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Title USE OF A DEEP-WATER LONGLINE OF THE "SPANISH TYPE» AND HIS MODIFICATIONS IN THE RUSSIAN RESEARCH OF ROSS SEA TOOTHFISH DURING THE SEASON 2004/05-2005/06.

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ABSTRACT

The description of a design of longline of the "spanish type" on European hake (Merluccius merluccius) fishery in the coastal and deep waters of the North Atlantic and its modifications used on fishery of Antarctic toothfish (D. mawsoni) and Patagonian toothfish (D. eleginoides) in waters of the Antarctic Region is given. The operational experience by the longline of the «spanish type» by two vessels under the Russian flag ("Yantar" and "Volna") in Antarctic waters (seasons 2004/05-2005/06) is described.

SUMMARY OF FINDINGS AS RELATED TO NOMINATED AGENDA IYEMS

Agenda item:
Findings

Use of a deep-water longline of the "spanish type» and his modifications in the Russian research of Ross sea toothfish during the season 2004/05-2005/06.

Kokorin N.V., Istomin I.G. (VNIRO)

The description of a design of longline of the " spanish type " on European hake (Merluccius merluccius) fishery in the coastal and deep waters of the North Atlantic and its modifications used on fishery of Antarctic toothfish (D. mawsoni) and Patagonian toothfish (D. eleginoides) in waters of the Antarctic Region is given. The operational experience by the longline of the «spanish type» by two vessels under the Russian flag ("Yantar" and "Volna") in Antarctic waters (seasons 2004/05-2005/06) is described.

In Antarctic waters two vessels (*"Yantar"* and *"Volna"*) under the Russian flag conduct four season research (2002/03-2005/06) on fishery on Antarctic toothfish (*D. mawsoni*) and Patagonian toothfish (*D. eleginoides*) in the Ross sea, collecting the data on biology of the object fishery and techniques of the fishery. As the gear of fishing during all the period of research the deep-water longline of the «spanish type» and its some modifications were used.

As the design features of the deep-water longline of the "spanish type» and its modifications cause the fair interest of fishery specialists in the various countries-participants of CCAMLR, in the present article we give the information available in our disposal.

Hooking gear received the name of longline of the "spanish type" is long used by the Spanish fishermen in the coastal waters of the North Atlantic on the European hake (*Merluccius merluccius*) fishery and only in the 1960s with the development of deepwater fish stocks its modification, a deep-water longline, appeared. Thus, now depending on the area (depths) of European hake fishery fishermen use two modifications of a longliner of the "spanish type": for fishing on the shelf (at the average depths of about 125-130 m) and on the continental slope (from 250 down to 550 м).

The scheme of a longline of the "spanish type" for fishing on European hake in shelf waters in its working position is shown on Fig. 1.

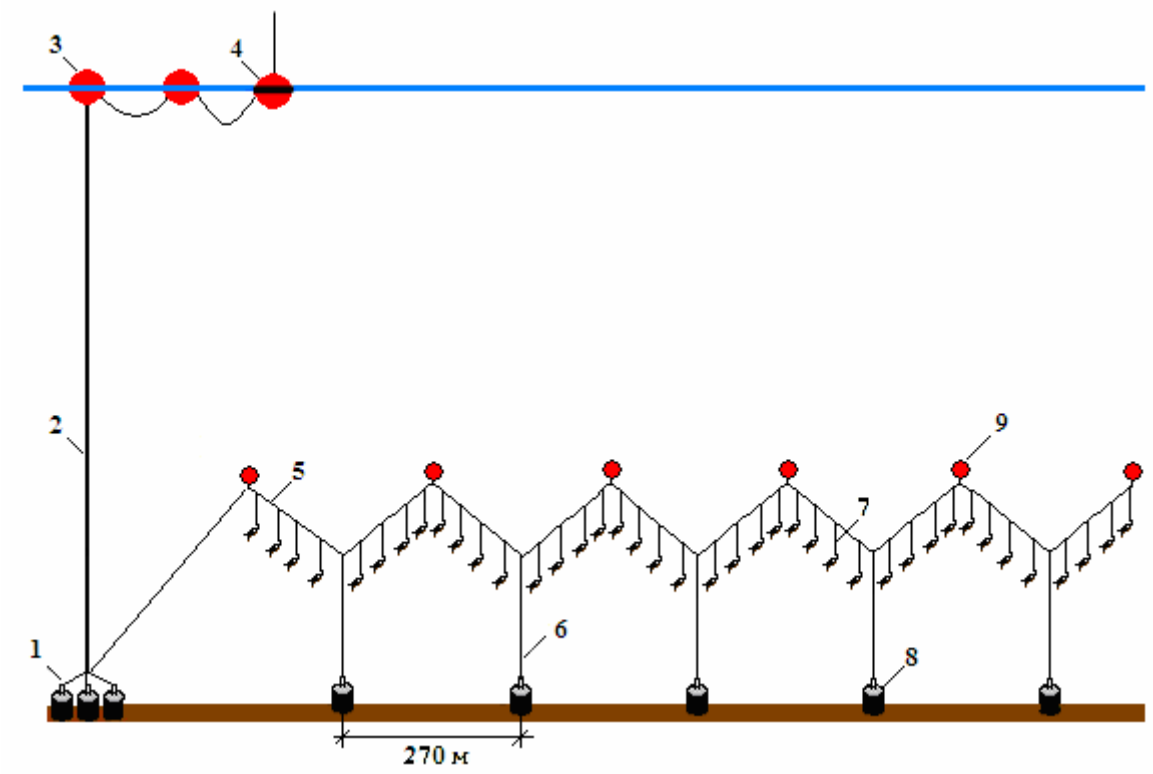

Fig. 1. Longline of the «spanish type» for fishing on European hake on the shelf:
1 - three concrete anchor loads with weight of 40 kg each ; 2 – buoy rope, Ø 12 mm; 3 - buoy;
4 – radio buoy; 5 - mainline, Ø 1,8-2 mm; 6 - rope ("barandija") from polypropylene, Ø of 8 mm;
7 – hooking snood, Ø 0,7 mm and length of 1,8 m; 8 – load with weight of 3-4 kg;
9 - buoy, Ø 100 mm

To the buoy rope (2) with the diameter of 12 mm three buoy (3) are attached from one end, including radio buoy (4), and from another - three concrete anchor load with weight of 40 kg each.

Mainline (5) with the diameter of 1,8-2 mm consists of the sections of the 270 m length. Each of them has 90 nylon hooking snoods (7) with length of 1,8 m and diameter of 0.7 mm. Snoods are attached to mainline on a distance of 3 m from each other. Usually during fishing on European hake hooks of the small size (No.12-14) are used. European sardine (*Sardina pilchardus*) is traditionally used as a bait.

For submersion of a mainline of the baited longline and its deduction on the bottom to the ends of each section of a longline by means of kapron rope (6) with a diameter of 8 mm and length of 8-10 m concrete loads with weight of 3-4 kg are attached. To elevate the baited hooks from the bottom buoy (9) with the diameter of 100 mm is tied to the center of each section of longline. As European hake makes the vertical daily migrations, fishermen shoot baited hooks at the various distance from the bottom by varying the length of mainlines, depending on the time of day and fishing area.

The longline of the «spanish type» for fishing on European hake on a continental slope (250-550 м) in its working position is schematically represented on Fig. 2.

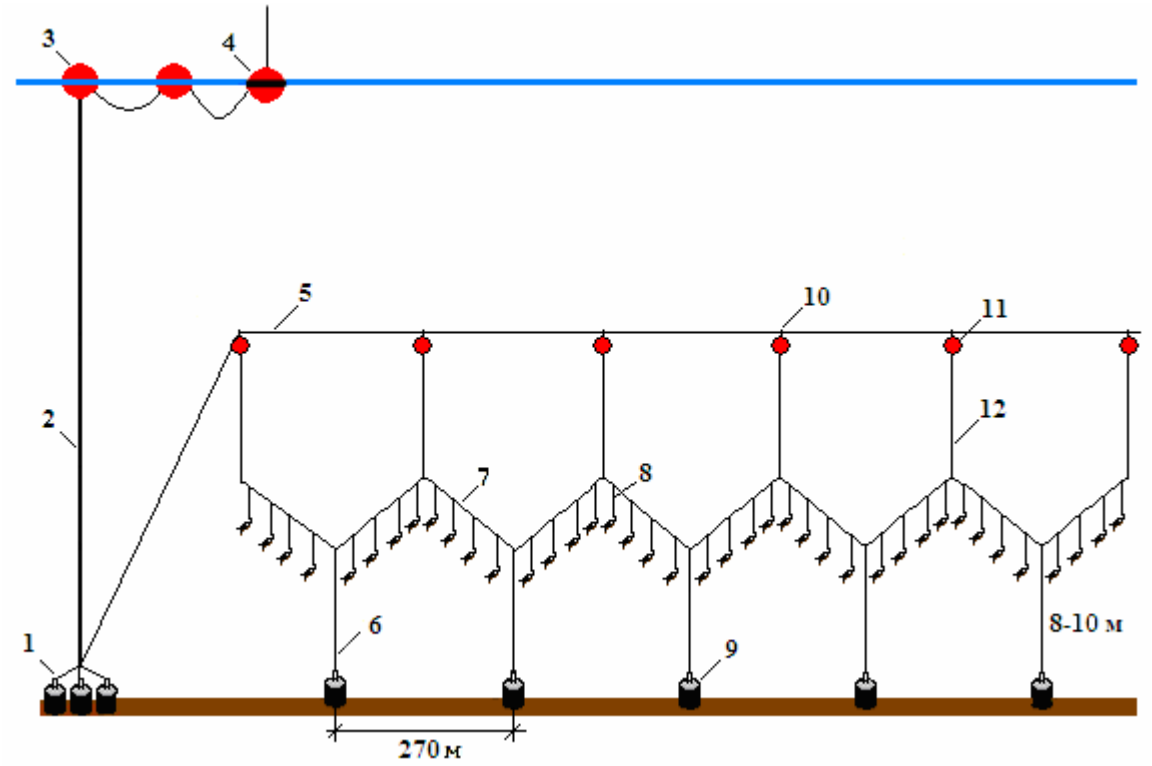

Fig. 2. Longline of the «spanish type» for fishing on European hake on the continental slope: 1 - three concrete anchor loads with weight of 40 kg each ; 2 – buoy rope, Ø 12 mm; 3 - buoy; 4 - radio buoy; 5 - mainline, Ø 8 mm; 6 - rope ("barandija") from polypropylene, Ø of 8 mm; 7 - additional line from polythene, Ø of 2 mm; 8 – hooking snood, Ø 0,7 mm and length of 1,8 m; 9 - load with weight of 3-4 kg; 10 - carbine; 11 - buoy, Ø 100 mm; 12 - rope ("barandija"), Ø 8 mm

The deep-water longline is equipped with two lines: the basic (5) with the diameter of 8 mm and additional (7) with the diameter of 2 mm. Buoys of diameter of 100 mm (11) are fastened to the basic line through every 270 m by means of carbines (10). The basic and additional lines are connected to each other by the ropes (12) with the diameter of 8 mm. All other constructive elements of a deep-water longline are similar to those for fishing on the shelf.

Equipping of a longline with two lines allows to prevent or considerably reduce the cases of losses of longline gears during the operating on hard bottoms. Besides, in the operational conditions in areas with the strong near-bottom and bottom currents, the opportunity of equipping of the fishing gear along its whole length by the concrete loads prevents to its drift.

Fishing is conducted from the 32-33 m length vessels. The average duration of one cruise is 15-17 days at the expenses for transitions in the fishing area and back ranged from 2 to 4 days.

On the average, during a day about 40 baskets ("aparechs") or about 10,8 km of a longline (3600 hooks) are shot and about 0,7 t of European hake or 194 kg/1000 of hooks are catched. The daily catch up to 2,0-2,5 t (556-694 kg/1000 of hooks) of European hake is considered as very good.

In research fishery on Antarctic (*D. mawsoni*) and Patagonian (*D. eleginoides*) toothfishes in the Ross sea the Russian vessels *"Yantar"* and *"Volna"* of the same type used some modifications of the deep-water longline of the "spanish type».

Some technical characteristics of fishing vessel "*Yantar*" are given below.

Characteristics of a vessel:

Year of building	2002
Country) of building	(China)
Total length, m	62,8
Length between perpendiculars, m	55,0
Width, m	10,0
Draft, m	3,90
Deadweight, t	800
Total register capacity, рег. т	1100
Volume of cooled holds, m^3	926
Volume of 4 freezing (up to-45º) chambers, m^3	245
Capacity of 6 tanks with fresh water, m^3	42
Capacity of oil tanks, m^3	17
Autonomy of navigation (on fuel), day	up to 140
Crew.	44

In the first years of the Russian biology and fishery research in the Ross Sea the modified deep-water (down to 1800 m) longline of the "spanish type» schematically shown on Fig. 3 was used as a fishing gear.

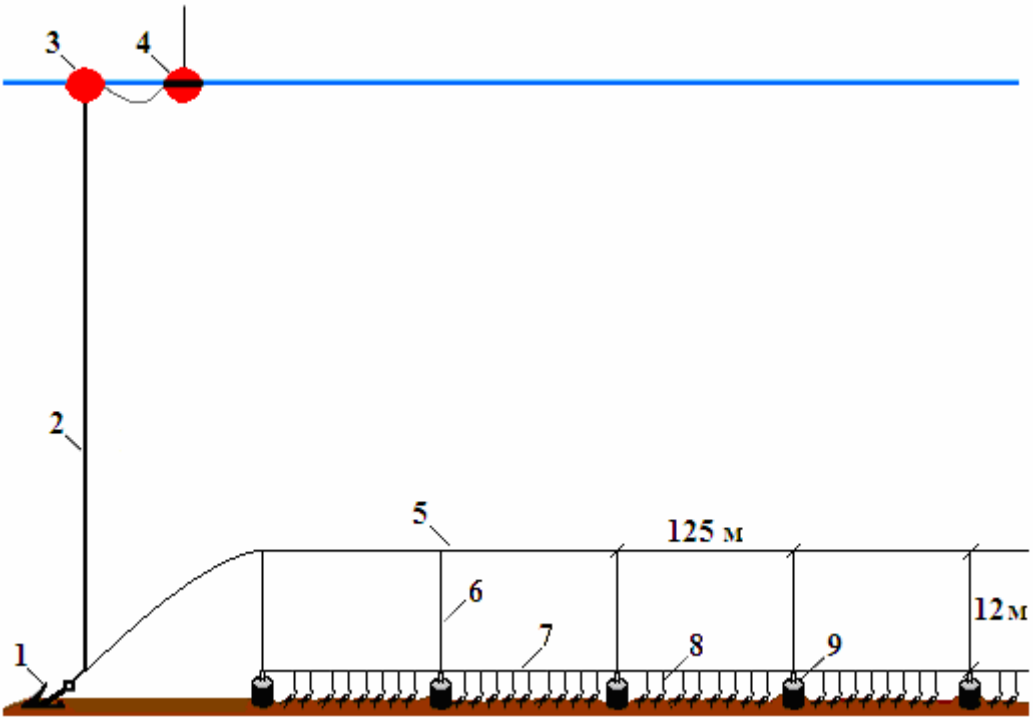

Fig. 3. The modified spanish deep-water bottom longline for fishing on toothfish:

1 – anchor with weight of 70 kg; 2 – buoy rope from polypropylene, ø 18 mm; 3 - buoy; 4 - radio buoy; 5 – mainline from polypropylene, ø 18 mm; 6 - rope (“barandija”) from polypropylene, ø 8 mm; 7 – additional line from polypropylene, ø5,0-5,5 mm; 8 – hooking snoods (69 hooks in a basket) with length of 0,4 m each with bait; 9 - concrete cylindrical load with weight of 10,5 kg

The distinctive feature of the modified longline for fishing on toothfish (Fig. 3) from traditional deep-water longline of the «spanish type» (Fig. 2) is an absence of buoys on the mainline and strengthening of all elements of the gear equipment: diameter of the mainline is changed from 8 to 18 mm, additional line - from 2 to 5,0-5,5 mm, hooking snoods - from 0,7 to 3,2 mm, the size of hooks - from No. 12 to No. 20-24, and also an increase in weight of concrete loads from 3-4 to 10,5 kg. Besides, in the modified longline the anchors with weight of 70 kg are tied additionally by concrete blocks with weight of 40 kg.

The fragments of equipment elements of a deep-water bottom longline of the «spanish type» for the fishery on toothfish in the Ross sea are shown on Fig. 4-7.

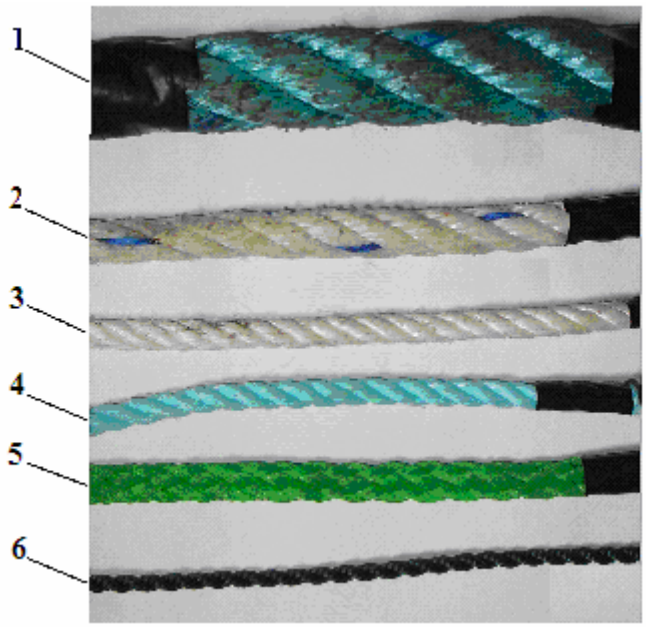

Fig. 4. Elements of equipment of the bottom "spanish type" longline for fishery on toothfish in the Ross sea:
1 - mainline (or buoy rope), blue color, ø 18 mm, from 4-twisted-twines polypropylene strings; 2 - additional line, white color, ø 8 mm, from 4- twisted-twines polypropylene strings; 3 - rope (“barandija”), white color, ø 5,5 mm, from 2- twisted-twines polypropylene strings; 4 - rope (“barandija”), light blue color, ø 5 mm, from 2- twisted-twines polypropylene strings; 5 - additional line (7,5x3,5 mm), green color, from turn-weaving polyethylene strings; 6 – hooking snood, ø 3,2 mm, from 2-twine kapron strings

It is necessary to note, that the ropes for equipping of buoy rope, mainline, additional line and "barandijas" have positive buoyancy.

Fig. 5. Hooks and the swivels used for fishery on toothfish in the Ross Sea:
1 - circle hook No.24 (II 24x3,1x74); 2 - the swivel for connection the hooking snood to additional line (length of 31 mm, ring diameter of 9,7 mm, cylinder diameter of 6,5 mm)

From the practice of industrial fishery it is known, that the catchability of hooking gear is impacted in a large extent by the form, size and power characteristics of a hook. In this connection, the economy due to equipping of fishing gears by circle hooks of a bad quality results in a loss of a part of the catch. And, nevertheless, in a fishing season 2004/05 for their equipping the Chinese manufactured circle hooks No. 20 were used. These rather cheap hooks possessed insufficient durability and were frequently unbent at the capture of large fish that resulted in the essential losses in catches. Therefore, in a season 2005/06 the longlines have been re-equipped by the larger (No. 24) circle hooks made from the enough strong steel wire. Such hooks have already allowed hauling aboard toothfish with weight up to 130 kg.

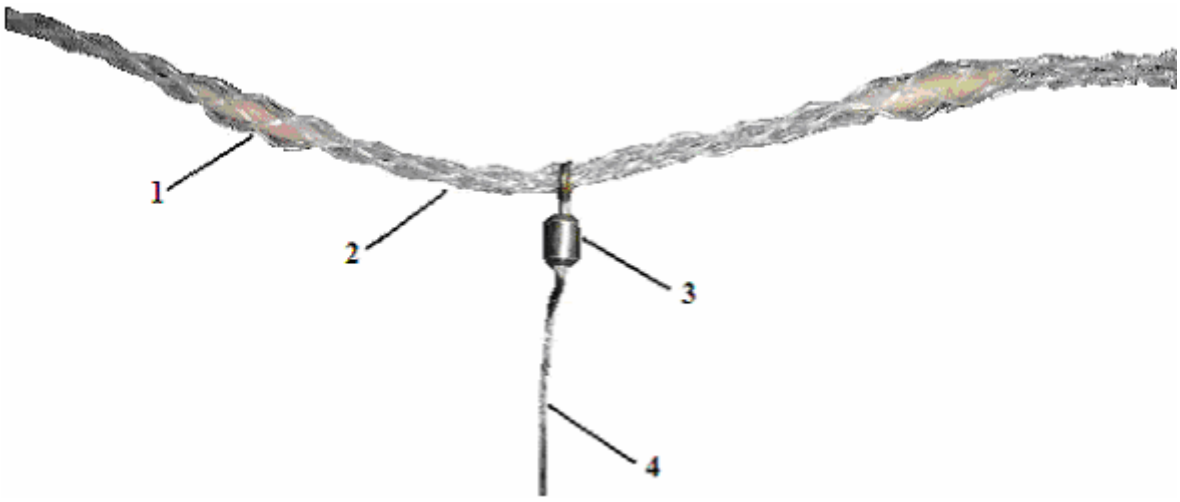

Fig. 6. Additional line of the bottom "spanish type" longline with a hooking snood:
1 - the plastic terminator of moving of swivel, ø 9 mm, twisted in line; 2 - additional line, ø 5,5 mm, from weaving 8-twines polyethylene strings with thickness of 1,3 mm; 3 - the swivel

(length of 31 mm, eye width of 9,7 mm, cylinder thickness of 6,5 mm; 4 - snood from polyethylene string, ø 1,4 mm

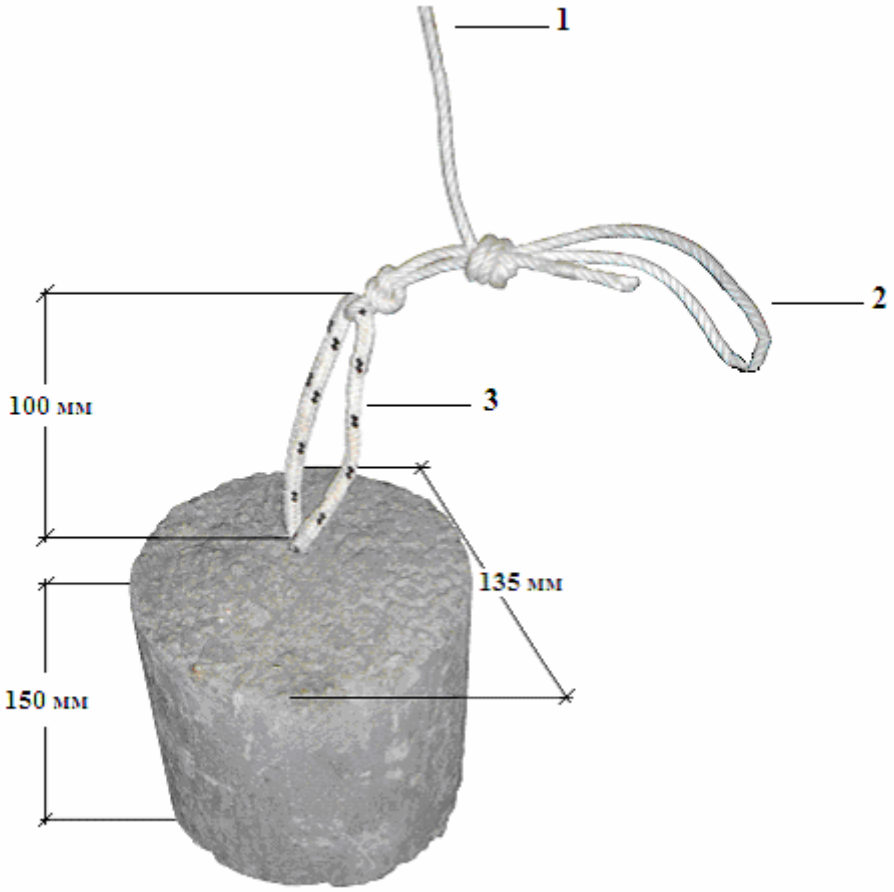

Fig. 7. Concrete cylindrical load with weight of 10,5 kg with a loop from kapron:
1 - rope (“barandija”); 2 - loop for attachment of a bunch of hooks; 3 - a loop of load

By preparation of the longline to setting, the mainline with the hooking snoods were stacked in plastic boxes and were baited (Fig. 8-10).

Fig. 8. Plastic box for a basket (“aparecha”) of the “spanish type” longline


Fig. 9. Basket (“aparecha”) of the traditional “spanish type” longline stacked in a plastic box

Fig. 10. Basket (“aparecha”) of the traditional “spanish type” longline prepared to shooting

The fragment of a rack (Fig. 11) with boxes and baskets (“aparecha”) of longline prepared to shooting is shown below, and the sizes of a rack for storage 560 baskets are given.

Fig. 11. Fragment of a rack for 560 (7x8x10) for baskets (“aparechas”) of the traditional “spanish type” longline

The sizes of a rack for storage aboard vessel 560 "aparechas":

Total length (8 boxes), mm … … … … … … … … … … … … ….. 4480
Total width, (7 boxes), mm …. …. … … … … … … … … … … … … … 3920
Total height (10 boxes), mm … … … … … … … … … … … … ….. 1800
Length of a cell for a box, mm … … … … … … … … … … … … … 560
Width of a cell for a box, mm … … … … … … … … … … … … … … 560
Height of a cell for a box, mm … … … … … … … … … … … … ….. 180

The setting of the gear is usually made at the speed from 5,5 to 7,5 knots. The 13-15 persons take part in it. After buoys, buoy rope, anchor and additional loads left a board, one fisherman is engaged in connection of one end of rope to the mainline, another - in connection of the other end of this rope to the concrete load, the third - submits coils with ropes to their hands, and the fourth - brings the coils to the third. One fisherman submits a tray of a baskets (“aparechas”) from racks**,** two others tie up the loads to the loops of baskets (from 2 to 4 loads on a basket with a length of 125 м), two others - bring loads, one - connects the ends of two adjacent baskets, one - shoots loads from a board and controls a continuity of a process of the shooting of the fishing gear, and also removes the empty baskets from a tray. One fisherman collects empty baskets and helps to wash them by seawater to other fishermen. The boatswain observes the whole process and helps other fishermen on the different operational stages, if necessary.

Depending on a depth of fishing, time of shooting of a longline can vary. For example, the shooting of 220 baskets of a longline (10560 hooks) at depths from 1160-1510 m occupied approximately 2,5 hour (hauling - about 19 hours).

During hauling of a longline about 20 persons are occupied: two - at longline winch and wheel (Figs. 13 and 14); one - on gaff; two - collect an additional rope with hooking snoods in a basket (Fig. 15) and release hooks from the rests of baits; about 10-12 persons are engaged in disentangling and repairing of mainline, additional rope and hooking snoods of longline, coiling of the longline in plastic boxes; one - collects the loads ("pedros") disconnected from the gear, if necessary, repairs the damaged ropes and loops, puts them on the conveyor and sends on a stern, where two fishermen are engaged in preparation of the baskets of the longline for the next shooting.

Fig. 13. Hydraulic winch MC-600 of «*Indunosfer SL* » for hauling of the mainline of a longline

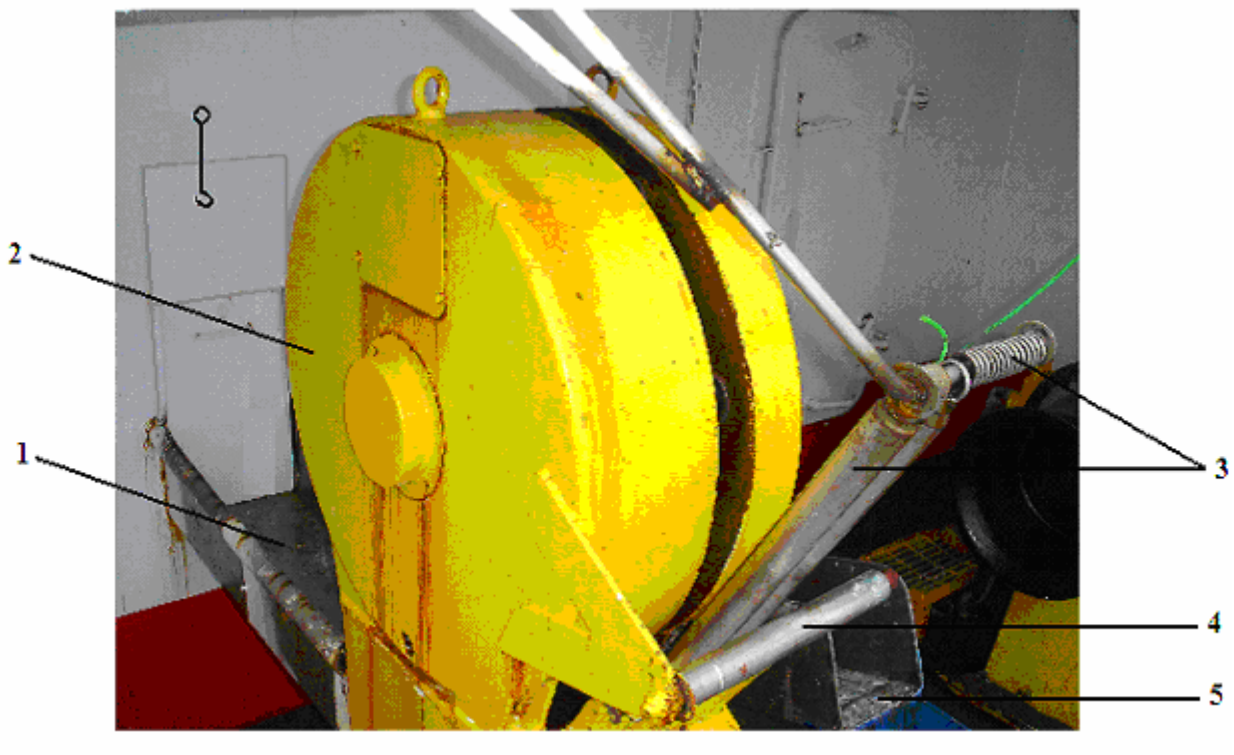

Fig. 14. Machine "Hauler" NAH-637-B « *Indunosfer SL* » for hauling of additional rope of the “spanish type” longline:
1 - metal tray for manual hand-somely to the fish factory and coiling additional rope of longline in baskets ; 2 - body of the machine with a wheel with magnets for an attraction of hooks at hauling; 3 - vertical roller with a clamping spring; 4 - horizontal roller; 5 - inclined metal tray for throwing the cylindrical loads ("pedros") in the bunker-store

On a stern two fishermen take baskets and loads from the conveyor, bait hooks of the longline and place the baskets prepared for shooting on racks. The loads are stored in special compartments on a stern deck. Three fishermen participate in hand-somely through blocks and manual stacking the mainline in coils on the top and covered decks of the stern. The boatswain supervises uninterrupted operation at hauling of the longline**.**

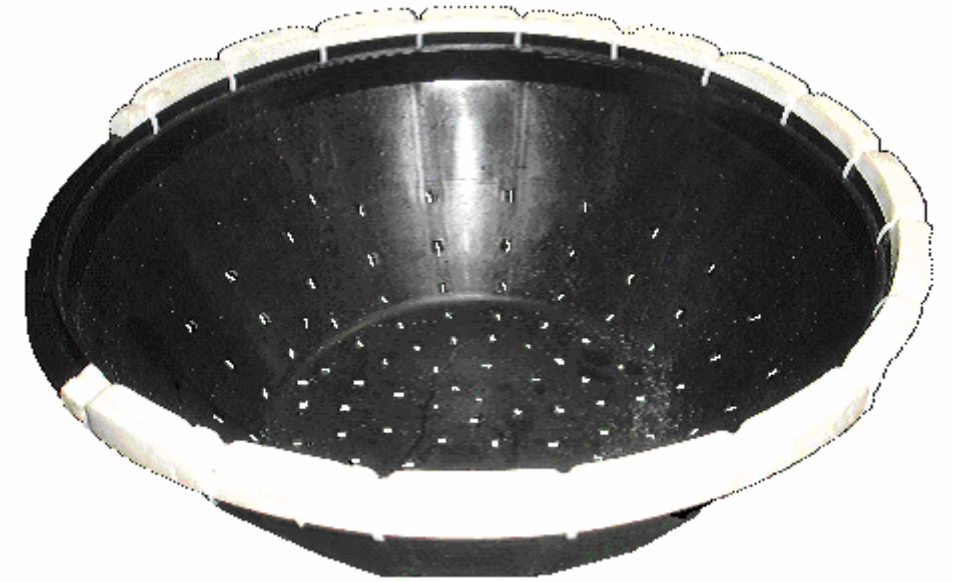

Fig. 15. Basket for coiling of the additional rope of the longline with hooking snoods at hauling of the fishing gear

The shortages in operation with the longline of the above construction are, first of all, associated with a rather large labour intensity of the processes due to necessity to repair of the fishing gear and his preparation for shooting which demand huge physical expenses.

Depending on fishing conditions (depth, current intensity, presence of bottom crustaceas eating baits and fish hooked, volume of by-catch, etc.) and behavioural features of toothfish, the design of the traditional "spanish type" longline changed, sometimes essentially.

The modifications and elements of equipment of the traditional “spanish type” longline used by vessels under the Russian flag in the Ross Sea on fishery of toothfish in seasons 2004/05 and 2005/06 are shown below (Figs.16-21).

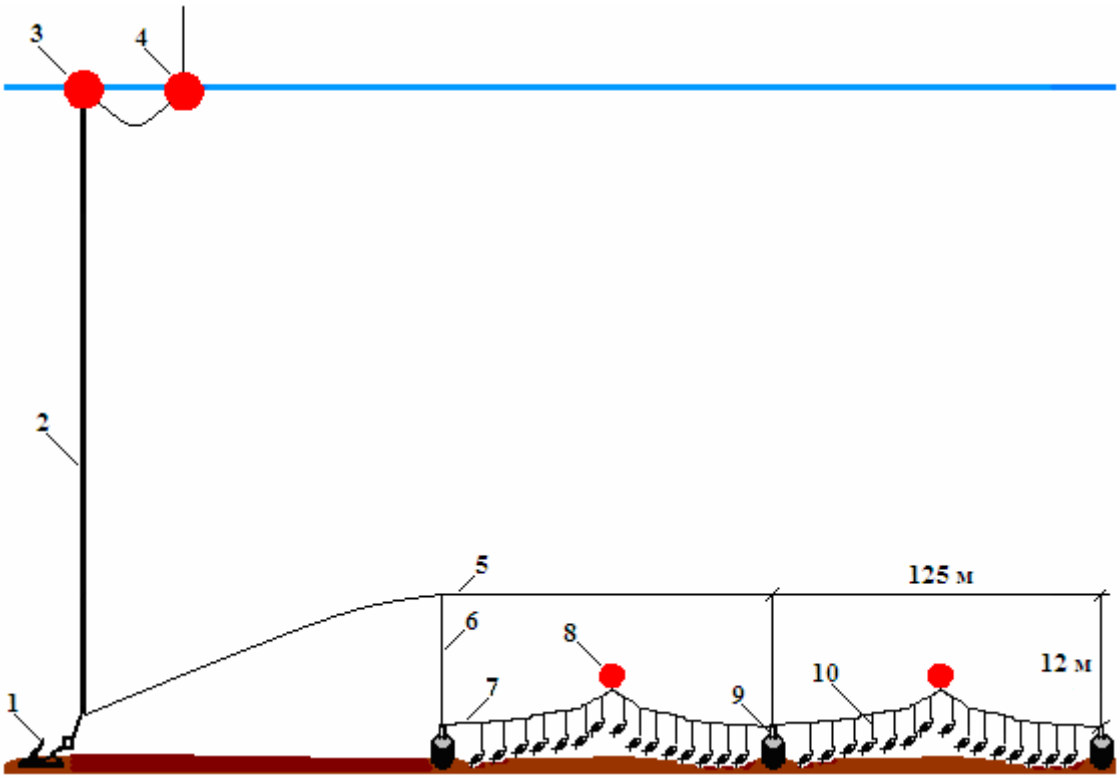

Fig. 16. Traditional “spanish type” longline with one float:
1 - anchor with weight of 70 kg; 2 – buoy rope from polypropylene, ø 18 mm; 3 - buoy; 4 – radio buoy; 5 - the mainline from polypropylene, ø 18 mm; 6 - rope (“barandija”) from polypropylene, ø of 8 mm; 7 - additional rope from polypropylene, ø 5 mm; 8 - float, ø 200 mm; 9 - concrete cylindrical load with weight of 10,5 kg; 10 – baited hooking snoods with diameter of 3,2 mm (69 hooks in a basket)

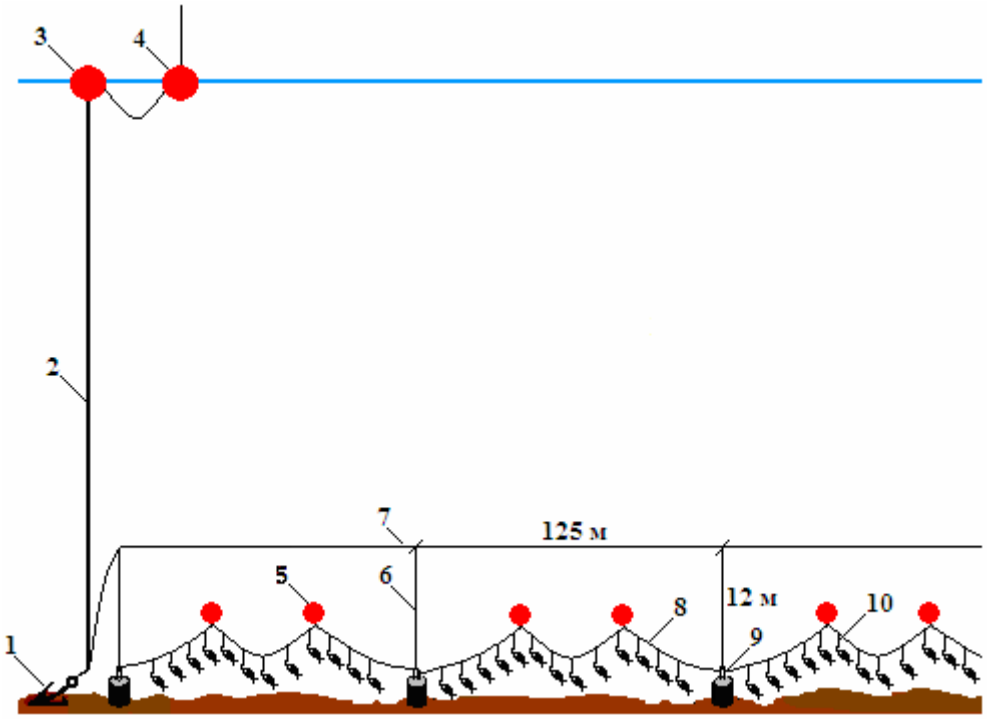

Fig. 17. Traditional “spanish type” longline with two floats:
1 - anchor with weight of 70 kg; 2 - polypropylene buoy rope, ø 18 mm; 3 - buoy; 4 - radio buoy; 5 - float, ø 200 mm; 6 - rope (“barandija”) from polypropylene, ø 8 mm; 7 - mainline from polypropylene, ø 18 mm; 8 - additional rope from polypropylene, ø 5 mm; 9 - concrete cylindrical load with weight of 10,5 kg; 10 – baited hooking snoods (69 hooks in a basket)

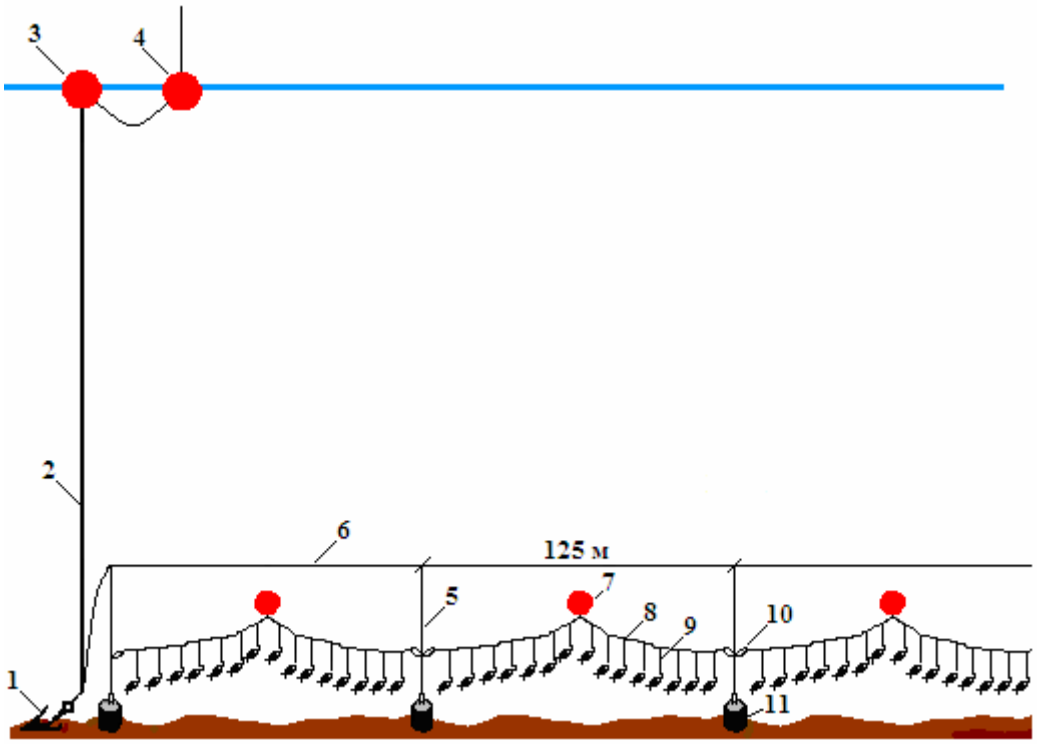

Fig. 18. Traditional “spanish type” longline with one float and additional line, tied up to the rope at distance of 1,2 m from load (“pedros”):

1 - anchor with weight of 70 kg; 2 - buoy rope from polypropylene, ø 18 mm; 3 - buoy; 4 - radio buoy; 5 - rope (“barandija”) from polypropylene, ø 8 mm; 6 - mainline from polypropylene, ø 18 mm; 7 - float, ø 20 mm; 8 - additional line from polypropylene, ø 5,5 mm; 9 - baited hooking snoods (69 hooks in a basket); 10 - place of connection of additional line to rope (“barandija”); 11 - concrete cylindrical load with weight of 10,5 kg

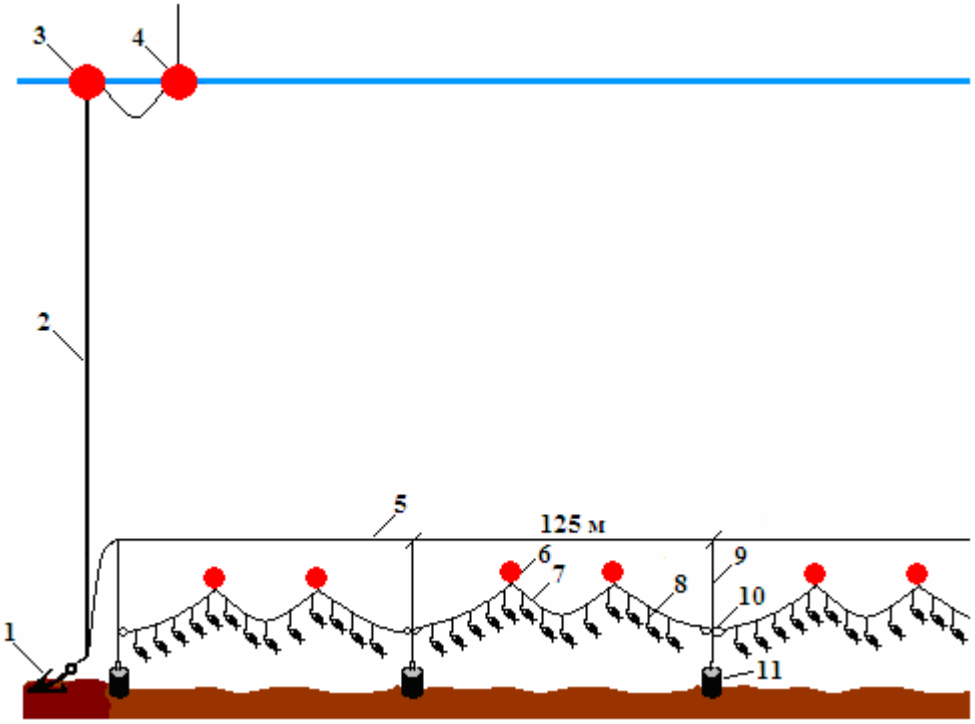

Fig. 19. Traditional “spanish type” longline with two floats and additional line tied up to rope at distance of 1,2 m from the load (“pedros”):

1 - anchor with weight of 70 kg; 2 - buoy rope from polypropylene, ø 18 mm; 3 - buoy; 4 - radio buoy; 5 - mainline from polypropylene, ø 18 mm; 6 - float, ø 20 mm; 7 - additional line from polypropylene, ø 5,5 mm; 8 - baited hooking snoods (69 hooks in a basket);

9 - rope (“barandija”) from polypropylene, ø 8 mm; 10 - place of connection of additional line to rope (“barandija”); 11 - concrete cylindrical load with weight of 10,5 kg

The use of the floats elevating the additional line of a longline over bottom allowed not only to reduce a probability of eating bait by bottom crustacea but also to reduce a number of a fish (Bigeye grenadier, Mackerel icefish, skate) in by-catch.

At the large depths and areas with the strong surface and near-bottom currents the longline shown on Figs. 20 and 21 was usually used.

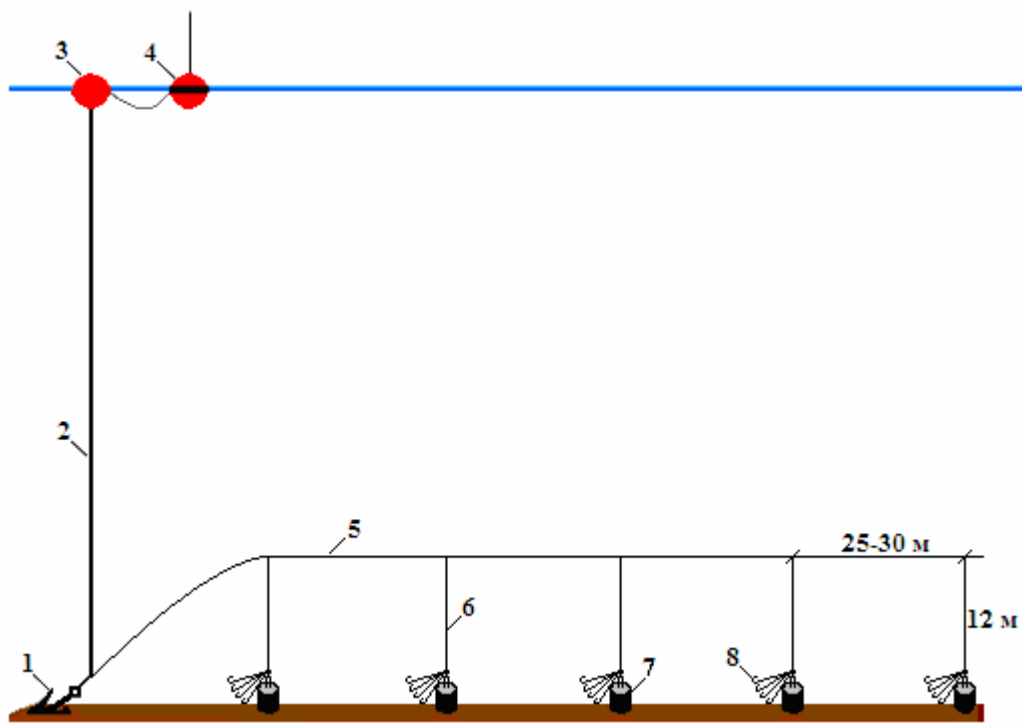

Fig. 20. Deep-water bottom “spanish type” longline with bunches of hooks:
1 - anchor with weight of 70 kg; 2 - buoy rope from polypropylene, ø 18 mm; 3 - buoy; 4 - radio buoy; 5 - mainline from polypropylene, ø 18 mm; 6 – rope (“barandija”) from polypropylene, ø 8 mm and length of 12-13 m; 7 - concrete cylindrical load with weight of 10,5 kg; 8 - bunch of 8-10 hooking snoods

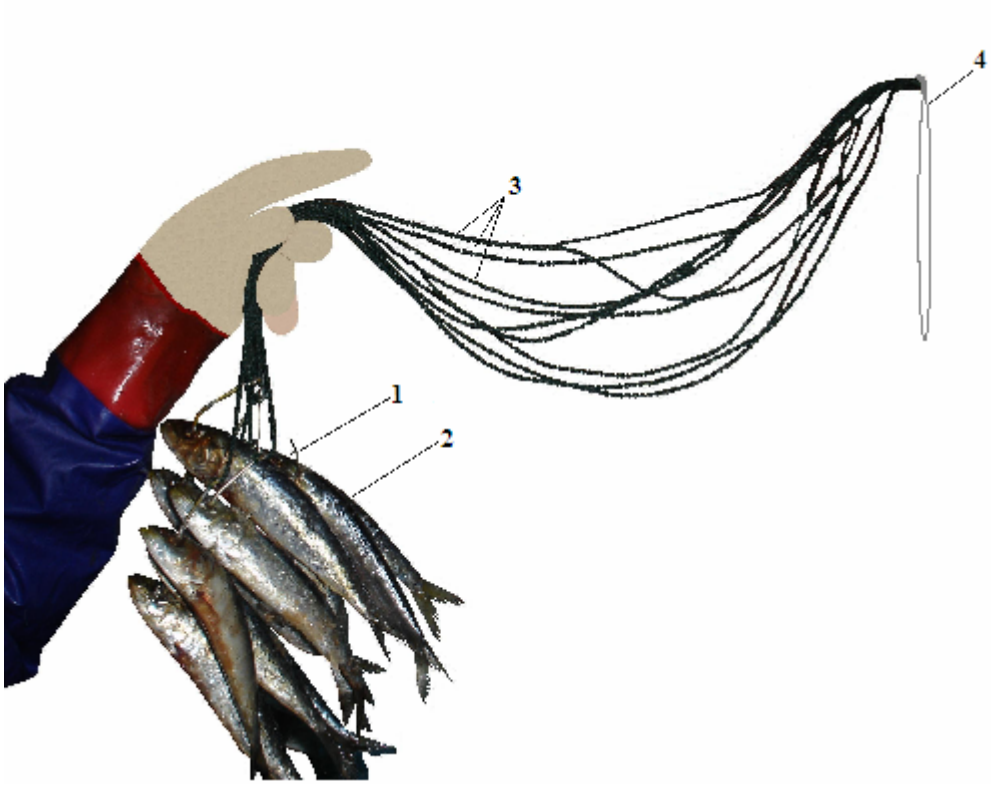

Fig. 21. A bunch of hooks with snoods baited by sardine:

1 - hook; 2 - bait; 3 - snoods; 4 - a rope loop for connection of a bunch of snoods (10 hooks) to the loop of a concrete load

Figs. 22 and 23 show the accommodation of bunches of baited hooks in a basket of a longline.

Fig. 22. Box with basket (“aparecha”) of experimental longline

Fig. 23. Fragment of a plastic box with the basket (“aparecha”) stacked in it of the baited modified “spanish type” longline

One of shortages of this design is a strong complication of a bunch (8-10 hooks) of hooking snoods among themselves and a loop of load (Fig. 24) which disentangling demands the excessive expenses of working time. Nevertheless, operation with such fishing gear demands considerably smaller expenses of working time, rather than with a longline of a traditional design. Moreover, the size of catch per unit effort (kg / 1000 of hooks) of toothfish under the use of the gear with the bunches of hooks is a little bit higher than under the use of a gear with two lines, and volumes of by-catch are lower. Increase in catchability may be explained, in particular, by a decrease in probability of fish loss at hauling of the fishing gear when large toothfish is frequently catched simultaneously by several hooks.

Now, the different variants of modernization of a longline are considered, in particular, with the purpose of prevention of snood complication.

Fig. 24. Load ("pedros") of an experimental longline with hooking snoods tied up to his loop and complicated after hauling

Depending on area (fishing depths) and period of the Antarctic summer, the catchability of the deep-water “spanish type” longlines for toothfish fishing can vary over a wide range, reaching sometimes 2000 and more kg of a fish on every 1000 exposed hooks.

The practice of use of the deep-water "spanish type" longlines and their modifications by vessels under the Russian flag depending on the fishing conditions for Antarctic and Patagonian toothfishes in the Ross Sea during seasons 2002/03-2005/06 showed its expediency and a rather high efficiency.