Reduction of cyprinid fish populations at Lake Hargsjön, Mjölby, by seine fishing in autumn 2022

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 has suffered 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 feeding activity of fish 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 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 individuals 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 was 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.

1) The figures are based on recorded data of through echo sounding during the fishing 2021. 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

The first seine fishing period in 2021 (four days 4th – 7th November) produced a 7810 kg catch (81 kg/ha) which consisted of big bream only. At the time Secchi depth was measured as 2,6 m and there was practically no dark refuge available for the fishes at Hargsjön during the fishing. All cyprinids except big bream were hiding in the littoral vegetation where the seining was not possible (Hautala and Kiiskilä 2021). Therefore the second seining period in 2022 was decided to take place earlier when secchi depth might preferably be about 1 m.

This report is about seine fishing in autumn 2022. 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 8 days and was adjustable according to catches.

Circumstances during fishing

The seining took place on 4th – 6th October (a month earlier than in 2021) including three days of fishing and four 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 was 13 °C (7-8 °C in 2021). Secchi depth was measured as 1,25 m (2,6 m in 2021). A daytime dark refuge in deep water is generally achieved when water

depth is more than twice the Secchi depth. Therefore, there was dark refuge available for the fishes at Hargsjön during the fishing and the timing was good and as planned.

Echo sounding and catches

The lake was echo sounded on all fishing days. The shallow area 0…2,5 m of the lake was mostly fishless except few shoals of big bream. Only one big shoal of big bream consisting of hundreds of individuals was observed whereas other few shoals consisted of only 5…10 individuals. And as wished, dense shoals of roach were observed in the deepest 3…5 m water (dark refuge area).

The biomanipulation catch was 14500 kg (151 kg/ha) and consisted mainly of roach (mört, 70 %) and bream (braxen, 14 %) (Tab 1). Other species in the catch were perch (abborre), ruffe (gers), bleak (benlöja) white bream (björkna), tench (sutare) and crucian carp (ruda). The last catch (haul number 4) consisted only perch and all fish were released back to lake. The average biomanipulation catches per seine haul and per fishing day were 3625 and 4833 kg.

About 1000 kg predatory fishes were released back to the lake in good condition. They consisted of pikeperch (gös, 28 individuals, 63 kg), pike (gädda, 231 ind., 524 kg) and predatory perch (abborre >15 cm, 2784 ind., 419 kg) (Tab 1). The prey-predator ratio (kg/kg) in the total catch was 14.

Notices and conclusions

The timing for the fishing was good in both years 2021 and 2022. The conditions in the first year were good for finding and seining of big bream, which are the most effective cyprinids to circulate the nutrients from the bottom and causing internal loading and murky water. The total catch of big bream in 2021-2022, about 100 kg/ha, is a high number for any lake. And now in 2022 the conditions were good for finding and seining of roach, which is the second important target in pursue for better water quality by reduction fishing.

The total biomanipulation catch 2021-2022 is now 22310 kg (232 kg/ha) which exceeds the target 200 kg/ha. The strong presence of perch both in catch and in predators is a good sign and should increase the durability of the results in water quality in coming years.

The fishing cost for the catch 2021-2022 was 5,3 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 178 kg phosphorus and 558 kg nitrogen from the lake´s ecosystem. The fishing costs relative to these figures were 660 SEK/kg P and 210 SEK/kg N.

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. We were told that the 2021 fishing had already improved water clarity at the lake. Hopefully the next summers will be even better.

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Catch of roach and some big bream from the deep area of the lake.

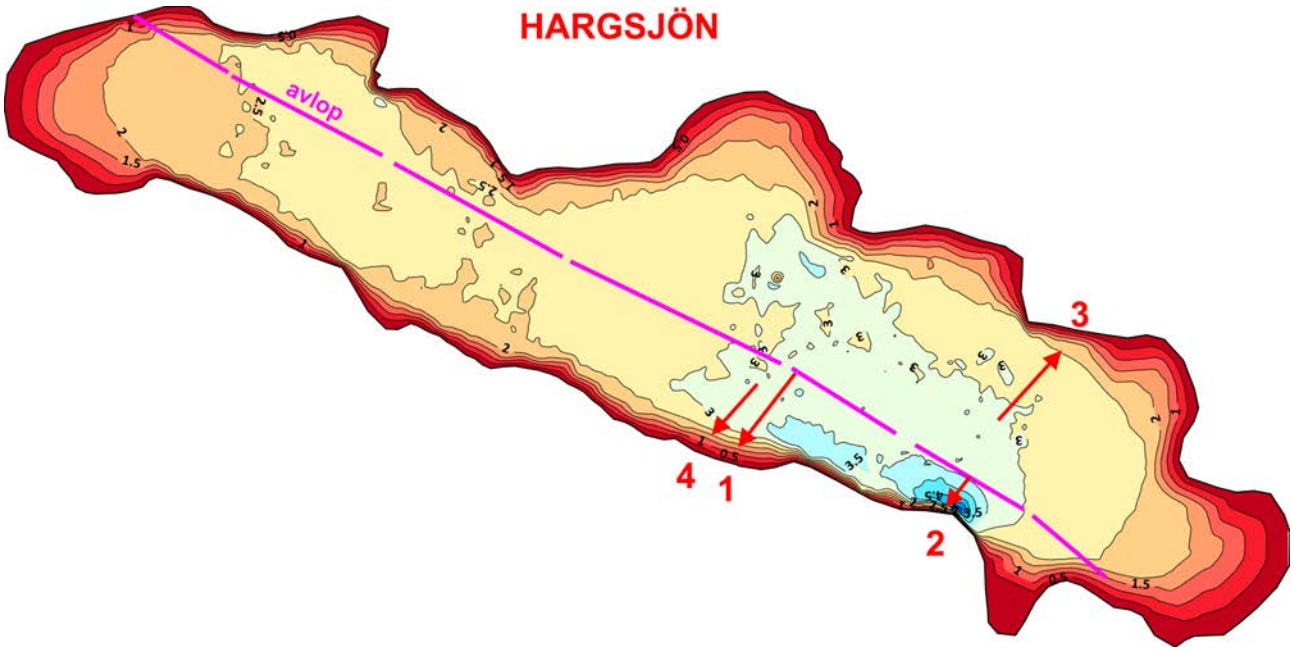

Figure 1. *The locations of 4 hauls made in the reduction fishing of cyprinids by seining at Lake Hargsjön in autumn 2022.*

Table 1. *The hauls and catches in the reduction fishing of cyprinids by seining at Lake Hargsjön in autumn 2022. 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	ruda	fångst kg	st.	kg [2]	st.	kg [3]	st.	kg [4]	tillsammans kg
1	4.10.2022	130	1,95		460	6500	40	350	70	20	50	10	7500	21	42	62	186	853	128	356
2	5.10.2022	70	1,4		100	3690	400	1200	80	10	20	0	5500	1	3	101	202	1925	289	494
3	6.10.2022	130	2,6		1495	1	0	0	0	0	4	0	1500	6	18	68	136	5	2	156
4	6.10.2022	120	2,4		(catch was about 400 kg perch, all were released)								0		0		0	1	0	0
			8,35	kg	2055	10191	440	1550	150	30	74	10	14500	28	63	231	524	2784	419	1006
				%	14,17	70,28	3,03	10,69	1,03	0,21	0,51	0,07	100							