

FISH SURVEYS IN THE VÄIKE VÄIN STRAIT BETWEEN THE ISLANDS OF SAAREMAA AND MUHU, WESTERN ESTONIA

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Abstract. During the summer of 1993 fish were collected from both sides of the embankment between the islands of Saaremaa and Muhu in western Estonia. Questioning of local fishermen completed the picture of the fish fauna, which now includes at least 35 species (compared with some 22 species recorded in the late 1960s). Several cyprinid species have increased notably during the last decades and so have both *Stizostedion lucioperca* and *Osmerus eperlanus*. *Salmo salar*, *Coregonus lavaretus*, and *Leuciscus idus* have decreased notably while *Salmo trutta trutta* is still a common species.

Fish diseases like lymphocystis and ulcers among *Platichthys flesus*, "cauliflower disease" and ulcers among *Anguilla anguilla*, and signs indicating a poor condition of *Clupea harengus v. membras* have been increasingly more frequently reported from the whole area during the last years.

Parasitological studies showed, with a few exceptions, no remarkable differences from the situation in the other coastal areas of the northern part of the Baltic Sea. Notable amounts of chlorinated hydrocarbons, mostly DDTs and PCBs, were observed in all the fishes, especially in *Clupea harengus v. membras*, *Cl. sprattus balticus*, *Belone belone* (DDTs and PCBs), and *Esox lucius* (PCBs).

Key words: changes in fish fauna; fish diseases; fish parasites; PCB; DDT; Väike Väin, Estonia.

INTRODUCTION

A survey of fish was carried out on both sides of the embankment in the Väike Väin Strait (Väinameri) between the islands of Saaremaa (Oesel) and Muhu (Mohn), western Estonia, from June through September 1993. Two ways of investigation were used: active fishing with nets and a small trawl, and questioning of professional local fishermen from both Muhu and Saaremaa islands.

The results of these investigations are combined in the Table 1. In this manner a total of 35 species of fish were recorded from the area. This is 13 species more than was recorded some 25 years earlier from the same waters (Erm et al., 1970). The aim of this investigation, however, was not only to make an inventory of the

fish fauna in the region and to estimate whether there has been any change in the fauna in comparison with the earlier situation, but also to study the health condition of the fishes and to analyse the content of harmful substances, such as chlorinated hydrocarbons and heavy metals in the fishes.

Table 1

Fish species recorded from the Väike Vään, West Estonia

+++ , very common; ++ , common; + , rare; (+) , almost extinct

Species	North of the embankment		South of the embankment	
	Professional fishing	Scientific fishing*	Professional fishing	Scientific fishing*
Salmon	+		+	+
Sea trout	++		++	
Whitefish	(+)		+	+
Smelt	++		+++	++
Baltic herring	++	++	+++	+++
Sprat	++		++	++
Pike	++	+	++	++
Perch	+++	+++	++	++
Pikeperch	++		++	++
Ruff	++		+	++
Orfe	+		++	
Roach	+++	+++	+++	++
Rudd	++	++	++	
Silver bream	+++	+++	+++	
Vimba bream	+			
Common bream	+			
Bleak		+++		++
Eel	+		++	
Garpike	++		++	++
Burbot	++			
Cod	(+)		(+)	
Sticklebacks		++		++
Pipefish	+		+	
Eelpout	(+)		(+)	
Butterfish			+	
Sandeels			+	
Sea scorpions			+	
Lumpsucker			+	
Flounder	++		+	+
Turbot	+			

* Data on scientific fishing from 30 June, 12 July, 30 July, 18 August, and 3 September 1993.

RESULTS AND DISCUSSION

The Väike Väin Strait has long been known as an important spawning ground for several fish species in the area (Mikelsaar, 1984), especially for the whitefish, *Coregonus lavaretus* (Erm et al., 1970; Sõrmus, 1993), and the orfe, *Leuciscus idus* (Erm et al., 1970; Kangur, 1993).

Because of the reduction of the content of dissolved oxygen in the water during at least four successive severe winters in the 1980s, the oxygen content in the Väike Väin was too low for the incubation of whitefish eggs (Sõrmus, 1993). This description of the unfavourable conditions for a successful reproduction for the whitefish, however, becomes more significant by statements like "the major reason for the present decline in the whitefish stock is undoubtedly [the] eutrophication in [the] coastal waters" (Sõrmus, 1993), and "The stock of lavaret (whitefish) was small [in 1992] due to the eutrophication processes and the unfavourable reproduction conditions" (Kangur, 1993).

Perhaps the observations by the fishermen from both Muhu and Saaremaa islands are even more adequate in this respect. The fishermen claim that the spawning grounds for the whitefish are, if not totally spoiled, at least very much disturbed as a result of the total closure of the embankment in 1991.

The health condition of the female whitefish also has changed for the worse after the closure. Moreover, both the quantity and especially the quality of the roe of this fish have severely decreased. Today the dead roe is often hardened and greyish. In fishes whose ovaries look healthy roe of a smaller size and amount than before the closure is nowadays found.

Fishing in these, today very shallow, waters is almost impossible and by no means comparable with the situation before the closure. Until the closure whitefish fishing was very successful and of a great economic importance for the whole region. Nowadays the catches are very small and occasional. For example, some young whitefish were included in the Baltic herring (*Clupea harengus v. membras*) catches from the southern part of the Väike Väin. As no adult whitefish were captured during the summer of 1993, no further investigations were possible.

The situation of the orfe is better than that of the whitefish although its spawning areas have also been partly spoiled by the closure of the embankment. In spite of this the orfe is rather common all through the spawning season in spring. Afterwards this species is almost lacking in the whole area in contrast to the situation before the closure of the embankment. Consequently, no orfes were captured during the summer of 1993.

Observations of other fish species, except for the so-called small fishes like minnow (*Phoxinus phoxinus*), goby (Gobiidae), and sticklebacks (Gasterosteidae), no spawning close to the embankment was recorded.

Another fish species that has almost vanished from these waters is the salmon, *Salmo salar*. Earlier it was quite a common species especially in autumn when it ascended freshwater outlets in the area. Some young salmon were, however, observed among the catches of the Baltic herring and sprat (*Clupea sprattus balticus*) from the southern part of the Väike Väin. Being far too small for meaningful investigations in this project they all were let free. According to the fishermen salmon is nowadays very seldom caught here. But its close relative, the sea trout, *Salmo trutta trutta*, is still an essential and quite often captured species in this area. As no adult salmon or trout were caught during the summer of 1993, there is no further information on them.

The smelt, *Osmerus eperlanus*, were numerous included in the big catches of Baltic herring and sprat from the southern part of the Väike Väin. This species has become much more common in these waters on both sides of the embankment in recent years indicating a decreasing transparency of the water and also an increasing eutrophication of the whole waterbody concerned.

The smelts captured were in good condition although all of them were infested by the nematode *Cystidicola farionis* in the swim bladder. This is the case for smelts all over the Baltic (Voigt, 1981b, 1989). The microsporidian parasite *Glugea hertwigi*, the cestode *Proteocephalus* sp., and some acanthocephalans also have been observed earlier in smelts from these waters as well as the swim bladder nematode mentioned above (Turovsky, 1993). Other new macroscopic parasites now observed here were larvae of the cestode *Triaenophorus nodulosus* from the liver and larvae of the nematode *Hysterothylacium aduncum* from the body cavity. The same parasites also occur regularly in the smelts from all over the Gulf of Finland (Voigt, 1977, 1981a, 1989).

The Baltic herring is common on both sides of the embankment. This species is of the greatest importance for the fishermen in the area. During the two or three last years the herrings here have been in a poor condition (Kangur, 1993) exactly as they have been all over the Gulf of Finland (Voigt, 1992).

As an explanation to this phenomenon poor nutritional conditions (Kangur, 1993) or changes in the zooplankton fauna have been suggested, but the real reason is still unknown.

The parasitofauna and the parasitic infestations of the herring in these waters have been carefully investigated by Turovsky (1992, 1993). The main parasites here are, in systematic order: spores of the fungus *Ichthyophonus hoferi*, larvae of the nematodes *Hysterothylacium aduncum*, *Contracaecum osculatum*, and *Rhabdiascaris acus* (Turovsky, 1992).

A severe mass infestation of the sporozoan *Eimeria sardinae*, causing among other troubles castration of male herrings, has been observed here regularly since 1990 (Turovsky, 1993).

The Baltic sprat is also of great economic importance in the region. This species is abundant in the whole area although it is more marine than the Baltic herring.

Among the sprats no meagre forms nor severe diseases or infestations have been observed. Their parasitofauna consists basically of the same species as that of the Baltic herring. However, the number of parasite species on sprats is significantly lower and so are their affects on the fish (Turovsky, 1992, 1993).

The pike, *Esox lucius*, is quite common all over the inshore waters in the Väike Väin. There may have been a slight decline during the last five years and in 1992 the stock of pike was small because of the unfavourable reproduction conditions (Kangur, 1993).

The results of the test fishing on 30 and 31 July 1993 gave the following mean lengths for pike of different ages: 235 mm for two-year-olds and 369 mm at age three. In 1969 the lengths were respectively 230 and 310 mm (Erm et al., 1970). This shows that the growth rate of pike here is remarkably higher than in Estonian lakes (Saat, 1993).

All the pike specimens captured during the summer of 1993 were in good condition although according to the fishermen tumour-like diseases, e.g. lymphosarcomatosis, have become increasingly frequent during the last ten years. An estimate of every tenth pike having this disease was given by the fishermen on both sides of the embankment. This estimate is strongly supported

by earlier observations on pike from the Estonian coastal waters (Боговский, 1983, 1988).

The perch, *Perca fluviatilis*, is a very common species all over the Väike Väin. It is also of great economic importance in the region. During the two last years the catches seem to consist of bigger perch individuals than in the 1980s, yet the catches seem to be as good as ever.

The growth rate of the perch in the Väike Väin is also remarkably higher than in Estonian lakes: its length here is 80 mm for one-year-olds, 120 mm for age two, 159 mm for age three, 187 mm for age four, 226 mm for age five, 259 mm for age six, and 271 mm for age seven (Saat, 1993).

The health condition of the perches was good with the exception of one 365-mm-long nine-year-old female, which showed some signs of hemorrhage within the bowels.

The pikeperch, *Stizostedion lucioperca*, has become notably more abundant during the last ten years, being now a very common and an economically important species all over the area. In the catches the number of great individuals has also increased. No severe diseases or abnormalities have been observed among the pikeperch by the fishermen in the Väike Väin.

The ruff, *Gymnocephalus cernua*, decreased very strongly in numbers in the 1970s and 1980s, during the so-called haddock boom. The same was observed in the Finnish coastal waters (Voigt, 1991) and the species seems not to have recovered completely yet. In some areas, however, the ruff is very common in the Väike Väin, especially in springtime. The health condition of the ruffs captured during the summer of 1993 was good.

With the exception of the orfe the cyprinids, especially the roach, *Rutilus rutilus*, the rudd, *Scardinius erythrophthalmus*, and the silver bream, *Blicca bjoerkna*, have increased notably in numbers all over the area during the last ten years. All these three species, but especially the two last ones, indicate an eutrophication of the water in the Väike Väin area.

Another quite common cyprinid species here is the vimba bream. *Vimba vimba*, especially in springtime during its spawning season. But the common bream, *Abramis brama*, is and has always been a very rare species here.

In the shallow waters also a small cyprinid fish, the bleak, *Alburnus alburnus*, is quite common all over the area. The health conditions of all the captured cyprinids were good.

The eel, *Anguilla anguilla*, is not so common in the Väike Väin as it is for example on the western coast of Saaremaa Island. Round blood-red ulcers are today quite common on eels captured from all over the western coast of Estonia including the Väike Väin. Among the eels here also the virus-induced so-called cauliflower disease has been observed for more than five years now. The first appearance of this tumour disease in Estonian waters dates back to 1982 (S. Bogovsky, pers. comm., March 1993).

The garpike, *Belone belone*, is quite a common species in the Väike Väin. It often appears numerously in the catches of the Baltic herring and sprat. All the captured individuals were in good condition.

Both the burbot, *Lota lota*, and the Baltic cod ("haddock"), *Gadus morhua callaris*, are nowadays quite rare fish species in the Väike Väin. Only some four or five years ago the cod was here a very common and economically important fish species. Now, after the great influx of saline ocean water into the Baltic Sea in December 1992 and January 1993, the Baltic cod stock may recover again. In other words it should be possible to catch cod in Estonian waters after three or four years (Kangur, 1993).

Both stickleback species, *Gasterosteus aculeatus* and *Pungitius pungitius*, are very common in the area. The same can be said about the broadnosed pipefish, *Syngnathus typhle*. Yet the straightnosed pipefish, *Nerophis ophidion*, is almost unknown to the local fishermen.

Larvae of the "birdworm"-cestode *Schistocephalus solidus* appeared in almost every investigated stickleback. The same has been observed for example in the case of the sticklebacks from the waters around the Åland Islands in Finland (Voigt, 1991).

The eelpout, *Zoarces viviparus*, has always been rare here but during the "haddock boom" it nearly vanished. The same happened all over the coastal waters of Finland (Voigt, 1991). The species seems to have not recovered here yet.

The gunnel or butterfish, *Pholis gunellus*, which looks similar to the eelpout, has been sometimes observed here by the local fishermen but its relative, the snake blenny, *Lumpenus lampetriformes*, has not been recorded here at all.

Sandeels, *Ammodytes* spp., were mentioned by the fishermen only as an "existing species".

Of the sea scorpions only the *Myoxocephalus scorpius* and *Taurulus bubalis* have been observed rarely though regularly during the last ten years. The four-horned sea scorpion, *Myoxocephalus quadricornis*, almost vanished during the "haddock boom". The same is characteristic of these species on the southern coast of Finland (Voigt, 1991).

The lumpsucker, *Cyclopterus lumpus*, appears occasionally among the big catches of the Baltic herring and sprat, but its close relative, the sea snail, *Liparis liparis*, has not been recorded here by the fishermen at all.

Of the flatfishes the flounder, *Platichthys flesus*, is more common in the Väike Väin than the turbot, *Scophthalmus maximus*, although the catches of the flounder have constantly decreased here. The main reason is probably unfavourable environmental conditions in the Baltic Sea (Kangur, 1993).

In the flounder an increasing tendency toward lymphocystis has been observed during the last ten years. The blood-red round ulcers, occurring mostly on the blind side of the flounders, have also become more frequent. Similar observations have been made from the Finnish coastal waters (Voigt, 1991).

As these diseases often occur among flounders from polluted and eutrophicated waters, they are commonly used as indicators of the changing environment in the Baltic Sea (Bogovski, 1992).

CONTAMINATION WITH CHLORINATED HYDROCARBONS AND HEAVY METALS

Some of these fish species were analysed for a probable content of harmful substances like chlorinated hydrocarbons and heavy metals at the Water Protection Laboratory of Tallinn Technical University (hydrocarbons by V. Riipulk) and the Laboratory of the Department of Limnology and Environmental Protection of the University of Helsinki (heavy metals by H.- R. Voigt).

As the results are still preliminary and even not quite complete (heavy metals), only some remarks can be made. The amount of both DDTs (DDE, DDD, and DDT) and PCBs was notably high in the muscle and liver homogenates of more open-sea species like the Baltic herring

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ERRATA

As the figures concerning the amounts of both sum-DDTs and sum-PCBs (52 congeners) in the article "Fish surveys in the Väike Väin Strait between the islands of Saaremaa and Muhu, western Estonia" by Heinz-Rudolf Voigt in the previous issue of the journal (Proc. Estonian Acad. Sci. Ecol., 1994, 4, 3, 128—135) were all wrong and totally mixed up, the correct data are presented here as Table 3.

Table 3

Content of sum-DDTs and sum-PCBs, mg·kg⁻¹, in fishes from Väike Väin in summer 1993

Fish species	Sum-DDTs		Sum-PCBs	
	Extractable fat	Fresh weight	Extractable fat	Fresh weight
Herring	0.6	0.02	2.9	0.08
Sprat	0.7	0.01	2.9	0.07
Garpike	0.3	0.002	4.6	0.04
Smelt	0.1	0.002	0.8	0.02
Perch	0.3	0.002	0.7	0.01
Pike	0.1	0.001	0.6	0.04

The amount of residues of both DDT:s (DDE, DDD and DDT) and PCB:s (52 congeners) were notably high in muscle-liver homogenats of more open sea living species like Baltic herring (mean; 0.6 respectively 2.9 mg/kg on the basis of fat content, sprats (0.7 resp. 2.9 mg/kg on the basis of fat content) and garpike (0.3 resp. 4.6 mg/kg on the basis of fat content).

In more coastal and inshore species these values were considerably smaller as for example in smelt (0.1 resp. 0.8 mg/kg on the basis of fat content), perch (0.3 resp. 0.7 mg/kg on the basis of fat content) and pike (0.1 resp. 0.6 mg/kg on the basis of fat content).

Accoring to unpublished data from the Finnish Institute of Marine Research, Mr. Hannu Haahti, corresponding data in 1993 for Baltic herring from Finnish waters off the Hanko-(Hangö-)peninsula at the inlet to the Gulf of Finland are 0.3 mg/kg on the basis of fat content (DDT:s) and 1.2 mg/kg on the basis of fat content (PCB:s).

As to heavy metals, the opposite seems to be the case: the more open-sea species like garpike and both clupeids are almost free of all the heavy metals analysed (Fe, Mn, Cu, Zn, Cd, Ni, Pb, and Hg) while the more nearshore species like e.g. the smelt showed somewhat higher concentrations. The results for the smelt are given in Table 2.

Table 2

Contamination of heavy metals in the muscle and liver of the smelt (*Osmerus eperlanus* L.) from the Väike Väin Strait in 1993

Heavy metal	Content, mg · kg ⁻¹ ,	
	in the muscle	in the liver
Fe	25.7	145.3
Mn	5.6	10.0
Zn	53.7	116.4
Cd	0.04	0.2
Ni	0.2	0.3
Pb	0.3	0.2
Hg	0.06	0.05