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Kamchatka Branch of FSBSI VNIRO (KamchatNIRO)

REPORT

**Studies in target pollock trawl fishery and of by-catch  
species in the Bering Sea in May–August 2020**

Petropavlovsk-Kamchatskiy, 2020

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## INTRODUCTION

The northwestern part of the Bering Sea is one of key pollock fishing areas in Far Eastern seas.

In the Russian part of the Bering Sea, pollock fishery is regulated separately in two regions corresponding to two stock units: West Bering Sea population in its western part (Olyutorsky Gulf and Karaginsky Gulf within the Karaginsky subzone and in adjacent waters near the Koryak coast up to 174°00 E within the West Bering Sea zone) and North Bering Sea population in the northwestern part of the sea (area from 174°00 E to the boundary delineated between Russian and U.S. fisheries within the West Bering Sea zone).

The Fishing Rules impose the following restrictions on the target pollock fishery in the Karaginsky subzone:

- ban on fishing during March 1 – April 30 due to spawning activities (Clause 13.1);
- no-entry areas for fishing, mostly at water depths less than 300 m (Clause 11b) with the purpose of restriction of by-catch of juveniles.

In the West Bering Sea zone, target pollock fishery is prohibited during March 1 – May 15 due to spawning activities (Clause 13.1).

Traditionally, the most favorable conditions for fishing and, accordingly, maximum yield occur in Q3.

The purpose of monitoring activities is studies in the target pollock trawl fishery and of by-catch species in the Bering Sea in May–August 2020.

Objectives of studies:

- collect information about total catches per each fishing operation;
- collect data on species composition of catches in abundance and weight units and on catches per unit effort (CPUE);
- collect data on key biological parameters of pollock and by-catch species (size and weight data, male/female ratio, condition of gonads, age testing samples, etc.);
- collect information about by-catch of marine mammals and seabirds, about VME species.

## 1. STUDY AREAS AND PERIOD OF STUDIES

Pollock fishing operations in the West Bering Sea zone were carried out during July 25 – August 26, 2020. A total of 75 trawl tows were made at depths of 100–358 m (201 m on average) (Fig. 1.1).

As for herring fishing in this area, 41 trawl tows were made at depths of 58–158 m (108 m on average) during August 27 – September 20, 2020 (Fig. 1.2). Total number of in-fishing days was 58 and that of analyzed hauls was 116.

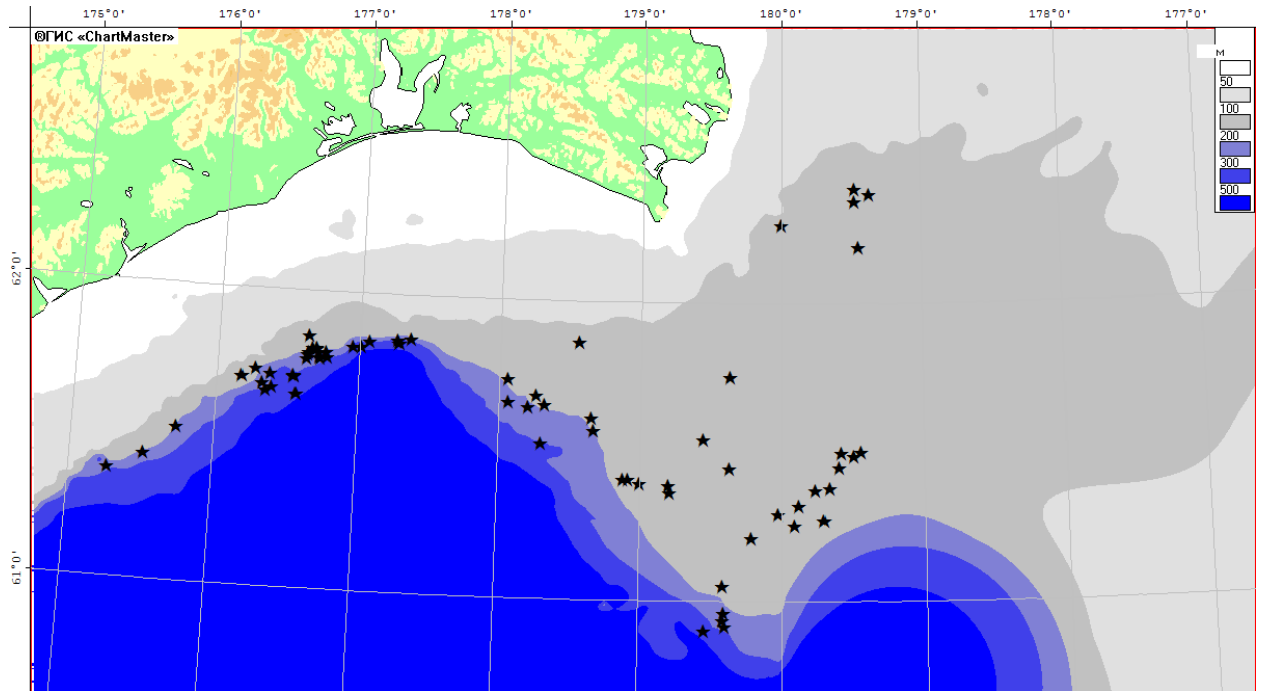


Fig. 1.1. Operating area of the LFFT (large freezer fishing trawler) *Boris Trofimenko* in July–August 2020 in pollock fishery in the West Bering Sea zone

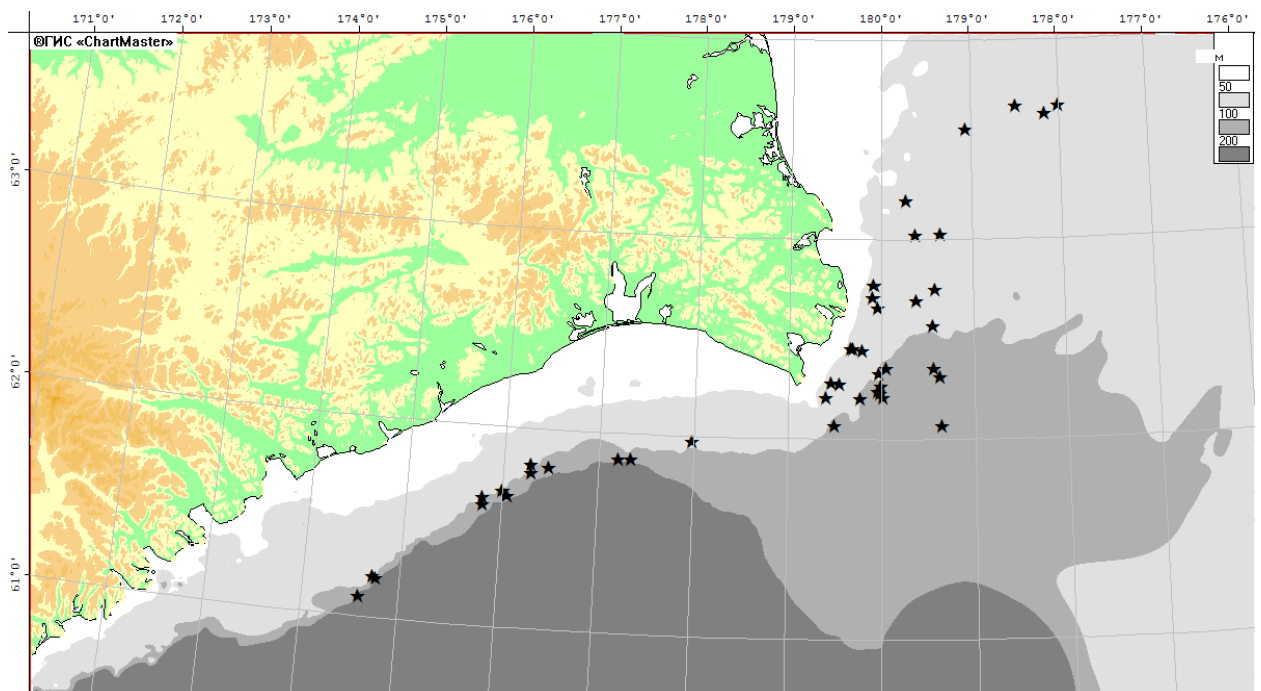


Fig. 1.2. Operating area of the LFFT *Boris Trofimenko* in August–September 2020 in herring fishery in the West Bering Sea zone

The rest time in this voyage was spent on search for fishable aggregations, cargo transfer operations, and passages.

## 2. METHOD AND MATERIALS OF STUDIES

Works were carried out on board the large freezer fishing trawler (LFFT) *Boris Trofimenko*, design D-1305, built at the yard Gijon (Spain) in 1994, hull number P-1430.

The LFFT *Boris Trofimenko* is a two-deck vessel with a stern ramp, one wheelhouse and trawl bridge. Length overall – 105 m, beam – 20 m, depth – 14.7 m. Crew number is 128 persons.

This vessel carried the following fishing gear on its board: pelagic trawl 215/720 of “Atlantic 1440 (is)” design (head rope length – 215 m, side rope length – 162 m, bottom rope – 215 m, false bottom rope – 215 m, full trawl perimeter – 1,440 m, Informrybflot system code – 647); pelagic trawl of “Atlantic 1600 (is)” design (full trawl perimeter – 1,664 m, Informrybflot system code – 611); pelagic trawl EGRSUND 608 (Norway) with an opening distance of 50/110. The design vertical opening of “Atlantic” type trawls is 40–45 m.

The EGRSUND 608 was used in the pollock fishery, Atlantic 1440 and, episodically, Atlantic 1600 were used in the herring fishery.

Trawl towing was carried out 24 hours a day. Trawling duration varied in the range of 1.3 to 14.0 hours averaging at 4.5 hours in the pollock fishery and in the range of 1.5 to 9.0 hours (3.8 hours on average) in the herring fishery. Trawling speed varied from 3.6 to 3.8 knots.

The vessel had all necessary navigation and fish finding equipment.

### 2.1. Determination of the amount and species composition of catch

The quantitative and species composition of catches was determined at least for 1 catch every day and all fishing operations were registered (coordinates, catch, etc.).

Information about each fishing operation was entered into a fishing operation card and included coordinates, water depth and horizon, duration of operation, total catch, etc. The observers based on board the ship identified fishing gear’s full name, type, and key parameters (vertical and horizontal opening distance, mesh size, etc.).

Total catch size was determined visually based on the volume it occupied in the receiving bin. To identify its species composition, we consecutively sampled approximately 300 individuals belonging to the target species (pollock, herring, etc.) and all by-catch. Furthermore, we inspected the remaining catch to register species not included in this sample. Then we counted individuals of each species in

the sample and determined the range of length variations and mean weight of one individual.

The species composition of catches was determined as follows:

1) we deducted total catch of individuals not covered by sampling from total catch weight;

2) then, we expressed the species composition of our test sample in per cent by weight, i.e. determined the weight percentage of each species in the weight of the whole sample base;

3) as the weight of the remaining portion of catch was known (see paragraph 1 above), we determined the weight of each species in it in accordance with its share (in %) in the sample base.

4) quotient obtained by dividing the weight of harvested aquatic organisms by their mean weight is their total number expressed in individuals.

Upon completion of relevant calculations, which included but were not limited to variation of length, mean weight of individuals, catch in kilograms and in individuals, data on the species composition of catch were transferred from deck log to haul card. This card mandatorily indicated the target species (or group of target species) of the fishing operation.

## **2.2. Biological analysis**

After determination of the species composition of the catch, biological analysis of abundant commercial fishes was carried out.

Size pollock measurements with dissection (SM) were made on 1–2 catches every day. The observers measured fish length by Smith (from the tip of snout to the end of middle rays of the caudal fin, length spacing 1 cm, right boundary). Then fish was dissected and its sex and gonad maturity stage were identified. When measurements were made without dissection, only Smith length was measured in fishes.

Full biological analysis (FBA) was performed on commercial fishes. The rate of analysis frequency was 30–50 individuals every day. Effort was taken to cover by analysis sufficient numbers both of most frequently occurring size groups and large-size individuals and, particularly, small-size individuals as well as separately females and males.

## **2.3. Collection of information on marine mammal by-catch and death**

During all daytime operations, by-catch and death of marine mammals were registered where possible.

When fishing gear was hauled on board the ship with captured marine mammals, an observer was to count them (live and dead), if any. Animal species were to be identified using relevant identification manuals. An observer also was to determine the sex of the animal. Pictures were to be taken.

Furthermore, the procedure of releasing all live marine mammals captured in fishing gear was to be witnessed.

An observer was to state in notes to daytime fishing operation cards whether marine mammal by-catch cases were recorded or not.

If any by-caught mammals were recorded, special registration cards were to be filled in (for live or dead animals).

A total of **58 observations** of marine mammal by-catch were made.

#### 2.4. Seabird by-catch recording

Records on by-catch and death of seabirds were made during all daytime operations.

When fishing gear was hauled on board the ship and contained any captured seabirds, they were to be counted (live and dead).

After that, live birds were to be released.

If any birds with tags were found, they were to be photographed and the tag color, shape, and number were to be recorded.

An observer was to state in notes to daytime fishing operation cards whether seabird by-catch was recorded or not.

If any by-caught birds were recorded, a special bird registration card was to be filled in.

A total of **58 observations** of seabird by-catch were made.

#### 2.5. VME species by-catch recording

When identifying the species composition of catches, special attention was given to by-catch of indicator species of Vulnerable Marine Ecosystems (Ascidiacea, Ceriantharia, Antipatharia, Gorgonaria, Actinaria, Pennatulacea, Thaliacea, Ophiuroidea, etc.). After counting and weighing representatives of these groups in a catch, they were to be photographed and, in case of any doubt regarding their species identification, preserved for further delivery to laboratory and exact identification.

The volume of ichthyologic materials collected during the voyage is presented in Table 2.1.

Table 2.1

Volume of ichthyologic materials (size measurements (MM), special analysis (SA), and full biological analysis (FBA)) collected during works on board the LFFT *Boris Trofimenko* in July–September 2020

Species	SM	FBA	SA
<i>Anoplopoma fimbria</i>	-	-	14
<i>Atheresthes evermanni</i>	-	-	172
<i>Atheresthes stomias</i>	-	-	385
<i>Bathyraja aleutica</i>	-	-	9

<i>Bathyraja interrupta</i>	-	-	23
<i>Bathyraja maculata</i>	-	-	1
<i>Bathyraja matsubarae</i>	-	-	1
<i>Bathyraja minispinosa</i>	-	-	4
<i>Bathyraja parmifera</i>	-	-	36
<i>Bathyraja violacea</i>	-	-	4
<i>Clupea pallasii</i>	6,693	417	2,447
<i>Gadus macrocephalus</i>	85	-	548
<i>Glyptocephalus zachirus</i>	-	-	38
<i>Hemilepidotus jordani</i>	70	-	-
<i>Hippoglossus stenolepis</i>	-	-	12
<i>Myoxocephalus polyacanthocephalus</i>	-	-	40
<i>Oncorhynchus kisutch</i>	-	-	18
<i>Oncorhynchus tshawytscha</i>	-	-	1
<i>Pleurogrammus monopterygius</i>	-	-	1
<i>Reinhardtius hippoglossoides matsuurae</i>	-	-	20
<i>Rhinoraja taranetzi</i>	-	-	7
<i>Sebastes alutus</i>	19	-	167
<i>Sebastes ciliatus</i>	-	-	1
<i>Theragra chalcogramma</i>	9,756	653	2,082
<i>Ulca bolini</i>	-	-	10
<b>Total</b>	<b>16,623</b>	<b>1,070</b>	<b>6,041</b>

**In total, KamchatNIRO's observer, working in the West Bering Sea zone in July–August 2020, recorded 116 trawl tows, analyzed 49 hauls, made 58 observations of by-catch of marine mammals and seabirds, carried out 16,623 size measurements, 1,070 full biological analysis tests and 6,041 special biological analysis tests on various fish species.**

All collected information was provided to VNIRO's Pacific Branch (TINRO), which is a party responsible for performance of studies and preparation of materials justifying TAC and recommended yield of aquatic organisms in the West Bering Sea zone.



### 3. RESULTS OF STUDIES

#### 3.1. SPECIES COMPOSITION OF CATCHES, SIZE COMPOSITION AND SOME BIOLOGICAL FEATURES OF FISHES IN THE POLLOCK FISHERY IN THE WEST BERING SEA ZONE

50 fish species belonging to 17 families and 5 invertebrate species (groups of species) were registered during studies in the pollock fishery. Pollock was an absolute dominant both in abundance and weight of catches (91.8% and 95.9% respectively (Fig. 3.1.1).

Table 3.1.1

Species composition of catches (share of total abundance and biomass, %) and some biological features (length AC, cm; mean weight, kg) of fishes from pelagic trawl catches in the pollock fishery in the West Bering Sea zone in July–August 2020

Species	Biomass, %	AC, min	AC, max	W, aver.
<i>Bathyraja aleutica</i>	<b>0.03</b>	112	146	13.46
<i>Bathyraja interrupta</i>	<b>0.02</b>	39	98	1.99
<i>Bathyraja maculata</i>	+	91	93	4.62
<i>Bathyraja matsubarae</i>	+	68	70	1.72
<i>Bathyraja minispinosa</i>	+	68	81	2.65
<i>Bathyraja parmifera</i>	<b>0.04</b>	24	111	4.36
<i>Bathyraja</i> sp.	+	22	31	0.14
<i>Bathyraja violacea</i>	+	55	75	1.80
<i>Rhinoraja taranetzi</i>	<b>0.01</b>	60	74	1.71
<i>Clupea pallasii</i>	<b>2.63</b>	25.5	37.5	0.40
<i>Oncorhynchus kisutch</i>	+	50	50	1.50
<i>Gadus macrocephalus</i>	<b>0.41</b>	39	105	3.99
<i>Theragra chalcogramma</i>	<b>95.87</b>	18	82	0.82
<i>Sebastes alutus</i>	<b>0.04</b>	11	41	0.37
<i>Sebastes ciliatus</i>	+	37	42	1.00
<i>Anoplopoma fimbria</i>	<b>0.01</b>	43	64	2.04
<i>Pleurogrammus monopterygius</i>	+	43	43	0.80
<i>Gymnacanthus detrisus</i>	+	33	43	0.76
<i>Hemilepidotus jordani</i>	<b>0.02</b>	18	37	0.27
<i>Melletes papilio</i>	+	36	38	0.56
<i>Myoxocephalus polyacanthocephalus</i>	<b>0.07</b>	34	73	3.41
<i>Icelus spiniger</i>	+	13	26	0.08
<i>Triglops forficatus</i>	+	21	28	0.08
<i>Triglops scepticus</i>	+	11	27	0.07
<i>Ulca bolini</i>	<b>0.01</b>	22	79	4.44
<i>Dasycottus setiger</i>	<b>0.01</b>	21	33	0.43
<i>Malacocottus zonurus</i>	<b>0.05</b>	10	30	0.25
<i>Percis japonica</i>	+	19	32	0.11
<i>Sarritor frenatus</i>	+	23	27	0.05
<i>Aptocyclus ventricosus</i>	+	31	32	1.70
<i>Careproctus colletti</i>	+	31	33	0.43
<i>Careproctus furcellus</i>	<b>0.01</b>	28	51	0.82
<i>Careproctus rastrinus</i>	+	20	31	0.41
<i>Crystallichthys mirabilis</i>	+	32	36	0.81

<i>Liparis ochotensis</i>	<b>0.01</b>	33	57	1.69
<i>Bathymaster signatus</i>	<b>0.01</b>	20	33	0.23
<i>Lycodes brevipes</i>	+	29	32	0.13
<i>Lycodes diapterus</i>	+	20	21	0.02
<i>Lycodes palearis</i>	+	29	50	0.35
<i>Lycodes soldatovi</i>	+	51	65	1.13
<i>Eumesogrammus praecisus</i>	+	20	21	0.06
<i>Lumpenella longirostris</i>	+	29	31	0.08
<i>Atheresthes evermanni</i>	<b>0.12</b>	30	66	1.05
<i>Atheresthes stomias</i>	<b>0.28</b>	32	65	1.26
<i>Glyptocephalus zachirus</i>	<b>0.01</b>	26	41	0.24
<i>Hippoglossoides</i> sp.	<b>0.07</b>	16	47	0.43
<i>Hippoglossus stenolepis</i>	<b>0.03</b>	46	102	4.86
<i>Lepidopsetta polyxystra</i>	<b>0.02</b>	25	50	0.50
<i>Pleuronectes quadrituberculatus</i>	<b>0.01</b>	35	46	0.97
<i>Reinhardtius hippoglossoides matsuurae</i>	<b>0.02</b>	44	85	2.91
Asteroidea	+			0.22
<i>Berryteuthis magister</i>	<b>0.10</b>	13	30	0.39
<i>Chionoecetes bairdi</i>	<b>0.01</b>	5	12	0.20
<i>Paralithodes platypus</i>	<b>0.01</b>	16	19	2.42

Note: + stands for less than 0.01%.

**Pollock** catches per unit effort (CPUE) varied from 3,592.5 to 38,892.2 kg and averaged at 16,792.1 kg.

Pollock length in catches varied from 18 to 75 cm (40.2 cm on average). Individuals sized 45–53 cm dominated (70.7%) (Fig. 3.1.1).

During July 25–31, length in catches varied in the range of 18–61 cm (45.8 cm on average), with individuals sized 44–51 cm dominating (70.0%) (Fig. 3.1.2). During August 1–10, pollock size varied from 19 to 71 cm (48.2 cm on average), with individuals sized 45–52 cm dominating (74.5%).

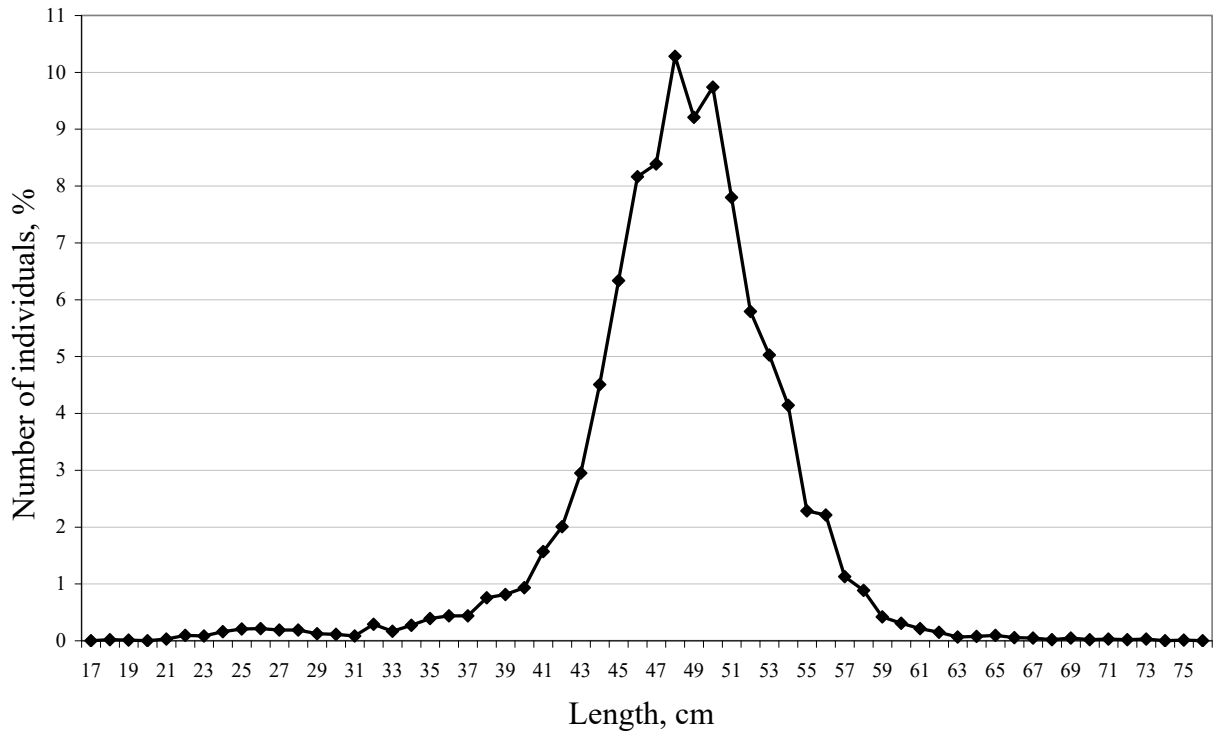


Fig. 3.1.1. Pollock size composition in pelagic trawl catches in the West Bering Sea zone in July–August 2020 (N=10,720, M=48.20)

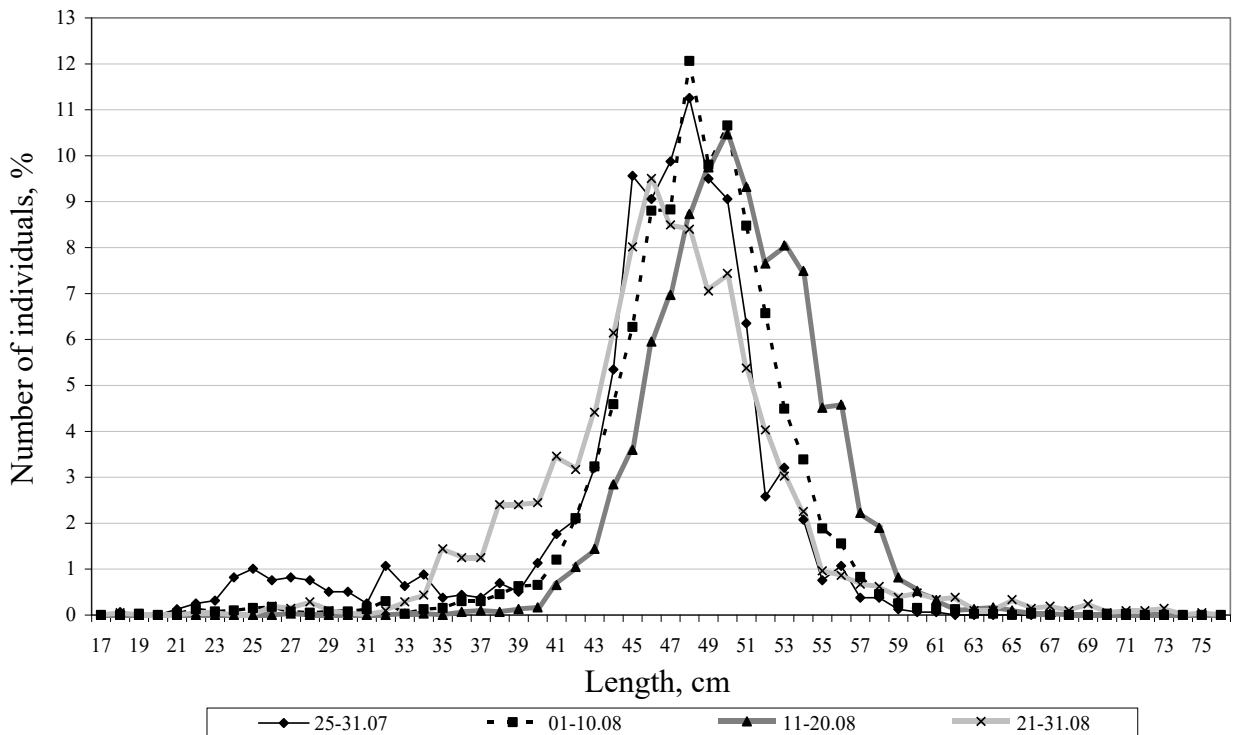


Fig. 3.1.2. Pollock size composition in pelagic trawl catches in the West Bering Sea zone in July–August 2020 by fishing periods (25–31.07: N=1,590, M=45.83; 01–10.08: N=3,988, M=48.18; 11–20.08: N=3,058, M=50.44; 21–31.08: N=2,084, M=46.75)

During August 11–20, length in catches varied in the range of 27–67 cm (50.4 cm on average), with individuals sized 46–54 cm dominating (74.4%). During August 21–31, length in catches varied in the range of 18–75 cm (46.8 cm on average), with individuals sized 44–51 cm dominating (60.4%).

Mean weight of individuals in various fishing periods is presented in Table 3.1.2.

Table 3.1.2

Mean pollock weight (g) in pelagic trawl catches in the West Bering Sea zone in July–August 2020 by fishing periods

25.07–31.07	01.08–10.08	11.08–20.08	21.08–31.08
745	824	932	680

Females dominated in catches (64.8% in total) (Table 3.1.3). Their share from fishing period to fishing period varied from 57.4% (21–31.08) to 73.4% (11–20.08). Female gonads were mostly at stages VI and VI-II (25.9% and 25.4% on average, respectively) and male gonads were at stage III (46.8%).

Table 3.1.3

Share of pollock males and females and maturity stages (%) in pelagic trawl catches in the West Bering Sea zone in July–August 2020 by fishing periods

Sex	Maturity stages							Total, %
	II	II-III	III	IV	V	VI	VI-II	
25.07–31.07								
♀	8.9	25.7	15.6	2.6	0.4	32.0	14.9	60.3
♂	18.8	0.0	42.0	6.8	0.0	6.3	26.1	39.5
J								0.2
∑	12.8	15.5	26.0	4.3	0.2	21.7	19.3	100.0
01.08–10.08								
♀	9.1	22.1	17.4	0.5	0.0	30.6	20.3	66.1
♂	12.8	0.0	40.1	1.5	0.0	12.2	33.3	33.9
∑	10.4	14.6	25.1	0.8	0.0	24.4	24.7	100.0
11.08–20.08								
♀	4.1	11.0	20.6	0.0	0.2	25.7	38.3	73.4
♂	11.4	0.0	37.0	6.5	0.0	3.8	41.3	26.6
∑	6.1	8.1	25.0	1.7	0.1	19.9	39.1	100.0
21.08–31.08								
♀	33.3	17.5	10.3	0.5	0.0	14.0	24.3	57.4
♂	15.7	0.0	64.3	0.7	0.0	2.1	17.1	42.6
J								0.2
S								0.6
∑	25.8	10.0	33.3	0.6	0.0	9.0	21.3	100.0
Total								
♀	12.8	18.5	16.6	0.7	0.1	25.9	25.4	64.8
♂	14.5	0.0	46.8	3.2	0.0	6.6	28.9	35.0
J								+
S								0.1
∑	13.3	12.0	27.1	1.6	0.1	19.1	26.6	100.0

Note: + stands for less than 0.1%.

**Herring** by-catch in the pollock fishery varied from 0 to 11,841.3 kg averaging at 212.8 kg.

Herring length varied from 25.5 to 37.5 cm averaging at 31.97 cm. Individuals 30.5–34.0 cm long dominated (61.3%) (Fig. 3.1.3). Mean weight was 0.388 kg.

Catches were dominated by females – 51.4%. The majority of them had their gonads at maturity stage II and males had their gonads at stage III (Fig. 3.1.4).

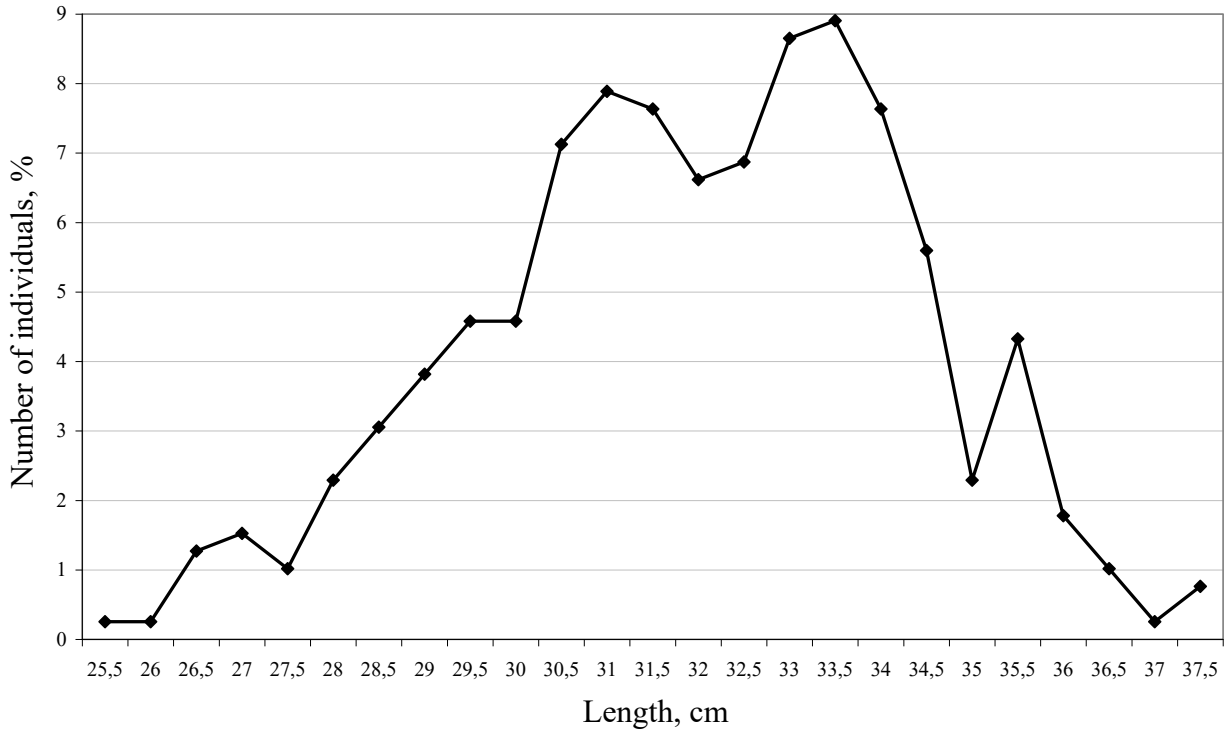


Fig. 3.1.3. Herring size composition in pelagic trawl catches in the West Bering Sea zone in July–August 2020 (N=393, M=31.97, W<sub>av</sub>=0.388)

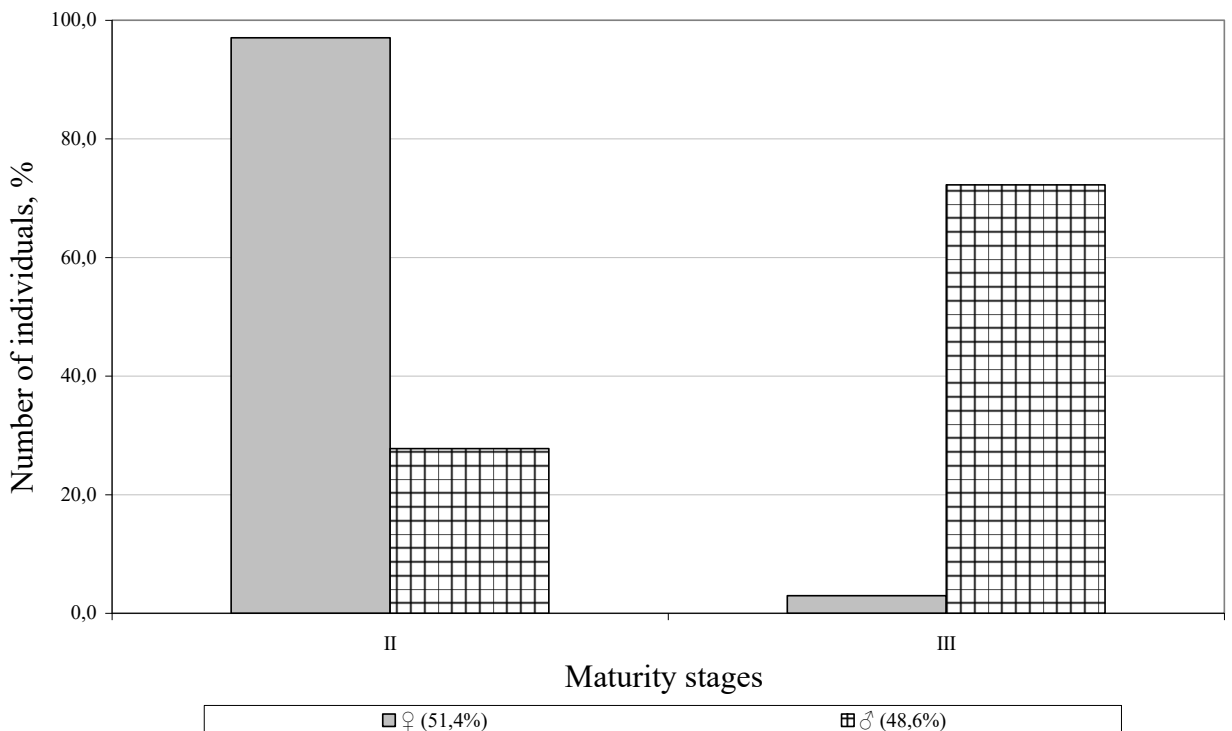


Fig. 3.1.4. Share of herring males and females and maturity stages (%) in pelagic trawl catches in the West Bering Sea zone in July–August 2020

**Cod** length varied from 39 to 105 cm and averaged at 69.74 cm. 42.3% of individuals were 60–70 cm long. Mean weight was 4.55 kg (Fig. 3.1.5).

**Pacific ocean perch** length varied from 11 to 41 cm and averaged at 29.97 cm. Individuals 33–37 cm long dominated (45.7%). Mean weight was 0.457 kg (Fig. 3.1.6). Males accounted for 49.1% (Fig. 3.1.7).

The length of **Kamchatka flounder** varied from 30 to 66 cm (44.96 cm on average) and that of **arrowtooth flounder** varied from 32 to 65 cm (49.92 cm on average). The former species was dominated by individuals 41–45 cm long (44.96%) and the latter species was dominated by individuals 47–52 cm long (39.0%) (Fig. 3.1.8). Mean weight was 1.02 and 1.30 kg, respectively.

**Yellow Irish lord** length varied from 21 to 35 cm and averaged at 26.5 cm. Its mean weight was 0.24 kg (Fig. 3.1.9).

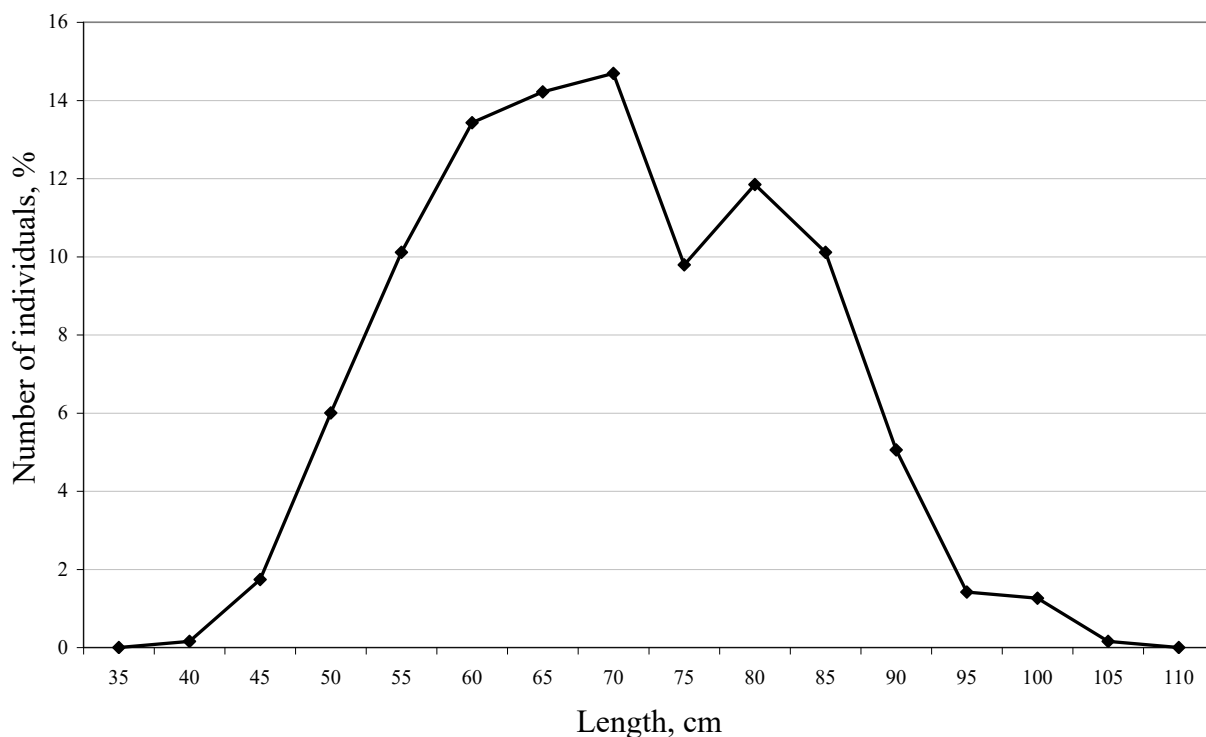


Fig. 3.1.5. Cod size composition in pelagic trawl catches in the pollock fishery in the West Bering Sea zone in July–August 2020 (N=633, M=69.74,  $W_{av}$ =4.546)

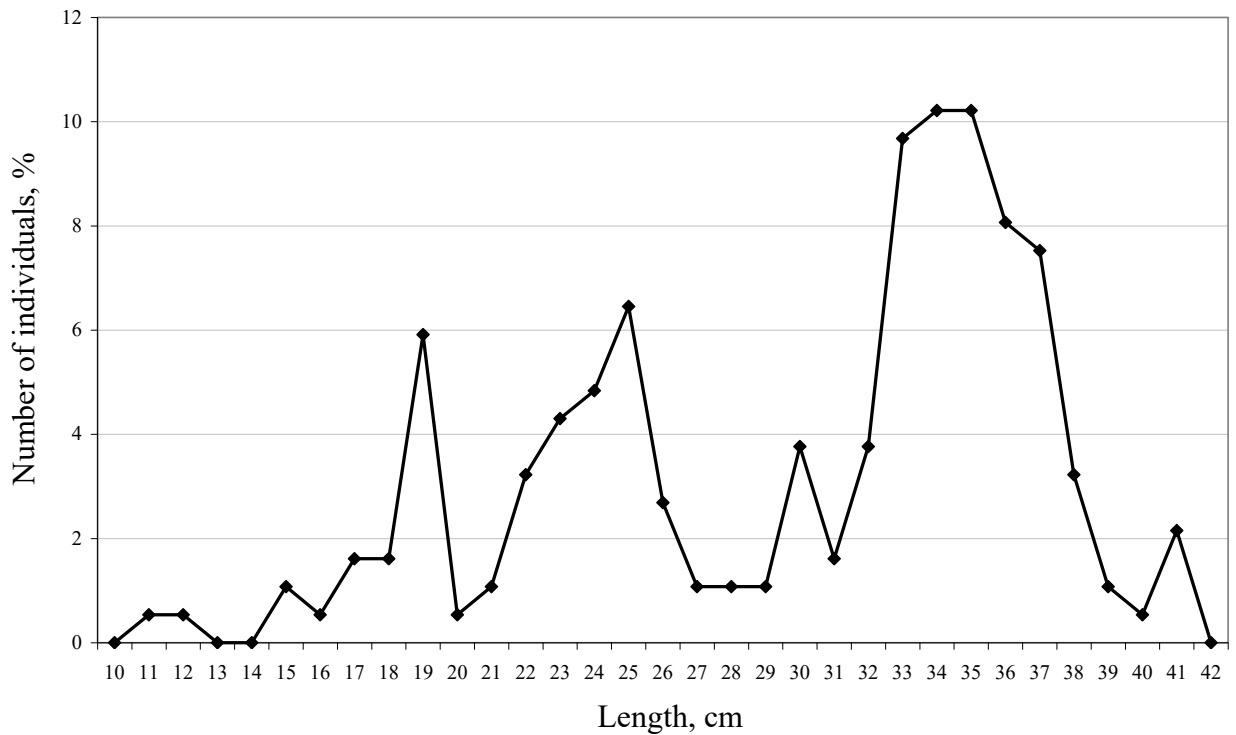


Fig. 3.1.6. Pacific ocean perch size composition in pelagic trawl catches in the pollock fishery in the West Bering Sea zone in July–August 2020 (N=186, M=29.97,  $W_{av}$ =0.457)

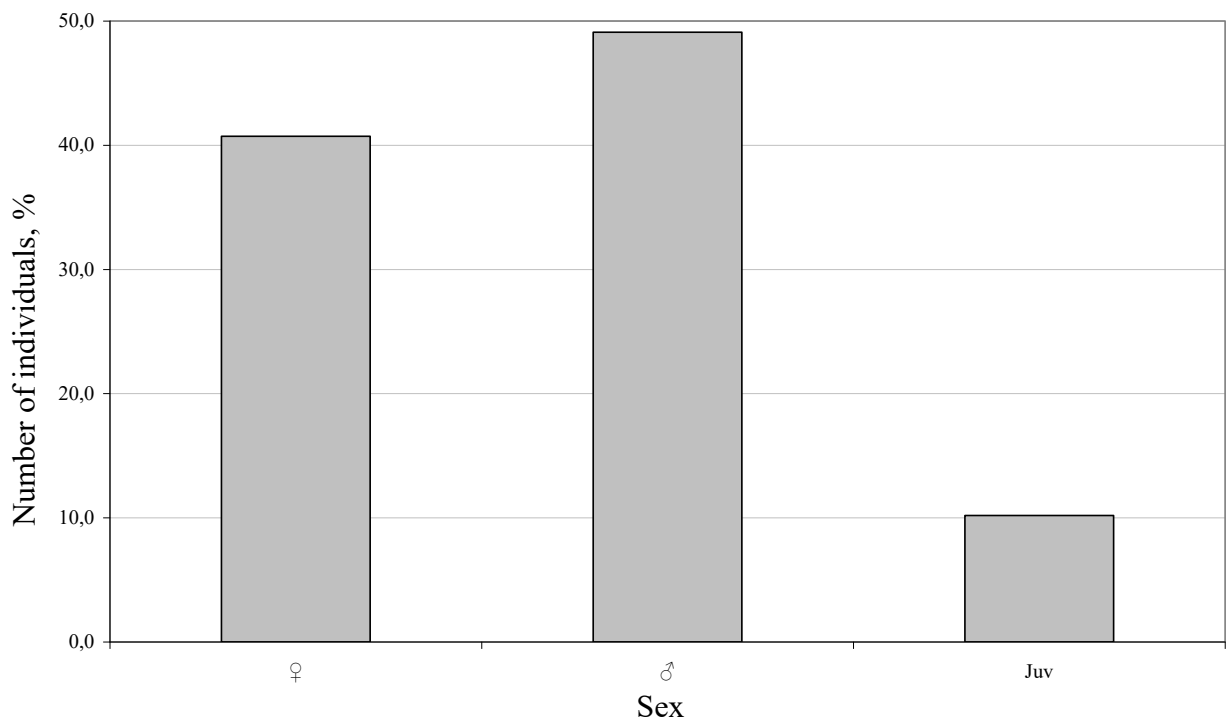


Fig. 3.1.7. Male/female composition (%) of Pacific ocean perch in pelagic trawl catches in the West Bering Sea zone in July–August 2020

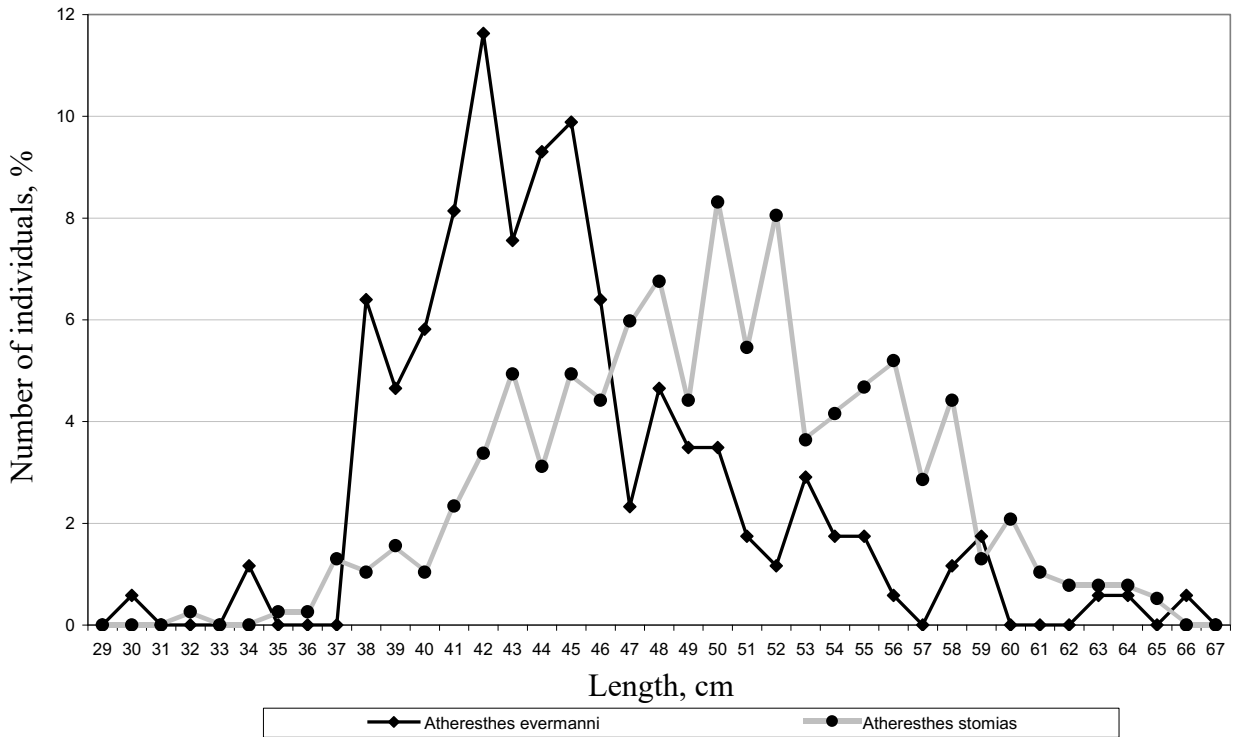


Fig. 3.1.8. Size composition of Kamchatka flounder (N=172, M=44.96,  $W_{av}$ =1.024) and arrowtooth flounder (N=385, M=49.92,  $W_{av}$ =1.295) in pelagic trawl catches in the pollock fishery in the West Bering Sea zone in July–August 2020

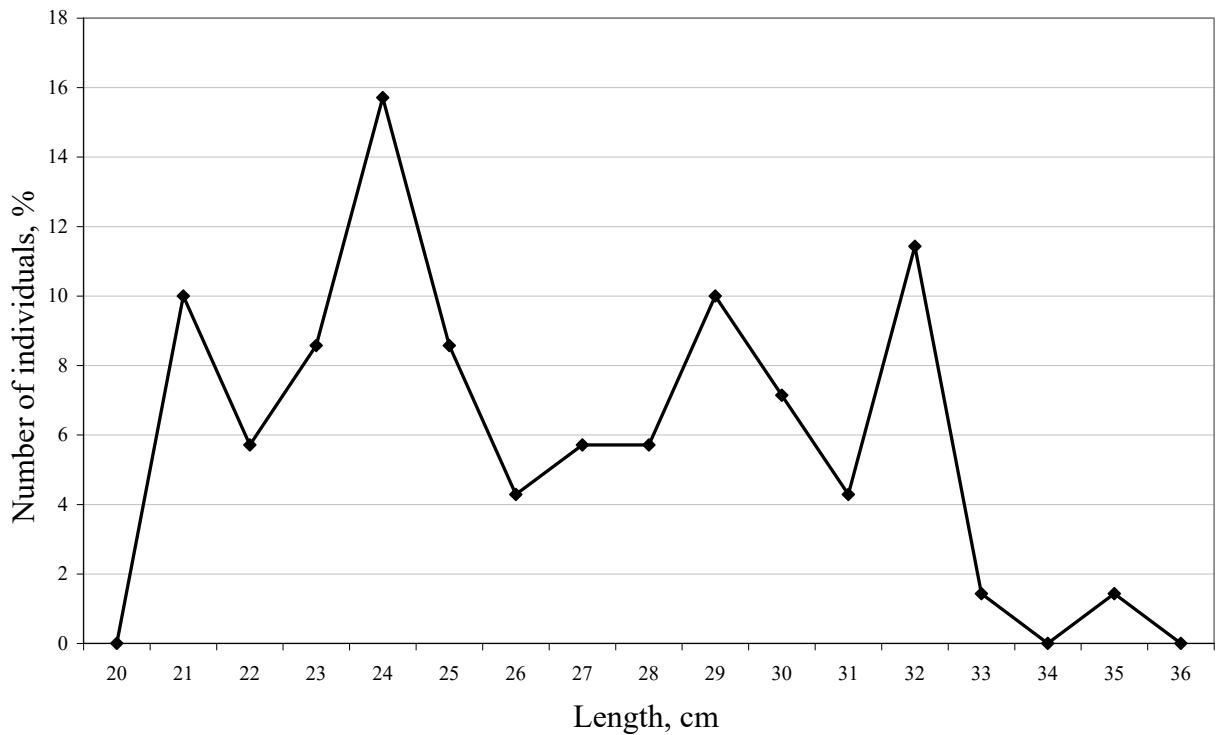


Fig. 3.1.9. Yellow Irish lord size composition in pelagic trawl catches in the pollock fishery in the West Bering Sea zone in July–August 2020 (N=70, M=26.50,  $W_{av}$ =0.24)



### 3.2. SPECIES COMPOSITION OF CATCHES, SIZE COMPOSITION AND SOME BIOLOGICAL FEATURES OF FISHES IN THE HERRING FISHERY IN THE WEST BERING SEA ZONE

9 fish species belonging to 6 families were registered in catches during works in the herring fishery. Herring was absolutely dominating in catches both in abundance (by numbers) and weight terms (in kg) (96.1% and 97.2% respectively) (Table 3.2.1).

Table 3.2.1

Species composition of catches (share of total abundance and biomass, %) and some biological features (length AC, cm; mean weight, kg) of fishes from pelagic trawl catches in the herring fishery in the West Bering Sea zone in July–August 2020

Species	Biomass, %	AC, min	AC, max	W, aver.
<i>Aptocyclus ventricosus</i>	+	28	34	1.29
<i>Clupea pallasii</i>	97.21	23.5	38.5	0.30
<i>Gymnacanthus detrisus</i>	+	35	37	0.47
<i>Oncorhynchus kisutch</i>	0.02	47	80	2.49
<i>Oncorhynchus tshawytscha</i>	+	74	80	5.58
<i>Salvelinus malma</i>	+	37	41	0.70
<i>Theragra chalcogramma</i>	2.76	16	74	0.45
<i>Zaprora silenus</i>	+	18	22	0.10

Note: + stands for less than 0.01%.

**Herring** catches per unit effort varied from 2,690.0 to 72,960.0 kg and averaged at 25,184.0 kg.

Herring size distribution in catches varied from 23.5 to 38.0 cm (29.9 cm on average). Individuals 27.5–31.0 cm long dominated (69.1%) (Fig. 3.2.1).

During August 26–31, length of individuals in catches varied from 23.5 to 37.0 cm (30.4 cm on average), with size group of 23.5–31.0 cm dominating (57.0%). During September 01–10, herring size varied from 25.0 to 36.0 cm (29.4 cm on average), with individuals 27.5–30.5 cm long dominating (68.0%). During September 11–20, fish length varied from 23.5 to 38.0 cm (29.9 cm on average), with individuals 28.0–31.0 cm long dominating (64.1%) (Fig. 3.2.2).

Data on mean weight of individuals in different fishing periods are presented in Table 3.2.2.

In general, females slightly dominated in catches (50.4%) (Table 3.2.3). Their share from fishing period to fishing period varied from 47.9% (26–31.08) to 52.6% (11–20.09). Female gonads were mostly at stage II (88.1% on average) and male gonads were at stage III (88.9%).

**Pollock** by-catch (CPUE) in the herring fishery varied from 0 to 10,368.0 kg and averaged at 2,212.7 kg.

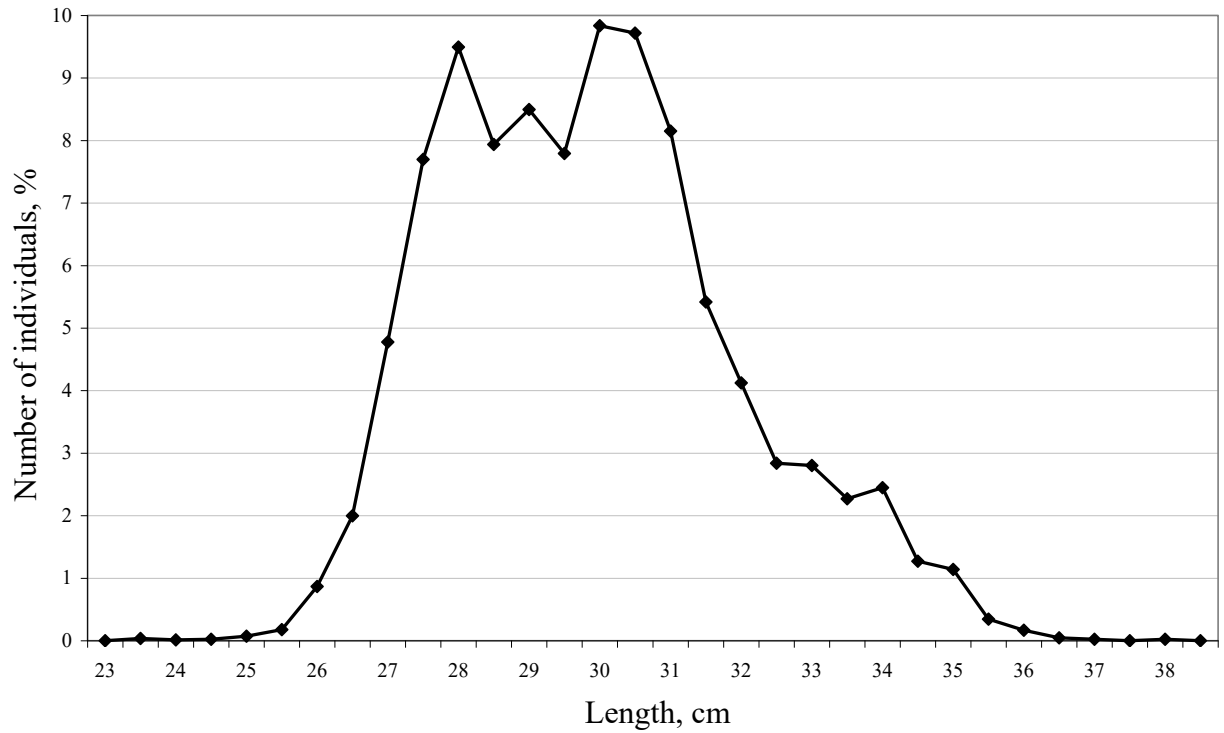


Fig. 3.2.1. Herring size composition in pelagic trawl catches in the West Bering Sea zone in August–September 2020 (N=8,417, M=29.89)

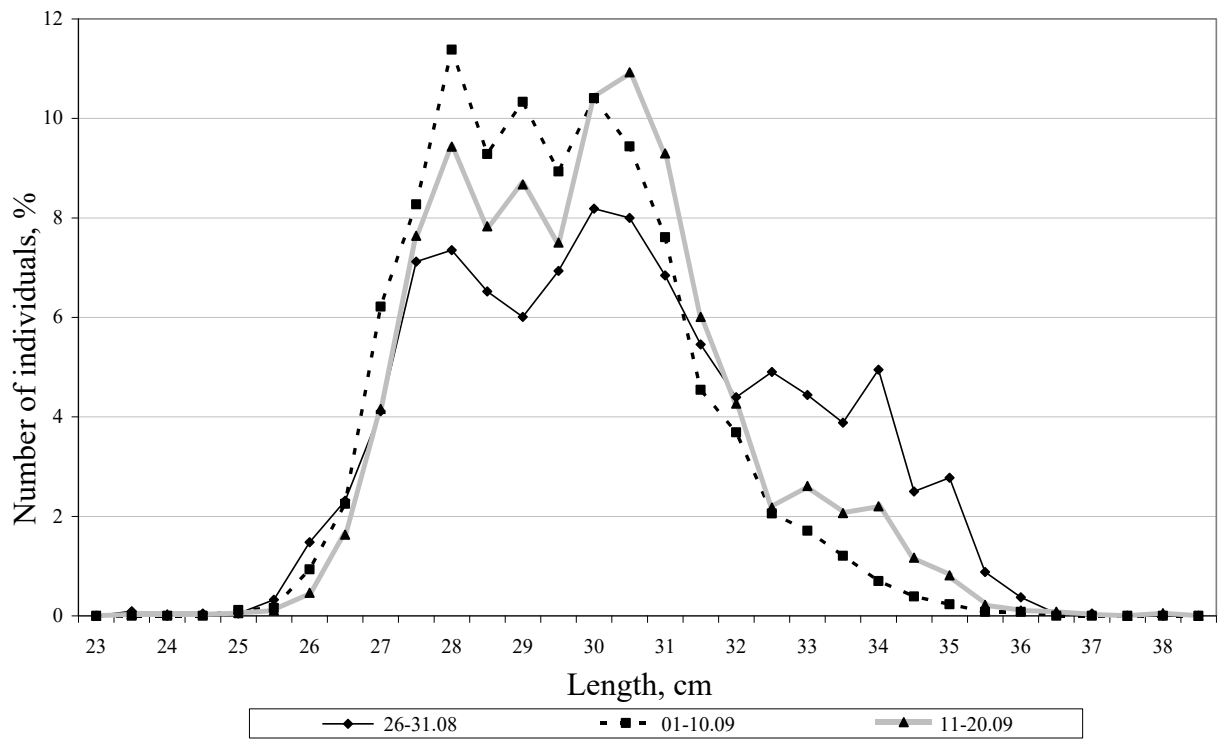


Fig. 3.2.2. Herring size composition in pelagic trawl catches in the West Bering Sea zone in August–September 2020 by fishing periods (26–31.08: N=2,163, M=30.39; 01–10.09: N=2,575, M=29.44; 11–20.09: N=3,679, M=29.91)

Table 3.2.2

Mean weight of herring (g) in pelagic trawl catches in the West Bering Sea zone  
in August–September 2020 by fishing periods

26.08–31.08	01.09–10.09	11.09–20.09
311	353	351

Table 3.2.3

Share of herring males and females and maturity stages (%) in pelagic trawl catches in the West  
Bering Sea zone in August – September 2020 by fishing periods

Sex	Maturity stages		
	II	III	Total, %
26–31.08			
♀	91.8	8.2	47.9
♂	15.0	85.0	52.1
01–10.09			
♀	93.5	6.5	49.8
♂	9.5	90.5	50.2
11–20.09			
♀	81.5	18.5	52.6
♂	9.8	90.2	47.4
Σ			
♀	88.1	11.9	50.4
♂	11.1	88.9	49.6

Fish length varied from 16 to 74 cm and averaged at 31.26 cm. Individuals 25–30 cm long dominated (50.4%) (Fig. 3.2.3). Mean weight was 0.447 kg.

Females dominated in catches – 53.9%. The majority of them had their gonads at maturity stage II-III (34.9%) and male gonads were at stage III (64.8%) (Table 3.2.4).

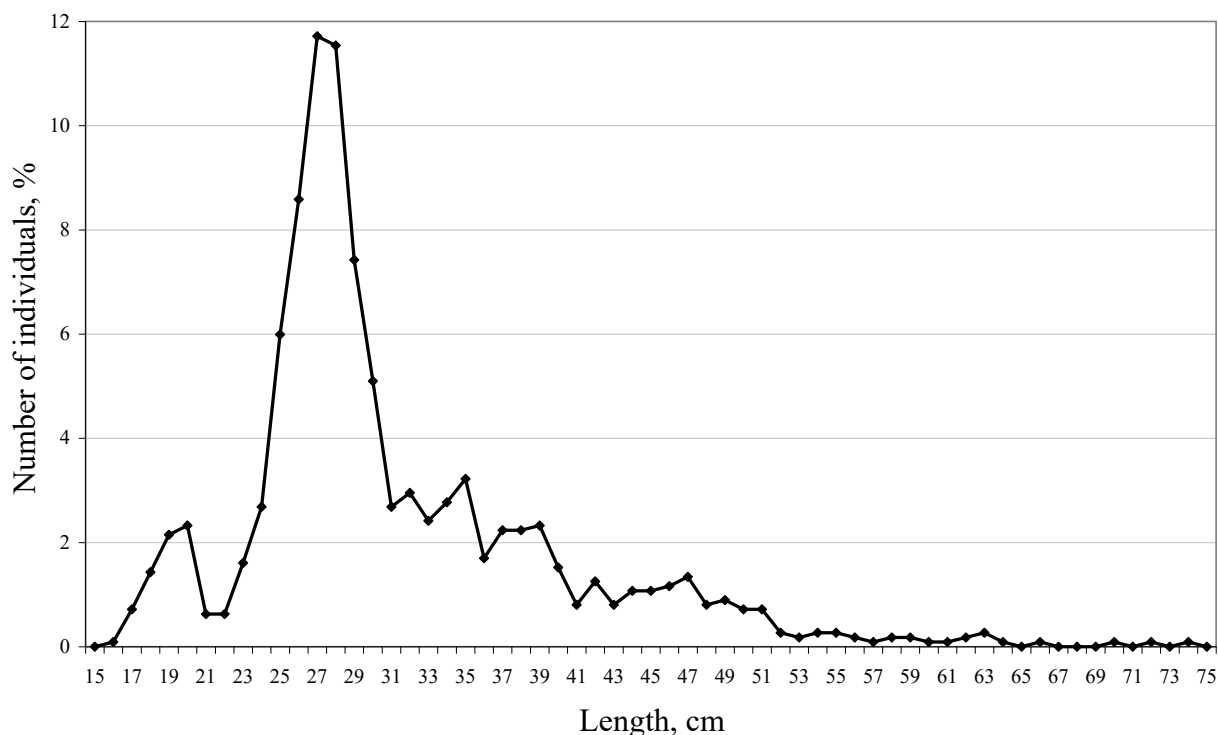


Fig. 3.2.3. Pollock size composition in pelagic trawl catches in the herring fishery in the West Bering Sea zone in August–September 2020 (N=393, M=31.97,  $W_{av}=0.388$ )

Table 3.2.4

Share of herring males and females and maturity stages (%) in pelagic trawl catches in the West Bering Sea zone in August–September 2020 by fishing periods

	II	II-III	III	IV	VI	VI-II	$\Sigma$
♀	15.7	34.9	21.7	2.4	14.5	10.8	53.9
♂	15.5	0.0	64.8	7.0	4.2	8.5	46.1

In the course of target herring fishing, chinook salmon (*Oncorhynchus tshawytscha*) was registered in 2 catches and coho salmon (*Oncorhynchus kisutch*) was registered in 5 catches.

Chinook catch per haul varied from 0 to 26.8 kg. Its length varied from 74 to 80 cm and its mean weight varied from 5.4 to 5.8 kg (Table 3.2.5).

Coho catch per haul varied from 0 to 208.9 kg. Its length varied from 47 to 80 cm and its mean weight varied from 2.2 to 3.4 kg.

Table 3.2.5

Chinook and coho salmon catch statistics for the West Bering Sea zone in August–September 2020

Card No.	Date	Latitude	Longitude	Depth	Lmin	Lmax	Mean weight, kg	Yield, ind.	Yield, kg
<i>Oncorhynchus tshawytscha</i>									
76	27.08.2020	62.4128	180.0948	88	74	76	5.35	5	26.75
93	09.09.2020	62.3798	180.0828	80	78	80	5.80	4	23.2
<i>Oncorhynchus kisutch</i>									

76	27.08.2020	62.4128	180.0948	88	54	60	2.24	60	134.58
78	28.08.2020	62.4308	180.2802	82	55	63	2.27	60	136.02
85	02.09.2020	62.2052	179.4902	91	47	64	2.28	70	159.39
93	09.09.2020	62.3798	180.0828	80	47	80	3.37	62	208.94
113	19.09.2020	61.4008	176.0912	134	55	62	2.30	28	64.4

### **3.3. INFORMATION ON BY-CATCH OF MARINE MAMMALS AND SEABIRDS**

No by-catch of seabirds and marine mammals was registered by observers in the course of fishing.

### **3.4. INFORMATION ON BY-CATCH OF VME SPECIES**

No by-catch of VME indicator species was registered.

## **CONCLUSION**

In total, KamchatNIRO's observer, working in the West Bering Sea zone in July–August 2020, recorded 116 trawl tows, analyzed 49 hauls, made 58 observations of by-catch of marine mammals and seabirds, carried out 16,623 massive measurements, 1,070 full biological analysis tests and 6,041 special biological analysis tests on various fish species.

50 fish species belonging to 17 families and 5 invertebrate species (groups of species) were registered during studies in the pollock fishery. Pollock was an absolute dominant both in abundance and weight of catches.

9 fish species belonging to 6 families were registered in catches in the herring fishery in August–September. Herring was absolutely dominating in catches both in abundance and weight terms.

Pollock catches per unit effort varied from 3,592.5 to 38,892.2 kg and averaged at 16,792.1 kg.

During July 25–31, length of individuals in catches varied in the range of 18–61 cm (45.8 cm on average), with size group of 44–51 cm dominating (70.0%). During August 01–10, pollock size varied from 19 to 71 cm (48.2 cm on average), with individuals sized 45–52 cm dominating (74.5%). During August 11–20, fish length varied in the range of 27–67 cm (50.4 cm on average), with individuals sized 46–54 cm dominating (74.4%). During August 21–31, fish length in catches varied in the range of 18–75 cm (46.8 cm on average), with individuals sized 44–51 cm dominating (60.4%).

Females dominated in catches (64.8% in total). Their share from fishing period to fishing period varied from 57.4% (21–31.08) to 73.4% (11–20.08). Female gonads were mostly at stages VI and VI-II (25.9% and 25.4% on average, respectively) and male gonads were at stage III (46.8%).

Herring catches per unit effort varied from 2,690.0 to 72,960.0 kg and averaged at 25,184.0 kg.

During August 26–31, length of individuals in catches varied from 23.5 to 37.0 cm (30.4 cm on average), with size group of 23.5–31.0 cm dominating (57.0%). During September 01–10, herring size varied from 25.0 to 36.0 cm (29.4 cm on average), with individuals 27.5–30.5 cm long dominating (68.0%). During September 11–20, fish length varied from 23.5 to 38.0 cm (29.9 cm on average), with individuals 28.0–31.0 cm long dominating (64.1%)

On average, females slightly dominated in catches (50.4%). Their share from fishing period to fishing period varied from 47.9% (26–31.08) to 52.6% (11–20.09). Female gonads were mostly at stage II (88.1% in general) and male gonads were at stage III (88.9%).

No by-catch of seabirds, marine mammals, and VME indicator species was registered.