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BYCATCHES IN THE SALMON DRIFT NET FISHERY
IN THE BALTIC SEA

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ABSTRACT

Concern has been expressed about the impact of large scale pelagic drift net fishery on the living marine resources. Especially the indiscriminate catches of other species than the target for the fishery is considered to be a problem. Consequently a ban on this fishing method is considered. As the offshore salmon fishery in the Baltic mainly is carried out by means of drift nets, information on the species and the quantities of the inevitable bycatches is needed. No direct investigations on bycatches in salmon drift nets in the Baltic have been initiated. The only data available on the subject are collected at research cruises with other purposes supplemented with a few logbook notes.

From the information available it appears that the amount of other fish than salmon entering into the fishery is insignificant. Records of marine mammals, porpoise and seals in drift nets are scarce, mainly because they occur in very few numbers offshore in the Baltic Main Basin where the drift net fishery is taking place. Sea birds are regularly entangled in salmon drift nets. Due to the insufficient data material the total annual number drowned cannot be assessed. As the Baltic stocks of the sea birds in question are in progress, the drift net fishery is not supposed to threaten the conservation of the stocks.

INTRODUCTION

According to a resolution adopted by the General Assembly of the United Nations a moratorium should be imposed on all large scale pelagic drift net fishing by 30 June 1992 (Anon. 1990). Drift net operated on the high seas is considered to be a highly indiscriminate and wasteful fishing method. One of the reasons, among others, is the unintended bycatches of protected species of mammals and sea-birds.

The offshore salmon fishery in the Baltic Sea is mainly carried out by means of drift nets, in 1990 about 80% of the total offshore catches of salmon were taken by nets.

The resolution makes it therefore imperative to know, to which extend other species of fish, birds and mammals are entering this fishery as bycatches and whether the conservation of these species are endangered.

DATA OF THE FISHERY

The offshore salmon fishery with drift nets in the Baltic is nearly exclusively performed in the Main Basin (Sub div. 24-29) and to an insignificant extend in the southern Gulf of Bothnia (Sub div. 30). Vessels from the following nations are participating in this fishery: Denmark, Finland, Germany, Poland and the USSR.

Net dimensions: 450 meshes long x 40-45 meshes deep (about 32-33 m x 5 m).
Mesh size (measured diagonally): 160 mm.

Net material: Multifilament (synthetic) twine 0.5 mm.

Net construction: Net panel mounted directly to a headrope equipped with floaters. Bottom line not weighted.

Net operation: 25 nets are tied in a chain with a buoy at both ends. The total number of nets are usually shot in a straight line with little space between the chains. The nets are set at sunset and hauling starts before sunrise (max. fishing time: 12-15 hours). Salmon vessels are equipped with net hauling devices. Max. number of nets permitted per net operation per vessel: 600, covering a distance of about 11 naut. miles.

Fishing with drift nets are prohibited from June 15th to September 15th (according to the Fishery Rules of the International Baltic Sea Fishery Commission) and are usually replaced by long-line fishery from November to February.

In 1990 the total effort of all the fleets amounted to about 3 million net x set (nights).

INFORMATION ON BYCATCHES

Investigation with the object to discover the species and the number of individuals as bycatches in the fishery in question has not been carried out. The scarce information available is collected by observers on board commercial vessels in connection with gear experiments and investigations with other purposes. Supplementary data are extracted from logbooks of commercial fishermen.

In connection with a Danish investigation in 1967-1969 on the catches of undersized salmon (<60 cm) and experiments with nets specially mounted to minimize this problem, also bycatches were registered (Christensen, 1968, 1969).

During the research cruises 61 sets (or fishing nights) and a total number of 26 645 net x set were accomplished.

The frequency or the number of nights the various species were registered and the total number of bycatches are listed below:

Bycatch species		Frequency no. of nights registered	Total of individuals registered
Herring	<i>Clupea harengus</i>	13	51
Sprat	<i>Sprattus sprattus</i>	2	2
Sea Trout	<i>Salmo trutta</i>	27	55
Rainbow Trout	<i>Oncorhynchus mykiss</i>	1	1
Pipefish	<i>Syngnathus</i> sp.	1	1
Cod	<i>Gadus morrhua</i>	23	340
Mackerel	<i>Scomber scombrus</i>	4	5
Lumpsucker	<i>Cyclopterus lumpus</i>	10	11
Stickleback	<i>Gasterosteus aculeatus</i>	2	2
Plaice	<i>Pleuronectes platessa</i>	1	1
Flounder	<i>Platichthys flesus</i>	22	38
Guillemot	<i>Uria aalge</i>	19	35
Razorbill	<i>Alca torda</i>	2	3
Divers	<i>Gavia</i> sp.	2	2
Harbour porpoise	<i>Phocoena phocoena</i>	1	2

From the list it appears that none of the fish species are taken by the salmon drift nets to a number that may inflict significant losses on the stocks.

As the size of the stocks of sea birds is of quite different order of magnitude the losses in the salmon fishery might be of importance for the maintenance of the stocks.

In the following table the number of sea birds caught are related to the time of the year and the fishing area (ICES Subdivisions). In order to estimate the number of sea birds caught per unit of fishing effort also the number of nets used is listed, together with the number of salmon caught.

Date	Sub-div.	No. of net x set	No. of salmon	Bycatches	
26.08.-02.09.67	29	2911	404	Guillemot	2
				Razorbill	2
08.09.-18.09.67	27	4187	398	Guillemot	15
02.04.-17.04.68	24	1446	59	Guillemot	3
				Razorbill	1
19.04.-28.04.68	26+28	4003	207	Guillemot	1
				Diver	1
06.06.-19.06.68	24	5526	212	no seabirds	
18.09-29.09.68	28	3869	576	Guillemot	5
				Diver	1
05.09.-22.09.69	28	4703	415	Guillemot	9

More recent observations on bycatches in the salmon drift net fishery were made during a Swedish net selection experiment (Karls-son and Eriksson 1990) with the following result:

Date	Sub-div.	No. of net x set	No. of salmon	Bycatches	
16.09.-12.11.90	27+28	7610	2434	Sea Trout	49
				Rainbow Trout	52
				Flounder	39
				Sea birds*	39±3

* Mainly guillemots and razorbills, but also divers.

The Swedish experimental nets were 400 meshes long and 45 meshes deep and include the following mesh sizes: 160 mm, 170 mm and 180 mm.

From 3 research cruises by a USSR commercial vessel in the Gulf of Finland (Sub-div. 32) bycatches of mammals and sea birds were reported (Kangur, unpubl.). During the cruises (1987, 1988 and 1989) covering one week each 200-300 nets were set per night. The number of bycatches observed amounted to respectively one black-throated diver (*Gavia arctica*), two ringed seals (*Phoca hispida*) and one grey seal (*Halichoerus grypus*).

According to Thurow (1966) flounders are frequently entering the German salmon drift net fishery, to a less extend plaice and only occasionally lumpsucker and herring. At that time harbour porpoise were taken every year, grey seal more rarely, while sea birds were regularly entangled in the nets.

In a logbook of a German commercial salmon fisherman from the fishing seasons 1959/60-1969/70 the drift net bycatch of 4 harbour porpoise, 3 seals and a number of unidentified and not regularly counted sea birds were mentioned (Thurow, unpubl.).

DISCUSSION

Bycatches of fish

The unintended catches of species of fish in the salmon drift net fishery seem to be so insignificant in relation to the catches in the target fisheries for these species, that they can be ignored when the maintenance of the stocks is considered.

Bycatches of porpoise

While marine mammals before the 1980s occasionally were entangled in salmon drift nets, today they are extremely rare as bycatches.

According to investigations by questionnaires the harbour porpoise has practically disappeared from the Baltic (Berggren and Pettersson, 1990). The scarce sightings, strandings and bycatch records from the southwestern Baltic confirm this statement (Kinze, 1990. Anon. 1991).

Among the possible causes of the decrease of the previously abundant stock, hunting, incidental killing, reduction of the stocks of food species and pollution effects are proposed. High content of PBC in porpoise may affect the reproduction, but also the severe ice winters might have contributed to the decline (Almkvist, 1989).

Records of incidental catches of porpoise were collected in Swedish waters in the years 1973-1988, but few were reported from salmon drift nets (Lindstedt & Lindstedt, 1989).

Bycatches of seals

In the 1950s and 1960s seals were occasionally entangled in the meshes of salmon drift nets attempting to predate on the captured salmon and for that reason caused great losses to the fishery (Söderberg, 1974). The above-mentioned German logbook notes three occurrences of bycatches of seal during the 1960s.

The other information on bycatches of seal of more recent date refers to a USSR research fishery in the Gulf of Finland, where commercial salmon drift net fishery is not carried out.

During the present century and especially during the later part the three species of seal living in the Baltic were drastically reduced in number. The stocks of grey seal (*Halichoerus grypus*) decreased from about 100.000 to about 3.500 individuals, the

ringed seal from perhaps several 100.000 to about 5.000 individuals, while the former widespread stocks of harbour seal (*phoca vitulina*) were reduced to some few haunts with a total about 260 individuals.

Formerly intensive hunting was the reason for the decline of the stocks. Later on environmental pollution is held responsible. The levels of pollutants found in seals are suggested to be the cause of very low natality, pathological changes and possibly affect their resistance to diseases. The effect of lowered reproduction rate is further enlarged by high mortality of young seals, mostly by drowning in not specified fishing gear (Almkvist, 1982. Helander, 1986. Anon. 1991).

The Working Group on Baltic Seals has expressed its concern about the incidental entanglement of young ringed seals and grey seals (Anon. 1989), but are not specifying the type of gear to be the main reason for the incidents.

Bycatches of sea birds

Of the various information on bycatches in the salmon fishery in the Baltic the greatest attention is attracted by the sea birds especially guillemots and razorbills. As a basis for an estimate of the total annual catch by the whole salmon fleet the available data are, however, too scarce. The Danish data series which are the most detailed, are not covering a representative part of the fishery neither as to fishing area nor as to time of the year.

The catches of birds from the Danish observations 1967-1969 related to the effort of the fishery (Table 2) show a variation of BCPUE (bycatch per unit effort) from zero to 3.6 birds pr. 1000 net x set. In the Swedish experimental fishery the bycatches of birds are estimated to 5.1 ± 0.4 per 1000 net x set. The Danish and the Swedish figures are directly comparable as practically the same length of nets were used for the two investigations. The Swedish and the Danish maximum BCPUE were both made in Sub div. 27, where also the greatest stocks of guillemot and razorbill are nesting.

If the Swedish BCPUE is reflecting an overall higher bycatch rate of sea birds today than in the 1960s, it should be considered that the populations of these species probably have doubled since the Danish observations on netted birds, as it appears from the following.

The capture of the birds is, however, not identical with the mortality. According to information of Danish fishermen most of the individuals entangled in the nets are alive when the nets are hauled and may survive, if they are carefully extricated from the meshes. Obviously the survival is dependent on the weather situation.

Guillemots tagged in the colony on Gråsholmen, an island in the southern Baltic, reported as bycatches in the fishery constitute about 40% of the total recoveries of dead specimens. The vast majority reported from the vicinity of the island were from cod

gill nets at depth of 30-70 m, while the recoveries from the fishery farther off were mainly from salmon drift nets. Since 1977 about 60% of all recoveries of razorbill tagged on Gråsholmen are reported as bycatches in the fishery, especially from the drift net fishery (Lyngs, in press). Bycatches of other sea birds such as divers enter the salmon drift net fishery so sporadically that the mortality cannot be of significance for these stocks.

From what is said above it appears that an assessment of the annually total bycatches of sea birds based on the dissimilar data available is supposed to be rather unreliable. Of more importance is the question whether the drift net fishery may endanger the maintenance of the stocks.

In the years 1880-1900 the guillemot was close to become extinct in the Baltic as a consequence of intensive shooting and collection of eggs. The former colony on Bornholm had completely disappeared and on Store Karlsö, occupied by the largest colony in the Baltic today only 20 individuals were left. Introduction of conservation measures resulted in stock increase and establishment of new colonies. In 1974 the Baltic stock constituted about 8.800 pairs and in the middle of the 1980s about 13000 pairs. According to a qualified guess the number is still increasing (Lyngs, in press).

Like the guillemot also the razorbill was extremely rare in the Baltic at the end of the previous century. Later on the number increased more or less regularly and even declined drastically during extraordinary cold winters. Since the early 1970s the growth rate of the stocks in the southern as well as the northern colonies amounted to 6%-8% p.a. Today the total Baltic stock is estimated to about 10.000 pairs (Lyngs, in press).

The large scale offshore salmon fishery started in the Baltic in the late 1940s, when long lines were introduced as a more efficient gear than the anchored lines. Later on the long lines to a great extent were replaced by drift nets, especially when nets of synthetic fibres came into use. Though the total effort of the offshore salmon fishery has declined, the number of drift nets in use no doubt has increased (Christensen & Larsson, 1979). Obviously the increasing drift net effort has not resulted in a decrease of the Baltic populations of guillemots and razorbill. Consequently drift netting for salmon in the Baltic at the present level cannot be supposed to endanger the maintenance of the stocks of sea birds.

Unlike the more random information on bycatches of sea birds in the Baltic salmon fishery, an investigation aimed at the sea bird mortality in the gill net fishery in the Swedish part of the southeastern Kattegat has been accomplished (Oldén et al. 1988).

In the winters 1982/83 - 1987/88 the number of sea birds drowned in cod and herring gill nets in this area is estimated to 25.000.

The birds entangled are mainly guillemots, frequently the only species in the nets and, at several occasions more than 40 individuals were caught per vessel. The highest number of guillemots were entangled in cod nets, and inevitably drowned, as the cod nets are placed at the bottom.

The fishing ground above is limited to less than one statistical rectangle (41G2), to be compared to the salmon drift net area in the Baltic covering more than 60 rectangles.

As was also reported on the recovery of guillemots close to the colony on Græsholmen, fishery with cod nets may locally inflict a mortality on the sea birds comparable to salmon fishery with drift nets.

CONCLUSION

The fish species that enter into the salmon drift net fishery in the Baltic as bycatches occur in numbers without any importance for the maintenance of the stock.

The few reports on stranded, bycaught and sighted harbour porpoise in the Baltic during the last decades suggest that the former abundant species in this water now is rare. Records on bycatches in salmon drift nets during this period are scarce.

Like porpoise the Baltic species of seals occasionally occur as bycatches in various fishing gear, but in recent years the number entangled in salmon drift nets cannot be significant, since very few are reported from this particular gear.

Sea birds, and especially guillemots regularly enter into the drift net catches in the Baltic. The data on bycatches however, are too few and heterogeneous to estimate the total annual number captured. The survival rate of the birds entangled in the nets is supposed to exceed 50%.

The stocks of guillemots and razorbills have shown a more or less steady increase since the beginning of the present century. The development of the large-scale salmon drift net fishery in the late 1940s did not imply a decrease of the stock size of these species. In spite of a continuous high level of the drift net fishery the number of individuals still seems to multiply.

As concluded above, none of the species bycaught in salmon drift nets in the Baltic seem to be seriously affected by this fishery.

REFERENCES

- Almkvist, L. 1982. Baltic Marine Mammals - A Status Report. ICES C.M.1982/N:16.
- Anon. 1989. Report of the Joint Meeting of the Working Group on Baltic Seals and the Study Group on the Effects of Contaminants on Marine Mammals. ICES C.M.1989/N:9.
- Anon. 1990. Report on the Baltic Salmon and Trout Assessment Working Group. ICES C.M. 1990/Assess:21.
- Anon. 1990. United Nations. Resolution adopted by the General Assembly. Large scale pelagic drift net fishing and its impact on the living resources of the world's oceans and seas. A/Res. 44/225 15 March 1990.
- Anon. 1991. Report on the Study Group on Seals and small Cetaceans in Northern European Seas. ICES ACMP 1991/8.
- Berggren & Pettersson, 1990. Observationer av tumlare i svenska kust- och havsområden. Fauna och flora 85.
- Christensen, O. 1968. Report on an Experimental Fishery with Salmon Drift Nets. ICES C.M.1968/B:11.
- Christensen, O. 1969. Progress Report on Experimental Fishery with Salmon Drift Nets. ICES C.M.1969/B:15.
- Christensen, O. & P.O. Larsson, 1979. Review of Baltic Salmon Research. ICES Cooperative Research Report no. 89.
- Helander, B. 1986. Survey of Grey Seal Halichoerus grypus and Harbour Seal Phoca vitulina along the Swedish Baltic Coast 1975-1984. ICES C.M.1986/N.13.
- Karlsson, L. & C. Eriksson, 1991. Experimental Fishery with Drift Nets of Different Mesh Sizes in the Baltic in Autumn 1990. ICES C.M.1991/M:13.
- Kinze, Chr., 1990. Marsvinet i danske farvande -udbredelse, yngleforekomst og trusler. Fauna och flora 85.
- Oldén, B., M. Peterz & B. Kollberg, 1988. Sjöfågeldöd i fisknät i nordvästra Skåne. Naturverket Rapport 3414.