Reduction of cyprinid fish populations at Lake Hargsjön, Mjölby, by seine fishing in autumn 2021

General

Hargsjön is a 96-hectare lake in Mjölby municipality. The average depth of the lake is 2,2 m, maximum depth 5,6 m, and volume 2246144 m^3 [1)]. The lake suffers from unnaturally high nutrient contents. A significant portion of specially summertime nutrients and algae problems are observed or suspected to be caused by internal loading. One of the common sources for internal loading are unbalanced food-webs where cyprinid fishes with high biomasses are dominating the fish populations.

Reduction fishing of cyprinids is one of the methods, and a relatively inexpensive one, for reducing internal loading of nutrients and summertime algae problems as well as increasing water clarity. The method suits best to lakes where highest nutrient contents and murkiest water are observed during warm summer months when fish activity is most intense.

The Finnish seining method for cyprinid fishing has been developed during the last 30 years, starting from early 1990s. In small lakes (about <100 ha) it can be used cost-effectively throughout a year but especially in large lakes the technique is most effective during autumn and cooling water when cyprinid fishes tend to shoal to dark refuges, i.e. deep areas of a lake, at daytime. If dark refuge is not available the fish may also hide to rivers, brooks and even ditches, or to littoral vegetation. In cooling water cyprinid fishes can meet their needs for daily feeding during twilight and night and thus being exposed for visual predators like pike and fish-eating birds during daytime is an unnecessary risk. The biggest cyprinids like adult bream and tench may still stay in open and illuminated water layer because their risk for predation is low.

A target catch for the 2021-2022 fishing at Hargsjön is estimated as 200 kg/ha, totaling 20 000 kg. The target is a rough figure and is based on the typical late summer total phosphorus in the lake (µg/l) and the lake's surface area[2)]. The target catch should be achieved in a relatively short time, usually within 1-2 years.

This report is about seine fishing in autumn 2021. The fishing was done by Tmi Arto Hautala (under consultant) and ordered by EnviroPlanning V Götaland AB (main consultant) and Mjölby municipality (customer). The contract was for six days and was adjustable downwards if daily catches were not satisfactory.

1) The figures are based on recorded data of through echo sounding during the fishing. The data was processed with Reefmaster software. The figures are valid only for the water level during the seining.
2) Target catch (kg/ha) = 16.9 x TP µg/l ^{0,52} ; Jeppesen, E. & Sammalkorpi, I. 2002. Lakes. In: Davy, A.J. & Perrow, M.R.(ed.). Handbook of ecological restoration. Vol. II. Restoration in practice. Cambridge University Press: 297-324

Circumstances during fishing

The seining took place on 4th – 7th November including four days of fishing and six seine hauls. The seine used was a 314 m long and 6 m deep cyprinid bottom seine. Conditions were good for both echo sounding and seining. Water temperature decreased slightly from 7,9 to 7,1 °C during the period. Secchi depth was measured as 2,6 m. A daytime dark refuge in deep water is generally achieved when water depth is more than twice the Secchi depth. Thus, there was practically no dark refuge available for the fishes at Hargsjön during the fishing.

Echo sounding and catches

The lake was echo sounded extensively on all fishing days and specially on the first and last fourth day (Fig 1). The open area of the lake was mostly fishless except few daily shoals of big bream which were observed on a restricted area where water depth was at least 3 m (Fig 2). Specially bream gathered there beside a (waste)water pipeline that runs lengthwise through the lake (Fig 2).

The biomanipulation catch was 7810 kg (81 kg/ha and consisted about totally of big bream (Tab 1). Only few ruffe (gers) and one roach (mört) were other target species observed in the catch. The average catches per seine haul and per fishing day were 1302 and 1953 kg. However, most of the total catch came already on the first day after which catches decreased fast and markedly (Tab 1) and the fishing was decided to end on the fourth day.

About 500 kg predatory fishes were released back to the lake in good condition. They consisted of pikeperch (gös, 137 individuals, 217 kg), pike (gädda, 139 ind., 278 kg) and few predatory perch (abborre >15 cm, 2 ind., 1 kg) (Tab 1). The prey-predator ratio (kg/kg) in the total catch was 16.

Notices and conclusions

Because the lake offered no dark refuge for the fishes during the fishing period, only the shoals of big bream were observed in the open water. According to our observations, the daytime refuge of smaller fishes situated mainly inside the littoral vegetation where fishes were observed visually and from where cormorants (skarv) and mergansers (skrake) chased them during the days. The inlet/outlet rivers were not checked.

The biomanipulation catch was 81 kg/ha, which is about 40 % of the rough target catch 200 kg/ha for the years 2021-2022. Even though unexpectedly clear water decreased the catches generally, the quality of the catch was very good and effective in the sense of biomanipulation. Big bream is the most effective species to circulate the nutrients from the bottom and causing internal loading and murky water. The species is usually difficult to observe by echo sounding when all the other species are present at the same time. Our experience is that big bream can be seriously neglected during the first years of fishing and the catch of the species is emphasized only during the last year(s). Also, our experience is that the biomass of big bream, even in eutrophicated lakes, is generally less than 100 kg/ha. Therefore, the achieved catch can be considered high and describes how strongly big bream had gathered to a one restricted area of the lake. In this situation seining was very effective which explains the fast diminishing of the catches. However, when the potential size of the shoal for shelter-seeking breams had markedly decreased, the survived specimens may also have preferred littoral vegetation. This might also explain the small catches on the last fishing days.

The fishing cost for the catch was 8,5 SEK/kg (just our fishing, without other possible costs). With this figure seining was cost effective at Lake Hargsjön and the lake is suitable for the method. In our seining and fykenet fishing contracts cost per kg has varied typically in a range of 1-20 SEK/kg. We consider costs under 10 SEK/kg cost-effective and 10-20 SEK/kg reasonable. Prices over 20 SEK/kg are costly and with these figures one should consider changing the methods.

The wet biomass of cyprinid fishes contains 0,8 % phosphorus and 2,5 % nitrogen. Therefore, the fishing removed directly 62 kg phosphorus and 195 kg nitrogen from the lake´s ecosystem. The fishing costs relative to these figures were 1056 SEK/kg P and 338 SEK/kg N.

The reduction fishing at Hargsjön will continue in the next year 2022. After the present experiences it might be now good to schedule the fishing to August…September, when the Secchi depth in the lake is most probably less than it now was. A Secchi depth less than 1,2 m would be ideal to catch also small cyprinids

effectively. Even though the water clarity might be better than that, all fish should be more present in the catch because warmer water causes a need for foraging also during daytime.

Thanks!

Thanks for the good organization of the project for Dennis Jonason (EnviroPlanning AB) and others. And thanks for all the help and good company for the local people during the fishing.

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"A fine catch from a fine lake". The photo shows the quality of the cyprinid catch at Hargsjön in 2021. The photo is from the first fishing day.

Table 1. *The hauls and catches in the reduction fishing of cyprinids by seining at Lake Hargsjön in autumn 2021. An excel file with a more complete fishing diary has been sent separately for the client.*

DRAG					FÅNGST kg								ROVFISKAR						
								abborre				Biomanipulering	gös		gädda		abborre >15 cm		Rovfiskar
nummer	dag	lengd m	yta ha		braxen	mört	gers	<15 cm	benlöja	björkna	sutare	fångst kg	st.	kg [2]	st.	kg [3]	st.	kg [4]	tillsammans kg
1	4.11.2021	170	2,55		6000	0,0	0,0	0,0	0,0	0,0	0,0	6000	26	52	36	72	0	0	124
2	5.11.2021	180	3,6		0	0,0	0,0	0,0	0,0	0,0	0,0	0	0	0	0	0	0	0	0
3	5.11.2021	150	3		1500	0,0	0,2	0,0	0,0	0,0	0,0	1500	41	82	45	90	1	0	172
4	6.11.2021	70	1,4		300	0,2	0,2	0,0	0,0	0,0	0,0	300	9	7	23	46	1	0	53
5	6.11.2021	150	2,25		0	0,0	0,2	0,0	0,0	0,0	0,0	0	46	46	18	36	0	0	82
6	7.11.2021	50	1		9	0,0	0,0	0,0	0,0	0,0	0,0	10	15	30	17	34	0	0	64
			13,8	kg	7809	0,2	0,6	0,0	0,0	0,0	0,0	7810	137	217	139	278	2	1	496
				%	99,99	0,00	0,01	0,00	0,00	0,00	0,00	81,4	kg/ha (96 ha)						

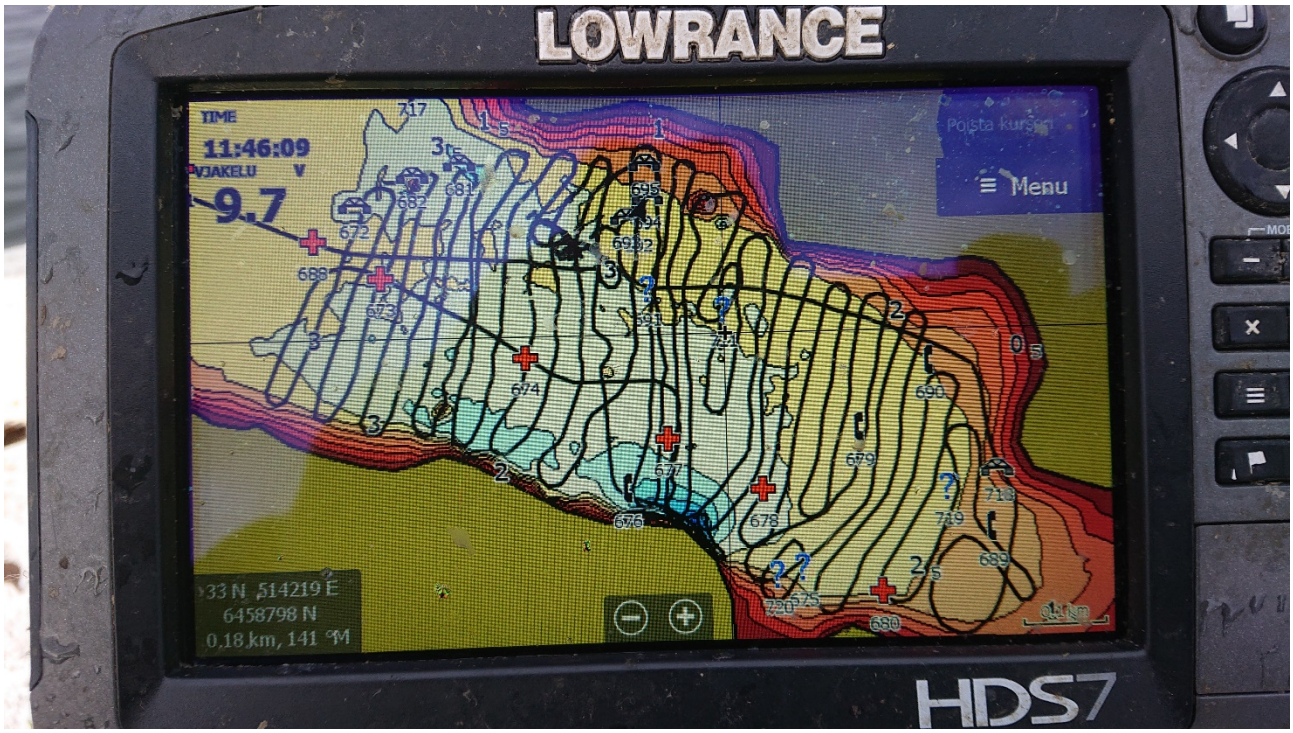

Figure 1. *The trails of one echo sounding unit in seeking fish on one day's morning or afternoon. The sounding was made with two units at the same time and the lake's area was thoroughly covered multiple times during the four days fishing period.*

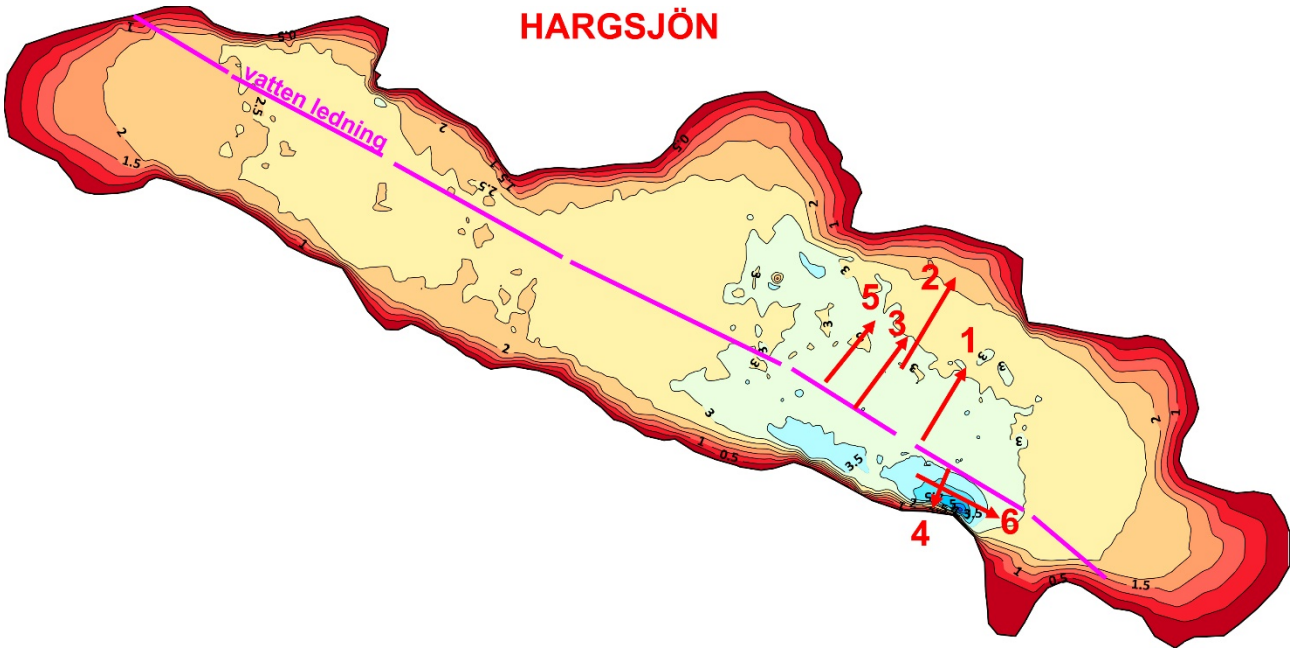

Figure 2. *The locations of 6 hauls made in the reduction fishing of cyprinids by seining at Lake Hargsjön in autumn 2021. Big bream (or any fish) was found only from the blue area where water depth is over 3 meters.*