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Selectivity of Driftlines and Driftnets in the Baltic Salmon Fisheries

by

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Introduction

Catching atlantic salmon (Salmo salar L.) is very important for the Baltic cutter fishery. According the fact that these fishes are of high quality, high takings can be received on the fish markets.

The main fishing gear in the salmon fishery are driftlines and driftnets. Both types of gear are operated from August to June in the regions of the Isle of Gotland, the Isle of Bornholm and the Gulf of Danzig. Other fishing gear, like traps, beach seines and gill nets in the river- and inshore-fishery are of local importance only.

After the second world war the development and improvement of the mentioned two main fishing gear enabled a growing intensity of the salmon fishery. On the other hand according the pollution in the spawing rivers, the upstream movement of salmon was detracted and a sufficient natural recruitment was no more guaranteed.

According this fact the states of Denmark, Sweden and the Federal Republic of Germany tried to preserve the salmon stocks by the Baltic Salmon Fisheries Convention of 1962.

This Convention includes regulations of the size of hooks for driftlines and of the size of meshes for driftnets. With the regulations of the fishing gear the selectivity itself is directly touched. This paper has to deal with the problematic nature of the selectivity of driftlines and driftnets in salmon fishery.

Salmon driftlines

In principle the salmon driftline is a recently improved fishing gear. Details of its construction are shown in Fig. 1. Driftlines for salmon have been used first by Danish fishermen shortly after the 2nd World War. Later on it was taken over by the salmon fishermen of other nations. This gear replaced the setlines used so far in salmon fishery.

Generally the selection of longlines and therefore also of salmon driftlines, can be influenced by the following factors (CLARK, 1960):

1) size and shape of hooks,
2) size and kind of baits,
3) effective time of catching,
4) seasonal and diurnal variations in patterns of behaviour,
5) availability of natural food,
6) eventual loss of larger fish by breaking of lines or hooks,
7) differences in characteristics of stocks during comparative fishing experiments, when the gear has to be tested on different grounds.

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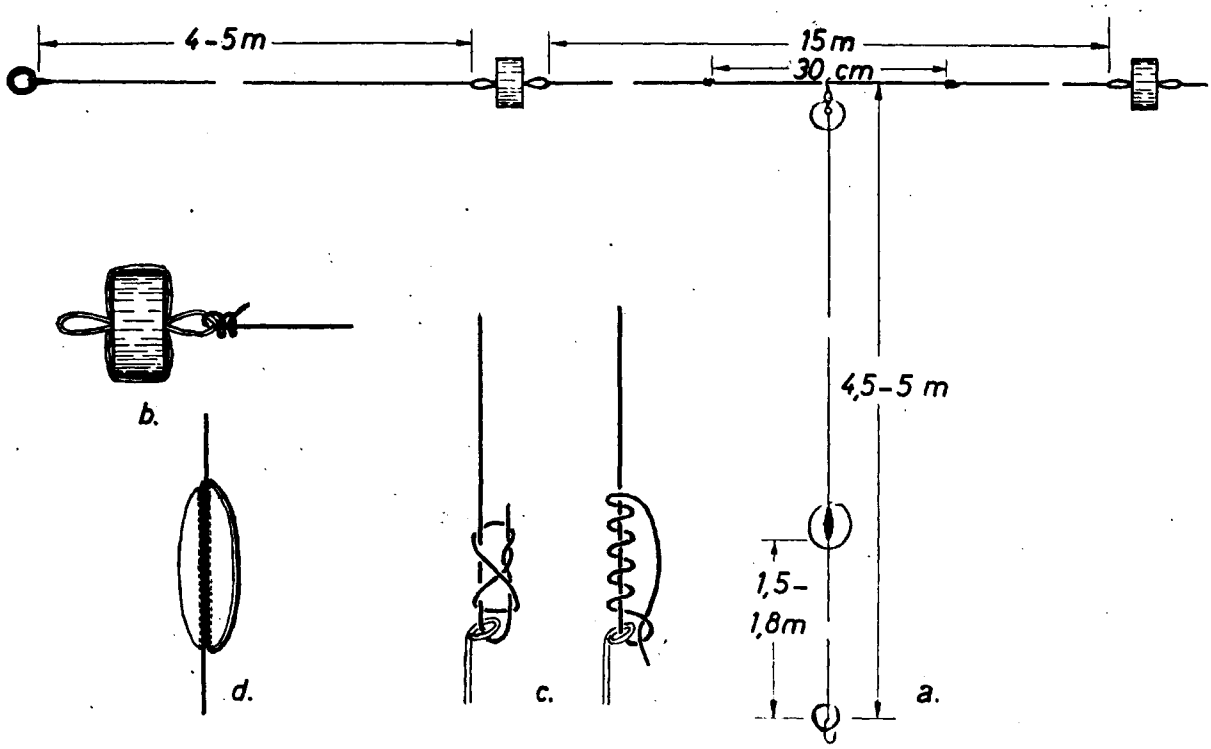

Fig. 1: The salmon driftline

a) Construction details of the line
b) Float made of corc
c) Two different knots for fixing the hook on the branch line (The same knots are used for fixing the swivel on the branch line).
d) Fixing the lead on the branch line

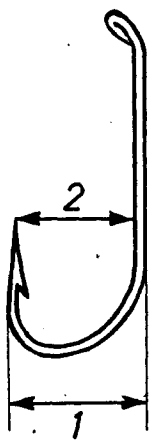

Fig. 2: The spread of the hook (1) and the opening of the hook (2)

Regarding to the influence of the selection these different factors are not yet investigated sufficiently. The few selection experiments, carried out so far with longlines for various species of fishes, show that the size of hook can influence mechanically the size composition of the catch under difinite conditions. This could be demonstrated in the cod fishery of Nova Scotia with hooks with big differences in size and where an appropriate fish population was present (McCRACKEN, 1963). Other investigations on the Baltic cod (KAULIN, 1964) showed, that also the kind of bait used has been essential for the selection.

By comparing the catches of cod with longlines and with trawls with covered codend it could be demonstrated that the longline itself has a selection. The longline catches always consisted of bigger cods. These results were received in the waters of New Brunswick and Nova Scotia (JEAN, FITZGERALD and MARCOTTE, 1959).

Comparing the length composition of the salmon catches with driftlines and driftnets it could be shown, that both gears have a different selectivity. The relative part of small salmons caught in driftlines was bigger than in driftnets (THUROW, 1966).

By introduction of a "minimum spread" of 19 mm for salmon hooks in the Baltic Salmon Fisheries Convention of 1962 the catch of salmon below 60 cm should be limited. Here some remarks are necessary. As well as in the Convention as in the literature the definition of the "hook spread" can cause misunderstandings. "Hook spread" is characterized as the distance between the point of the hook and the inner edge of the hook shank. This definition corresponds to the hook opening. By the hook spread, normally used in hook selection investigations, the widest distance between the outside edge of the hook shank and the outside edge of the bend of the hook is understood (Fig.2).

Comparative fishing experiments with salmon hooks with the openings of 13, 15 and 19 mm did not show a significant decrease of catch of smaller salmon by using the big hooks. In this connection a selection effect due to the physiology of sense was supposed (THUROW, 1964).

Till now, the efficiency of size regulation for salmon hooks could not be clearly pointed out by experiments.

As mentioned above the selectivity of longlines can be influenced by an occasional loss of fish when the branchline is breaking. For this reason with regard to the recommendation of the Permanent Commission of the Baltic Salmon Fisheries Convention of 1962, the breaking strength of branchlines of salmon driftlines was tested.

In 1967 these investigations were carried out in the Institut für Fangtechnik, Hamburg, with the aim to test the breaking strength of those points of the branchline where, in consequence of knots, a weakening of the material has to be expected. As shown in Fig. 1a there are three knots in the branchline:

1) on the attachement of the hook to the branchline,
2) of the branchline to the swivel and
3) of the lead on the branchline.

For the knots (1) and (2) two different types of knots were tested, which are used in the commercial fisheries (Fig. 1c). Testing of point (3)

was impossible, because the lead was already cut by the monofilament of the branchline at loads less than the breaking load of the branchline material. The results of these investigations showed, that the weakest point of the branchline, for both types of knots, is that on the swivel.

Salmon driftnets

At present the salmon driftnet has occupied an important position and has to be considered as the more important of the two main gear. The details of construction and dimensions of a driftnet used today are represented in Fig. 3.

Within the group of gillnets the salmon driftnet takes an exceptional position because its catching method is as well gilling as entangling. Nevertheless, for determining the selection data and the factors which can influence the selectivity, it is generally possible to use the same methods as in the common gill net fishery.

The methods for studying the selectivity of gill nets can be done in the following manner:

1) by comparison of catches of gill nets with those of other gears,
2) by comparison of catches between gill nets of different mesh sizes,
3) by controlling the relation between fish girth and mesh size.

Apart from the mesh size the selectivity can be influenced by a number of factors. Among others the following are to be mentioned (CLARK, 1960):

1) Extensibility,
2) strength and flexibility and
3) visibility of the twine;
4) hanging coefficient of the net and
5) the patterns of behaviour of the fish.

Moreover, there can be another factor, the saturation of the net (KENNEDY, 1951). Transferred to the salmon drift net fishery the last one may be insignificant because the number of salmon caught per net is normally very low and the nets are mostly drifting in the water for 12-15 hours only.

Special investigations on the selectivity of salmon drift nets are done next to nothing. So far as known to the author in one case selection data for salmon driftnets have been determined by comparing the salmon catch of the driftnet with that of a driftline (THURROW, 1966). Studies on the selectivity of gillnets in the herring and halibut fishery are available (HOLT 1963, OLSEN, 1959 and 1961), but not for salmon fishery.

The influence of the different physical properties of the net material as mentioned above has not yet been tested in the salmon fishery. But their selective importance shall be shown later in examples of fishing other species with gill nets.

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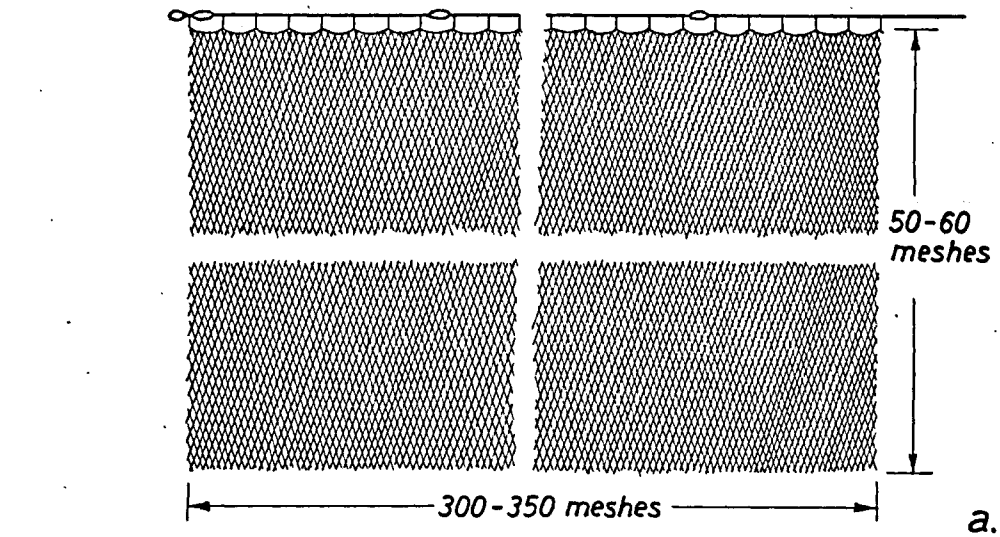

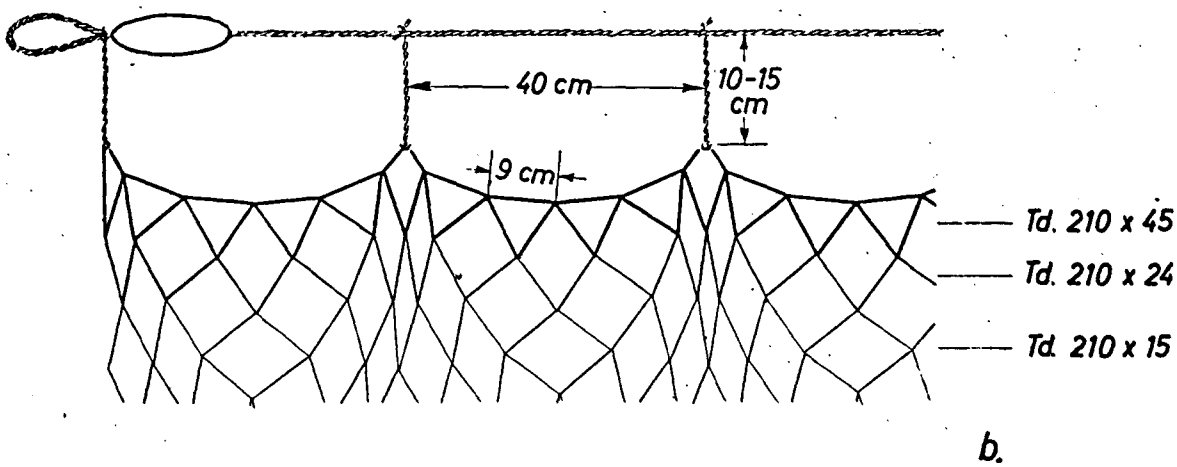

Fig. 3: The salmon driftnet

a) The dimensions of the net
b) The special method of hanging the net on the headline and floatline

 mesh opening

In spite of missing clear datas about the selectivity of this fishing gear mesh regulations were introduced. Drift nets made of synthetic fibres must have a minimum mesh size of 160 mm, those made of natural fibres of 170 mm. To this the corresponding passage of the article 5 of the Baltic Salmon Fisheries Convention of 1962 has the following text:

> "Drift nets for catching salmon must be constituted so that a flat measuring instrument with a thickness of 2mm easily can be moved through the diagonally lengthened mesh of the wet net. The width of these measuring instrument must be 165 mm for driftnets made of natural fibres, 157 mm for driftnets made of synthetic fibres."

In view to the selection of the driftnet these mesh regulation can lead to errors. Within the group of natural and synthetic fibres partly there are materials with very different selective properties. On the other hand the selection of definite natural fibres can be the same like this of definite synthetic fibres. From experiences with other fishing gear it applies to cotton and hamp nets as well as to polyamide and polyester nets (International Fisheries Convention, 1957; PARRISH, 1963). Because these four materials are used in salmon drift nets it is not clear why this difference of 10 mm has been done between wet nets of natural and synthetic fibres. In case of dry nets a certain compensation in the mesh sizes could happen by shrinkage of natural fibres and by a possible lengthening of synthetic fibres.

It is wellknown, that the proposed measuring method for the mesh size is not sufficient in exact selection investigations because this measuring by different persons gives different results (v.BRANDT and BOHL, 1959). Therefore it is to recommand to use a gauge with which the measurements can be done under constant loadings. Such a gauge is used with the International Lake of Constance Conference for controlling the minimum mesh size of gill nets (FLORIN, 1957). In its conception this "Bodensee-gauge" corresponds to the requirements demand by the Comparative Fishing Committee of ICES.

Today salmon driftnets are made of polyester and polyamide fibres. Both materials have, as shown in Fig. 4, very different extensions. Under a load of 1 kg extension of polyamide fibre (3) and (4) can be nearly 10%. Polyester fibres (1) and (2) show a much less extension. The influence of the extension on the selection is definitively not yet cleared. A direct influence in case of the gill net fishery for perch and roach is not assumed. In this connection it is rather noted, that the visibility and also the strength of twine are influencing the length composition of the catch (STEINBERG, 1962).

In the gill net fishery for perch it was also shown, that the hanging of the nets could have an influence on the selection. The hanging coefficient of 1/2 had the smallest, 2/3 the best selectivity (MOHR, 1965).

Another factor, which can influence the selectivity of gill nets, is the flexibility of the twines. With an increasing stiffness also an increasing selectivity of the gear was observed by catching perch (MOHR, 1965).

A problem appeared two years ago connected possibly with the pattern of behaviour of salmon, when the strops of the driftnet were shortened from 30-60 cm to 10-15 cm.

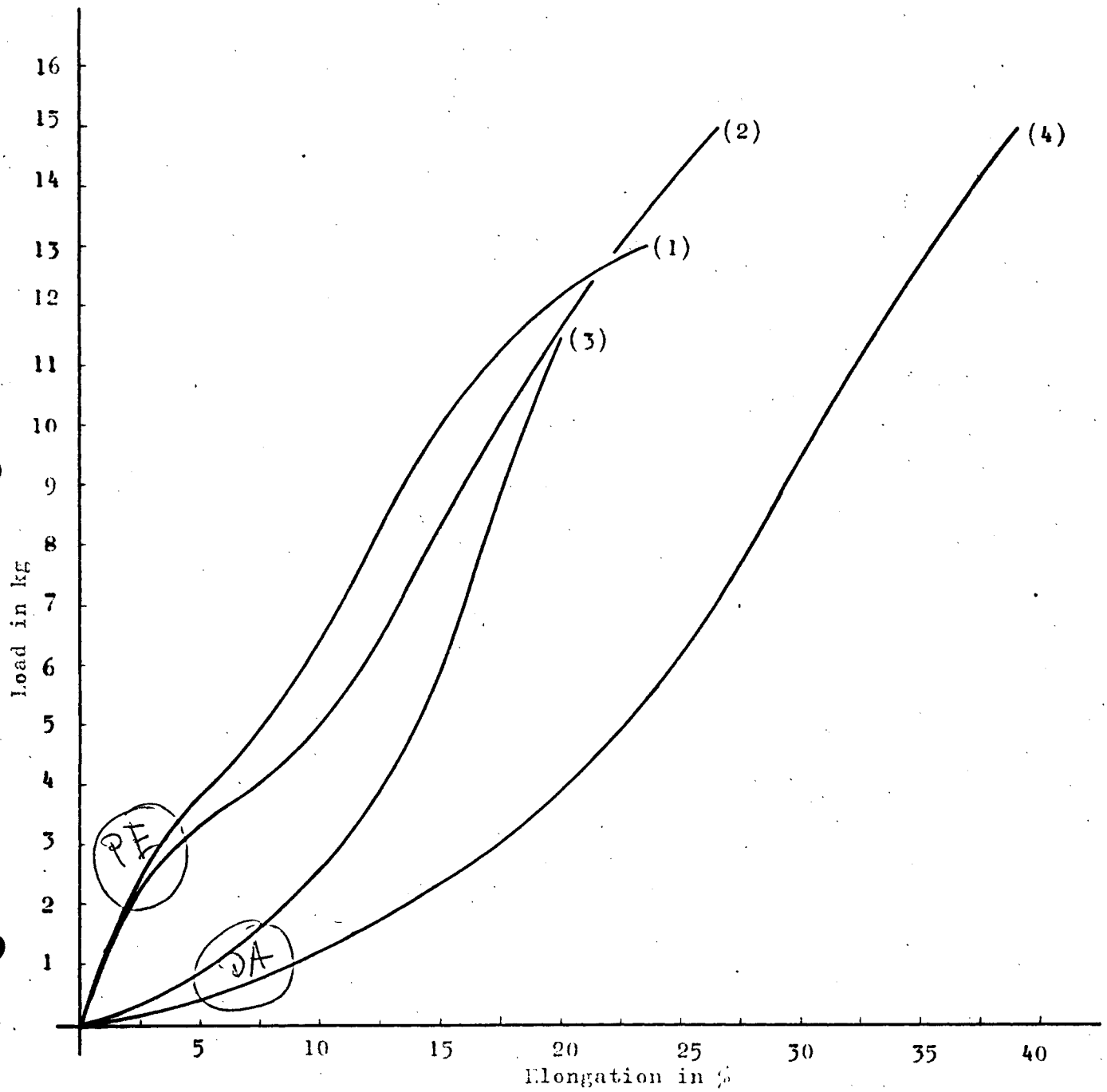

Fig. 4: Load-elongation curves for twines used in the salmon driftnet fishery

(1) Polyester Td. 210x15 (Japan, green)
(2) " Td. 210x15 (" , blue)
(3) Polyamide Td. 210x12Z (impregnated with Racosit)
(4) " Td. 210x12S (brown)

In this way a better catching effect was expected, but it was observed that with these short-stropped nets during definite seasons a higher number of undersized salmon was caught.

Danish and Swedish investigations on this "strop-problem" could not demonstrate a clear relation between the length of the used strops and the size of caught fishes (CHRISTENSEN, 1968; CARLIN and LUNDIN, 1968).

Moreover, in this connection another problem arose. The construction details of a salmon driftnet, represented in fig. 3b, show, that by knitting the head line to the seam meshes of the netting a triangular head mesh comes in which has not the necessary opening of 160 mm required by the Convention for the stretched mesh. (This triangular mesh is already fitted into the webbing of new nets today).

By the same investigations an observation made by commercial fishermen could be confirmed in certain ways, that in these head meshes a higher part of undersized salmon was caught.

This problem of the "triangular mesh" can be solved by changing the technics of mounting the net. For example this can be done by threading the loose seam meshes on the head line or by lengthening the shanks of the triangular head meshes until the mesh opening of 160 mm is reached.

But sometimes small salmon are completely entangled in the meshes after they have hooked in the twine of the net by their teeth, so that their catch cannot be avoided completely.

Summary

In the Baltic an intensive catch of atlantic salmon (Salmo salar L.) with driftlines and driftnets takes place. Indications of endangering the salmon stock were appearing. That was the reason for constituting the Baltic Salmon Fisheries Convention of 1962. The measures decided by this Convention also include regulations of the used fishing gears. With this the problems of their selectivity are touched.

The selection in line fisheries, including the salmon drift lining can be influenced by the size of hooks, the kind and size of bais, by the feeding behaviour of the fishes and by a probable loss of bigger fish by breaking of the line or the hook. In this connection a clear definition of the hook size is necessary. The size of hooks is characterized by its spread, i.e. the widest distance between the outer edge of the shank and the outer edge of the bend.

Under distinctive conditions the hook size can affect the selection. Generally the bait and the feeding behaviour are essential for the hook selection.

Transferred to the salmon drift line fishery an influence of the selectivity by hooks of different sizes could not be observed.

Investigations of the breaking strength of branchlines showed, that its weakest point is in the knot on the swivel.

According their gilling and entangling effect salmon drift are a special form of gill nets. The selection of gill nets can be influenced by the opening of the mesh, the extensibility, the strength and visibility as well as the flexibility of the twine, by the hanging of the net and by the behaviour patterns of the fish.

Special selection investigaions on salmon drift nets are missing nearly completely. In the gill net fishery for perch and roach could be demonstrated that the selectivity can depend on the flexibility, the visibility and strength of netting twine and on the hanging coefficient of the net.

Catching small salmon in short-stropped driftnets can be explained as a special kind of behaviour. But by investigations an influence of the length of strops on the size of fishes could not yet be demonstrated clearly. Moreover, it was demonstrated that a high quantity of undersized salmon were caught in the upper triangular mesh. By changing the technics of mounting the net it would be possible to reduce the catch of small salmon.

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