International Council for the
Exploration of the Sea

C.M. 1962

Comparative Fishing Committee

No. 120 F

On the Behaviour of some Fish in Trawls

(according to underwater observation data)

by

D.V. Radakov

THÜNEN
Digitalization sponsored by Thünen-Institut

The net-type appliances for catching fish present to the fish a danger having specific features that distinguish it from the natural dangers - it is a factor which is relatively (or absolutely) new for the separate speciemens as well as for the species (Nikolayev, 1960); besides that, the work, at least that of selective and non-selective gear types for fishing, is of a very different character than the actions of predatory fishes. There is no need to prove that the problem of the behaviour of fish in the area of fishing gear operation is of substantial interest from the point of view of the biological theories of fish behaviour as well as from the practical point of view. Nevertheless our knowledge in this field is still very insignificant. The use of hydroacoustic instruments makes it possible to acquire only a very general idea of the behaviour of fish during a catch, whereas a whole number of the most important peculiarities of this phenomena are quite beyond the "operational capabilities" of this method. The means of statistical analysis, based on the comparisons of the volume of catches with the use of gear of different design, rigging and operation regimen, is burdened with the same handicap.

That is why one of the important means of accumulating data on the behaviour of fish at the time of their catch are the visual, on-the-spot, observations, conducted with the aid of special equipment (and, also of course, underwater cine and photographing and TV). But, alas, up to now there has been accumulated very few data. Gvozdukhin (1938), Vlasova (1938), Ponomaryov (1953), Nikonorov (1956), Ionas (1960), Vyskrebentsev (1962), Clark (1958), Sand (1956), Springer (1957), Livingstone (1962) and some others describe some interesting observations of fish behaviour in the area of operation of various moving fishing gear, but the results of these observations, for the most part, are of a very fragmentary character or pertain only to special cases and do not give grounds of evaluating the given phenomenon in all its fullness and variety. In order to study the behaviour of fish at the time they are being caught comprehensively, the efforts of many researchers during an adequate time are needed. The blank spot in our knowledge of fish behaviour may be filled in only the future works of a number of research workers. In this paper we only want to inform of the actual data obtained on this problem, i.e., of the results of underwater observations conducted in the summer of 1961 in the Azov Sea on board the vessel "Moksha".

The skin-diver's kit "Podvodnik-1" was used for the underwater observations. 15 minutes before the drawing-in of the trawl the observer (the author) entered the water from the gangway, and holding onto the rope extending from the ship's stern to the top middle section of the trawl, quickly transferred himself onto the trawl and began observations. In case it was needed the observer moved onto different parts of the trawl or climbed on the spreader boards. The trawling duration was 30 minutes. The trawl was of the bottom type, 18 m with meshes of 60, 40 and 20 mm, and in the codend 10 mm. Speed of trawling at the time of observations equalled 1.5 miles per hour. The catches in the trawl in the cases when underwater observations were conducted amounted to, in the main, of 50-150 kg of Gobiidae, Clupeonella delicatula (Nordm.), Engraulis encrasicholus L., and Atherina sp. The work was mainly done at 6 to 12 m depth; the water was rather muddy - the white trawl itself was seen in the most favourable instances at 5-6 m and in the worst conditions for observations at only 2 m. Altogether six rides on the trawl were effected when it was possible to see the fish. The behaviour of same species of fish during different ways of trawling remained the same.

As is known Gobiidae are of the bottom living kind which behaved in the area of operation of the trawl as follows:- those of them that were not frightened away by the spreaders, the trawl's wings, or by some other parts of the trawl or the mud raised by it, floated 1-1.5 m above the bottom; finding themselves in water media, i.e. in unfamiliar surroundings, the Gobiidae behaved rather sluggishly - most of the time swimming in different directions or were simply drifting and were naturally very soon in the trawl's codend. Some species tried to go in the same direction the trawl was

moving, but they could keep it up only for a few seconds, as they were soon out of wind. Sometimes, but very rarely, it could be seen that separate Gobiidae slipped through the mesh in the front part of the trawl and went out of it, but this was not a result of the active search by the fish of a way out; it was the consequence of automatic "seepage" of a comparatively small-size specimen through the 40-60 mm mesh. The Gobiidae which have floated up (1-1.5 m above the bottom) were caught nearly all of them by the trawl.

Other Gobiidae which were in the trawl's way remained on the ground up to the time the lower edge of the trawl was 10-15 cm away from them. These specimens, as distinct from the ones that left the bottom, exhibited a greater manoeuvrability; they made quick, sharp dashes away from the lower edge of the trawl, and made use of even the slightest gaps between it and the bottom in order to dive under it. On the left side of the trawl where its lower edge at some points was lifted somewhat above the bottom, all the Gobiidae who did not float up managed to leave the area of the catch by going under the lower edge of the trawl.

We could observe permanently the Clupeonella delicatula (Nordm.), Engraulis encrasicholus L., and Atherina sp., but already in the bag-net mainly in the pre-codend part. Here these fish kept by themselves in dende, clearly defined shoals. Nearly all the time they swam with the same speed the trawl was travelling (up to the time they were capable of keeping it up), only sometimes overtaking it's speed and sometimes (which was more often) falling back. When the observer frightened them with a wave of a hand they somewhat gathered speed for a brief period, submerged a little bit deeper or went to one side after which they continued to swim in the same fashion as before until, as a result of getting tired, they did not "land" in the codend. The increase of the catch on account of such exhausted fish was very uniform.

It is very important to note that Clupeonella delicatula (Nordm.), Engraulis encrasicholus L., and Atherina sp. did not try to leave the trawl even when travelling by its side with the 40-60 mm mesh. It was noticed once that three specimens, probably Atherinas, were travelling in the direction of the trawl's movement, but on the outside of the bag-net, slowly falling back of it.

Lucioperca lucioperca behaves differently in the trawl operating area. During one of the trawlings one specimen of pike perch hugged the side wall of the trawl. The observer gave the pike perch a little push and it began swimming in the direction of the trawl's movement, leaving it behind. Among the fish concentrated at the end of the trawl there were not enven one pike perch. But when the trawl was pulled in, there were in the catch, apart from Gobiidae and other small fish, 30 pike perches. Therefore during the trawling the pike perches must have been swimming somewhere between the trawl's wings or in the front part of the net-bag and were not caught until the lifting of the trawl.

Such behaviour is evidently in the nature of the sturgeon species only. During the trawling mentioned above a small-size Asipenser stellatus Pall. (about 40 cm long) was discovered at the top plank of the trawl where it possibly got stuck. When the observer gave it (the Asipenser) a slight push, it swam, without seemingly exerting itself, in the direction of the exit from the trawl and overtaking the trawl. There was no Asipenser present in the catch taken from the trawl.

As has been mentioned already not once were there discovered shoals of fish or even single specimens in the front part of the trawl or even in the front part of the bag-net. As for the single specimens they could easily escape visual observation, of course, owing to the low transparency of the water during the time of our observations. But most probably it would have been impossible not to notice a shoal of more or less considerable dimensions. Thus, the results of our observations characterise the behaviour of some of the fishes inhabiting the Azov Sea, which are distributed in a scattered formation or are travelling in very small shoals (a few specimens to each one); this is also evidenced by the uniformity with which the trawl is filled with fish during trawling.

Comparing the existing data in scientific literature on the behaviour of fish in the fishing gear of the trawling type the results of our observations are very close to such data, the ensuing differences being quite natural, because in each and every case there was manifested the species' peculiarities of the behaviour of the fishes as well as the peculiarities of the conditions of fishing.

Conclusion

1. The Engraulis encrasicholus L., Clupeonella delicatula(Nordm.), Atherina sp., Lucioperca lucioperca L., and those of the Gobiidae species which have floated up during the trawling, do not, as a rule, try to leave the net even through a mesh which is large enough, and such "speedy" fish as the pike perch do not leave the net by increasing speed even though potentially they are capable of doing this. In all probability, these species have no specific, stable defence reflex against the trawl and do not fear it very much. The defence reflexes of these fish conditioned by natural conventional irritants do not ensure such behaviour by the fish that would be of effective defence significance when it finds itself in the bag-net of the trawl.

The following are also factors of the greatest importance that define the behaviour of Engraulis encrasicholus L., Clupeonella delicatula (Nordm.), Atherina sp., Gobiidae and Lucioperca lucioperca L. species in the trawl at the time of trawling: firstly, the ratio of the trawling speed on the one hand, and on the other hand the speed with which this or that fish can (or cannot) swim while trawling is taking place; secondly, it may be that the behaviour of fish in the trawl depends on the optomotoric reaction peculiar to many species of fish (Altukhov and Protasov 1959; Livingstone 1962).

2. One of the principles of advancing the design of fishing gear and also of the methods of fishing in conformity with the needs of a rational fishing economy may be based, in our opinion, on the implementation of the relative adaptability phenomenon (Vasnetsov 1953; Marty 1961), which is based on the premise that given adaptations are useful only in certain conditions; in this case we have in view the creation of such situations during fishing, when all the conventional defence reflexes of the fish cease to be effective.

3. It is very important to find out in the future what is the behaviour of fish in shoals when the trawl is nearing the shoal, because the specific features of shoal behaviour in such a situation are of substantial importance both from the theoretical and practical points of views.

References

Altukhov, J.P. and Protasov, V.R.	1960	"On some fish reaction upon visible moving net wall". Rybnoe khozjajstvo, Nr. 4.
Clark, J.R.	1958	"Underwater television observations of the effect of chafing gear on escapement of haddock". Mater. of VIII Session ICNAF, No. 26.
Gvozdukhin, P.	1938	"Underwater observations of herring fishery in Azov Sea". Rybnoe khozjajstvo, Nr. 2.
Ionas, V.A.	1960	"Study of behaviour of bullhead in the area of operation of bottom sweep-net". Rybnoe khosjajstvo, Nr. 2.
Livingstone, R.	1962	"Underwater television observations of haddock (Melanogrammus aeglefinus, Linnaeus) in the codend ". Journ du Cons., Vol. 27, 1.
Marty, J.J.	1961	"ICES Comparative Fishing Committee".
Nikolaev, D.S.	1960	"On the relation some shoal fish on moving net obstacles". Tezisy docl. IV nauchnoj conf.molodyh specialistov IMJ AN SSSR.
Nikonorov, I.V.	1956	"Observation of behaviour of the Caspian kilka". Voprosy ichtiologii, nr. 6.
Ponomarev, V.B.	1953	"Underwater observations of fish behaviour during fishing". Rybnoe khosjajstvo, Nr. 12.
Radakov, D.V.	1961	"On the peculiarities of defending behaviour of the pelagic fish shoal". Trudy In-ta Morph. Jivot. An SSSR
Radakov, D.V. and Nikolaev, D.S.	1959	"Relation of saida-fry to moving net gear (experiments in aquarium)". Zool. J. Vol. XXXVIII, 7.

Sand, R.F.	1956	"Application of the underwater television to fishing gear research". Trans. Amer. Fish. Soc., 86.
Springer, S.	1957	"Some observations on the behaviour of schools of fishes in the Gulf of Mexico and adjacent waters". Ecology, 38, 1.
Vasnetsov, V.V.	1953	"The untegrity of species ecology in fishes". Ocherki po obschim voprosam ichtiologii.
Vlasova, N.	1938	"On the Caspian bottom". Vauka i jizn, Nr. 5.
Vyskrebentsev, B.V.	1962	"Observations of trawls in the Black Sea" Trudy Plenuma sekcii podvodnyh issledovanii Oceanograficheskoj komissii AN SSSR (in press).