

Year 2010-2011 Research on the Status of Bering Sea Pollock Stocks and other
living marine resources

Paper submitted
by
the Russian Federation

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**Resources status, spatial differentiation and biological indicators of
pollock in the Northwest Bering Sea according to research of TINRO center in
2010**

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**Distribution, abundance, biological indicators of pollock at bottom layer
in July-early September 2010**

In the second half of the first decade of 2000-th, pollock biomass decreased to a minimum level for the last thirty years by the reasons of natural character, that caused the decrease of annual catch, both in Russia and USA. At the same time three large generations appeared in this period – in 2006, 2008 and 2009. In connection of this, in 2010 pollock biomass significantly increased, mostly by generation of 2006. The distribution of pollock's stocks in the Northwest Bering Sea in the summer-autumn period annually varies significantly depending on variability of oceanological conditions, number of food (zooplankton), number of some generations and total biomass of the population.

In the second half of the summer and early autumn of 2010, in bottom layer of the Northwest Bering Sea the pollock was distributed either at the shelf, or at the continental slope (depth 24-450 m) from the southern part of the Koryak coast to area, adjoining to the Bering Strait (Fig. 1.1, 1.2).

The highest concentration of pollock's stock (3.6-8.2 tones per hour during the control trawling) was recorded on the shelf around the central area of the Koryak shelf and in the Anadyr Bay (eastern of the Navarin cape). The density accumulations of pollock's stock in this period was maximum in the Anadyr bay (24.697 thous. ind./km² and 12.251 t/km²), slightly lower at the Koryak coasts (16.931 thous. ind./km² and 8.843 t/km²) and minimum in the North Bering Sea, east of 175⁰⁰ W (0.863 thous. ind./km² and 2.6 t/km²). The relative abundance and biomass of pollock in the North Bering Sea (Chukotskaya zone) was very low (1.3% of total quantity, 3.1% of total biomass). At the same time of the Koryak coast was almost a quarter (22.8%) of total biomass and 14.2% of total quantity.

Thereby, in the bottom layer major portion of pollock at summer and early autumn of 2010 was distributed in the Anadyr Bay. Total abundance of pollock in bottom layer of the Northwest Bering Sea zone in this period was, on the results bottom survey, 6.297 billion of ind. and biomass of 1.818 million tones. Of that number in the Anadyr Bay abundance was 5.32 billion of ind., biomass 1.347 million tones, of the Koryak coast 0.89 billion ind. and 0.415 million tones, in the Northern Bering Sea (east of the 175°00' W) – 0.085 billion of ind. and 0.055 million tones respectively. The portion of pollock was 84.5% of total abundance and 74.1% of total biomass in the bottom layer of the Anadyr Bay during this period.

The size range of pollock was very large (6-85 cm) in the bottom layer of the Northwest Bering Sea in summer and early autumn of 2010 (Fig. 1.3-1.4). The bulk of total abundance in the bottom layer of the Northwest Bering Sea (77.7% or 4.89 billion of ind.) was immature fish, and the bulk of biomass (69.7% or 1.268 million tones) – mature pollock.

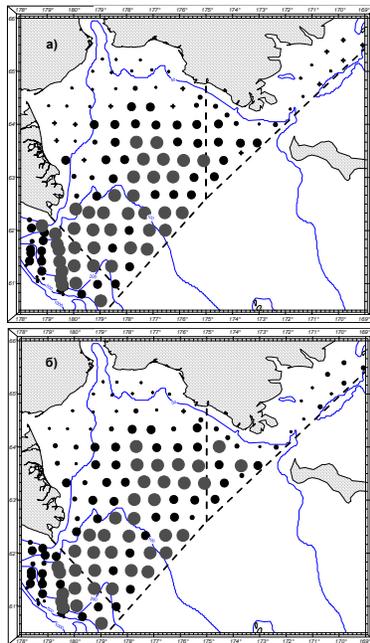


Figure 1.1. Distribution of abundance (ind./km²) (a) and biomass (kg/km²) (б) of pollock (1+ and older) in the Anadyr Bay and in the Northwest Bering Sea in July-September 2010.

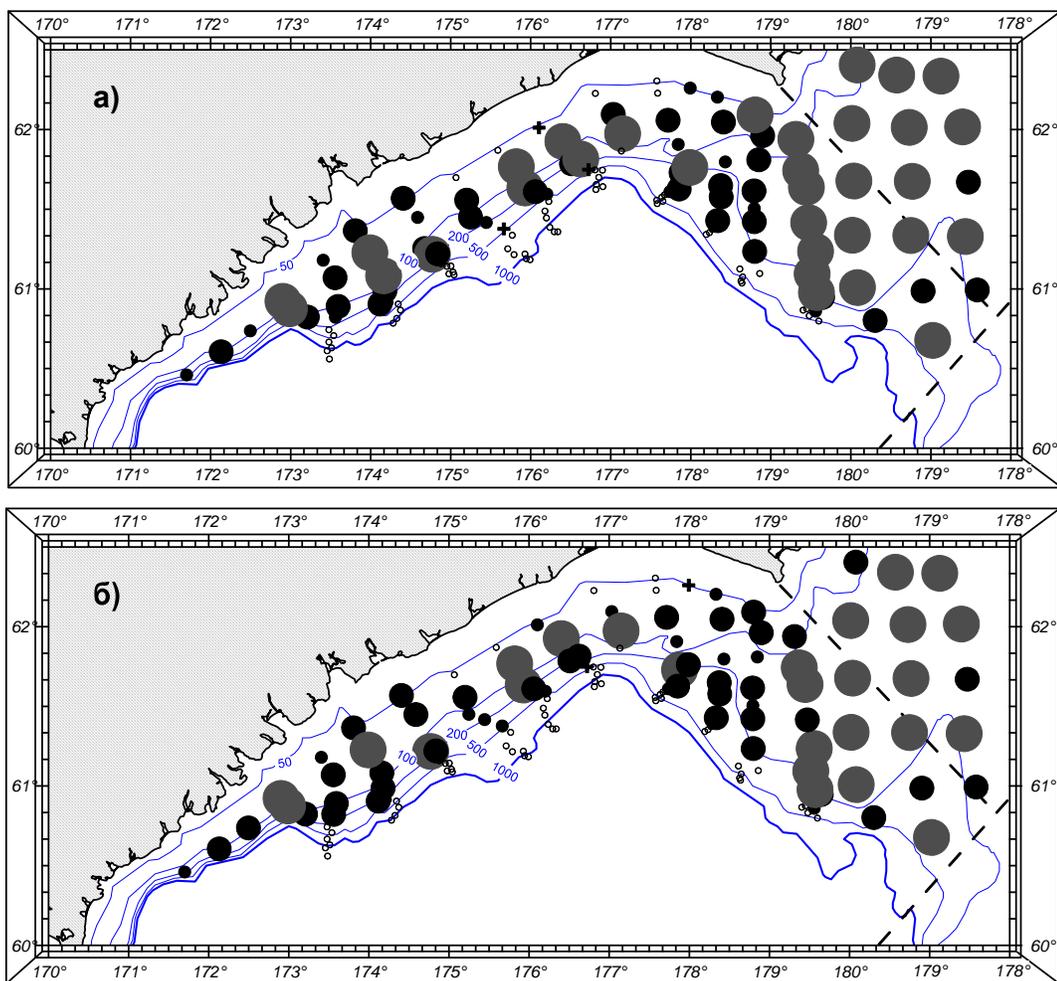


Figure 1.2 Distribution of abundance (ind./km²) (a) and biomass (kg/km²) (б) of pollock (1+ and older) of the Koryak coast in July-September 2010.

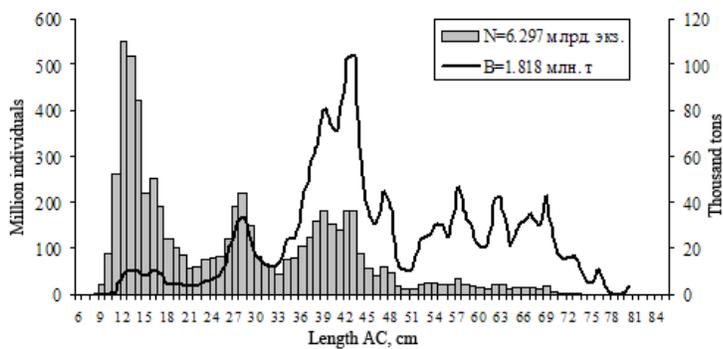


Figure 1.3 Abundance (N) and biomass (B) of different pollock's size groups in bottom layer of the Northwest Bering Sea in July-September 2010.

Four length groups of fish are in the size structure of pollock: the first (20 cm) – the most numerous, represented by generation of 2009, the second (22-33 cm) – mostly immature aged 2-3 years and the third (34-48 cm) – the first time maturing and adult pollock ages 4-6 years, the fourth dimension-age group (over 48 cm) aged pollock at the age of 7 years. Abundance of aged pollock is very small, while at the same time, it was a significant part of total biomass (38.9%).

The pollock of length group 12-20 cm was more numerous (generation of 2009) in the Anadyr Bay. The fish with length of 22-28 cm (generation 2008) and 35-42 cm (generation of 2006) were relatively numerous. The young pollock 2009 generation (12-18 cm) completely dominated by the abundance in the Northern Bering Sea (east of 175°00' W). Middle-aged, mature pollock in this region in summer-autumn period 2010 was absent, most adult fish (62-75 cm) were observed in small amounts.

The pollock's size-age composition in the bottom layer of the Koryak coast in summer-autumn period of 2010 differed significantly from the size-age composition of pollock in the Anadyr Bay and in the Northern Bering Sea. The young pollock at age of 1 year was practically absent there, and the fish at length 26-32 cm (generation of 2007) and 38-48 cm (generation of 2003, 2004) dominated. All generations, which dominate in the Koryak coast are few to pollock that prevalent in the Anadyr Bay, in the Eastern and Northern Bering Sea. It is likely that in this area was distributed mainly Western Bering Sea population of pollock in summer-autumn period of 2010.

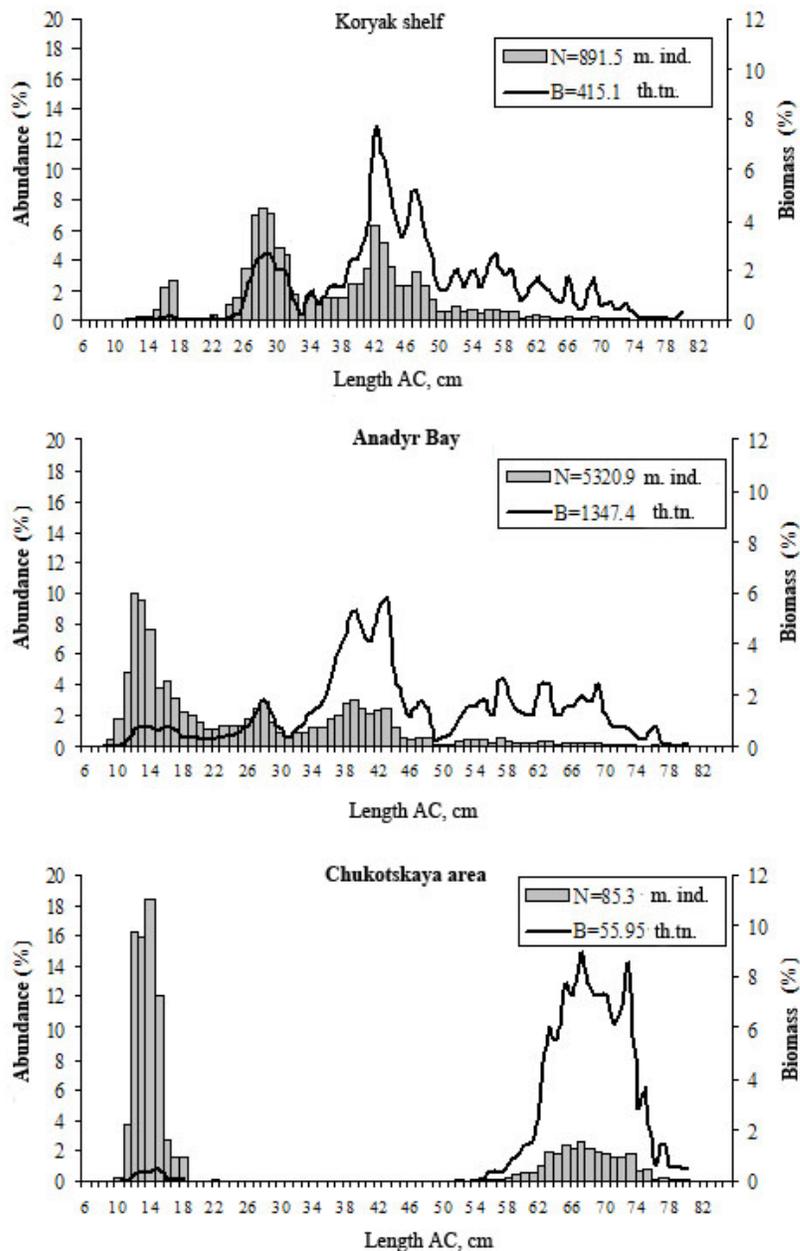


Figure 1.4 Abundance (N) and biomass (B) of pollock from different size groups in bottom layer of the Northwest Bering Sea in July-September 2010 by areas.

Distribution, abundance and biological indicators of pollock in the pelagic in September-October 2010.

In the pelagic of the Northwest Bering Sea in September-October 2010 the pollock lived mostly in the shelf zone and in small number on the upper part of the continental slope to a depth of 270 m.

During this period the pollock was distributed unevenly in the Anadyr Bay (Fig. 1.5). Relatively dense concentrations (9-21 t/h in the control trawling) were observed in the southwest part. In the area located to the north of 62°30' N the abundance of pollock was very low (up to 1.4 t/h) and this species was unevenly distributed. The average catch in the control trawling when pollock presented in the catch was 2.6 t/h in the entire area of the Anadyr Bay, when all control trawling were taking into account, the average catch was 1.52 t/h. The average dense distribution of fish per area was 63.17 thous. ind./km² and 15.3 t/km².

Abundance of pollock in pelagic zone of the Koryak coast in September-October was very low (Fig. 1.6). Pollock's catches during the control trawling in the area did not exceed 0.5 tones per hour of trawling, distribution of pollock was unevenly. Maximum catches within the main aggregation ranged from 1.3 to 2.9 t/h, and throughout the area in general trawling average haul was 0.38 tons per hour, taking into account the zero catches – 0.14 t/h. Average density of fish per unit area (6.2 thous. ind./km² and 0.98 t/km²) was more than an order of magnitude lower than in the Anadyr Bay.

The size structure of pollock in the Northwest Bering Sea in September-October was very broad either in the pelagic, or in the bottom layer – (6-80 cm) (Fig. 1.7). The three modal groups are distinguished in the general dimensional number: the first of them (20.8% of abundance, 1.15 billion of ind.) are young fish of 15-20 cm in length (generation of 2009), the second, the most numerous are immature fish of 25-33 cm in length, the generations of 2007-2008 (about 3 billion of ind., 54.4%) and the third, the smallest group of pollock, including mature pollock, 34-48 cm in length, the generations of 2004-2006 (0.89 billion

of ind., 16.1%). Despite of the low abundance of the latter group, its biomass (411.5 thous. t) made more than a third (36.3%) of the total biomass, of pollock, accounted during the survey.

The total number of pollock in the pelagic of the Northwest Bering Sea, according to the trawl survey, is estimated at 5.51 billion ind., biomass at 1.13 million tones.

The greater part of pollock in the pelagic of the Northwest Bering Sea during September-October was distributed in the Anadyr Bay. The number of pollock in bay was 4.18 billion ind., biomass 0.934 million t (82.5%). Therefore the ratio of size groups of pollock in this area is close to the general dimensional number in all northwest part. (Fig. 1.8, look Fig. 1.7). The pollock of 25-33 cm in length (generations of 2007-2008) was the most numerous in the bay.

On the shelf of the Koryak coast the abundance of pollock was 0.893 billion of ind., biomass 0.111 million t. The immature fish of 16-21 cm (generation of 2009) dominated (58% of total) in this area.

In the Olyutor Bay the abundance of pollock was 0.433 billion of ind., biomass 0.086 million t. The immature pollock was dominated by the abundance (84.7%) and biomass (54.5%) in this bay.

According to the ehoIntegrated trawl survey, the pollock's biomass in the pelagic of the Navarin area was 128 thous. t (RV "Oscar Dyson") in late July-early August 2010 and 144 thous. t in September-October (RV "TINRO").

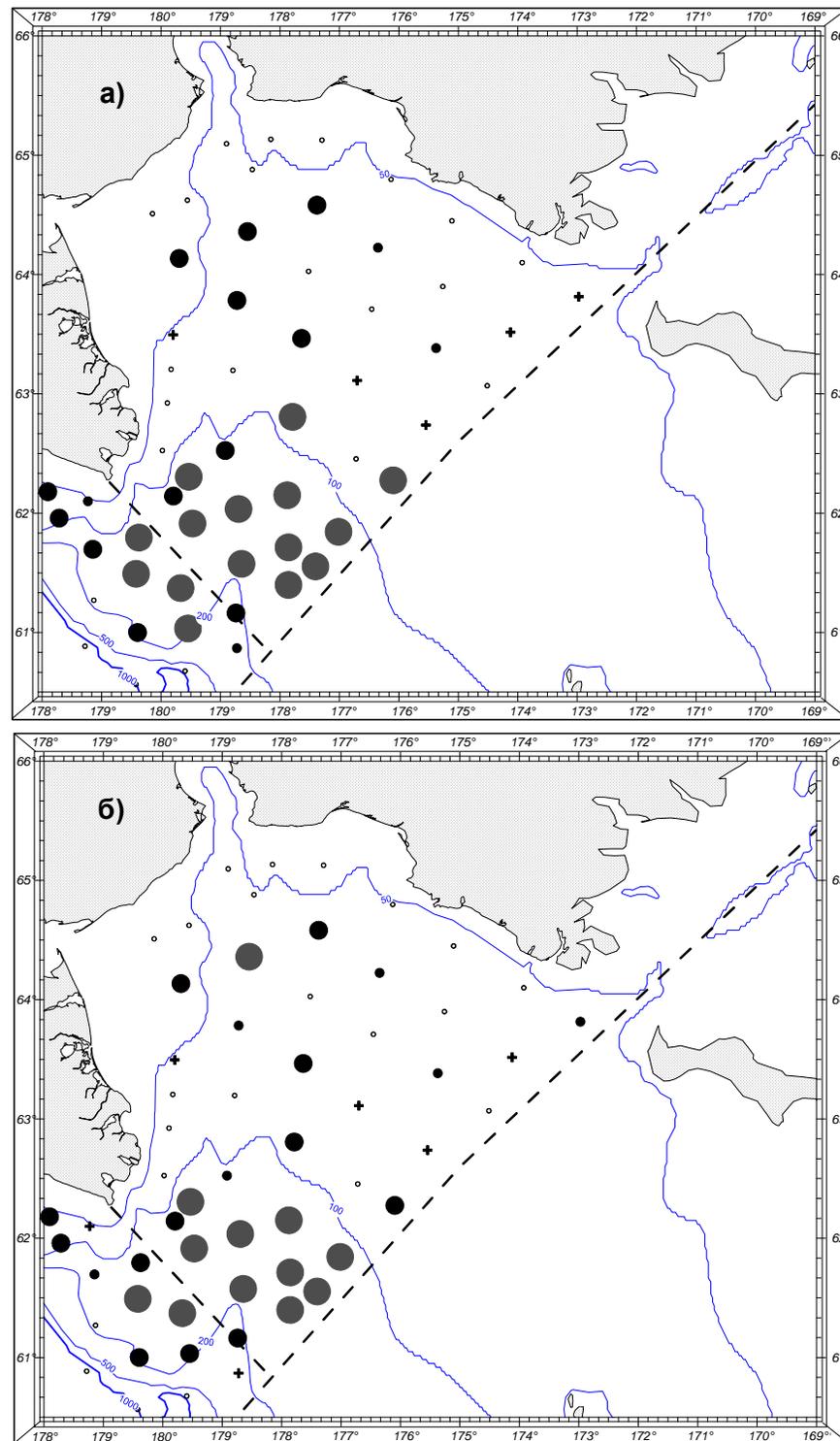


Figure 1.5. Distribution of abundance (ind./km²) (a) and biomass (kg/km²) (b) of pollock in the pelagic of the Anadyr Bay in September-October 2010.

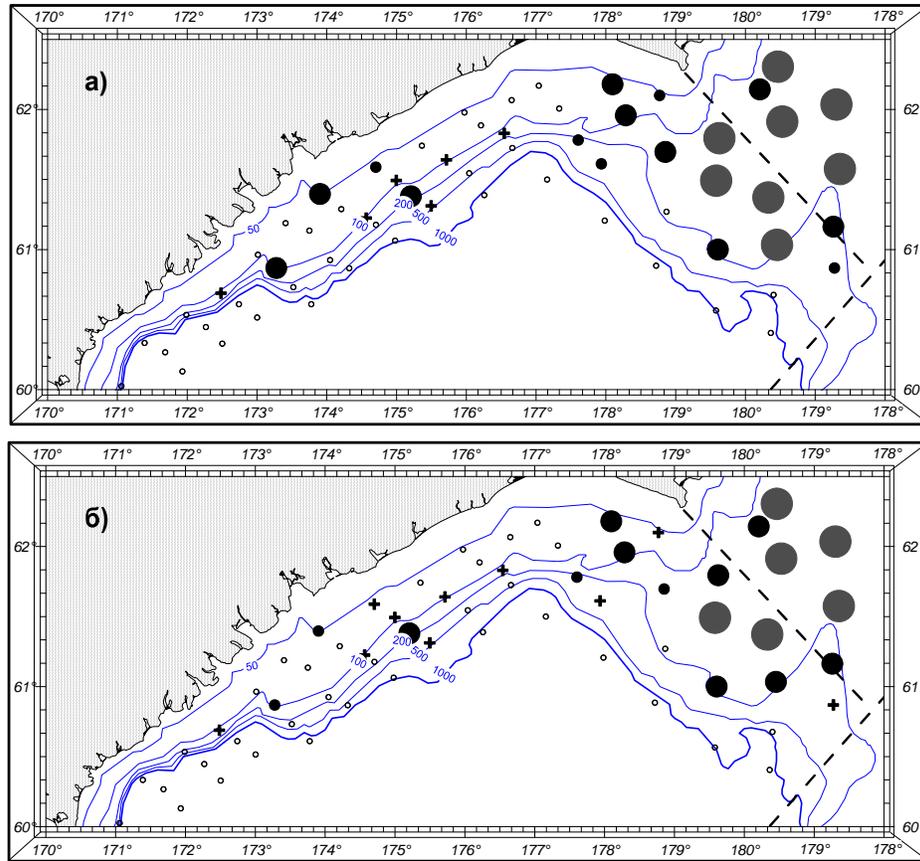


Figure 1.6. Distribution of abundance (ind./km^2) (a) and biomass (kg/km^2) (b) of pollock in the pelagic of the Koryak coast in September-October 2010.

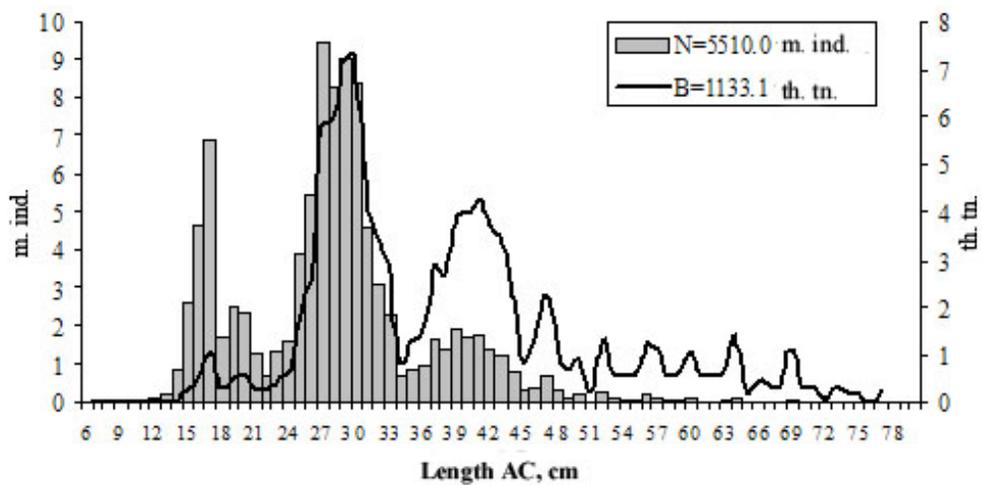


Figure 1.7. Abundance (N) and biomass (B) of the different pollock's size groups in the pelagic of the Northwest Bering Sea in September-October 2010.

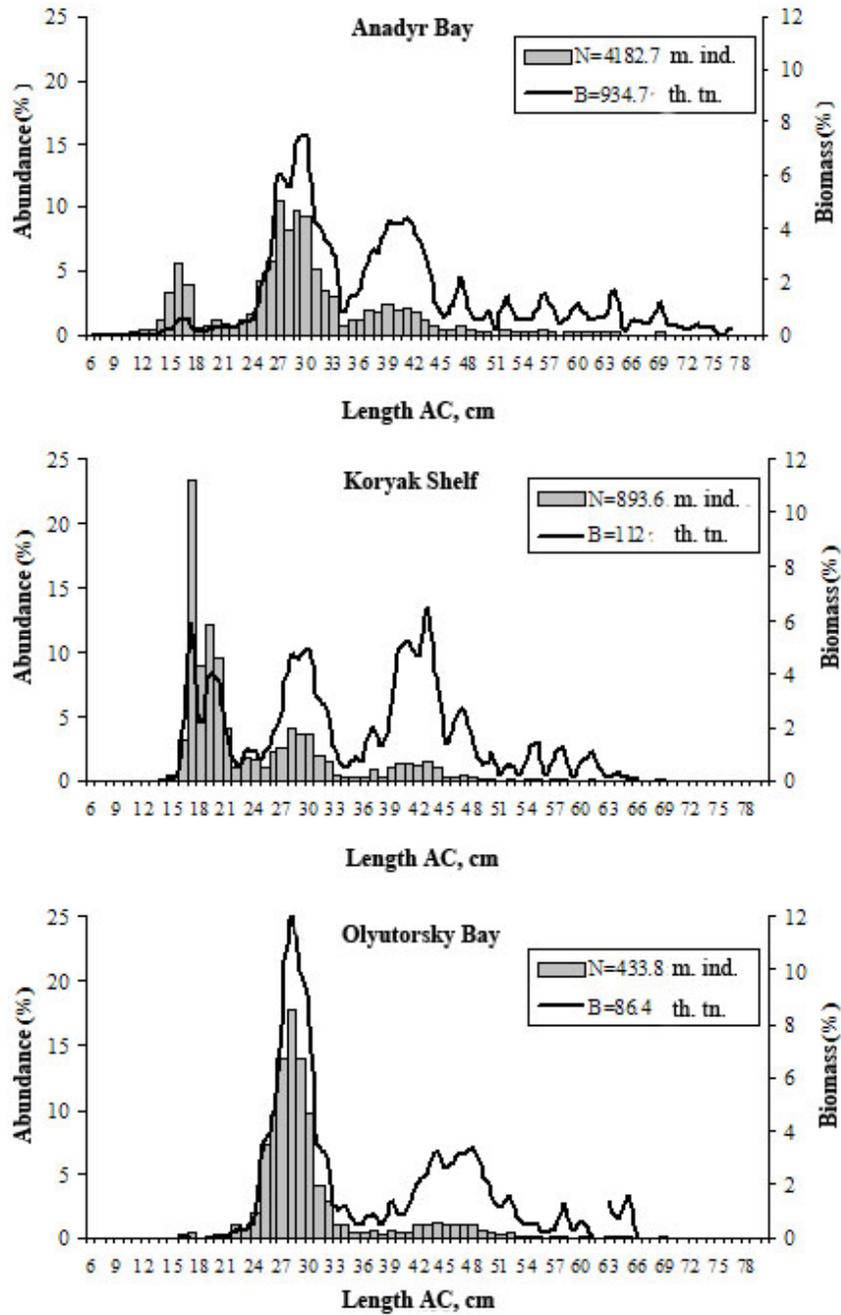


Figure 1.8. The ratio (%) of abundance (N) and biomass (B) of the different pollock's size groups in the pelagic of the Northwest and West Bering Sea in September-October 2010.

The pollock of largest generation of 2006 (38-42 cm), which was in number about 39.5% of the total catch, dominated in the commercial catches in the Navarin area in 2010.

The fish of two generations of 2005 and 2007 made a significant part of the catch (about 1/3). The abundance of older pollock in the catch of the fishing fleet is very small.

The age groups of pollock which dominated in 2010 in the catches of the Russian commercial fleet correspond to the largest generation according to research surveys in the bottom layer. According to the survey in 2010, the fish of the largest generation in 2006 made 26.6%.in the bottom layer of the Northwest Bering Sea.

**Cruise aboard RTMK-S Pr.-1228 "Vasiliy Kalenov" to the Bering Sea in
October-November 2010**

A.I.Glubokov, D.V.Pelenev

The **aim** of the work is to explore the spatial and temporal variability of the distribution and status of the pollock's stocks in the area of around the maritime boundary of the Russian Federation and the USA.

The objectives:

- to map the surface density of pollock in the northern Bering Sea according to the catch per unit effort;
- to spend the comparison with the density distribution of pollock in the previous years;
- to estimate the limits of the spatial distribution of the northern Bering and Okhotsk Sea pollock in the Russian EEZ according to the fishing hauls;
- to spend the comparison with the distribution of previous years in the same period;
- to compare the spatial distribution of pollock and the density of the ocean surface temperature;
- to collect the fishery-biological information;
- to prepare the information about the work of the Russian fleet in the West Bering Sea zone in October-December 2010 by the results of the daily fishing Councils.

The working area

The working area (Fig. 2.1) was the West Bering Sea zone from the coastal line to the boundary of the EEZ $53^{\circ} 20' 0'' - 65^{\circ} 00' 0''$ N

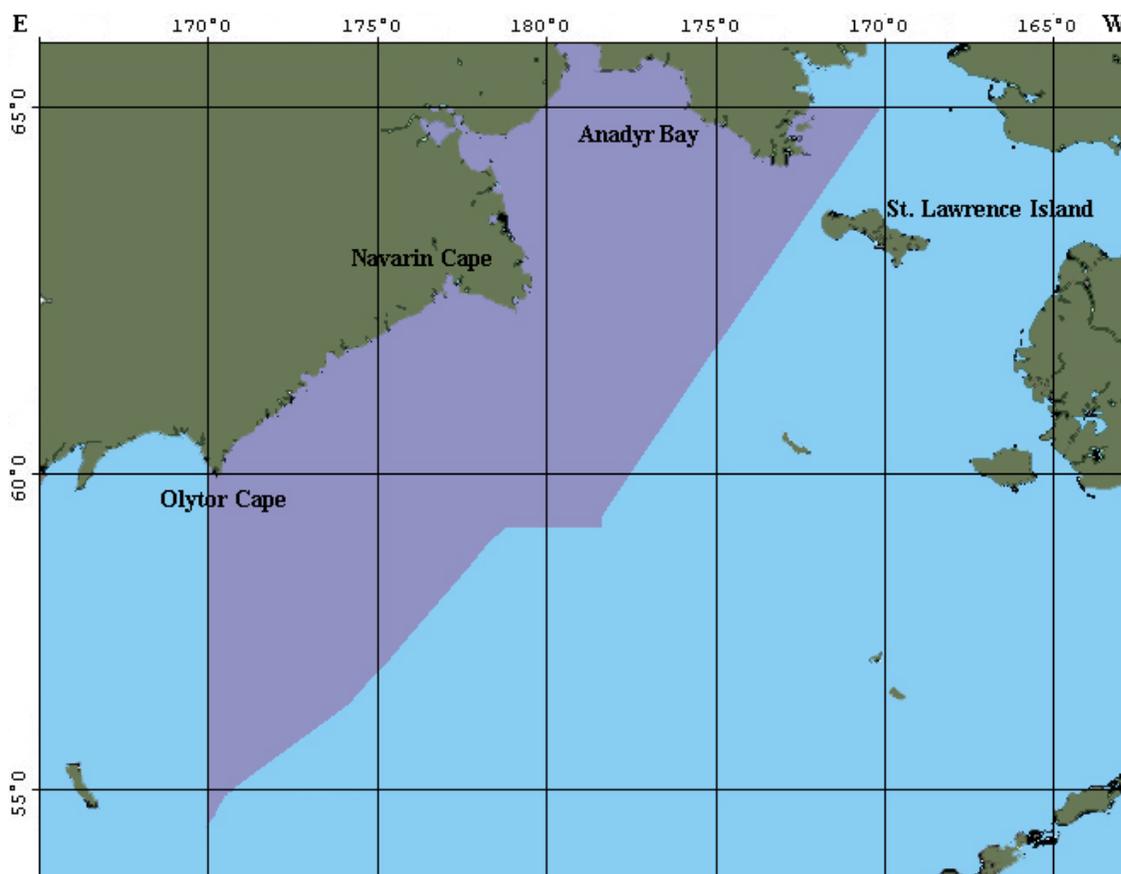


Figure 2.1. The West Bering Sea zone.

Characteristics of the vessel, equipment, appliances

Freezer trawler (type "super" with stern trawling) RTMK-S "Vasiliy Kalenov" (Fig. 2.2) belongs to the class of heavy-tonnage vessels with capacity of the main engine of 5296 kW. The greatest length – 108.12 m, width – 19 m, displacement – 9232 tons. The vessel is capable to accelerate speed to 15 knots. "Vasiliy Kalenov" is equipped with all necessary equipment for exploration, production, processing (frozen fish, not cut and decapitated, fish meal) and storage of fish (the general capacity of holds – 3.949 cubic meters). Year of construction 1993, Stralsund, Germany. The number of the vessels' crew is 90 people.



Figure 2.2. RTMK-S Pr.-1228 "Vasiliy Kalenov".

The vessel's site was determined using the satellite system "Navis 3000", "Furuno GP-31", mapping systems "D KART". The complex of fish-finding and recording equipment was presented by introduced fish-finding sonar "FURUNO FCV-1000" and the acoustic sonar "SIMRAD SP-1970", "WESMAR TCS-780".

The trawlings were made with mid-water trawl in a benthonic variant of DT/TV 112.0/97.1 with the vertical opening in operation status 11-14 m and horizontal – 30 m, mesh size in codend – 110 mm, and mid-water trawl RT/TM 608 50 m with vertical opening 50 m and horizontal – 70 m, mesh size in codend – 110 mm.

The ichthyological researches were carried out by measuring board (division value of 1 mm), electronic scales of firm «Marel» with compensated pump (maximum weight 20 kg, step – 1 g) and the cup weights (step 10 mg).

Research technique, the volume of collected material

The duration of hauls in cruise ranged from 1 to 10 h. At each trawling the trawling card including the characterization of trawling, the species composition of target species, their weight in the catch was filled. From each catch were selected samples for mass measurements, individual weight and biological analysis of pollock and the most abundant species of fish. The otoliths were taken for further cameralistic studying of age. During the cruise: **pollock** 17718 mass measurements were made; 2175 biological analyses were carried out, from them – 1796 total; 1796 morphological studies; 1000 sampling for age were taken; **herring** 805 mass measurements were made; 200 full biological analysis were carried out.

The biological analysis of fish included:

- measurement of the Smith's length, up to 1 mm;
- determination of total body weight, up to 1 g;
- determination of body weight without interiors, up to 1 g;
- definition of sex and maturity stage of 6-point scale (Sakun, Butsko);
- definition of filling the stomach to 5-point scale (0-4);
- determination of food composition and the proportion of each object in the stomach content.

The main bodies of hydrobionts – gonads and liver were weighted for the morphophysiological study. Then the indexes of each of the organs (the ratio of organ mass to body weight without viscera, expressed as a percentage) were calculated.

The data of trawling cards, biological analyses, morphological researches were brought in program Excel.

Figure 2.3 shows the coordinates of the ship hauls of RTMK-C Pr. 1228 "Vasily Kalenov" in the Karagin subzone from 07 October to 10 October and from 06 November to 17 November (13 hauls), and the rest (91) hauls were made in the West Bering Sea zone.

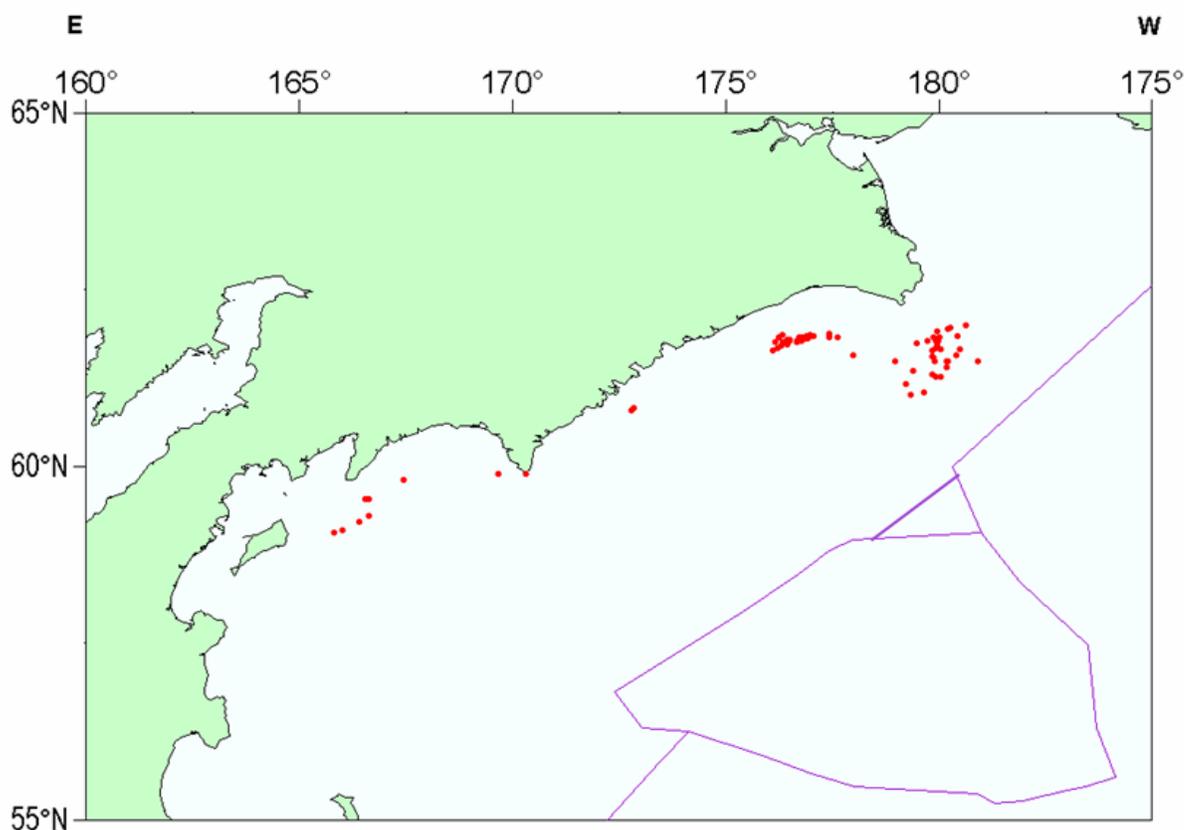


Figure 2.3. The scheme of trawlings which were made in the Karagin subzone and in the West Bering Sea zone in October-December 2010.

Common characteristics of the catch, catch statistics

During the period of work from 07 October to 02 December 2010 104 trawlings were carried out at the depths of 80-550 m. The total catch of walleye pollock was: 1325,350 tons in the West Bering Sea zone, 94,836 tons in the Karagin subarea.

The catches for 1 trawling varied from 0 to 55 t. The fishing conditions in the West Bering Sea zone were unsatisfactory in October-December 2010.

In October-November in the Bering Sea fishing expedition were involved up to 30 units of fleet. After the termination of pollock's quotas the vessels passed in other fishing areas. To the beginning of December, the number of Russian large-fleet operating in the fishery for pollock in the West Bering Sea area was reduced to 10 units. Catches per unit effort during the entire period of work was at 35-45 t

per fishing day of fishing. The improvement of fishing conditions were fixed in some period while catches for fishing day rose to 40-60 tons, but as a rule, these periods were short.

The Navarin area of the Bering Sea between 178° E and 178° W and 61°-62° N was the most attractive area in the relation of fishing. Fishing was carried out in a wide range of depths from 65 to 560 m.

The biological status of pollock in the West Bering Sea zone in October-December 2010

RTMK-C "Vasiliy Kalenov" worked at that area from October 10 to November 02 and from November 22 to December 02.

The length of pollock in the catch varied from 18 to 82 cm; the average length was 41.43 cm (Fig. 2.4). There were two modes in catches: 27-31 cm, which accounted for 17.7% of the catch, and the greatest quantity had the size group of 42-49 cm, which accounted for over 32.7% of the catch.

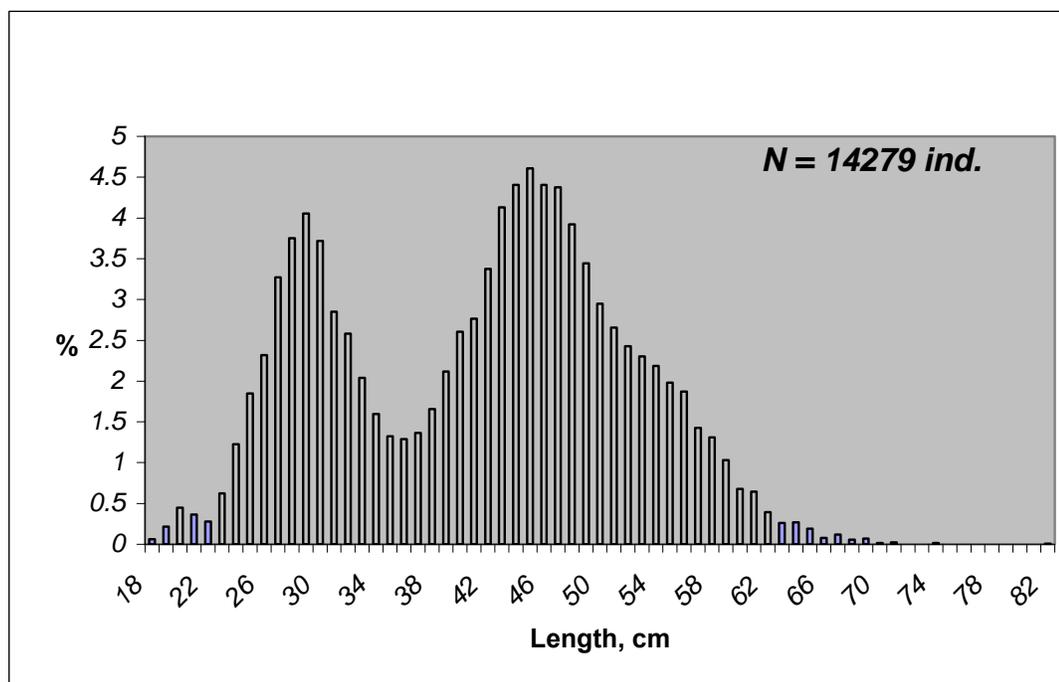


Figure 2.4. Length composition of pollock in the West Bering Sea zone in October-December 2010.

Females dominated in catches. They constituted 58.7% against 41.3% (males). 5.0% of individuals were immature. Gonads of most individuals were on the II-III and III stages of maturity (Fig. 2.5).

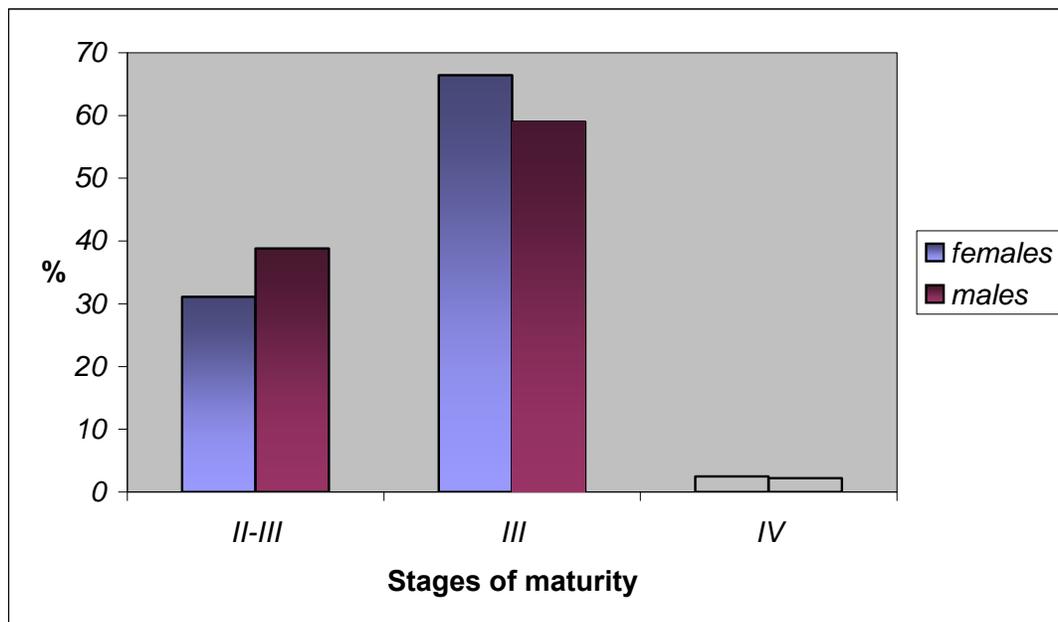


Figure 2.5. Ratio of quantity (%) of pollock' females (N = 897) and males (N = 627) with gonads at different stages of maturity, in the West Bering Sea area in October-December 2010.

The gonadosomatic index of females (from 0.19 to 20.08 (in average – 2.25)) was higher than the male's index (from 0.03 to 13.31 (in average – 2.03)) (Fig. 2.6).

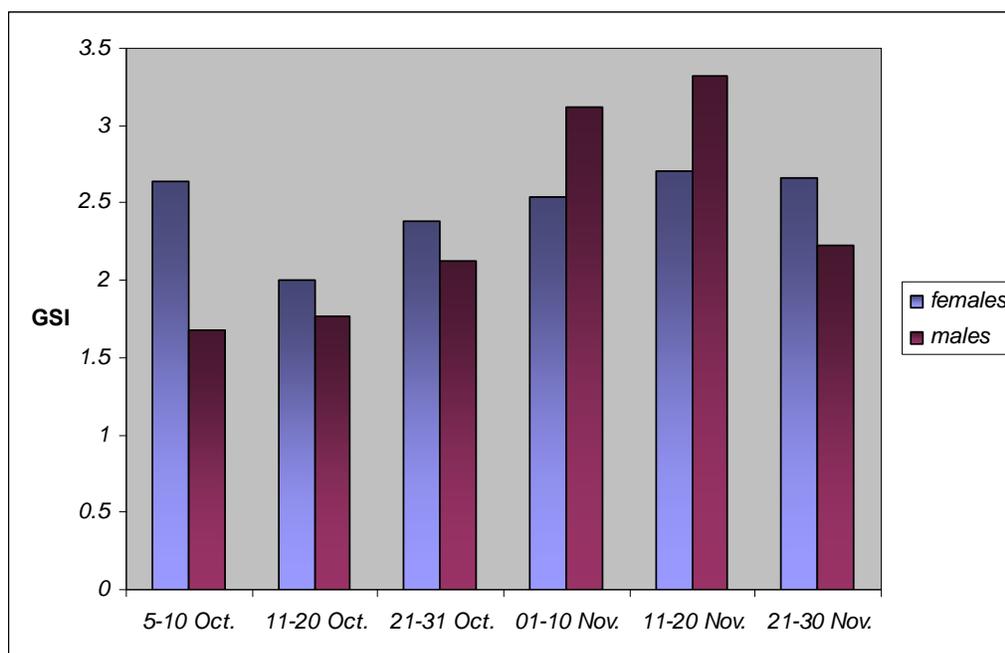


Figure 2.6. The gonadosomatic index of pollock in the West Bering Sea zone in October-November (by 10 days).

The female's hepatosomatic index was higher than the male's one: 1.61-17.92 (in average – 8.60) against 1.84-16.81 (in average – 8.18). The hepatosomatic index decreased in both sexes in the period of observations (Fig. 2.7).

Body weight of females was 89-2725 g (in average – 753.2 g), males – 99-2528 g (in average – 700.1 g).

The relationship between length and body weight had a well-defined power law (Fig. 2.8) with a high degree of accuracy of approximation for both sexes ($R^2 = 0.95-0.96$).

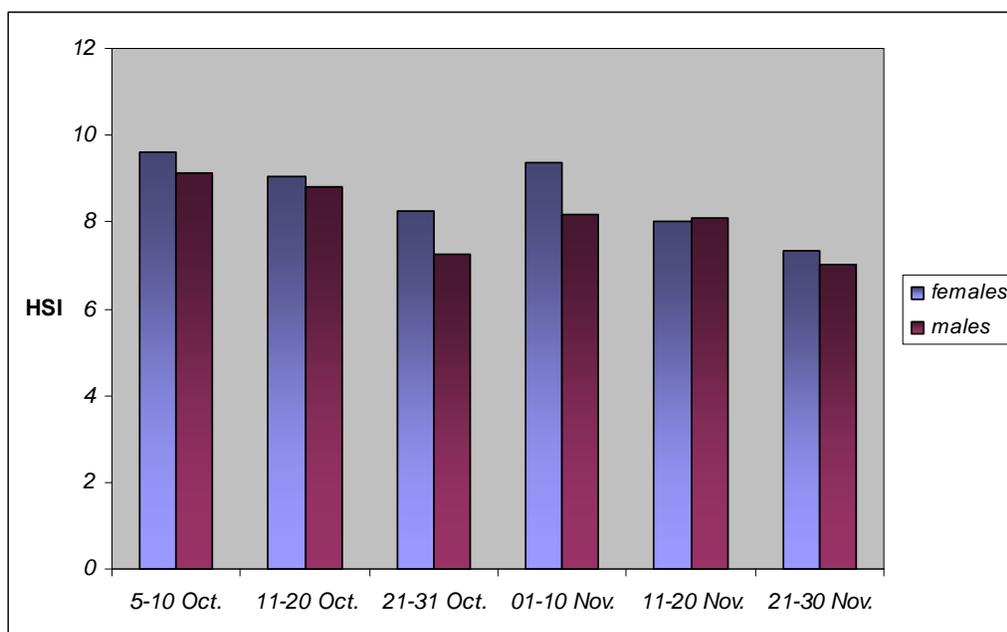


Figure 2.7. The hepatosomatic index of pollock in the West Bering Sea zone in October-November (by 10 days).

The feeding of pollock in the reviewed period was high. The average point of stomach fullness was 1.95. 21.20% of the analyzed fish had empty stomachs. The cubic condition factor of pollock was 0.626.

Euphausiids, calanus and shrimp dominated in the stomachs of pollock of all sizes (Fig. 2.9).

Cannibalism was observed with a frequency of occurrence – 4.4%. For the first time it was marked with at the minimum sizes of pollock (32.2 cm), and cannibalism was the most frequent – at the length more than 45.9 cm.

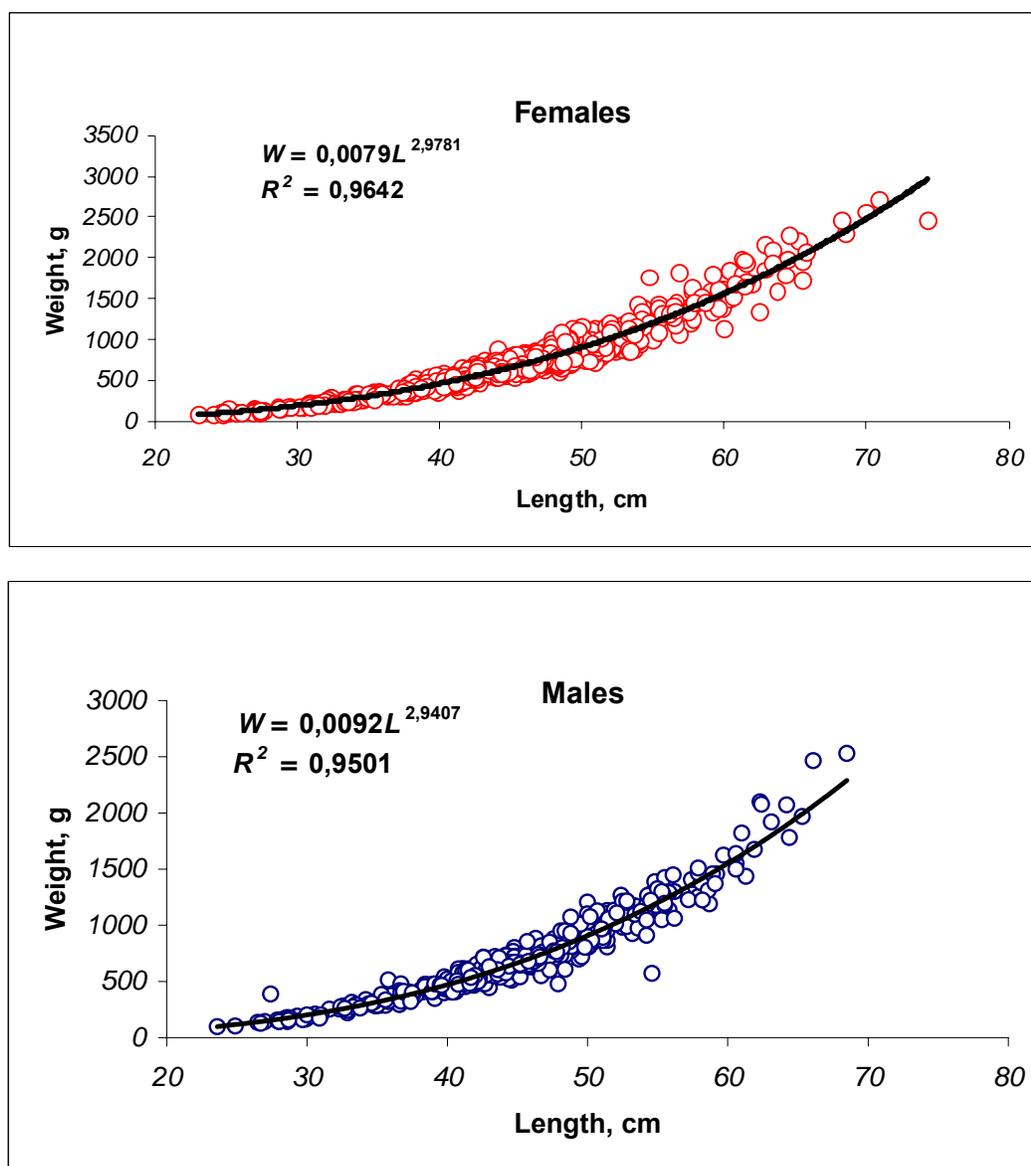


Figure 2.8. The relationship between length and weight of pollock in the West Bering Sea zone in October-December 2010.

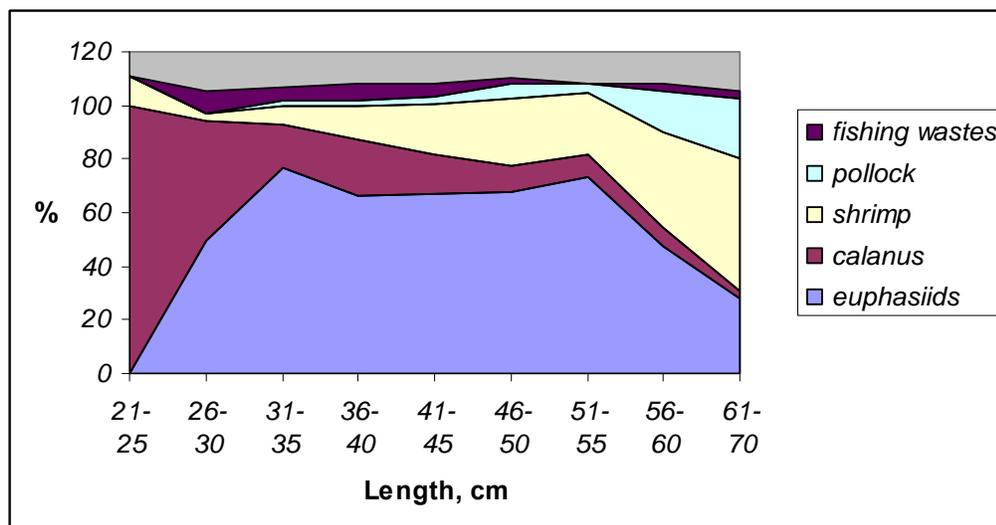


Figure 2.9. The changing of the pollock's food composition depending on the size of the West Bering Sea zone in October-December 2010.

The common biological characteristic of pollock from the West Bering Sea zone in October-December 2010 is presented in Table 1.

The conclusion that the temperature of the previous year affects the distribution of pollock in the subsequent year was drawn at the comparison of the ocean surface temperature (Fig. 2.10) with the distribution of commercial concentrations of pollock (Fig. 2.11) in October-December 2007-2008 and 2010. In the years after the highest temperatures of the ocean surface temperature the accumulations of pollock were distributed to the north of the Navarin cape, the density and area of clusters increased. After cold years the return picture was observed.

Table 1. The biological characteristic of pollock from the West Bering Sea zone in October-December 2010.

average length, cm/number of measurements		41.43/14279
minimum - maximum		18-82
mode		27-31; 42-49
average weight, g		701.3
minimum - maximum		41-2725
share of males, %		41.3
dominated stages of maturity of the mature fish, %	females	II-III – 31.1; III – 66.0; IV – 2.5
	males	II-III – 38.8; III – 59.0; IV – 2.2
stomach fullness, point		1.95
predominant forage organisms, %		euphausiids-66.6; calanus-14.0; pollock-4.4; shrimps-15.0
morphological indexes of the immature fish		
cubic condition factor		females 0.624± 0.004; males 0.617±0.005
gonadosomatic index, %	females	1.275 ±0.067
	males	0.889±0.061
hepatosomatic index, %	females	8.773± 0.183
	males	8.203 ±0.202
morphological indexes of the mature fish		
cubic condition factor		females 0.624± 0.003; males 0.632±0.004
gonadosomatic index, %	females	2.294±0.082
	males	2.027±0.079
hepatosomatic index, %	females	8.598± 0.093
	males	8.165± 0.117
number of individuals		1775

Note: the average length is given by results of mass measurements, the rest is based on the results of the full biological assays.

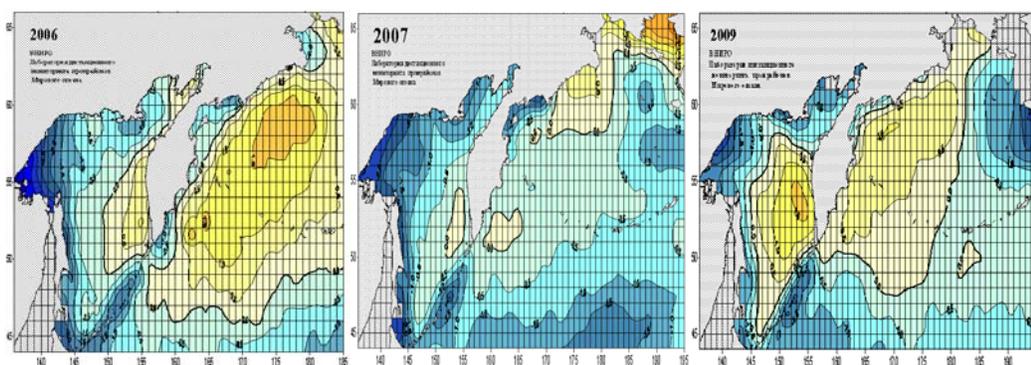


Figure 2.10. The sea surface temperature in the West Bering Sea zone in 2006-2007 and 2009.

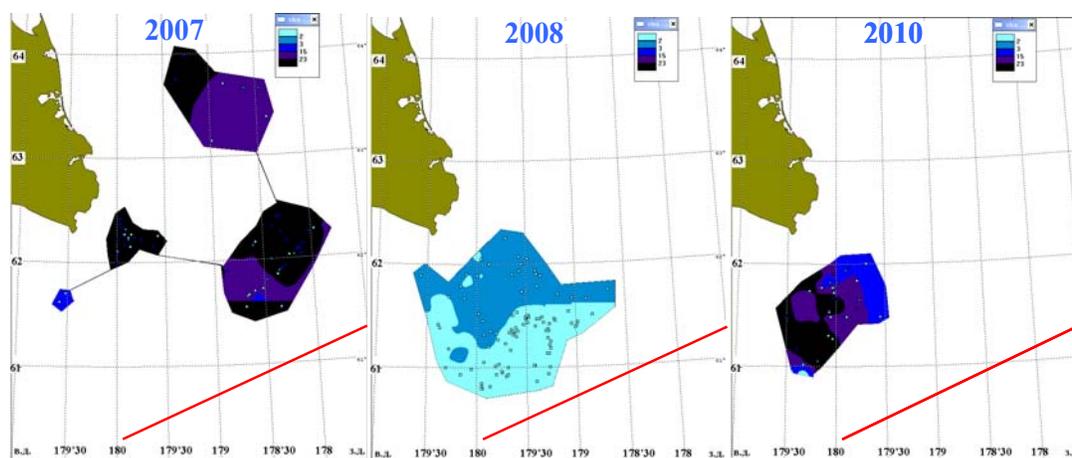


Figure 2.11. The distribution of the pollock's commercial aggregations in October-December 2007-2008 and 2010.

According to the results of the Russian fleet's work in the West Bering Sea zone, the largest catches per catch day were in the last decade of November and the lowest – in the first ten days of November 2010 (Fig. 2.12).

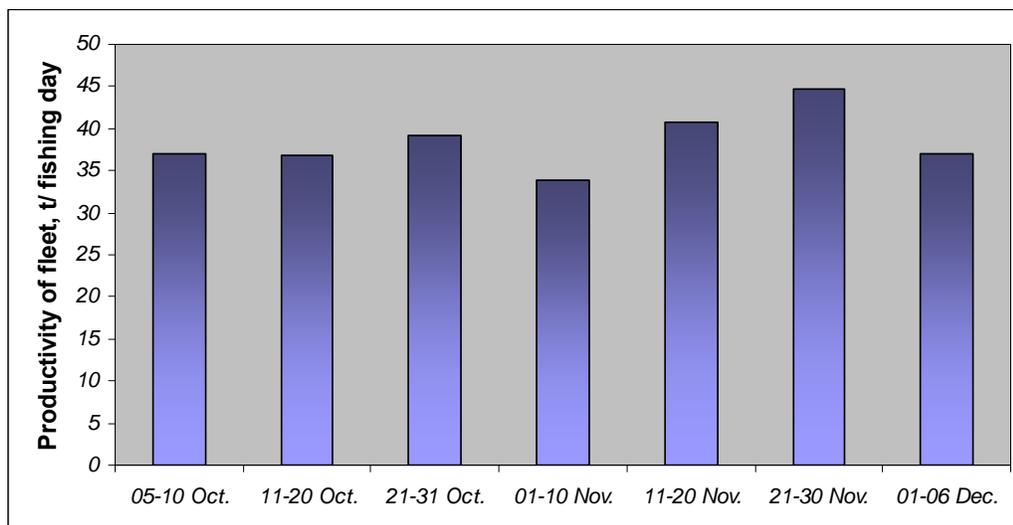


Figure 2.12. The productivity of the Russian fleet fishing in the West Bering Sea area in 2010.

The number of fleet decreased in the first week of December because the quota of some vessels was ended and they left the working area (Fig. 2.13).

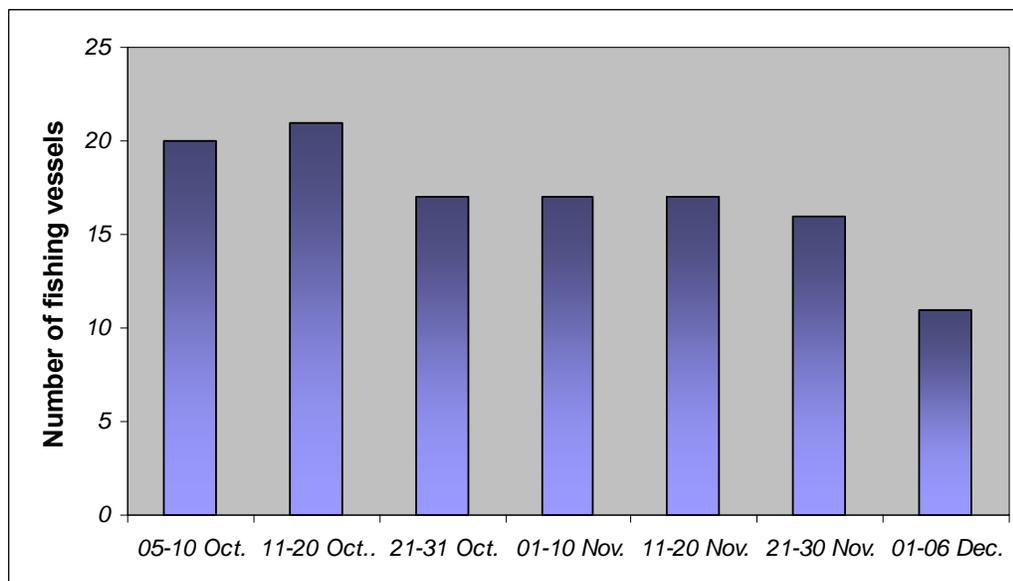


Figure 2.13. The number of Russian large-trawl fleet in the West Bering Sea area in October-December 2010.

In connection with the cooling of water, and following this depletion of forage base in the northern district of the Navarin area, the pollock shifted to the

wintering grounds on the outer boundary of the shelf, as seen in the shift to the south of the fishing fleet (Fig. 2.14).

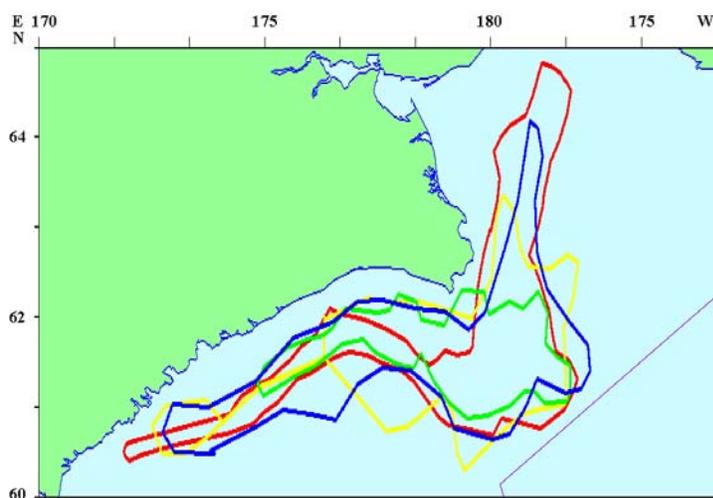


Figure 2.14. Areas of work of the commercial large-fleet in October-December 2010 by 15 days.

Where: — 5-20 October, — October 21 – November 5, — November 6-20,
— November 21 – December 6

The characteristic of bycatch

Herring

RTMK C "Vasiliy Kalenov" made four trawling with mid-water trawl from 10 to 12 November in the coordinates $59^{\circ}12' - 59^{\circ}37' \text{ N}$, $166^{\circ}24' - 166^{\circ}41' \text{ W}$ at depths of 130-210 m. Catches ranged from 4 to 16 t, an average of 9.3 t per trawl; 4.9 t per trawling hour. Herring was represented by specimens with length from 22 to 38 cm (an average – 29.3 cm) (Fig. 2.15). The fish from size group 29-31 cm dominated in catch – 45.2% of total catch.

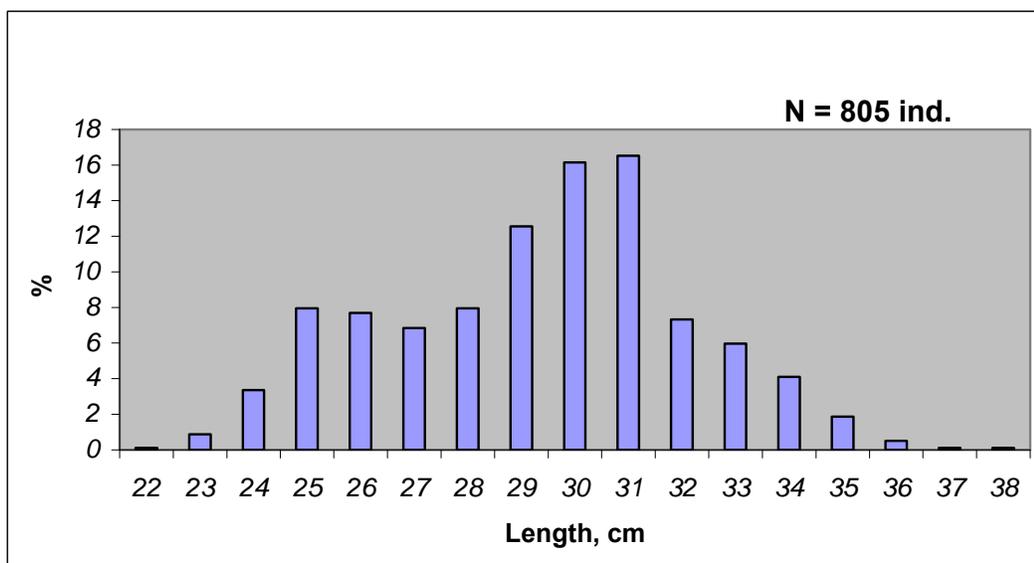


Figure 2.15. Length composition of herring in the Karagin subzone in October-December 2010.

The mass of herring was varied from 136 to 592 g, an average, 351 g. Male and female ratio was 59:41, respectively. All individuals were mature; the second and third stages of gonads' maturity dominated in catch. The gonadosomatic index was 14.27.

In the stomachs of some individuals calanus and euphausiids were observed. Despite the low intensity of feeding, herring had a fairly high cubic condition factor – 1.004, which is obviously due to the active feeding during the previous period.

The Results of KamchatNIRO's Researches of the Pollock from the Bering Sea;
Salmons, Sea Mammals (Northern Fur Seal, Steller sea lion, etc.) from the
North Pacific Basin in 2010-2011

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**The review of researches of pollock and herring made in the Western
Bering Sea in 2010**

In 2010 experts of KamchatNIRO monitoring the composition of catches, the biological status of the pollock from the Western Bering Sea (on board of the fishing vessel RTM "Arctic Leader") as a stage of monitoring of the pollock's stocks in the Bering Sea, the Sea of Okhotsk and the Pacific coast of Kamchatka. The main trawlings were carried out in the West Bering Sea zone (the area to the east of the longitude of Cape Olyutor) in the period from August 29 to September 25; only 2 trawlings were made in Olyutor Bay (Karagin subzone) at the end of September (Fig. 3.1). Trawlings were carried out with the bottom trawls - 77/63, Fiska II 550/55 and with the midwater trawl – 99/624.

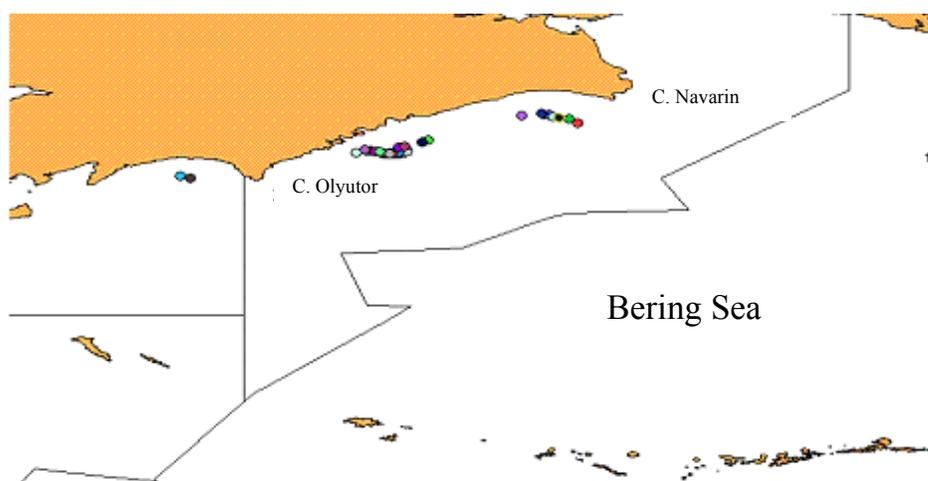


Figure 3.1. Areas of work of the SRTM "Arctic Leader" in the Bering Sea in autumn 2010.

In the West Bering Sea zone the RTM "Kamlayn" carried out trawlings in two areas: 1) between 177°-178° E at depths of 195-320 m 2) between 173°-174° E at

depths of 167-385 m. In the first area to the south of the Cape Navarin, pollock catches varied from 2.4 to 15.0 tons/hour of trawling (average - 5.1). Catches have been presented by exclusively large pollock with length from 38 to 66 cm long. Fish less than 37 cm were not met in the catches. The individuals from the size groups of 42-54 cm (86.2%) dominated in catches (Fig. 3.2). The average length of walleye pollock was 47.9 cm, with an average weight of fish of 0.927 kg.

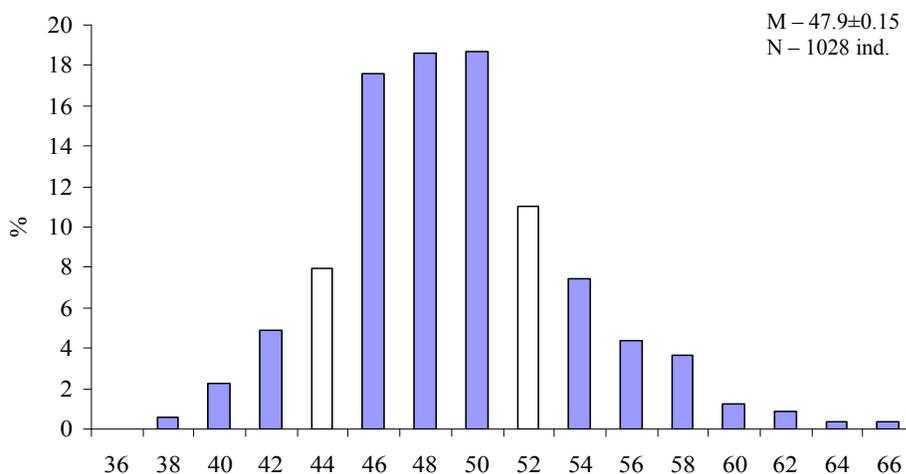


Figure 3.2. Size composition of walleye pollock in the West Bering Sea zone in the area of 177°-178° E in autumn 2010.

The sex ratio has been shifted towards females (61.7%). Both among males and females of pollock predominated fish with gonads at maturity stage III: 89% and 59%, respectively.

It was noted during trawlings in the area of 173°-174° E, that in comparison with 2009 pollock catches were met only to isobath of 385 m. From the big depths they have been forced out, most likely by the Commander squid; during its fishery pollock wasn't observed even in bycatch. Pollock's catches in this area were stable and fluctuated slightly: 6-7 t/hour of trawling (in average – 6.4). In 2009 the catch per hour trawling in the area was lower and amounted to an average of 5.1 m.

The length of walleye pollock in the catch ranged from 36-66 cm; individuals of size groups of 40-50 cm dominated in catches (85.4%) (Fig. 3.3). The average length of this species was 44.9 cm, with an average weight of fish of

0.705 kg. Ratio of males/females was 56.4/43.6%, respectively. The share of commercial size fish was not amounted to 0.2%. Among the male dominated fish with gonads at II-III and III stages of maturity (20.1% and 38.6%, respectively). Among females dominated the fish with gonads at maturity stage III (75.5%).

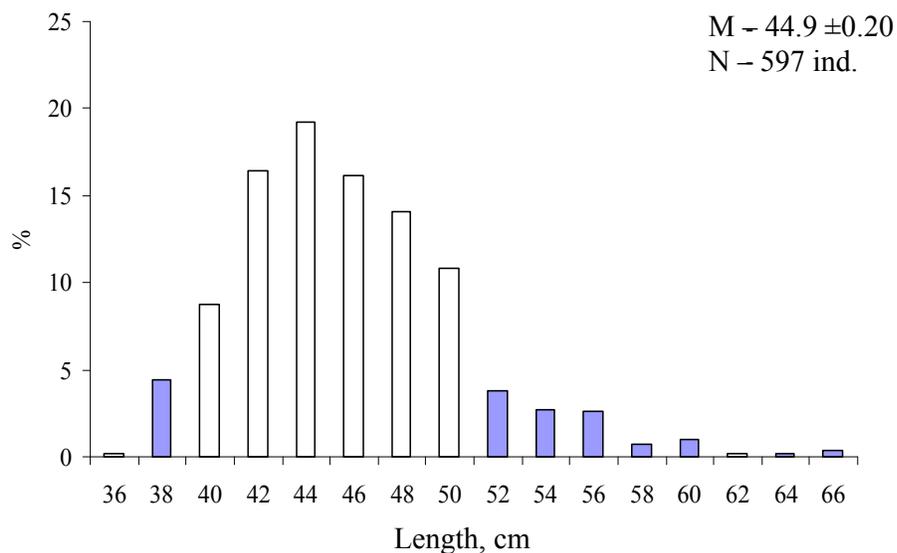


Figure 3.3. Size composition of walleye pollock in the West Bering Sea zone in the area of 173°-174° E in autumn 2010.

Two trawlings were carried out in the central Olyutor bay; in Karagin subzone at depth of 390-410 m. Pollock in the catch was present only as bycatch. The catch reached 0.7 tons/hour of trawling

The length of walleye pollock ranged from 36 to 64 cm; the fish from the size groups of 40-52 cm dominated in the catches of (84.5%) (Fig. 3.4). The average length of fish was 47.1 cm, average weight - 0.802 kg. The share of non-target fish less than 1% and amounted to 0.52%. The females dominated in the catch (56.1%), most of them had gonads at maturity stage III (88.5%). Most of the males also had gonads at maturity stage III (97.2%).

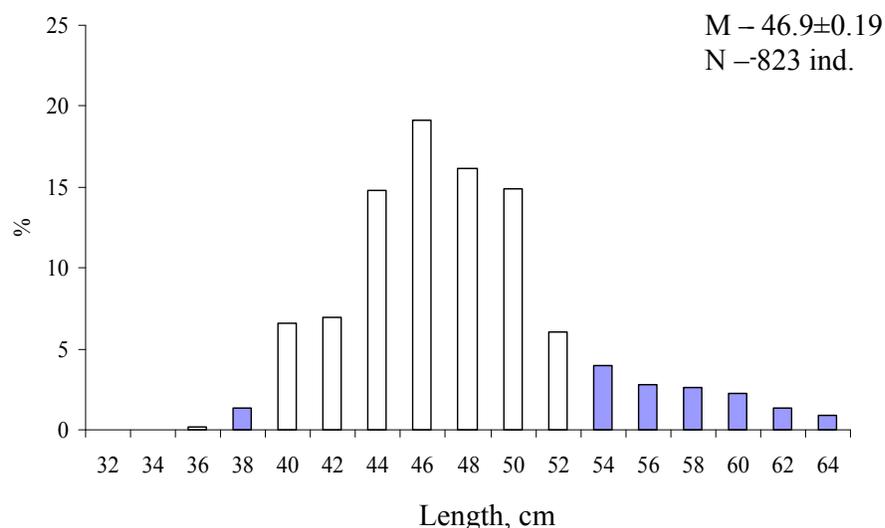


Figure 3.4. Size composition of walleye pollock in Karagin subzone in September 2010.

The preliminary results of pollock's studies in the Western Bering Sea in May-June, 2011

In 2011 the KamchatNIRO's monitoring the catch's composition and the pollock's biological condition in the Western Bering Sea were held simultaneously with the beginning of fishing in the middle of May on board of the fishing vessel BATM "Pollux" ("Okeanrybflot").

In the Russian part of the Bering Sea pollock fishery is regulated separately in two regions corresponding to two stock units: the western bering sea population – in the western part of the sea (Olyutor and Karagin bays within Karagin subzone and the adjacent waters at Koryak coast to 174°00' E within the boundaries of the West Bering Sea zone) and the northern bering sea population – in the northwestern part of the sea (the area of 174°00' E to the dividing line of zones of Russia and the United States within the West Bering Sea zone).

These are the limits of fishing for pollock in the Karagin subzone in the "Regulation of fishing ...":

- A ban on fishing from March 1 to April 30 due to spawning (13.1)
- The areas forbidden for fishery mostly at depths less than 300 m (11 b) to limit the catch of juveniles.

The specialized pollock's fishing in the West Bering Sea zone is prohibited from March 1 to May 15 due to spawning (13.1).

During the period from May 23 till May 29, BATM "Pollux" carried out search and trade works in the Karagin subzone in coordinates $59^{\circ}55' - 60^{\circ}00' N$, $169^{\circ}20' - 169^{\circ}36' E$ at depths of 140-155 m. For the duration of up to 6 hours of trawling, the catches per hour of trawling reached 4 tons, and, on average, were about 1.6 t/h trawling. The length of walleye pollock in the catch ranged from 26 to 58 cm; the fish with length 39-43 cm dominated in the catch (about 50%) (Fig. 3.5). The average length of fish is 38.6 cm, weight – 0.461 kg. Proportion of fish less than 37 cm (35 by AD) was 24.6%. The bulk of the fish was in the III stage of gonads' maturity. Individuals with fluid and spawned ovaries were met solitary.

As a by-catch there was a herring in the area. Its catches reached 0.5 tons per tow, and, on the average, accounted for about 0.025 t. The length of the fish ranged from 24 to 37 cm, with an average value equal to 28.4 cm. Average weight of specimens was 0.255 kg.

In the West Bering Sea area in late May the vessel operated along the dividing line of the Russian Federation and the United States in the coordinates of $61^{\circ}11' - 61^{\circ}20' N$, $178^{\circ}10' - 179^{\circ}30' E$ at depths of 130-160 m. The catch per hour of trawling was not high and did not exceed 1.2 t. In early June the working area was restricted to the coordinates of $60^{\circ}40' - 60^{\circ}58' N$, $178^{\circ}32' - 179^{\circ}27' W$. At the duration of trawling less than 12 hours the catches in the recalculation on hour of hour trawling did not exceed 1.8 tones (an average – 1.2 t). There was no bycatch. The length of the fish in the catches varied from 27 to 68 cm, and the basis of catch was of several specimens of size groups: 29-32 cm, 45-48 cm and 53-55 cm (Fig. 3.5). The average length of walleye pollock was equal to 42.4 cm, weight - 0.646 kg; there was 20.9% of fish less than trade measure. The biological condition of the producers' gonads was close to those in the Karagin subzone.

During the period from June 6 till June 12, the vessel carried out searching and fishing of pollock around $174^{\circ} E$. The trawlings were carried in the area of $60^{\circ}52' - 61^{\circ}15' N$, $173^{\circ}20' - 174^{\circ}52' e$ at the depths of 107-194 m. Pollock's

catches for hour of trawling didn't exceed 5 t (on the average – 1.7 t) for the duration of trawls up to 9 hours and were represented by small fish with length of 32.2 cm and weigh of 0.3 kg. In the catches dominated females (56%) and males (44%) with gonads at maturity stages II, II-III.

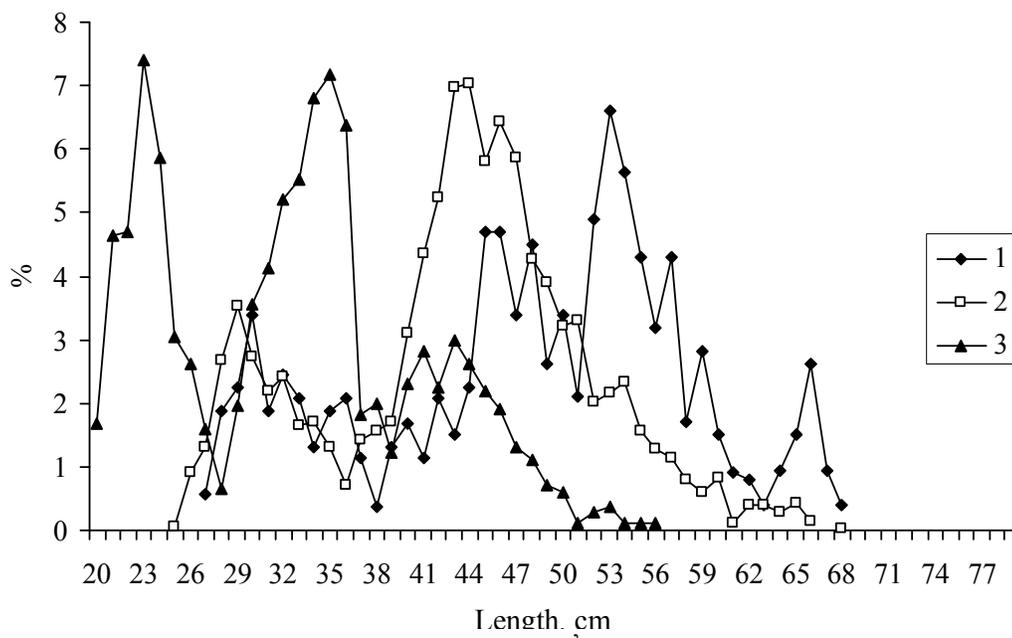


Figure 3.5. Size composition of walleye pollock in the West Bering Sea zone on 28-29.05 (1) 30.05-5.06 (2) and 6-12.06 (3), cm

The results of studies of early marine period of life of the Pacific salmon

In 2004 KamchatNIRO began the complex works on studying of coastal waters of Kamchatka. The main purpose of this work was to evaluate the habitat of juvenile Pacific salmon during the early sea period of life. Trawls 33.6/72 m and 33.6/56 m designed in the Laboratory of industrial fishing of KamchatNIRO specifically to work in the coastal zone were used in research as the fishing gear. The working area in 2004-2006 included the coastal waters of the Sea of Okhotsk (the Western Kamchatka). In summer 2007 research projects were conducted in the waters of the Western Kamchatka, as well as in the Gulf of Kamchatka (the Eastern Kamchatka).

In 2010 (after two-years break in 2008-2009) studies were resumed and carried out in the waters of the Western Kamchatka in the period from 21 to 28 July, as well as in the waters of the Eastern Kamchatka – from 19 to 30 August. We will notice that in 2010 the working area in the waters of the Eastern Kamchatka included not only the Kamchatka Bay, but also the Kronotsky Bay. The trawl RK-33, 6/56 m (estimated vertical opening – 6-8 m) was used in the waters of the Western Kamchatka in 2010, and trawl RC-33, 6/72 m (vertical opening of 10-12 m) was used in the waters of the Eastern Kamchatka. 62 control trawlings were made in the waters of the Western Kamchatka during the period of research, and 56 trawlings were made in the waters of the Eastern Kamchatka.

The Western Kamchatka. The analysis of the data about specific structure of fish community of coastal waters of the Western Kamchatka obtained in 2004-2007 and in 2010 indicates that the basis of the number of ichthyocenosis in this area forms the several main fish species: sand lance, capelin, sandfish and young salmon. The total share of these species in July 2004-2006 accounted for more than 90% of the total number of catches.

22 species of fish (and also jellyfishes and squids) were noted in trawl catches in July, 2010, but the basis of population still formed sandfish, juvenile salmon, sand lance and capelin (a total of 84.7% of total), as well as juvenile

pollock (14.1%). Jellyfish dominated in biomass (93.6% of the total weight of catch) in July 2010. Maximum catches of all types of nekton in the area were observed at stations located to the south of 54° N

The maximum proportion of juvenile salmon (58% of total) in the community waters of the Western Kamchatka awarded in 2006, and the minimum (less than 0.1%) – in 2004. In July 2010, the proportion of juvenile salmon was only 29.9%. However, the maximum amount of juvenile salmon for the entire period of observation in the absolute terms was considered in 2010. Thus, 5584 specimens were caught in 62 trawl stations in the current year; whereas only 2199 individuals were caught at 64 stations in July 2006 (the maximum for the previous years).

As it is shown in Figure 3.6, the young salmon in the catches in July 2010 was dominated by sockeye salmon. Its total catch taken during the survey was ind., or 73.2% of the total number of juvenile salmon. Also there were high catches of chinook (817 ind.), coho salmon (434 ind.), and chum salmon (213 ind.). Juveniles salmon trout (32 ind.) and pink salmon (2 ind.) were met only a few catches. Maximum catches per effort of juvenile sockeye salmon reached 400-600 ind./15 min. of trawling; chinook salmon – more than 300 ind./15 min. of trawling, chum and coho salmon – 60-110 ind./15 min. trawling. Maximum concentrations of juvenile salmon were observed mainly in medium and extreme seaward stations of control sections with depths more than 20 m. At the coastal stations, the number of juvenile salmon in the catch as a rule, decreased.

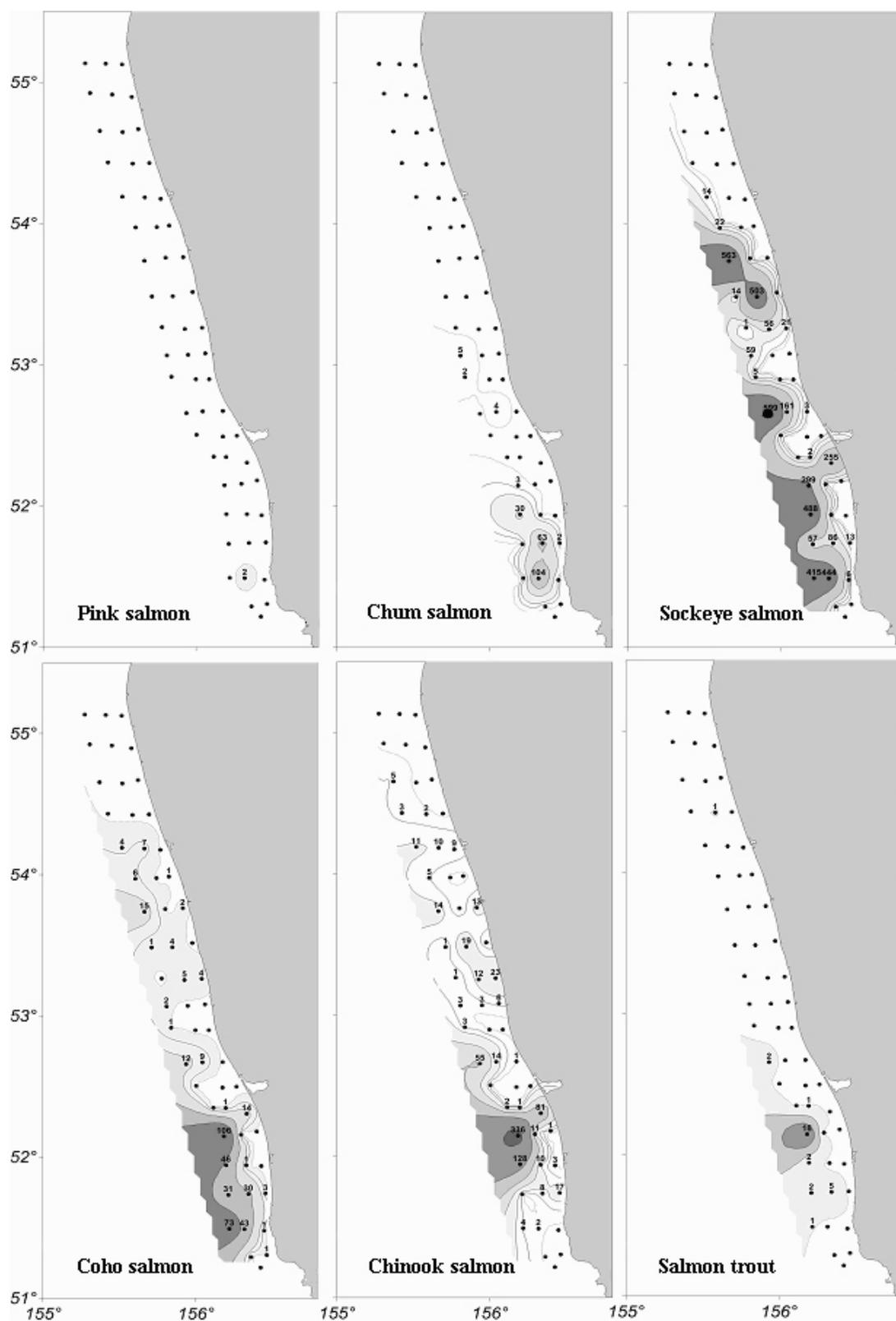


Figure 3.6. Distribution of catches of juvenile salmon (ind./15 min. of trawling) in the coastal waters of the Western Kamchatka in July 2010.

Such character of juveniles' distribution, apparently, has been connected with features of hydrological conditions in July, 2010 as the positive communication between juveniles' catches and water temperature on a surface has been noted during the accounting works. Thus, the vast majority of juvenile salmon (5526 individuals) was caught at stations with surface water temperatures of 10-13° C, and only 58 individuals at the stations at which the temperature was below 10° C.

According to hydrological supervision, in July, 2010 on horizons of 0 and 5 m the value of water rose from coast to open sea, and the temperature gradient in the coastal and seaward stations could reach a few degrees. Apparently, it also has served as the reason of that during the current year has compelled a migration into the seaward part of the area, where there was a higher temperature, close to the optimum values. We will notice that similar character of distribution of juveniles salmons in coastal waters of the Western Kamchatka was marked in July, 2006 and was associated with abnormally low values of the temperature in the coastal zone (3-4 ° C).

The Eastern Kamchatka. 20 species of fish (as well as young squid and jellyfish) were noticed in catches in waters of the Eastern Kamchatka in August 2010; among them Pacific herring, juvenile and immature salmon, pollock yearlings, adult and juvenile squid, Pacific lamprey dominated by number. The herring dominated in catch by biomass (94.9 %). We will notice that the similar species composition of catches was observed the waters of the Gulf of Kamchatka in August 2007.

Maximum catches of almost all species of nekton in 2010 were observed in the northern part of Gulf of Kamchatka – not far from the estuary of the river Kamchatka. Thus, the average biomass per the fishing effort in the northern part of the gulf (690.5 kg/15 min. of trawling) was more than in 50 times higher than in its central and southern parts (13.4 kg/15 min. of trawling), and more than in 80 times higher than in the Kronotsky Bay (8.6 kg/15 min. of trawling). This was due

primarily to the large number of herring caught in the north of the Gulf of Kamchatka.

Of juvenile Pacific salmon chinook salmon (total catch taken during the period of survey is 916 ind.), chum salmon (427 ind.), pink salmon (327 ind.), sockeye salmon (320 ind.) and coho salmon (155 ind.). Thus, the total catch of young fish in 2010 amounted to 2145 ind., which is also significantly higher than the results obtained in August 2007, when 616 ind. of juveniles were considered in the Gulf of Kamchatka.

As can be seen from the figures 3.7-3.8, the main cluster of young salmon in the working period were marked, mainly, at the stations located in the northern part of the Gulf of Kamchatka; the overall increase of catches in the direction along the Kamchatka Peninsula to the east were pointed with species such as pink, chum, sockeye and coho salmons. In places of congestions the catch per unit effort of chinook reached 100-200 ind./15 min. of trawling, sockeye salmon – 150 ind./15 min. of trawling, pink and chum salmon – 100-120 ind./15 min. of trawling; coho salmon – 10-20 ind./15 min. of trawling. In the central part of the Gulf of Kamchatka the catches of juveniles salmon were marked only at certain stations, where they in total did not exceed 10 ind./15 min. of trawling. There was an increase in catches up to 50-150 ind./15 min. of trawling in the south part of the bay. In the Kronotsk gulf catches of juvenile salmon (mainly due to the coho salmon) did not exceed 20-30 ind./15 min. of trawling.

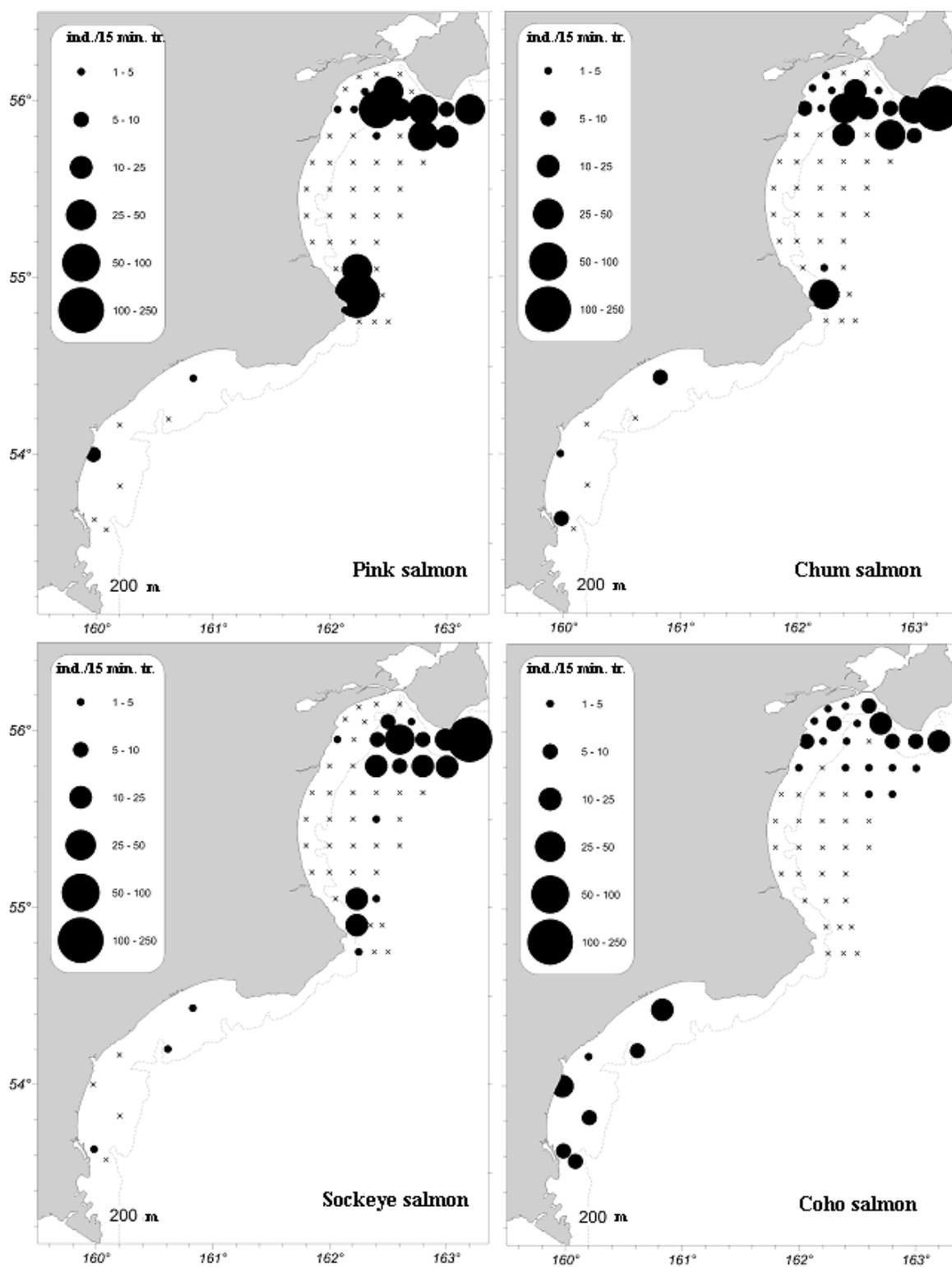


Figure 3.7. Distribution of catches of juvenile salmon (ind./15 min. of trawling) in the coastal waters of the Eastern Kamchatka in August 2010 (the crosses mean no catch).

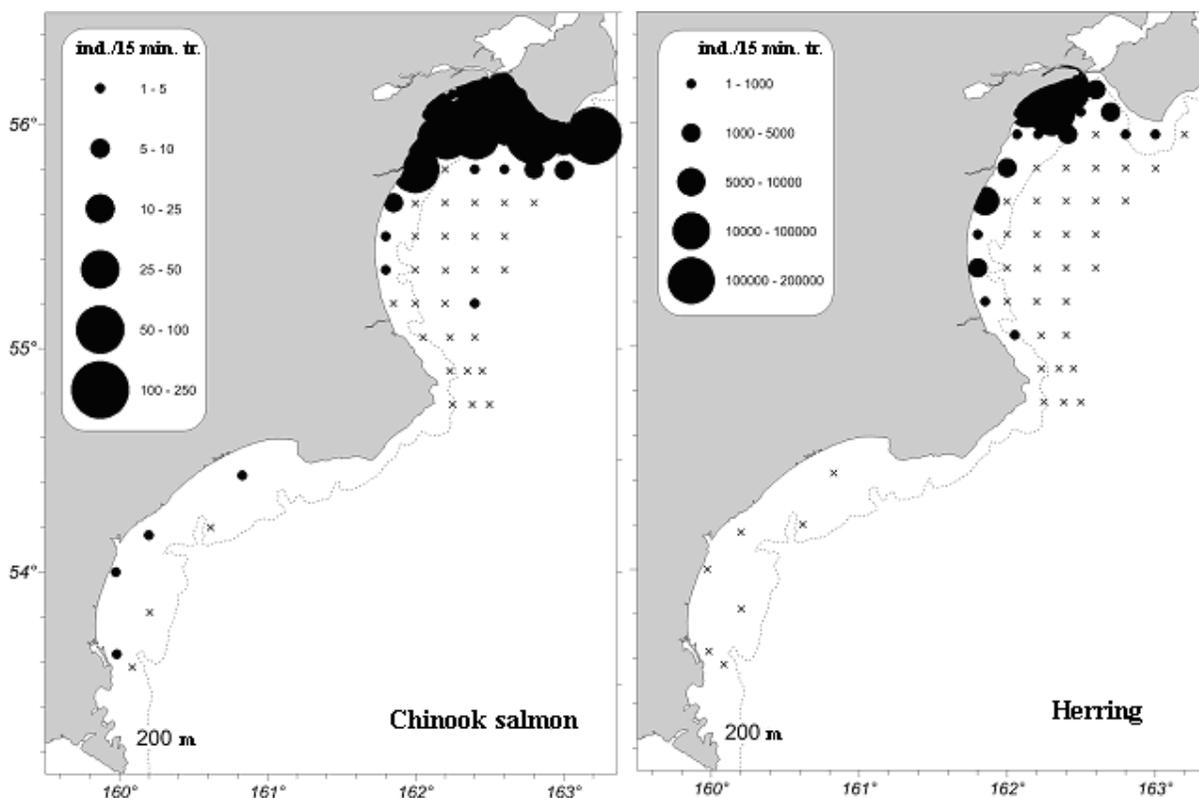


Figure 3.8. Distribution of catches of juvenile chinook salmon and Pacific herring (ind./15 min. of trawling) in the coastal waters of the Eastern Kamchatka in August 2010 (the crosses mean no catch)

In general, the overall increase in the size and weight of juvenile salmon performance in the direction of the shore into open water from north to south was observed during the period of the survey in the waters of the Eastern Kamchatka. Thus, the minimum size and weight of all juveniles were observed in the most northern part of the working area in around the mouth of river Kamchatka, and the maximum – in the Kronotsk gulf.

Thus, the character of catch's distribution in the Gulf of Kamchatka in August 2010, obtained on the basis of trawl survey data indicates that juvenile salmon after the slope of the river Kamchatka migrate into the Pacific waters along the coast of the Kamchatka Peninsula to the east. This is evidenced by the increase in catches from the coast towards the open waters of the Gulf of Kamchatka in the north, and the lack of juveniles in its central part. The increase in size-weighted

indices of juvenile salmon in the northern Gulf of Kamchatka in the direction of the coast into the open waters can also indirectly testify the same fact.

The results of sea mammals' researches

Northern fur seal

There are four reproductive rookeries of seals on the Commander Islands (Fig. 3.9). Since 1958 the Laboratory of sea mammal of KamchatNIRO has been monitoring all the Commander populations annually.

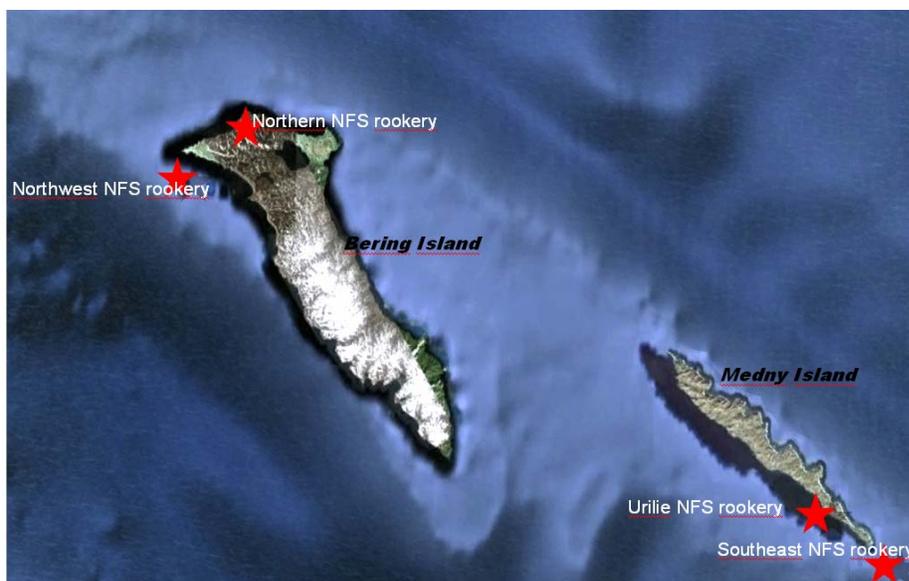


Figure 3.9. The location of the reproductive rookeries of fur seals in the Commander Islands.

The total number of fur seals offspring on the Commander Islands in 2010, according to registration, which was carried out, was 64295 pups, including 60952 living and 3343 dead. Indicators of offspring in the current year are the highest in the last 10 years, they are 6.3% higher than the average for 10 years (60462 pups). Over the last 10 years as a whole on Commodores it is possible to speak more likely about stable number of an issue with preservation of a positive trend (Fig. 3.10).

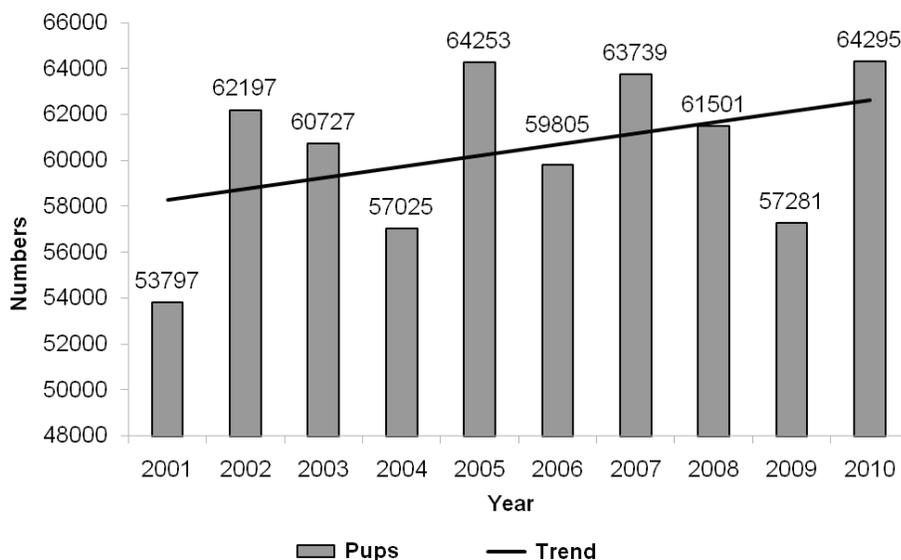


Figure 3.10. The dynamics of the number of fur seals' pups in the Commander Islands in 2001-2010.

In total on the Commander rookeries in 2010 it was counted 7487 adult males, including 4018 males with harem and 3469 without. On the average for 10 years the number of the adult males, present on rookeries, has made 7456 goals that is approximately equal to an aggregate number of the adult males on the Commander Islands during the current year.

Over the past 10 years there are a high number of seals in this category at all rookeries. On one adult male for all rookeries in the Commander Islands in 2010 there were an average of 8.6 females which had given birth this year, at an acceptable sex ratio of adult males to the total number of females of 1:30 and to optimal of 1:20. This figure indicates that the amount of males on commercial rookeries more than doubled relative to the optimum, which creates excessive competition among males and is undesirable in the management of controlled fur seal industry.

The total number of shore single males (males at the age from 2 till 6 years) was 10348 individuals on reproductive rookeries Commander Islands in 2010. The average number of single males on the Commander rookeries was 12540 heads for

the period from 2001 to 2010, which is higher on 17.5% than the number of single males recorded on all rookeries in the Commander Islands in this year.

For all period of researches on Urilem and Southeast island rookeries Copper 147 tests of excrement and an eructation of a fur seal have been collected and processed. In 44 % of tests the rests of squids (beaks, eyes) contained, the rests of fishes (отолиты and bones) contained in 32 % of the collected tests. From the fish eaten by cats prevailed greenlings (11 %) and cods (5 %). It is individual there was a lamprey, the capelin, a sandwort and other kinds of fishes (a Fig. 3).

There were collected and processed 147 samples of feces and eructations of seals on Urilov and South-East rookeries of the island Mednij over the entire period of research. 44% of the samples contained the remains of squid (beaks, eyes); fish remains (otoliths and bones) were kept in 32% of the collected samples. Greenlings (11%) and cod (5%) dominated in eaten fish. met Lamprey, capelin, sand lance and other fish species were met solitary (Fig. 3.11).

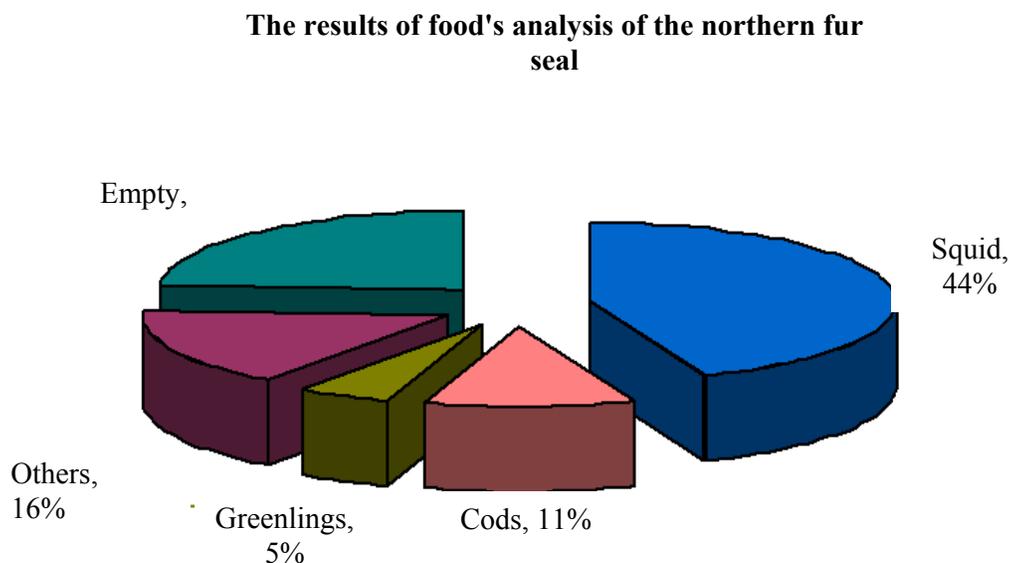


Figure 3.11. Diet composition of seals on Mednij island 2010 on fodder objects.

At least 5 cases of killer whales hunt sea lions were identified in the area of Mednij island in 2010. It is difficult to ascertain the total number seals, eaten by killer whales, however it is necessary to consider the predatory by killer whales near the Commander islands as an additional negative factor affecting the number of seals.

Thus, over the past 10 years the number of pups, adult males and single males has stable indicators, or with a slight trend of growth either on a whole Commander islands, or on separate rookeries.

Sea otter

On Commander Islands the number of sea otters has considerably decreased in last two years in comparison with the maximum number in 2007, and makes about 4.8 thousand individuals. Including 2286 animals, accounted on Mednji island in 2010. Incomplete accounts were carried out on Northern Kuril Islands in 2010. Number of a sea otter, in comparison with 2008 in the northern part of an island of Paramushir remained approximately at former low level (nearly 3576 individuals). It seems that the number falling on Northern Kuril Islands has stopped in last two years (2009-2010).

Steller sea lion

The main seat of the concentration of steller sea lions on the Commander Islands is a South-East rookery, which is breeding of this species. Spent almost single account of the number of steller sea lions on islands has shown that to the Southeast rookery is concentrated to 70 % of the group. Currently, steller sea lions breed on the islands only at this rookery. The total number of steller sea lions haul out on approximately 400 individuals. In 2010, the total number of steller sea lions in the Commander Islands was 541 specimens, which corresponds to that of the first half of the 90th of the last century.

Every year since the late 1990th, the Laboratory of mammals of KamchatNIRO monitors steller sea lions wintering in Avacha Bay within the boundaries of Petropavlovsk-Kamchatsky. This year, the number of this species

was more stable compared to last year. The wintering group reached the maximum amount in March (279 ind.).

We can assume that wintered in the bay about 250-280 sea lions of different origin, gender, and age. The origin of sea lions tagged set of brand and, in part, on plastic labels, put to the Stone Kozlov since 2000s, showed a stable prevalence of animals who was born in the Kamchatka rookery.

The results of observations of cetaceans in the Commander Islands

Seven species of cetaceans were observed over the past year in the waters of Bering and Mednij islands: minke whales *Balaenoptera acutorostrata*, humpback whales *Megaptera novaeangliae*, Baird's beaked whale *Berardius bairdii*, Cuvier's beaked whale *Ziphius cavirostris*, sperm whales *Physeter macrocephalus*, killer whales *Orcinus orca* and Dall's porpoises *Phocoenoides dalli*.

In the waters of Bering Island in the coastal observations *minke whales* were recorded 28 times, humpback whales – 306 times. Either solitary animals or groups of up to 9 individuals were observed. *Baird's beaked whales* were recorded in the waters of Northern Bering Island abeam of cape Chornij on April 14. A group of 43 individuals was observed. Baird's beaked whales were met during the works at sea on November 13 at beam of cape Tonkij (Western). The total number of groups was about 30 animals. A group of Cuvier's beaked whales of 10 individuals was observed at February 23, 2010 on the beam of cape Revizor.

Sperm whales were recorded only three times: twice in early October on the beam of cape Vchodnoj Reef and once (on March, 11th) on the beam of cape Chernij. There were solitary animals every time.

Killer whales were observed 6 times from the coast. Killer whales were observed 3 times in December, the groups consisted of 2-10 individuals. A group of 8 individuals and a single male were watched on the beam of cape Chernji on March. Killer whales were met 4 times at sea in autumn 2010. The total number of registered killer whales was 19 individuals. The general considered number was 44 individuals.

Dall's porpoises were observed in September-November 2010 only during works at sea. In total they were noted within 7 days. The general total number was 45 individuals.

Minke whales were registered within 30 days in the water area of Mednij, the total number was 47 individuals. *Humpbacked whales* off the southern extremity of island were observed by 55 days, total of 602 individuals. *Sperm whales* were observed at a southern extremity of island during all season, the total number was 44 whales. *Killer whales* were observed during all period of works. The total registered number of killer whales was made 323 individuals. *Dall's porpoises* (9 individuals) were observed only once from the coast (on June, 12th) from the southeast part, at a distance of 3 km.