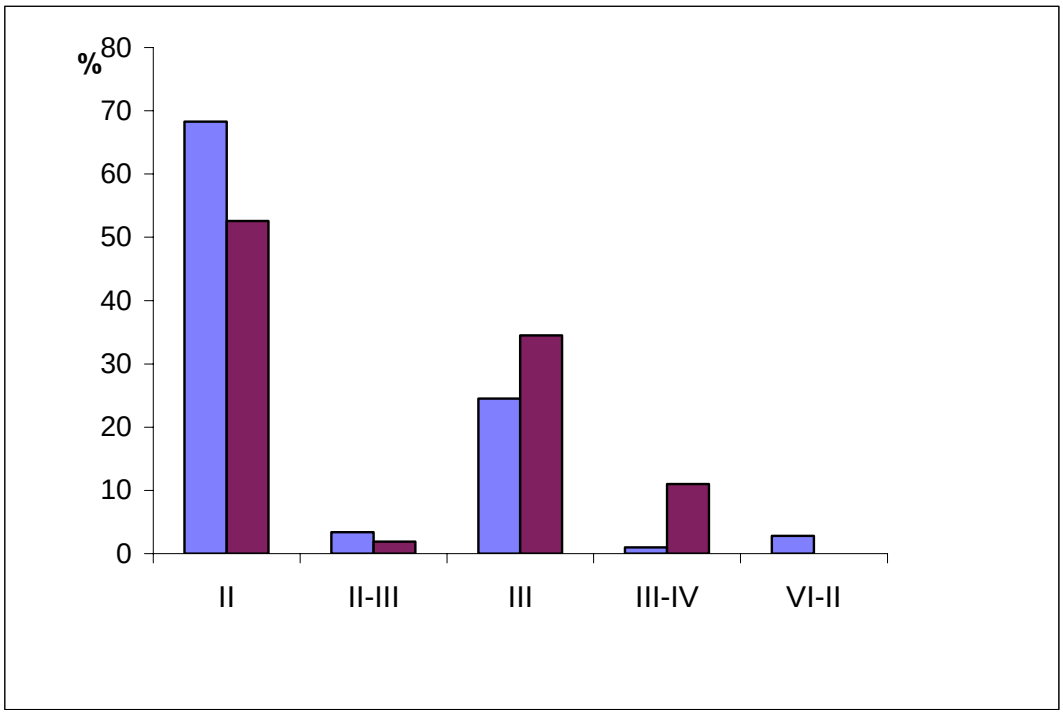
– pollock 30-45 cm – pollock more than 45 cm

Figure 8. Distribution of pollock in Karagin subzone, by size, November 2003.

Catches of pollock on the slope around the 300 m isobath all across the area surveyed from opposite Olutor peninsula to the southern Litke were lower and included mostly the fish of the older age-groups 55-77 cm long (Fig. 8).

Biological characteristics of pollock.

The sex ratio in pollock was close to 1:1. Immature individuals were prevalent in catches (52,6% males, 68,3% females) having II and III maturity stage gonades (Fig. 9).



■ - females; ■ - males.

Figure 9. Sex ratio in pollock (%) by the maturity stage of gonads, November 2003.

Table 4. Some biological indicators of Pollock, November 2003.

	Length, cm	Weight, g	Weight sm., g	Kupit.	GSI	HIS	HerSI	SSI
Females N=290					N=285	N=290	N=130	N=126
min	12,8	12	10	0,394	0,1	2,16	0,12	0,028
max	77,5	3730	3050	1,035	18,64	12,4	0,638	0,516
aver.	40,27	560,79	483,65	0,59	1,48	6,85	0,22	0,16
Males N=310					N=185	N=310	N=106	N=107
min	16,2	26,9	24,5	0,446	0,41	1,67	0,09	0,06
max	59	1520	1320	0,785	13,55	10	0,49	0,259
aver.	38,7	470,61	407,22	0,59	3,6	6,45	0,22	0,19

Note: Weight sm. – weight without raw, Kupit. – cubic condition index, GSI – gonadosomatic index, HIS – hepatosomatic index, HerSI – heart somatic index, SSI – spleen somatic index.

Biological characteristics of pollock are shown in table 5.

In Karagin subzone the November feeding intensity in pollock was relatively not high: the relative stomach fulness index was 1,52 in females and 1,43 in males. Out of the individuals analyzed 71,8 % were feeding. Some 10-11 species of fish and invertebrates were recorded in stomachs. Representatives of Euphasiidae, Mysidae, Hyperiidae were more frequent. Shrimp were among the major food items as well. Calanus was the leading food species for fish under 15 cm. Cannibalism was found in 5-6 % fish.