Results of the pollock fishing season in the Sea of Okhotsk in 2017: view of KamchatNIRO specialists

One of the largest-scale Russian fisheries - pollock fishery in the Sea of Okhotsk - was in process from January 01 to March 31 in the northern part of the Sea of Okhotsk within West Kamchatka (61.05.2) and Kamchatka-Kuril (61.05.4) sub-zones and from January 01 to April 09 in the North Sea of Okhotsk sub-zone (61.05.1).

The specialists of Far Eastern fishery research institutes and, in particular, FSBSI KamchatNIRO traditionally provided active input to its information support. Observers from several institutes had been working onboard fishing vessels virtually since the very first days of the fishery: TINRO-Center – 12 persons, KamchatNIRO – 3, MagadanNIRO – 1. This fishing season's results were record-high in terms of the total number of observers (16 persons totally on mid-water trawlers), processed and analyzed fishing operations (over 1,000), biological tests on pollock and by-catch species (more than 200,000 individuals).

Huge massive of fishing and biological statistical information will be further processed and thoroughly analyzed but some results of the 2017 fishing season can be summed up already now.

Brief characteristic of meteorological and ice conditions during the fishing season

Meteorological conditions. A specific feature of meteorological conditions in the Northwest Pacific during the whole winter period (December 2016 – March 2017) was a westward shift of the Aleutian Depression relative to its average multi-year position. Its main focus was located above the ocean off Southeast Kamchatka (Fig. 1–4). This specific feature was caused by a large number of deep cyclones reaching this area and remaining in it. The unusual position of this depression is illustrated by distribution of the surface pressure anomaly. Thus, maximum positive deviations from normal were observed above Alaska Peninsula (January, February) and eastern part of the Bering Sea (March) where the anomaly is normally distributed. However, this area was influenced by an anticyclone in February and March.

The Aleutian Depression reached its peak in February. Surface pressure in its center was reaching 992 GPa which is 7GPa below normal. An intensive inflow of relatively warm sea air to this area occurred due to proximity of the depression to Kamchatka and surrounding offshore areas and resulting deep cyclones coming here from south. This circumstance, in turn, became the key reason for significantly "milder" winter weather and meteorological characteristics.

Ice conditions. The buildup of ice cover in the Sea of Okhotsk during December 2016 and January 2017 was generally in line with a multi-year scenario and in some periods its rate was even above normal (Fig. 5). However, the situation abruptly changed at the end of the first ten-day period of February due to intensification of cyclonic activities. As a result, ice cover growth virtually stopped and the process of ice cover breakup by wind and waves was prevailing. While the ice coverage in the Sea of Okhotsk was 65% in the first ten-day period of February which was 4% higher than normal, in the third ten-day period of March it declined to 42% which is 25% below its multi-year mean.

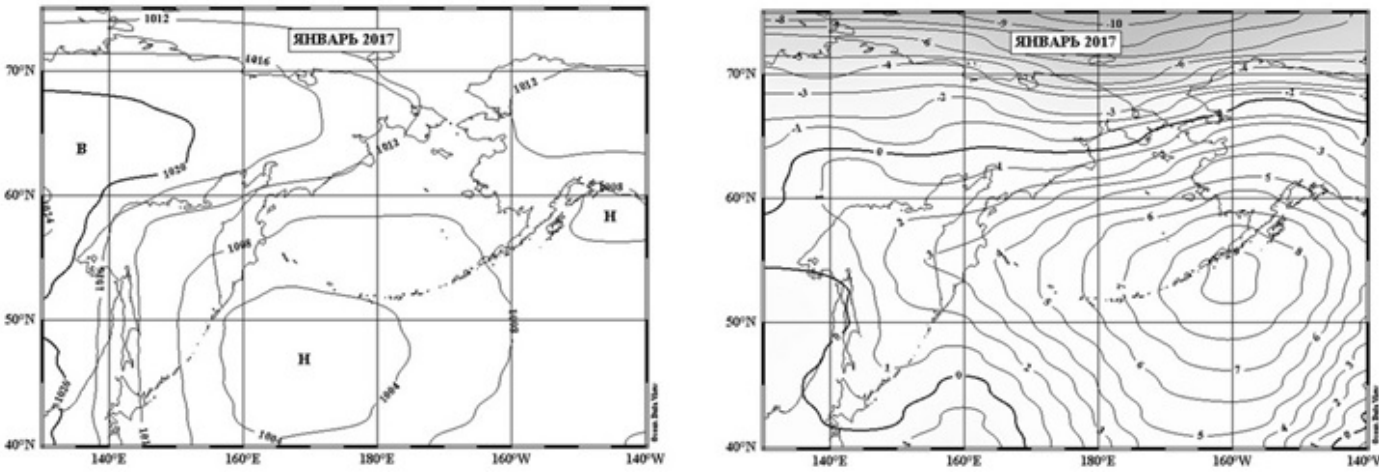

Fig. 1. Mean monthly field of surface atmospheric pressure and its anomalies in January 2017

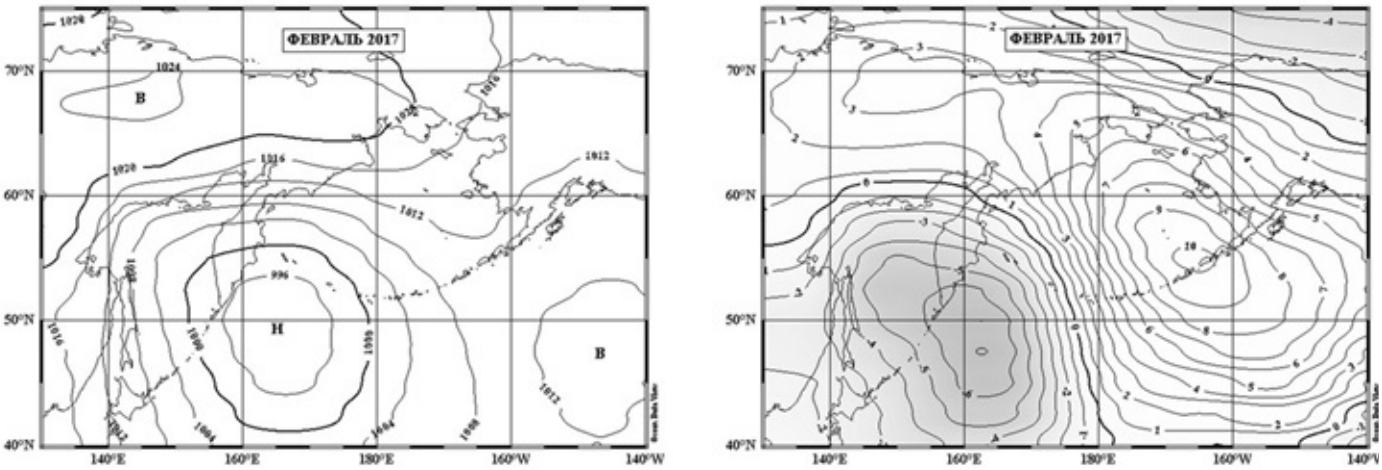

Fig 2. Mean monthly field of surface atmospheric pressure and its anomalies in February 2017

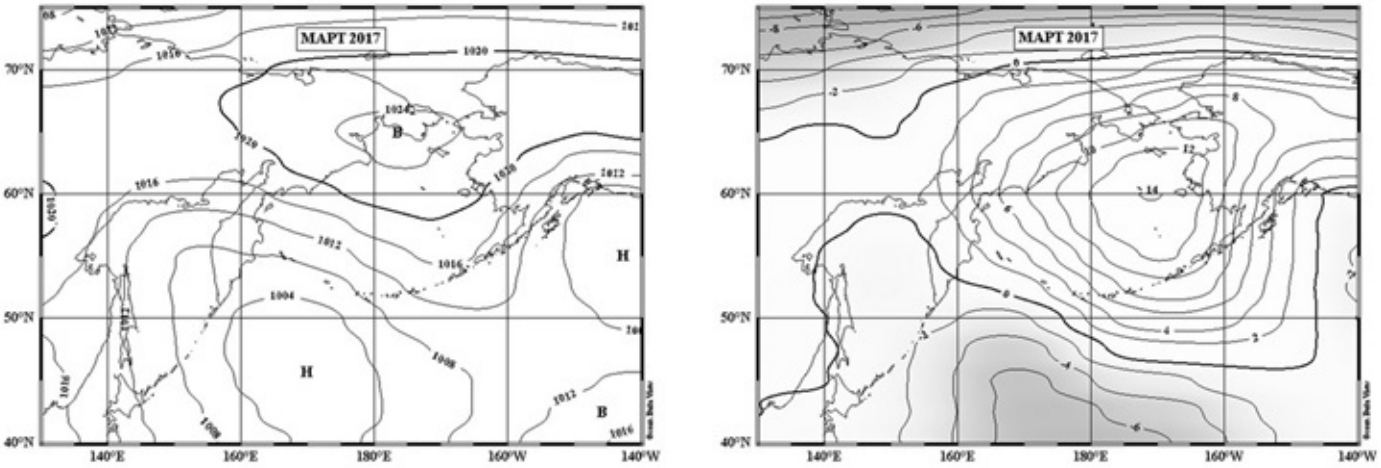

Fig 3. Mean monthly field of surface atmospheric pressure and its anomalies in February 2017

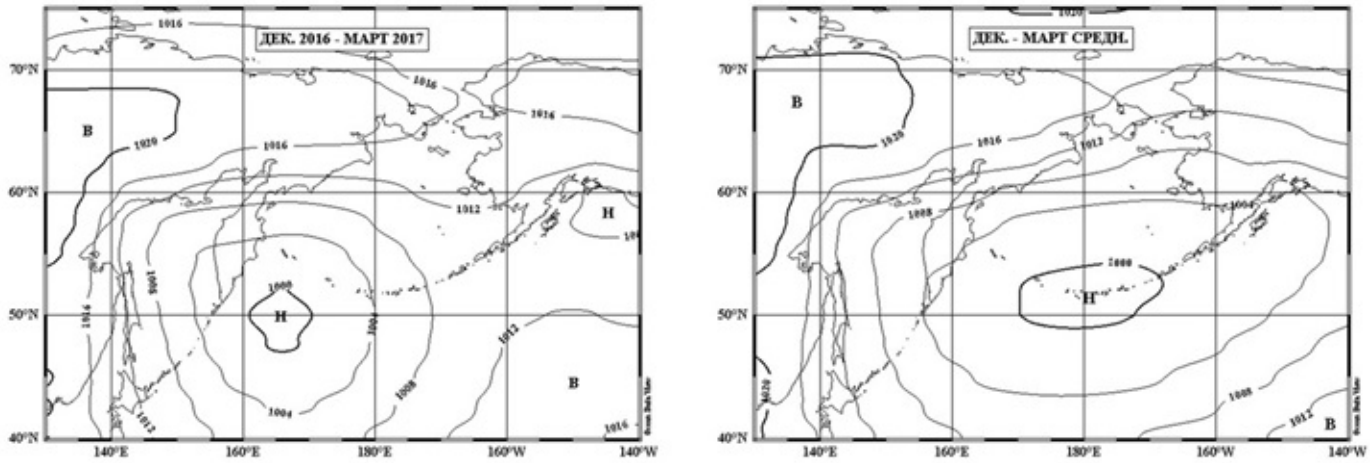

Fig. 4. The mean of surface atmospheric pressure for December 2016 through March 2017 and multi-year mean for the same period

In summary, due to domination of relatively warm conditions in February and particularly in March, this winter season in the Sea of Okhotsk may be characterized by “low ice coverage”.

The year-to-year variability of mean ice coverage in January – March presented in Fig. 6 is also indicative of the fact that ice coverage was below its multi-year mean in the past winter season. It should be taken into account that ice cover buildup and breakup processes proceeded unevenly during the season, with rather high values in January and abnormally low in March.

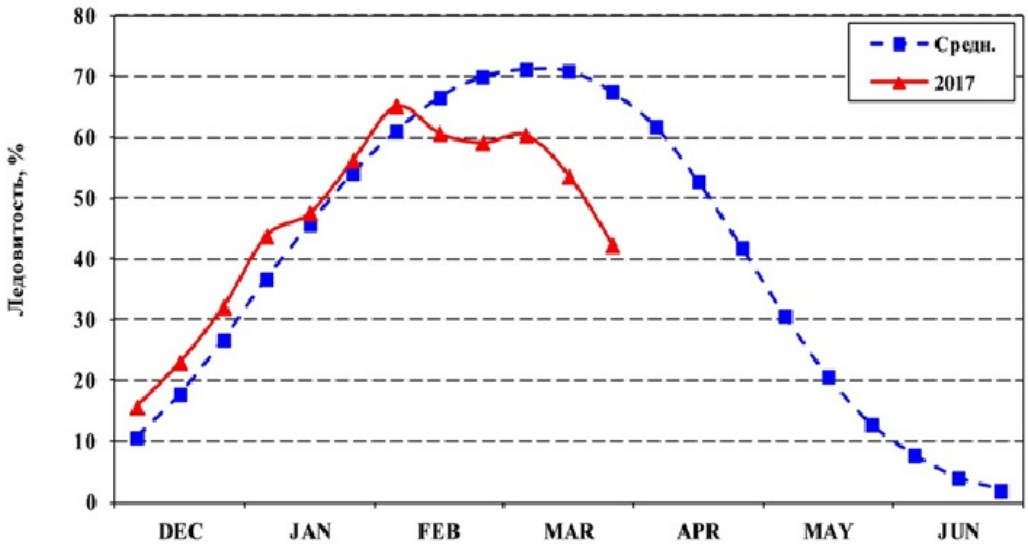

Fig. 5. Ice coverage variability in the Sea of Okhotsk in winter season (December 2016 – March 2017) and mean values for 1997 – 2014

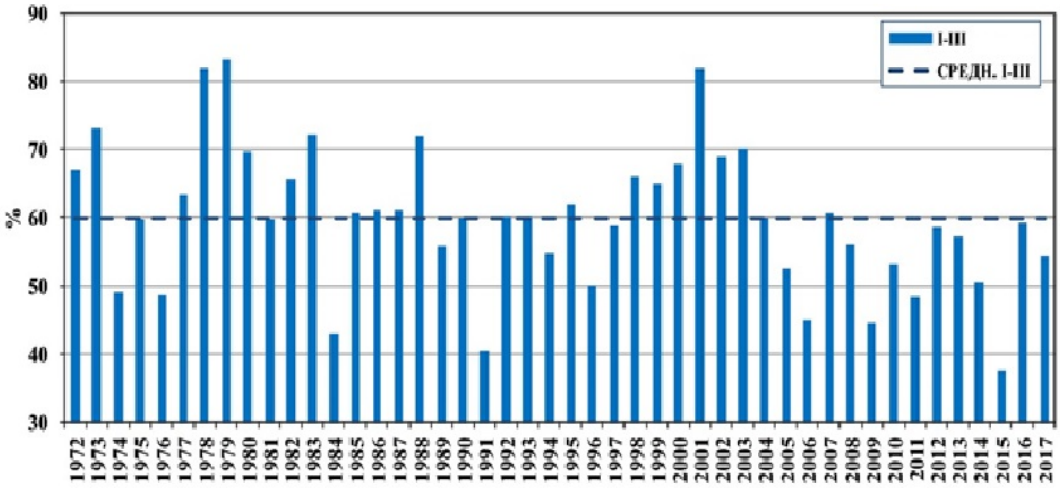

Fig. 6. Year-to-year ice coverage variation in the Sea of Okhotsk in January – March during 1972 – 2017

Sea surface temperature (SST) (ТПМ in figures below). According to satellite-based SST monitoring data, lower-than-normal temperatures dominated in the northeastern part of the Sea of Okhotsk in January and, on the contrary, increased temperatures were registered in February and March, particularly off West Kamchatka (Fig. 7–9).

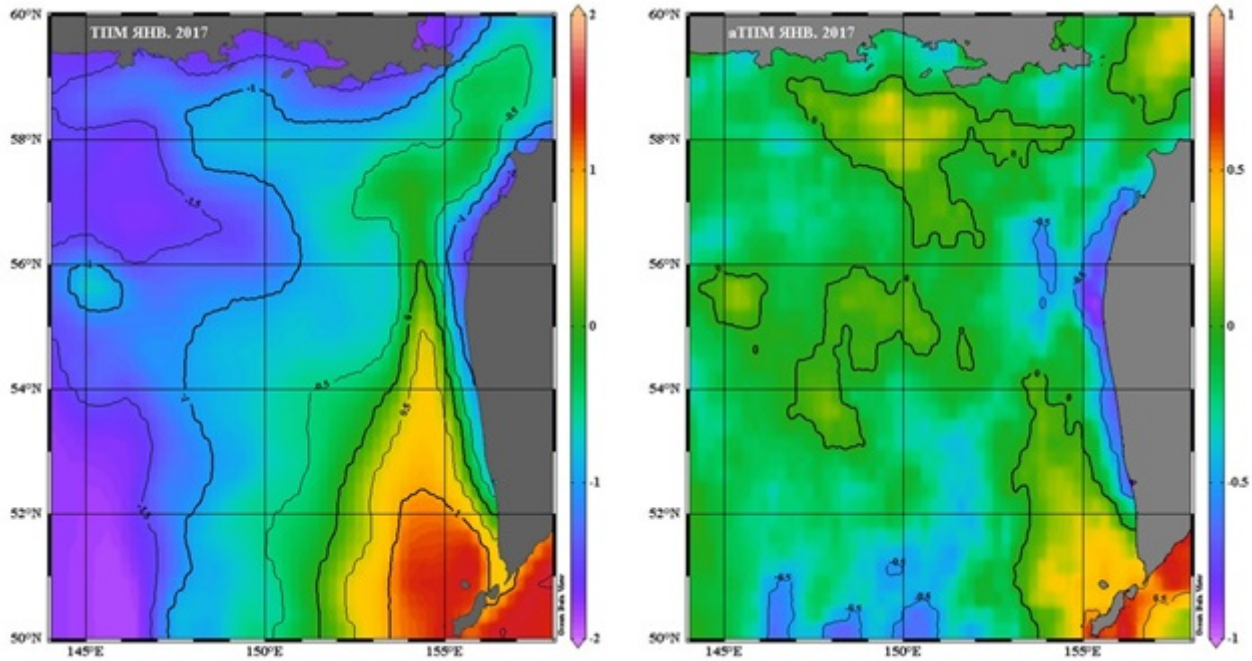

Fig. 7. Spatial distribution of sea surface temperature (ТПМ) and its anomalies (аТПМ)

in the northeastern part of the Sea of Okhotsk in January 2017

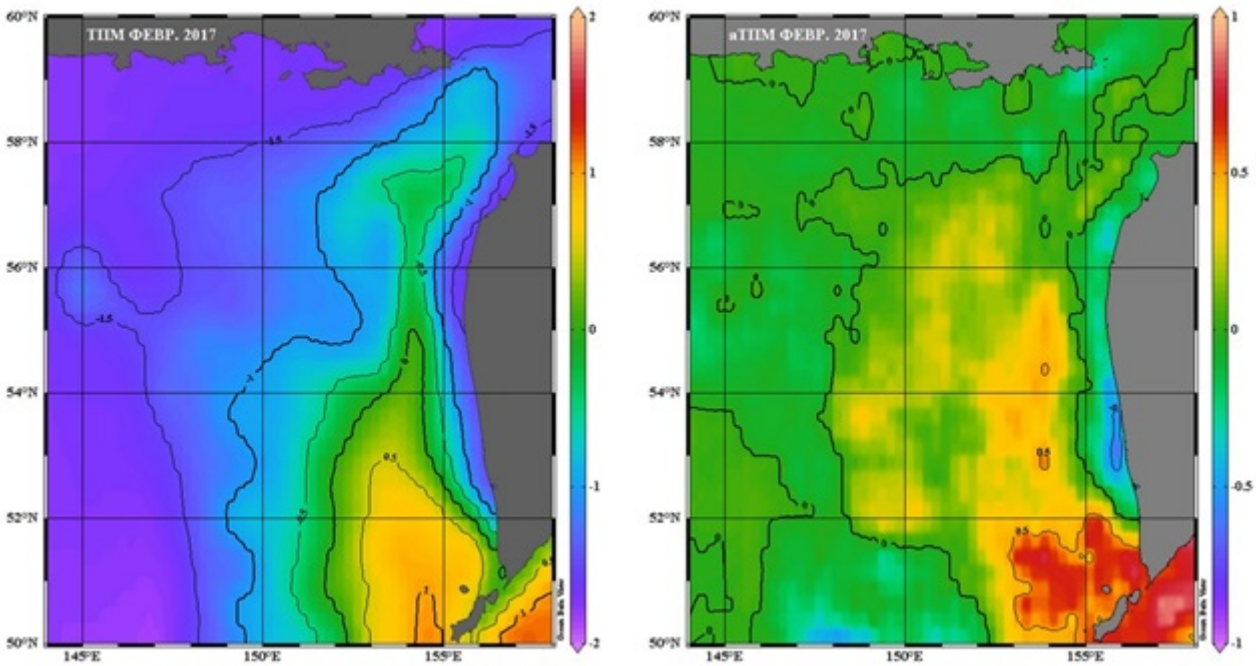

Fig. 8. Spatial distribution of sea surface temperature (ТПМ) and its anomalies (аТПМ) in the northeastern part of the Sea of Okhotsk in February 2017

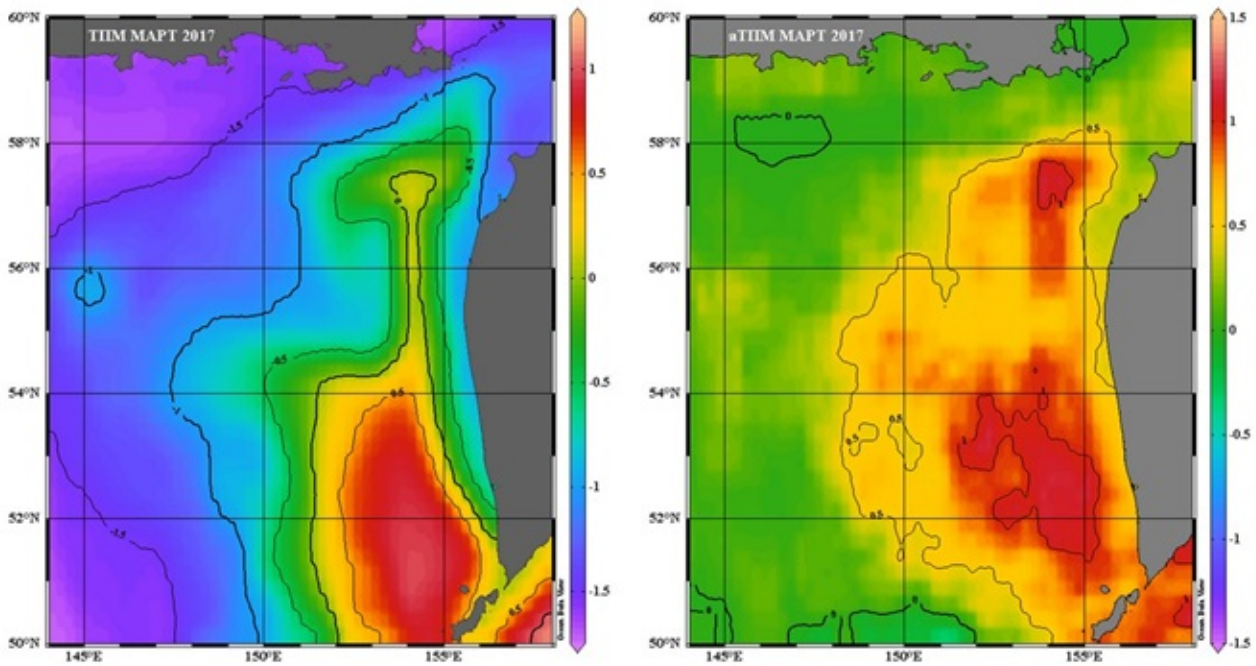

Fig. 9. Spatial distribution of sea surface temperature (ТПМ) and its anomalies (аТПМ) in the northeastern part of the Sea of Okhotsk in March 2017

Fig. 10 shows a curve of intra-seasonal variation of the water temperature at its surface and its anomalies averaged for the northeastern part of the Sea of Okhotsk (the area of averaged data corresponds to the area presented in SST spatial distribution maps). According to this Figure, SST values varied insignificantly during the first half of January – within 0.3°C. The values of SST anomaly were primarily below-zero (minus 0.2–0.4°C).

Intensive cooling of the sea surface has continued since the latter half of January but lasted for a short time only – till that month's end. The surface temperature, average for the area under consideration, has lowered to –1.1°C by that time which is 0.1–0.3°C below normal. When a strong warm southern cyclone arrived in the area in the first ten-day period of February, atmospheric circulations abruptly changed their directions and cyclones started coming more frequently thereafter. As a result, intensive seasonal cooling of surface waters discontinued and SST values were remaining at roughly same level during February varying in the range of –0.8 to –1.2°C. Surface temperature anomaly values steadily moved to the "+" side of the axis and amounted to 0.1–0.2°C. Since early March and till presently, surface temperatures, average for the area under consideration, have started steeply rising and reached –0.6°C by early April. The anomaly has also considerably grown during this period and amounted to ≈0.6–0.7°C as of the end of the first ten-day period of April.

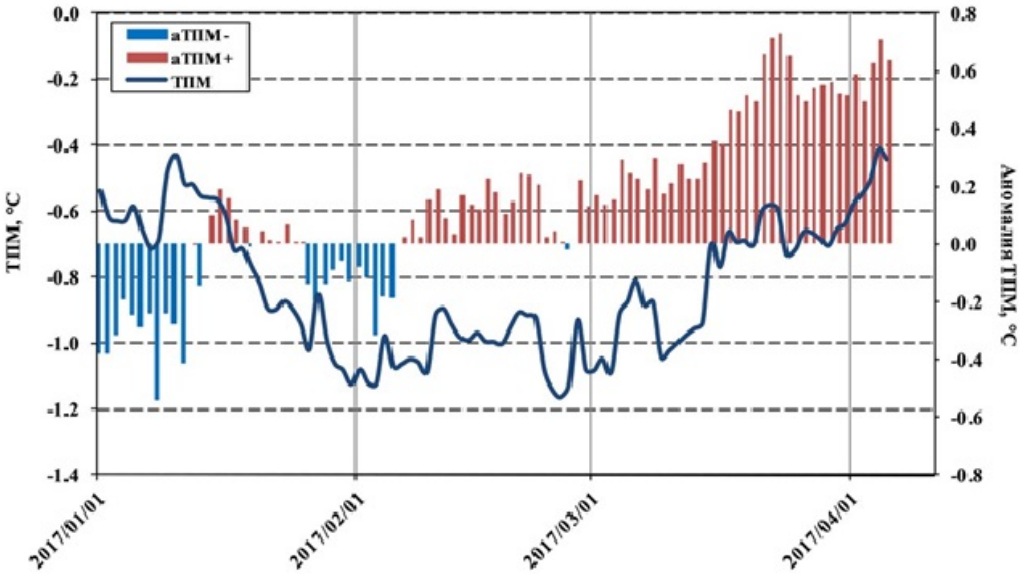

Fig. 10. Temporal variation of surface temperatures (ТПМ in the Figure) and its anomaly (аТПМ) in the northeastern part of the Sea of Okhotsk during January – early April 2017

Based on year-to-year SST variability data for the northeastern part of the Sea of Okhotsk, averaged for January – March 2017 (Fig. 11) and taken separately for each month (Fig. 12), the following conclusions can be made:

1. January 2017 was relatively cold and comparable with January 2016 and January 2012
2. Surface temperature in February corresponded to its multi-year mean and was close to values of 2012, 2013 and 2014.
3. "Abnormally warm" conditions were observed in March. In recent years, similar values were registered in 2008 and 2009.
4. On average, the January – March season of 2017 turned out close to its multi-year mean. Among latest winters, the most similar seasons were observed in 2013 and 2014.

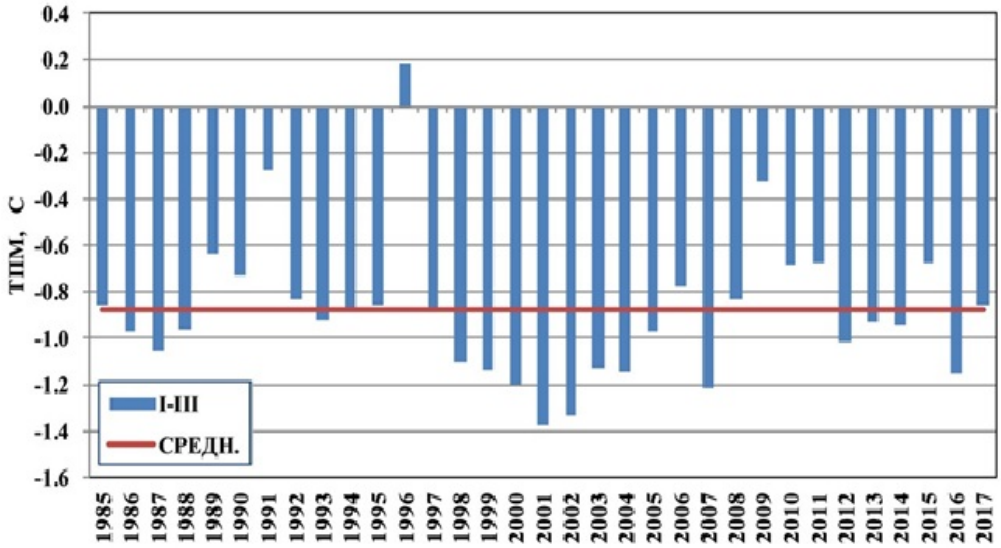

Fig. 11. Multi-year variation of mean surface water temperature in January – March in the northeastern part of the Sea of Okhotsk during 1985 – 2017

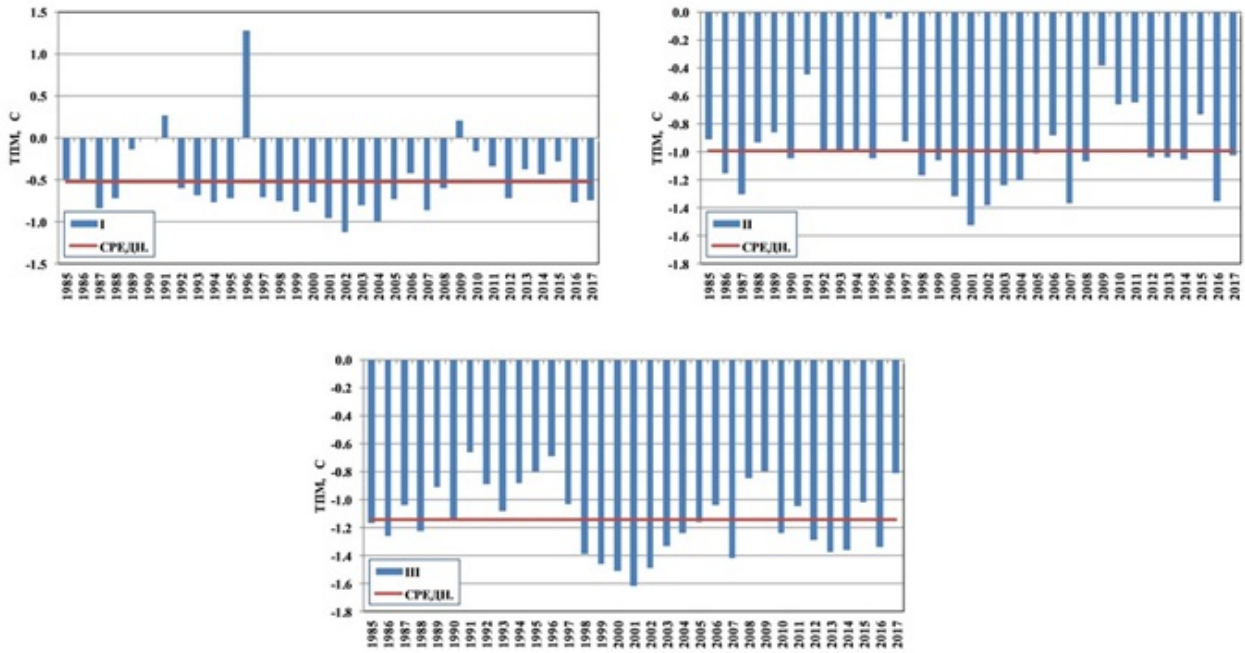

Fig. 12. Year-to-year variation of mean surface water temperature in January (I), February (II) and March (III) in the northeastern part of the Sea of Okhotsk during 1985 – 2017

In summary, according to sea surface temperature satellite-based monitoring data, lower-than-normal temperatures dominated off West Kamchatka in January, while increased temperatures were observed in February and March.

As a result of active cyclonic processes, abnormally warm conditions with little ice were registered in February and particularly in March. While the last year's fishing situation was largely affected by severe ice conditions, in this year it was affected by more active cyclonic processes and, as a consequence, more frequent storms.

Characteristic of fishing situation

Same as in 2016, pollock TAC in 2017 in sub-zone 61.05.1 is 348.0 thsd tons, 61.05.2 — 348.0 thsd tons, 61.05.4 – 270.7 thsd tons. Same as in 2010–2016, pollock fishery in sub-zones 61.05.2 and 61.05.4 in 2017 was using a common TAC for both sub-zones equal to 618.7 thsd tons.

According to Vessel Daily Report (VDR) data from the Industry Monitoring System (IMS) of the Federal Fisheries Agency, 179 catching vessels of various types (172 ones in 2016) belonging to 70 Far Eastern companies were engaged in the target pollock trawl fishery in the 2017 fishing season (Table 1). Traditionally, Primorsky Region's flotilla was the largest, with Sakhalin and Kamchatka ranking second and third respectively. Primorsky Region was the leader in total catch as well, with Kamchatka and Sakhalin Regions ranking second and third.

Table 1. Performance of Far Eastern companies in the pollock fishery in the Sea of Okhotsk in January – early April 2017

Region	Target trawl fishery				Total catch, tons	
	Number of companies	Number of ships	Number of ship-days	Number of hauls	Specialized trawls	All fishing gear types
Primorsky Region	21	71	3441	7801	306359	306426
Sakhalin Region	16	39	1819	4171	155825	158427
Kamchatka Region	17	38	1970	5257	225220	256444
Magadan Region	2	3	241	608	19107	19107
Khabarovsk Region	14	28	1191	2948	116775	118618
Total	**70**	**179**	**8662**	**20785**	**823286**	**859022**

Pollock catch by pelagic trawls harvested in a commercial fishery mode in the RF EEZ (target fishery) by all vessels has totaled roughly 823.3 thsd tons by 10 April 2017 which is more than a year ago (766.8 thsd tons) (Table 2). Another 35.7 thsd tons (36.2 thsd tons in 2016) was produced by other fisheries, primarily Danish seine fishery off West Kamchatka. Total pollock catch in Season A was 859.0 thsd tons and TAC use percentage was 88.9%. In the last year, fishing season in the North Sea of Okhotsk sub-zone came to an end 9 days earlier. This circumstance partly explains why catch was higher in this year both in absolute and relative terms (802.7 thsd tons or 83.1% of TAC in 2016).

Table. 2. Pollock TAC, catch and percentage of TAC used by sub-zones in the northern part of the Sea of Okhotsk in January – April 2017

Sub-zone	TAC, thsd tons	Number of ship-days in target trawl fishery	Number of hauls in target trawl fishery	Total catch, tons		% of TAC use by all fishing gear types since year's beginning, %
				Specialized trawls	All fishing gear types	
61.05.1	348.0	3387	7942	334295	336138	**96.7**
61.05.2	348.1	2339	5354	207070	227373	**84.5**
61.05.4	270.7	3062	7489	281921	295509	
Total	**966.7**	**8788**	**20785**	**823286**	**859020**	**88.9**

A total of 522.9 thsd tons was produced off West Kamchatka in January – March which by more than 10 thsd tons exceeds catch of the last years (511.1 thsd tons). Same as in 2016 and in 2009–2012, largest pollock catches off West Kamchatka were harvested in Kamchatka-Kuril sub-zone (56.5%).

One of the reasons why fishermen harvested 56.3 thsd tons more in Season A of 2017 than in the last year is a longer duration of the fishing season in the North Sea of Okhotsk sub-zone, a larger number of catching vessels and, accordingly, a larger number of fishing operations (8,788 and 7,945 ship-days, 20,785 and 19,592 hauls respectively), although mean catch per ship-day for trawlers was somewhat lower than in the last year (93.7 and 96.5 tons respectively).

In January 2017, unlike in 2016, the pollock fishery was concentrated in Kamchatka-Kuril sub-zone (Fig. 13–14, Table 3). Some 146.1 thsd tons was harvested here during one month. For comparison, only some 24.6 thsd tons of pollock was harvested in this sub-zone in January 2016 and the bulk of catch was produced in the North Sea of Okhotsk sub-zone (125.2 thsd tons). On some days, the number of vessels in January 2017 in sub-zone 61.05.4 reached 76, with maximum and mean daily catch being nearly 9.0 and 4.7 thsd tons respectively. Mean catch per vessel was varying in a broad range and averaged at 96.9 tons. Fishing intensity was much lower in other sub-zones and fishing areas were traditional: in the North Sea of Okhotsk sub-zone – Kashevarov Bank, in West Kamchatka sub-zone – area between 56 and 57 parallels and at the entrance to Shelikhov Bay. Total catch in all areas of the northern part of the Sea of Okhotsk in January 2017 was 195.5 thsd tons which is more than in the last year (176.0 thsd tons).

Table 3. Dynamic of mean daily and total catch, number of vessels and catch per 1 vessels in the pollock fishery by sub-zones and months during the fishing season of 2017

Month	Mean daily catch, tons	Total catch, tons	Number of ships	Mean catch per 1 vessel
61.05.1	50-3198/725*	**January**	2-54/16	19.6-86.4/46.3
61.05.2	18-3407/866	22466	1-38/14	13.3-111.4/51.3
61.05.4	427-8956/4714	26841	7-76/47	57.2-135.7/96.9
		146149		
61.05.1	147-6581/2265	**February**	3-73/29	38.2-110.1/73.5
61.05.2	831-4809/2838	63414	15-62/36	50.2-115.3/79.3
61.05.4	1011-7018/3762	79464	9-83/49	54.0-138.0/83.6
		105324		
61.05.1	2057-10340/6306	**March**	30-78/54	68.6-140.7/112.8
61.05.2	1305-7593/3903	195499	22-66/46	43.9-131.1/81.5
61.05.4	372-2289/1417	120996	7-42/23	36.3-109.6/64.5
		43914		
61.05.1	3482-7647/6084	**April 01-09**		
		54759	30-59/51	84.9-139.3/119.1

* – min-max/mean

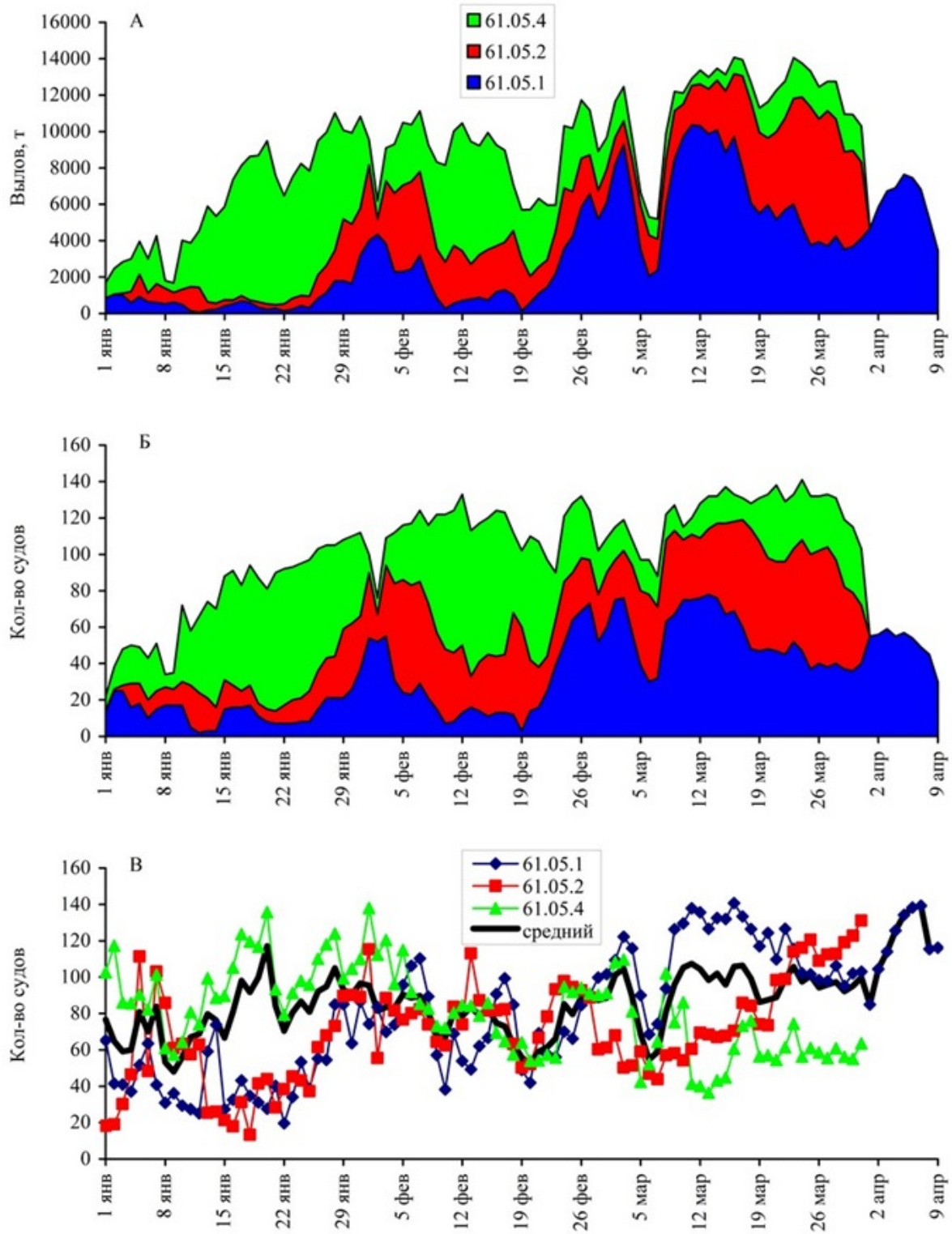

Fig. 13. Dynamic of daily catch (A), number of vessels (Б) and mean catches per 1 vessel (B) in the northern part of the Sea of Okhotsk in January – first ten-day period of April 2017

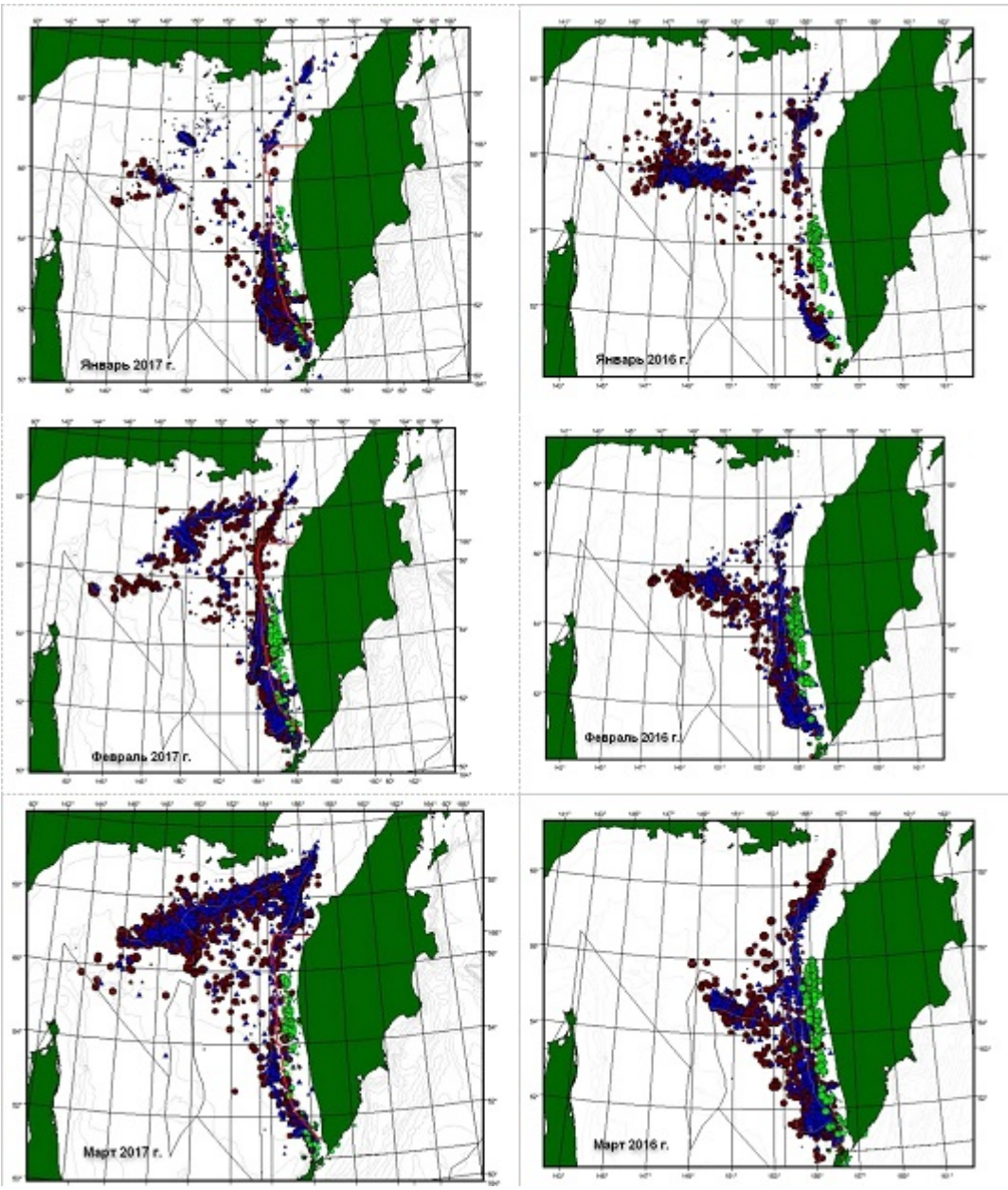

Fig. 14. Chart of fleet distribution in the pollock fishery in the northern part of the Sea of Okhotsk in January – first ten-day period of April 2017 (left) and January – March 2016 (right) (circles – large-tonnage vessels (trawls), blue triangles – medium-tonnage vessels (trawls), green diamonds - all vessel types (Danish seines)

The Kamchatka-Kuril sub-zone was remaining the main fishing area in February. The catch in this area noticeably reduced from January and amounted to 105.3 thsd tons (see Fig. 13–14, Table 3). Up to 83 vessels of various types operated on some days, with an average being 49 vessels per day. Maximum and mean catch also reduced and amounted to 7.0 and 3.8 thsd tons respectively. Mean catch per 1 vessel somewhat reduced as well (83.6 tons). On the contrary, total pollock catch in the West Kamchatka and North Sea of Okhotsk sub-zones significantly grew, primarily due to an increased number of catchers and mean catch per 1 vessel; still, both figures were lower than in the Kamchatka-Kuril subzone. Total monthly pollock catch in all sub-zones amounted to 248.2 thsd tons compared with 285.4 thsd tons in the same period of the last year.

In March 2017, due to worsened meteorological and fishing conditions in the Kamchatka-Kuril sub-zone, the focus of fishing activities moved to the North Sea of Okhotsk and West Kamchatka sub-zones (see Fig. 14) where 195.5 and 121.0 thsd tons of pollock was harvested respectively (see Fig. 13, Table 3). Up to 78 vessels operated in sub-zone 61.05.1 simultaneously and their mean monthly number was 54. Daily catch reached 10.3 thsd tons, with a mean being 6.3 thsd tons. Mean catch per vessel was at its highest among all sub-zones and amounted to 112.8 thsd tons. In the West Kamchatka sub-zone, up to 66 vessels operated simultaneously in that month and their mean monthly number was 46. Daily catch varied in the range of 1.3 to 7.6 thsd tons and averaged at 3.9 thsd tons. Mean catch per 1 vessel was considerably lower than in the North Sea of Okhotsk sub-zone. Total monthly pollock catch in all sub-zones amounted to 360.4 thsd tons compared with 341.5 thsd tons in the same month of the last year.

During April 01–09, 54.8 thsd tons of pollock was harvested in the North Sea of Okhotsk sub-zone (see Fig. 13, Table 3). Vessel number was 30 to 59 and averaged at 51. Mean daily catch and mean catch per 1 vessel was approx. 6.1 thsd tons and 119.1 tons respectively. Fishing was performed in Kashevarov Bank and on northwestern slopes of the TINRO Depression (see Fig. 14).

In general, as the number of catchers and their fishing efforts was increasing, total daily pollock catch in the northern part of the Sea of Okhotsk during the 2017 fishing season was gradually rising: from 1.47 thsd tons in early January to 11.0 thsd tons at the end of that month (see Fig. 13). It was remaining at roughly the same level till the end of the first ten-day period of February and then abruptly fell almost two times in the second ten-day period of that month, obviously due to bad weather conditions. By the end of February, daily catch recovered to its level in January and again abruptly fell in early March due to same reason. From the second ten-day period of March and till the month's end, catches were steadily high and averaged at 12.6 thsd tons/day.

Upon comparison of fishing conditions in this pollock fishing season and last year's fishing season, it can be stated that, in general, they were more favorable despite a larger number of storm days.

By data of KamchatNIRO observers directly from fishing areas, fish length varied from 29 to 54 cm in the target pollock trawl fishery in January 2017 in the Kamchatka-Kuril sub-zone – main fishing area in this month, with size groups of 40–43 cm dominating (51.8%) and average length being 41.6 cm (Fig. 15), the majority of such individuals belonging to the 2011 year class. Mean percentage of individuals under commercial size was 9.2%.

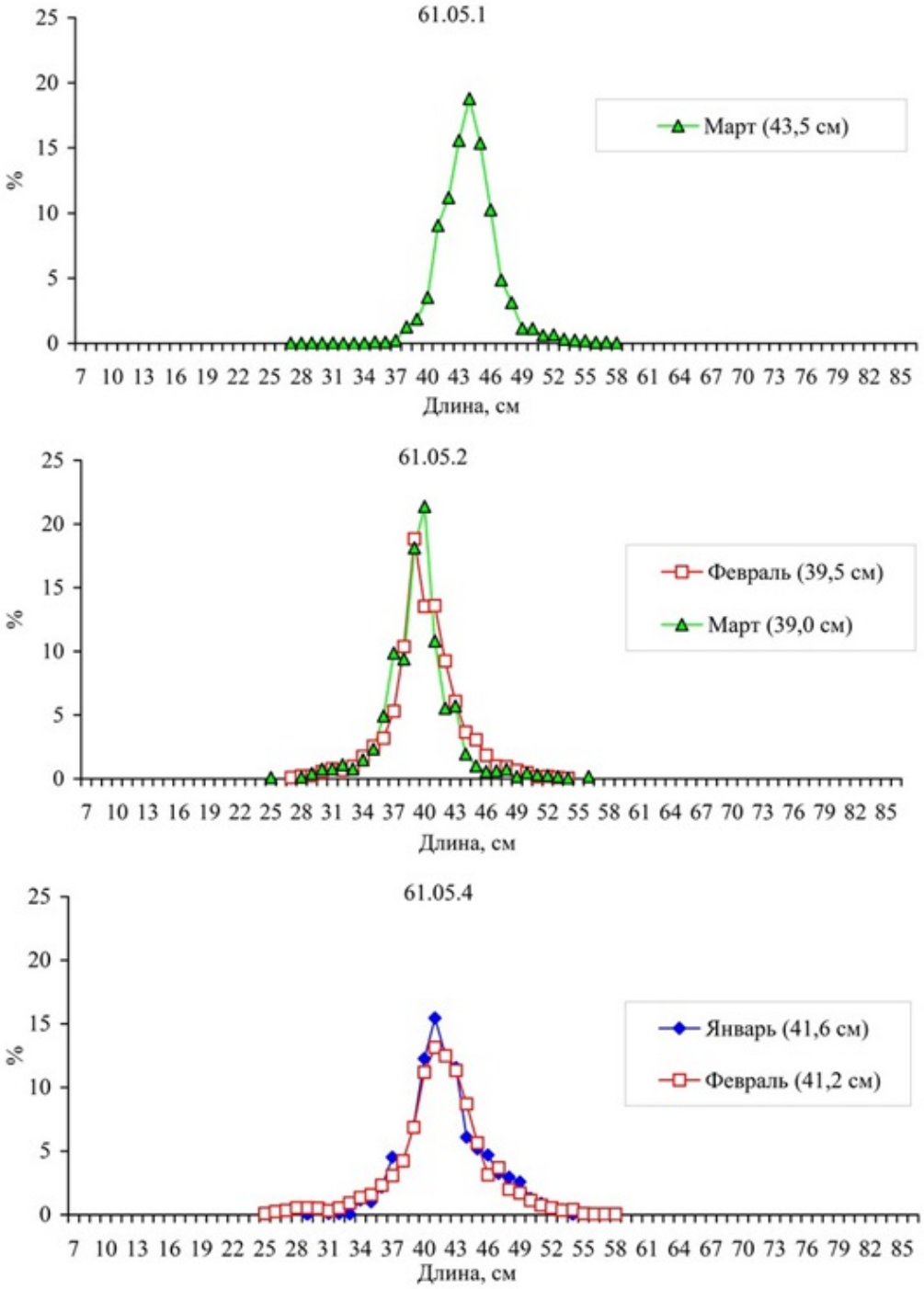

Fig. 15. Pollock size distribution in commercial trawl catches in January – March 2017 in the northern part of the Sea of Okhotsk

One month later, pollock size distribution in catches in sub-zone 61.05.4 virtually did not change (see Fig. 15). In sub-zone 61.05.2, fish length varied in the range of 27 to 54 cm, the bulk of catch being size groups of 38–41 cm (56.3%) of the strong year-class born in 2011. Mean length was 39.5 cm.

In March, fish length in sub-zone 61.05.1 varied from 27 to 57 cm, with 7-8-old individuals 42–46 cm long dominating (71.2%). Mean length was 43.5 cm. In the West Kamchatka sub-zone, pollock size distribution in catches virtually did not change compared with February.

According to data obtained by KamchatNIRO observers, pollock size distribution in Danish seine catches off West Kamchatka significantly differed from trawl catches. In February, fish length varied from 30 to 58 cm, with size groups of 43–47 cm dominating at an average length of 43.4 cm (Fig. 16). In March, the bulk of catches were individuals 39–42 cm long (40.2%) and mean length was 42.3 cm.

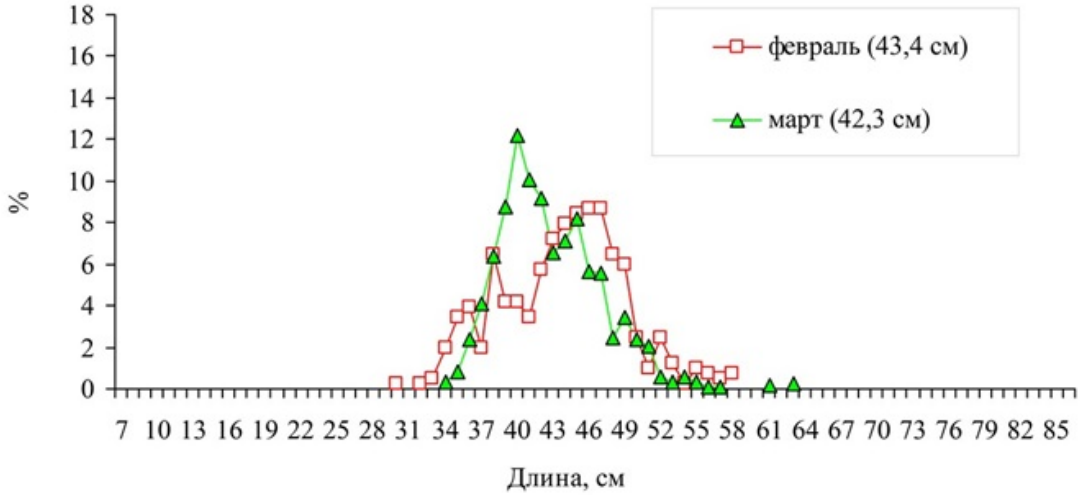

Fig. 16. Pollock size distribution in commercial Danish seine catches in February – March 2017 in the northern part of the Sea of Okhotsk

In summary of the above said, we can state that this year's fishing season generally confirmed scientists' opinion that the current status of the North Sea of Okhotsk pollock stock is quite favorable (above average). Obvious evidence of that is catch volumes, quantitative and qualitative composition of pollock in commercial catches. This fishing season's differences from the last year's one, highlighted in this overview, are explained largely by hydrological, thermal and ice particular features in this year which were reflected in the timing of spawners arrival to their spawning grounds, distribution of commercial aggregations of pollock and, accordingly, distribution of catching flotillas by fishing areas.

In conclusion, we would like to express our sincere gratitude to fishing company managers and vessel crews: *"Irtyshsk" Freezer Trawler (PJSC "Okeanrybflot"), "Mikhail Staritsyn" Freezer Trawler (Collective farm named after V.I. Lenin), "Ogni" Refrigerated Seiner-Trawler ("Kamchattralflot" LLC), "Sibir" Fishing-boat (Sfera-Marine LLC)* who accommodated KamchatNIRO staff on their board for surveys during the pollock fishery in the Sea of Okhotsk. As a result, scientists have a full volume of necessary biological and statistical information which will be a basis for the Sea of Okhotsk pollock stock assessment in 2017, forecasting of its resources and TAC for 2019.

Original text at KamchatNIRO webpage is here.