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A device that prevents the loss of catch from a trawl designed to work on a small vessel

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Abstract. Improving the technology and design of fishing gear for fishing aquatic biological resources by small vessels is of practical importance in the development of fishing in inland waters and coastal areas with shallow depths, as well as in regions where shallowing of reservoirs is observed. The development of aquatic biological resources in the shallow part of the reservoir is especially important for the delta part of the Volga River and coastal areas of the Caspian Sea in connection with the shallowing of fishing areas and a drop in sea level. The organization of fishing at shallow depths and coastal areas is possible not only with stationary fishing gear (traps, set seines), but also with trawling fishing gear. One of the most serious problems in the development of trawl fishing by small vessels is the imperfection of the trawl design due to loss of catch both during trawling and when lifting the catch on board the vessel. The improvement of the design or adaptation of existing fishing gear for use for industrial fishing purposes in the organization of fishing by small vessels makes it possible to catch fishing objects not only in the form of clusters, but also shoals of fish distributed throughout the reservoir with a low concentration. Some observations of the effectiveness of fishing with the hand-held delirium of amateur fishermen show that fishing with relatively small trawls towed at a speed of 0.3-0.8 m/s in shallow water along the coast may be a promising direction for the development of fishing carried out by motorboats. To meet the needs of industrial fishing in the Astrakhan region, which is mainly produced by small vessels represented by boats with outboard motors, the idea of using a trawl as a fishing tool is being developed, which is planned to be designed taking into account the characteristics of shallow water. Due to the alleged certain features, which include the inability to sample the trawl through the stern due to the transom arrangement of the outboard motor, as well as sampling the trawl during the movement of the vessel for the reason that there are no trawl winches and lifting the trawl with the catch to the deck is carried out manually from the side when the vessel is completely stopped or towed to shore to drain the catch, A device is proposed that will prevent the fish from leaving the trawl in the absence of towing.

Keywords: small vessel, trawl mouth, outboard boat motor, trawl bag, loss of catch

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Научная статья

Устройство, предотвращающее потерю улова из трала, предназначенного для работы на маломерном судне

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Аннотация. Совершенствование технологии и конструкции орудий лова для промысла водных биологический ресурсов маломерными судами имеет практическое значение в развитии рыболовства во внутренних водоемах и прибрежных районах с небольшими глубинами, а также в регионах, где наблюдается обмеление водоемов. Освоение водных биологических ресурсов в мелководной части водоема особенно актуально для

дельтовой части р. Волги и прибрежных районов Каспийского моря в связи с обмелением рыбопромысловых районов и падением уровня моря. Организация лова на небольших глубинах и прибрежных районах возможна не только стационарными орудиями лова (ловушками, ставными неводами), но и тралирующими орудиями лова. Одной из наиболее серьезных проблем в развитии тралового лова маломерными судами является несовершенство конструкции тралов, вследствие чего происходит потеря улова как во время траления, так и при подъеме улова на борт судна. Совершенствование конструкции или адаптация существующих орудий лова для использования в целях промышленного рыболовства при организации промысла маломерными судами позволяет облавливать объекты промысла не только в виде скоплений, но и косячную распределенную по всему водоему рыбу с низкой концентрацией. Некоторые наблюдения за результативностью вылова рыбы ручным бреднем рыбаков-любителей показывают, что лов сравнительно небольшими тралами, буксируемыми со скоростью 0,3–0,8 м/с на мелководье вдоль берега, может являться перспективным направлением развития рыбного промысла, осуществляемого моторными лодками. Для удовлетворения потребностей промышленного рыболовства Астраханской области, которое производится в основном маломерными судами, представленными лодками с подвесными моторами, разрабатывается идея об использовании в качестве орудия лова трала, который планируется спроектировать с учетом особенностей мелководья. Ввиду предполагаемых некоторых особенностей, к которым относится невозможность выборки трала через корму из-за транцевого расположения подвесного мотора, а также выборки трала во время движения судна по той причине, что отсутствуют траловые лебедки и подъем трала с уловом на палубу осуществляется вручную с борта при полной остановке судна либо буксируется к берегу для слива улова, предлагается устройство, которое предотвратит выход рыбы из трала при отсутствии его буксировки.

Ключевые слова: маломерное судно, устье трала, подвесной лодочный мотор, траловый мешок, потеря улова

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Introduction

Currently, information on the use of a small fleet with outboard motors for the organization of fishing in coastal areas of bays, shallow waters, rivers using small trawls is increasingly found in the public domain. Artisanal trawls have a simple device resembling either a ship's dredge or a trawl bag equipped with cables for towing. In the process of using this fishing gear, disadvantages such as the fish leaving the trawl when the vessel stops for various reasons, and accordingly the absence of towing, are manifested. When using these adapted fishing gear for fishing by small vessels on an industrial scale, some refinement is required [1].

To date, there are various devices operating on different principles to keep the catch in the trawl, for example, during the development of the topic, we considered a device [2] that uses acoustic, sound and light emitters to scare away fish that moves in the direction of the trawl. The disadvantage lies in the complexity of the design, in particular when placing a branched route of live wires in the trawl structure and in the difficulty of using the device for different species of fish, since it requires tuning sound signals for each individual type of fish, and light pulse signals can, on the contrary, serve as bait for predatory fish species that will direct the fish to the mouth of the trawl. Or the second example [3] is represented by a flap, which is arranged according to the principle of a knapsack parachute and is activated by remote control. The parachute opens and shifts the catch into the depths of the trawl [4]. However, this catch loss prevention device is not applicable in the conditions of trawling by small vessels, since it cannot close the mouth without towing the trawl and prevent the loss of catch from the trawl. The second negative side of this solution is the rapidly occurring hydrodynamic resistance and a sharp decrease in the speed of the vessel occurs, in relation to small vessels, this device cannot be used, since there is no redundancy of the outboard motor power, as a result of which loss of catch is possible.

In the process of solving a number of problems related to the armament of adapted fishing gear for small vessels, a group of specialists from the Federal State Budgetary Educational Institution of Higher Education “Astrakhan State Technical University (ASTU)” of the department of “Operation of Water Transport and Industrial Fishing” developed two devices whose work is aimed at preventing loss of catch from the fishing zone [5].

A funnel-shaped net device that prevents the loss of catch from a trawl designed to work on a small vessel in the form of a funnel-shaped mesh device

The device we offer that prevents the loss of catch and trawl is designed for the organization of trawl fishing on small vessels with an outboard motor. The schematic diagram of the device is shown in Fig. 1.

At the moment when the vessel is towing the trawl by means of cables, the mouth of the trawl is opened vertically, under the action of pop-up cranes, and loads that pull the lower pick-up down.

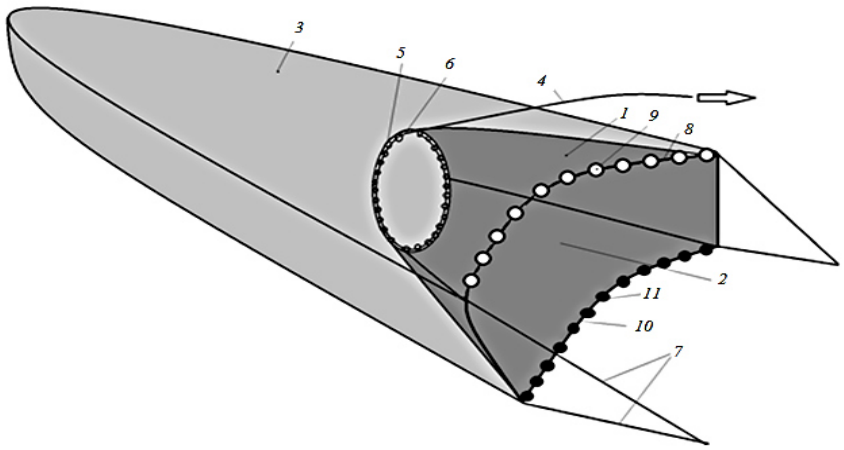

Fig. 1. A trawl with a funnel-shaped net device in the section:
1 – flap (funnel-shaped device); *2* – mouth of the trawl; *3* – trawl bag; *4* – tie flexible cable;
5 – selection of the flap (funnel-shaped device); *6* – rings; *7* – cables;
8 – upper selection, equipped with *9* – float; *10* – lower selection; *11* – loads

As a result, the flow of water entering the mouth reveals the proposed device, made in the form of a funnel. Horizontal opening can be provided by a beam made of bamboo or carbon fiber poles. The open mouth captures the fish, which moves, bypassing the open net funnel-shaped device into the net part of the trawl bag. After the end of the trawling, the net part of the funnel-shaped device is tightened with a flexible cable passed through the rings, which prevents the fish from leaving the mouth of the trawl bag (Fig. 2).

The proposed counting funnel-shaped device prevents the fish from leaving the mouth of the trawl, since with the help of a flexible cable passed through the rings, the mouth of the trawl is fixed.

This device is capable of closing the mouth in the absence of towing a trawl, and creates the least resistance when towing a trawl due to the mesh design of the funnel-shaped device, as it creates less resistance.

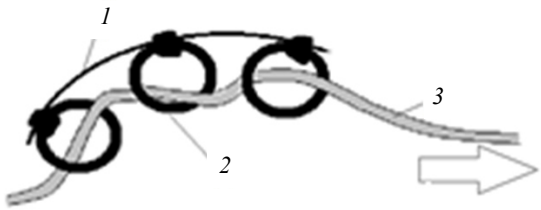

Fig. 2. Closing mechanism of the mesh funnel-shaped device:
1 – selection of a funnel-shaped mesh device;
2 – rings; *3* – a flexible cable tie

This device prevents the fish from leaving the mouth of the trawl after the towing is stopped, which allows the catch to be removed from the net bag from the side of a small vessel (Fig. 3).

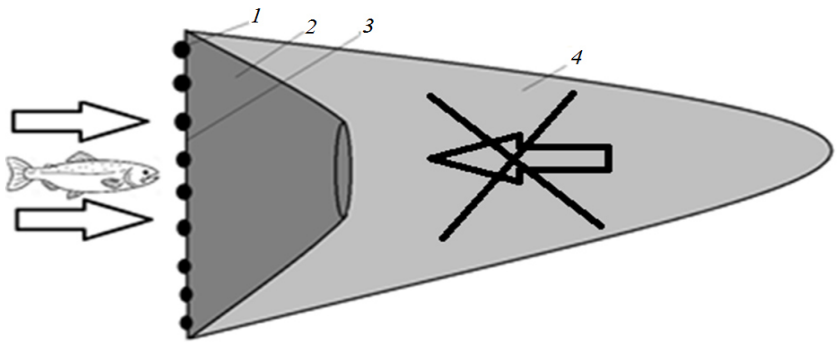

Fig. 3. A trawl with a funnel-shaped device made from Delhi, a schematic diagram:
1 – float located on the upper pick-up /loads located on the lower pick-up;
2 – funnel-shaped device; *3* – upper/lower pick-up; *4* – trawl bag

The device creates less resistance when towing the trawl due to the mesh design of the funnel-shaped device and is recommended when fishing from small vessels with outboard motors located aft on the tran-

som, the installation of which eliminates the sampling of the trawl through the aft slip.

A device that prevents the loss of catch from the trawl in the form of rings forming a flap

The second version of the device to prevent exit from the trawl is a flap, which is designed to block the mouth of the trawl and is made in the form of oval rings attached to the upper and lower pickups. The mechanism of remote control of the flap is represented by a tie cable, which, in case of manual pulling from the side of the vessel, tightens the oval rings, forming a flap, at the same time both pickups are tightened to the center (Fig. 4).

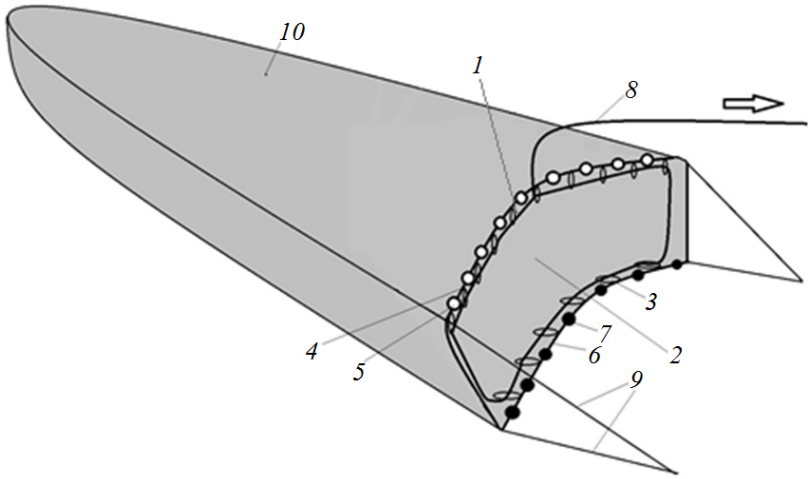

Fig. 4. Device preventing loss of catch from the trawl in the form of rings forming a flap: *1* – flap; *2* – mouth of the trawl; *3* – oval rings; *4* – upper trawl; *5* – float; *6* – lower trawl; *7* – weights; *8* – flexible tension rope; *9* – cables; *10* – net part of the trawl bag

The proposed device works as follows.

In the process, when the vessel is towing the trawl by means of cables, the mouth of the trawl is opened vertically, under the action of floats, and loads that pull the lower pick-up down. The open mouth captures the fish, which moves, bypassing the open flap into the net part of the trawl bag. After the end of the trawling, the flap is tightened with a flexible cable passed through the rings, which prevents the fish from leaving the mouth of the trawl bag.

The proposed device is capable of closing the mouth in the absence of towing the trawl, and creates the least resistance when towing the trawl due to the tightening of the mouth. The positive side of this solution is that when the cable is released, the trawl opens under the action of floats and loads. This can be used during breaks in trawling.

An example of a specific execution. The proposed flap prevents the fish from leaving the mouth of the trawl, since with the help of a flexible cable passed through the rings, the mouth of the trawl is fixed (Fig. 5).

The positive effect is that the proposed device prevents the fish from leaving the mouth of the trawl after the towing is stopped, which allows the catch to be removed from the net bag from the side of a small vessel.

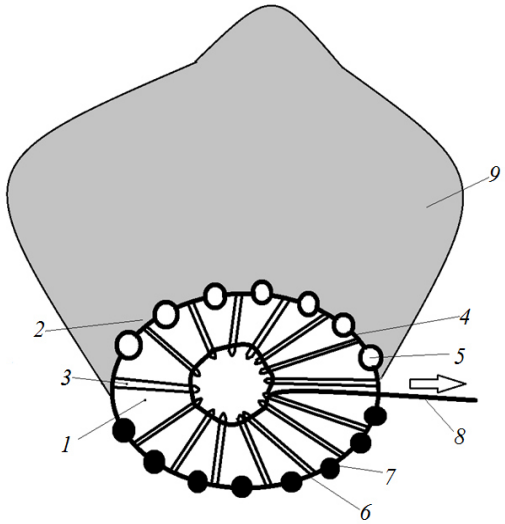

Fig. 5. Closed trawl flap: *1* – flap; *2* – trawl mouth; *3* – oval rings; *4* – upper trawl; *5* – floats; *6* – lower trawl; *7* – weights; *8* – tie-down rope; *9* – trawl bag

The device creates less resistance when towing the trawl due to the tightening of the mouth of the trawl, the trawl acquires a drop-shaped, streamlined shape (Fig. 6).

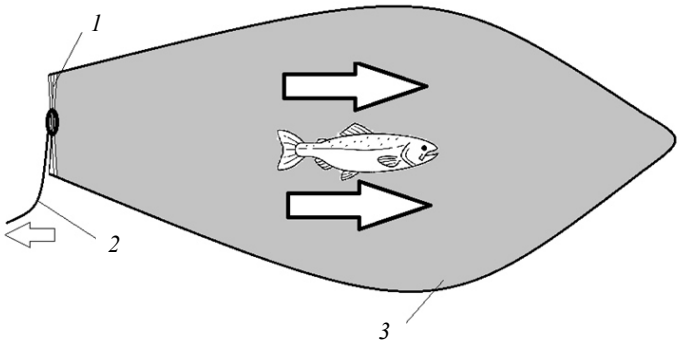

Fig. 6. The appearance of the device to prevent fish from leaving the trawl in a closed state:
1 – flap; *2* – flexible cable tie; *3* – net part of the trawl bag

The proposed device is recommended for fishing from small vessels with outboard motors located aft on the transom, the installation of which eliminates the sampling of the trawl through the aft slip.

A small vessel for carrying out fishing operations for scientific purposes

A manned floating laboratory created on the basis of the Scientific, Educational and Production Laboratory "Outboard Boat Motors" of the Department of "Operation of Water Transport" of the Astrakhan State Technical University was chosen as a small vessel that is planned to be used for trawl testing in real conditions [1]. The hull of the vessel is a Yuzhanka-2 project with an increased deck area in the bow equipped with rails, lighting equipment and an anchor winch. The deck area was increased in order to increase the working space (Fig. 7).

Fig. 7. A small vessel used by the Department of "Operation of Water Transport" of the Federal State Budgetary Educational Institution of Higher Education "ASTU" as a floating laboratory for scientific research:
1 – anchor winch; *2* – guard rail; *3* – lighting equipment;
4 – deck; *5* – removable cabin; *6* – outboard outboard motor

The vessel is equipped with navigation safety equipment such as life jackets in the amount of 4 pieces, a lifebuoy with a 20-meter long line, two rowing oars, fire extinguishers, a pump for pumping water, a sound alarm device, a white light electric lantern and waterproof overalls. To carry out fishing operations for scientific purposes, the vessel is equipped with radar equipment (humminbird 160 echo sounder; GPS tracker with software; NAVITEL navigator; Aceline G radio station).

The vessel is equipped with an outboard Tohatsu outboard motor with a capacity of 30 l/s (22.1 kW), which, in combination with the Yuzhanka-2 hull, allows speeds of up to 45 km/h (Fig. 8).

Fig. 8. General view of the TOHATSU outboard motor

The hull and outboard motor of the floating laboratory were selected taking into account the factor of prevalence among industrial fishermen of the Astrakhan region of housings of domestic production equipped with outboard motors of imported production with a capacity from 15 to 40 liters/s. A screw TV 12 14 was installed on this outboard motor, which was replaced with a screw 9 1/8x14-F, this screw has a smaller screw pitch and allows you to develop sufficient revolutions of the crankshaft of the internal combustion engine, excluding "slipping" of the screw when operating the vessel in trawl towing mode. The prepared vessel passed preliminary mooring tests, a 20-meter-long cable was tied to the transom, which, in engagement with a dynamometer rigidly fixed on the shore, showed the propeller thrust within 62 kg, The motor was also tested for the screw thrust indicator at the small experimental pool stand [6], where an outboard motor in in conditions close to a moving vessel with an incoming flow on the screw, the result was 60 kg. Thus, some data appeared necessary for the design of a trawled fishing gear.

Conclusion

In the waters of the rivers of the Astrakhan region and the delta part of the northern Caspian in recent years, there has been a decrease in water levels, at the same time, sand deposits from the upper Volga River create new islands and vast areas of shoals. Due to the specifics of the region, dictated by the multitude of shallow channels represented by the Volga River delta, fishermen engaged in industrial fishing massively use a small fleet with outboard boat motors as the main fishing fleet. Arming a small vessel with a trawl with a device to prevent fish from escaping from the caught volume opens up new opportunities for fishing in areas free of aquatic vegetation and at the same time involve a minimum number of fishermen compared to fishing with seines or reduce the time spent on installing fixed seines or traps. This direction of development of trawl fishing implies the adaptation of the trawl to the use of a small vessel, in terms of devices to prevent fish from leaving the trawl, as well as justification of the size of the trawl and other devices to improve the technology of fishing by small vessels with outboard motors. The idea of trawl fishing by small vessels with outboard motors presented in the article requires additional research in terms of hydrographic studies of mining areas and calculations related to traction resistance and aggregate drag of the trawl.

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