Reduction of cyprinid fish populations by seine fishing at four lakes in Åtvidaberg in autumn 2021; Båtsjön, Getryggen, Fallsjön and Håcklasjön

General

Håcklasjön, Fallsjön, Getryggen and Båtsjön are adjacent tributary lakes of River Storån in Åtvidaberg municipality. The lakes suffer from unnaturally high nutrient contents. A significant portion of specially summertime nutrients and algae problems are observed 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 the lakes where the highest nutrient contents and murkiest water are observed during warmest summer months, July-August, when the feeding activity of fishes is most intense.

A 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 throughout a year but especially in large lakes the technique is most cost 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, 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 the 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.

Target catches for the lakes

Target catches for cyprinids are calculated according to late summer total phosphorus in the lakes and their surface area (Table 1). The target catch should be achieved in a relatively short time, usually within 1-2 years. Lake Båtsjön was already seined in autumn 2020 while in other lakes the autumn 2021 was the first year of reduction fishing.

Seining 2021 and its circumstances

The seining of the four lakes took place on 25th October – 3rd November including ten days of fishing and 19 seine hauls (Table 2). The seine used was a 314 m long and 6 m deep cyprinid bottom seine. Weather was suitable for echo sounding and seining on all days.

Water temperature was steadily 7,5…7,8 °C during the fishing and water was clear in all lakes. In Båtsjön, Getryggen and Fallsjön Secchi depth varied between 2,4…2,6 m and in Håcklasjön Secchi depth was 2 m. A dark daytime refuge in deep water is generally achieved when water depth is more than twice the Secchi depth. All the four lakes are shallow and thus there was no daytime dark refuge available for the fishes at Håcklasjön (max depth 2 m), Båtsjön (3,5 m) and Fallsjön (5 m), and just vaguely at Getryggen (6,5 m).

Catches

The total catch was 10460 kg and consisted mainly of big bream (braxen 89 %) that was longer than 40 cm and weighed over 800 g (Table 2, Figures 1 and 2). Big bream, assisted with tench (sutare 4,4 %), was the main catch in all lakes except Håcklasjön where the main catch was crucian carp (ruda 1,8 %). About all roach (mört 4 %) came from Getryggen. Other species noticed in the catch but with very small portions were ruffe (gers), small perch (små abborrar), white bream (björkna) and bleak (benlöja). (Table 2, Figures 1 and 2). The average catches per seine haul and per fishing day were 550 and 1046 kg.

About 1170 kg predatory fishes were released back to the lake in good condition. They consisted of pikeperch (gös, 435 individuals, 911 kg), pike (gädda, 100 ind., 236 kg) and predatory perch (abborre >15 cm, 87 ind., 19 kg) (Table 2). The prey-predator ratio (kg/kg) in the total catch was about 9.

Notices and conclusions

After the seining at Båtsjön autumn 2020 we wrote in the report (Hautala and Kiiskilä 2020): *"Lake Båtsjön is shallow and the present catch might already be enough to increase the autumnal Secchi depth over 2 meters. When this happens, the lake does not offer dark refuge for fishes anymore. In that situation all small cyprinids that are under the biggest risk to be eaten by pike or fish-eating birds may move to rivers or inside littoral vegetation during the autumn. Accordingly, all what is left for seining at open lake area is the biggest roach and bream. They may be enough to achieve the target catch but if not, the fishing method must be changed. Firstly, the seining could be started earlier during warm water (> 12 °C) when all the fishes are usually still in the lake. Or secondly, the river areas where fishes migrate should be sought and found a method to catch them from there."* This was the situation for almost all lakes now and only the deepest lake, Getryggen, produced some catches of roach and small bream even though these are common in all the four lakes. In the shallowest lake, Håcklasjön, even big bream had escaped from the open water. According to our obseravions, the daytime refuge of the four lakes seemed to situate mainly in the littoral vegetation where fishes were observed visually and from where cormorants (skarv) and mergansers (skrake) chased them during the days. The rivers between the lakes were checked too but no notable fish gatherings were found.

The biomanipulation catch considering all four lakes was now 68 kg/ha and altogether (2020-2021) 95 kg/ha which is 62 % of the four lake's joint target 154 kg/ha. The target catch of Båtsjön is about achieved (155/157 kg/ha) and the catch of Getryggen is close (96/115 kg/ha). Fallsjön is on half way (76/142 kg/ha) and Håcklasjön is in the very beginning (6/185 kg/ha).

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 usually 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 in the lakes is generally less than 100 kg/ha. The catches of big bream from Båtsjön (altogether about 90 kg/ha 2020 and 2021), Getryggen (76 kg/ha) and Fallsjön (71 kg/ha) can therefore be considered high.

The biomass of cyprinid fishes contains 0,8 % phosphorus and 2,5 % nitrogen of wet weight. Therefore, the fishing 2020-2021 has removed directly 188 kg phosphorus and 589 kg nitrogen from the lakes' ecosystem.

The fishing cost for the catch was about 5,8 SEK/kg in 2020 (just Båtsjön) and now 14,3 SEK/kg (just our fishing, without other possible costs). With this figure seining was altogether reasonably cost effective even though Håcklasjön was now very costly per kg. 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.

If the reduction fishing by seining is continued in future, it might be good to schedule it to August…September, when the Secchi depth in the lakes is perhaps less than it now was. Specially at Håcklasjön Secchi depth should be clearly under 1 m and in the other lakes perhaps not more than 1,5 m, to catch also roach and small bream. Even though the water clarity might be better than that, the fish

should be more present at open water because of warm water causing a need for foraging also during daytime.

Thanks!

Thanks again for the good organization of the project for Anton Sunnergren, Ola Helmerson and others. And thanks for all the local people for the help and good company during the fishing.

Arto Hautala
Fisherman, Fish biologist
www.vårdfiske.fi

Petteri Kiiskilä
Fisherman, Engineer

Above: typical catches of big bream from Båtsjön (left) and Fallsjön (right)
Below: catch from first haul at Getryggen with both bream and roach

Table 1. *Target catches for the reduction fishing of cyprinids at four Åtvidaberg lakes starting from year 2020 and number of fishing days used in each lake in 2021.*

	Area	Total_P	Target catch [1)]		Catch 2020	Target catch 2021	Fishing days
	ha	ug/l	kg/ha	kg total	kg	kg	used in 2021
Båtsjön	111	73	157	17500	13100	4400	3
Getryggen	15,6	40	115	1800	0	1800	1
Fallsjön	81	60	142	11500	0	11500	4
Håcklasjön	40	100	185	7500	0	7500	2
	248			38300	13100	25200	10

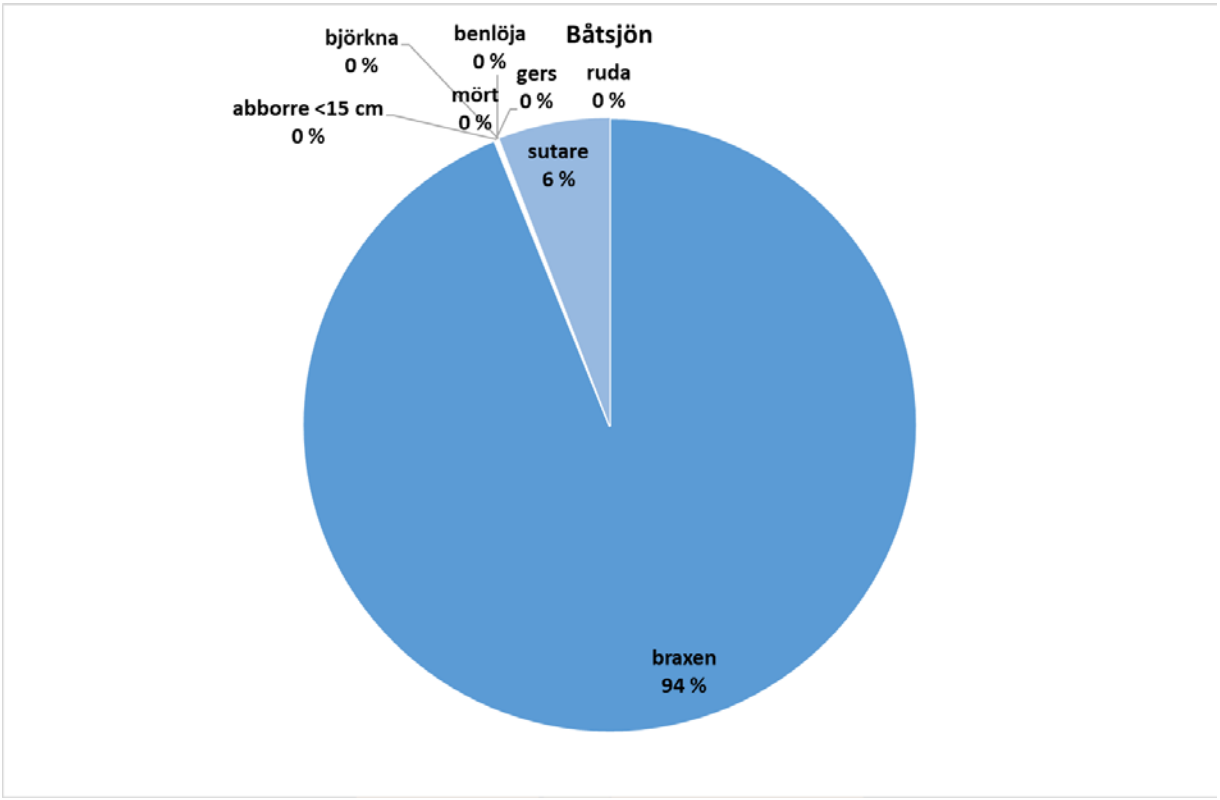
1) Target catch (kg) = 16.9 x TP ug/l $^{0.52}$;

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

Table 2. *The hauls and catches in the reduction fishing of cyprinids by seining in the Åtvidaberg lakes in autumn 2021. An excel file with a more complete fishing diary has been sent separately for the client.*

DRAG				FÅNGST kg									ROVFISKAR						
							abborre					total vitfisk	Gös		Gädda		Abborre >15 cm		rovfisk
	sjön	datum	ha	braxen	mört	gers	<15 cm	benlöja	björkna	sutare	ruda	fångst kg	n	kg	n	kg	n	kg	fångst kg
1	Båtsjön	25.10.		998	0	0	0	0	2	0	0	1000	9	9	9	18	1	0	27
2	Båtsjön	25.10.		10	0	0	0	0	0	0	0	10	32	22	7	14	1	0	37
3	Båtsjön	26.10.		36	2	0	1	0	1	0	0	40	29	58	3	9	4	1	68
4	Båtsjön	26.10.		1798	0	1	0	0	1	200	0	2000	17	34	7	21	0	0	55
5	Båtsjön	27.10.		1057	0	2	0	0	1	40	0	1100	49	74	3	9	0	0	83
6	Båtsjön	27.10.		6	0	0	0	0	0	3	0	9	10	20	12	30	7	1	51
7	Getryggen	28.10.		200	290	4	4	1	1	0	0	500	7	14	8	16	0	0	30
8	Getryggen	28.10.		980	15	1	1	0	1	2	0	1000	11	28	3	9	0	0	37
9	Fallsjö	29.10.		1030	107	10	3	0	0	50	0	1200	54	135	3	6	49	7	148
10	Fallsjö	30.10.		1550	4	5	1	0	0	40	0	1600	51	128	6	18	7	1	147
11	Fallsjö	30.10.		430	0	10	0	0	0	10	0	450	17	43	4	4	1	0	47
12	Fallsjö	31.10.		185	0	5	0	0	0	10	0	200	45	90	1	2	3	0	92
13	Fallsjö	31.10.		475	0	5	0	0	0	20	0	500	5	10	3	6	0	0	16
14	Fallsjö	1.11.		193	0	1	0	0	0	6	0	200	42	105	2	4	1	0	109
15	Fallsjö	1.11.		376	2	2	0	0	0	20	0	400	51	128	5	10	4	1	139
16	Håcklasjön	2.11.		1	0	0	0	0	0	44	0	45	0	0	6	24	0	0	24
17	Håcklasjön	2.11.		4	1	0	0	0	0	0	145	150	1	0	2	4	3	2	7
18	Håcklasjön	3.11.		0	0	0	0	0	0	6	14	20	2	6	7	14	0	0	20
19	Håcklasjön	3.11.		1	0	1	0	0	0	6	27	35	3	9	9	18	6	4	31
			kg	9330	421	47	11	1	7	457	186	10460	435	911	100	236	87	19	1166
			%	89,2	4,0	0,4	0,1	0,0	0,1	4,4	1,8	98							
				Båtsjön															
			kg	3905	2	3	2	0	5	243	0	4160							
			%	93,9	0,0	0,1	0,0	0,0	0,1	5,8	0,0	100							
				Getryggen															
			kg	1180	305	5	5	1	2	2	0	1500							
			%	78,7	20,3	0,3	0,3	0,1	0,1	0,1	0,0	100							
				Fallsjön															
			kg	4239	113	38	4	0	0	156	0	4550							
			%	93,2	2,5	0,8	0,1	0,0	0,0	3,4	0,0	100							
				Håcklasjön															
			kg	6	1	1	0	0	0	56	186	250							
			%	2	0	0	0	0	0	22	74	100							

All four lakes 2020-2021 (248 ha)		
10460	kg seining 2021	
13100	kg seining 2020 (Båtsjö)	
23560	kg	
95	**kg/ha**	
Båtsjön (111 ha)		
4160	kg seining 2021	
13100	kg seining 2020	
17260	kg	
155	**kg/ha**	
Getryggen (15,6 ha)		
1500	kg seining 2021	
96	**kg/ha**	
Fallsjön (60 ha)		
4550	kg seining 2021	
76	**kg/ha**	
Håcklasjön (40 ha)		
250	kg seining 2021	
6	**kg/ha**	



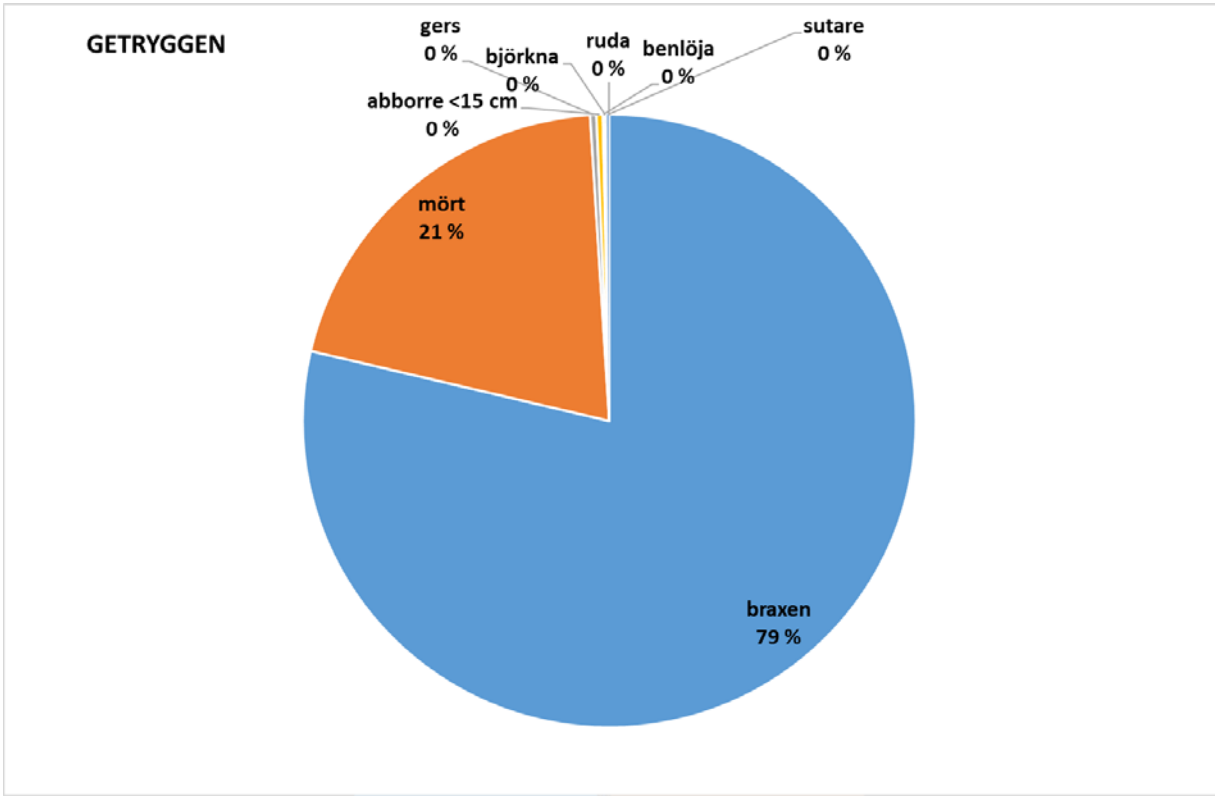
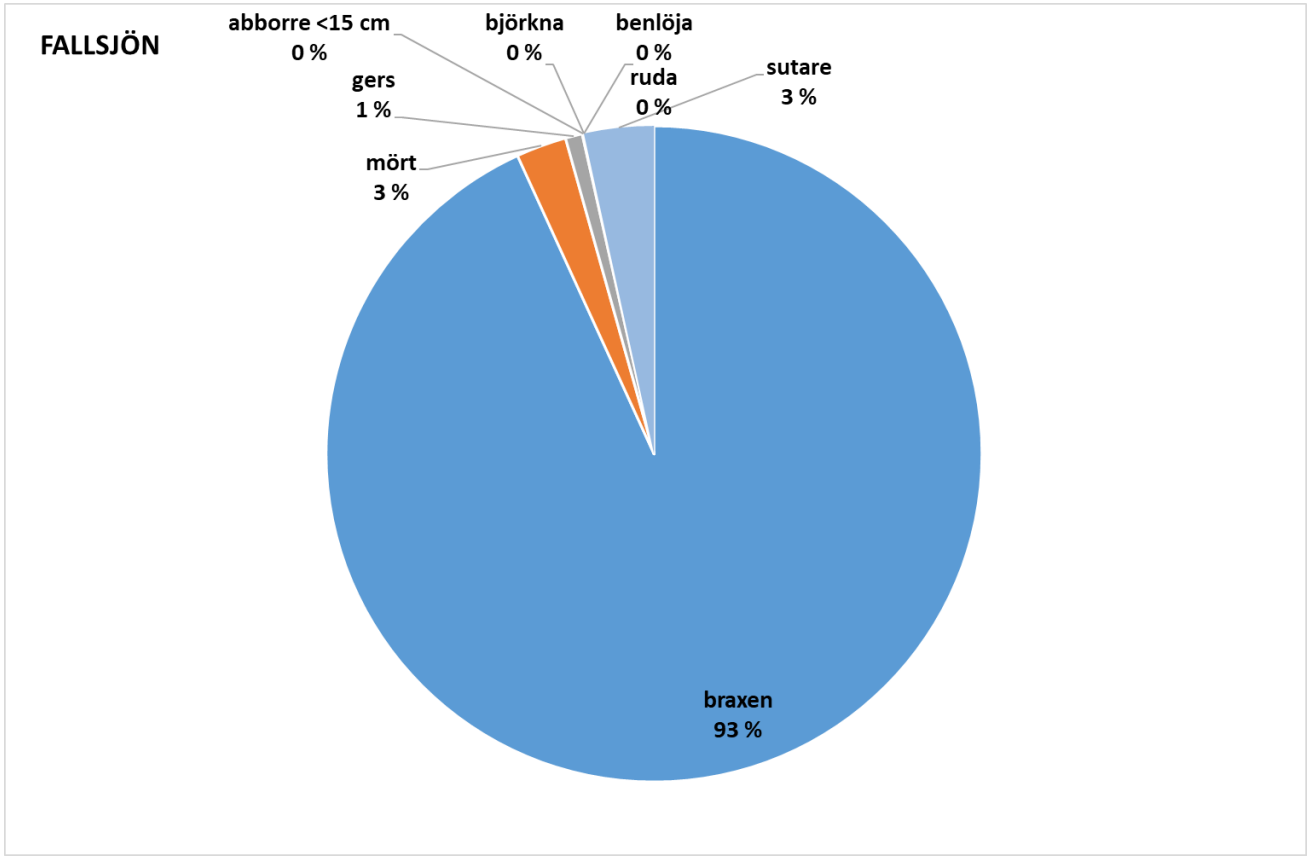


Figure 1. *The composition of catch in the reduction fishing of cyprinids by seining in Lake Båtsjön and Lake Getryggen in autumn 2021*



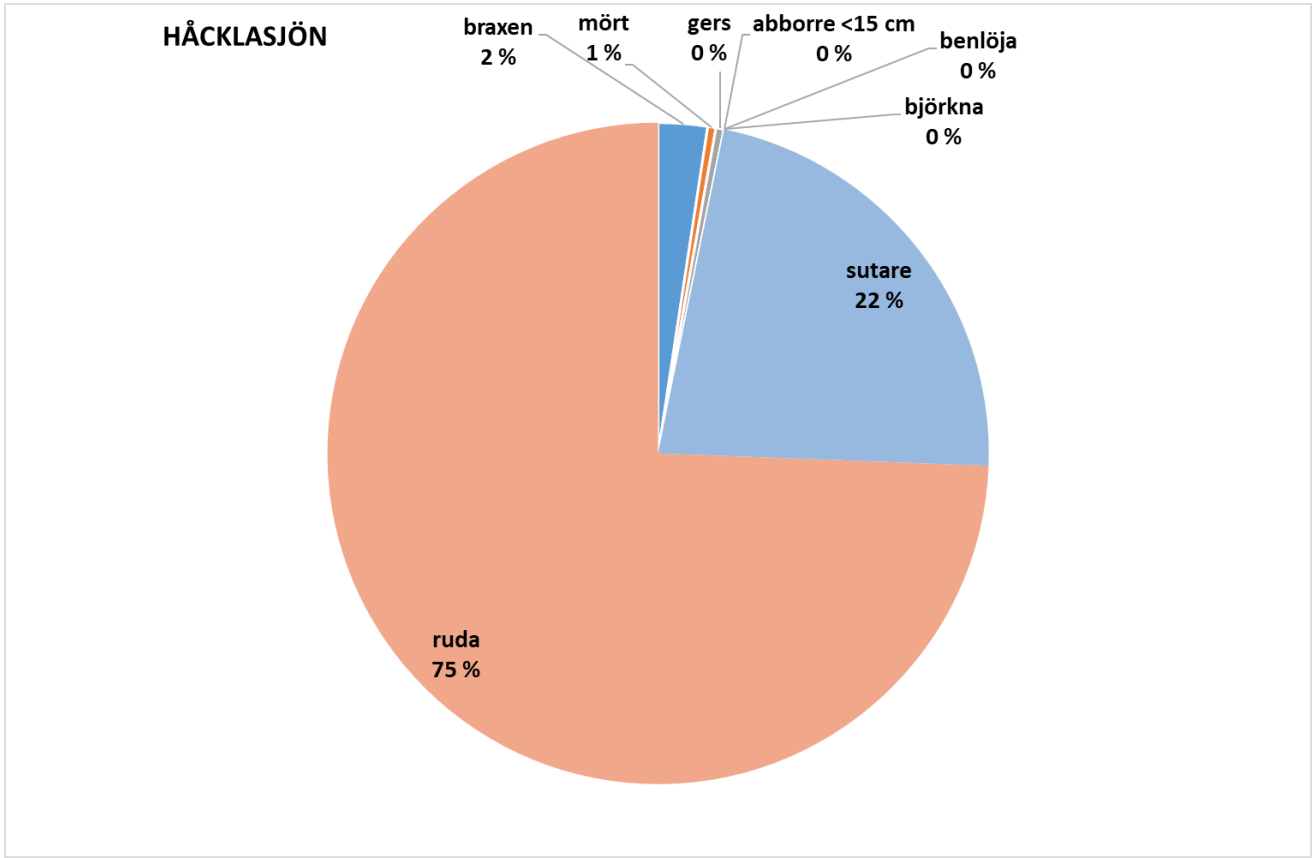


Figure 2. *The composition of catch in the reduction fishing of cyprinids by seining in Lake Fallsjön and Lake Håcklasjön in autumn 2021*

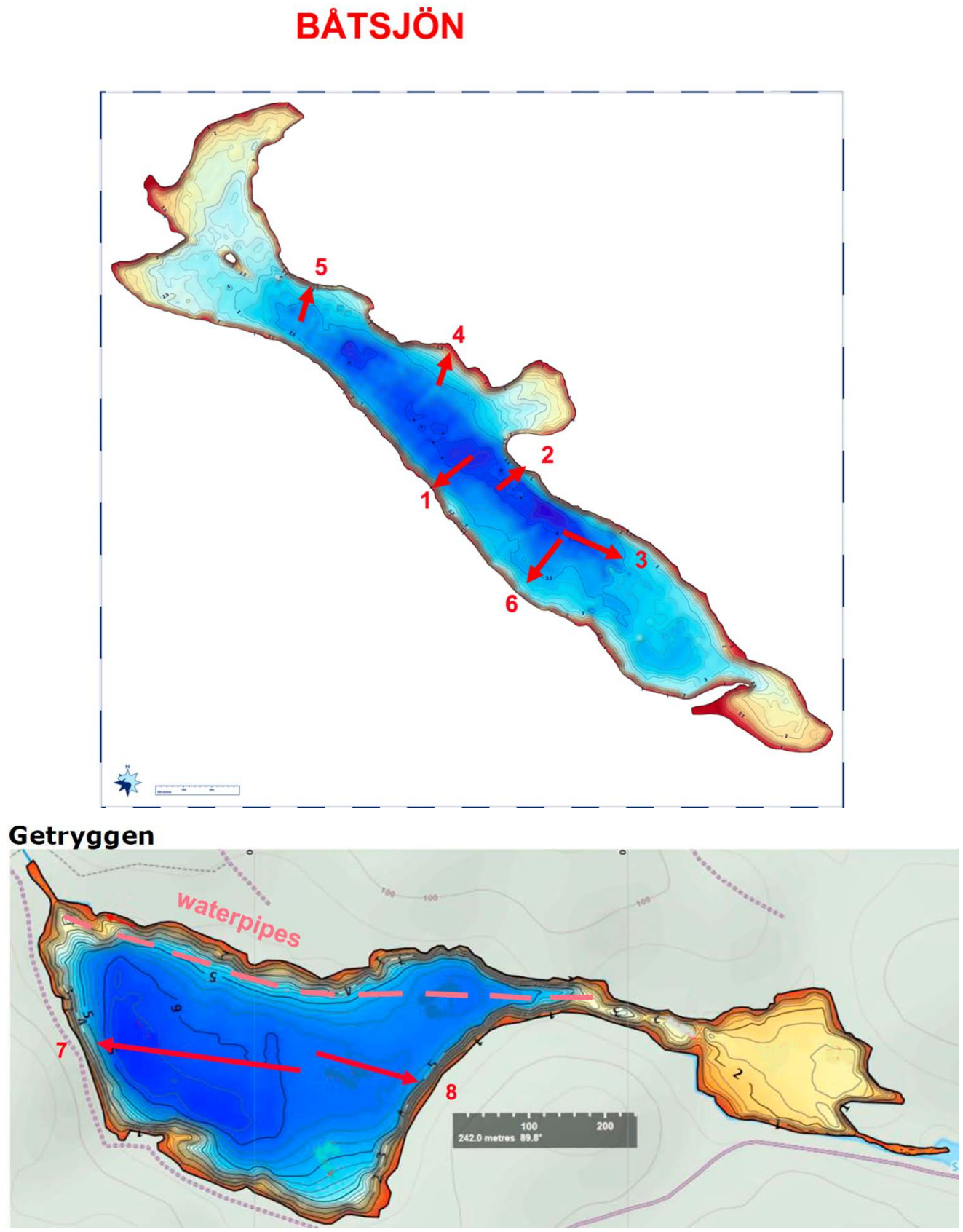


Figure 3. *The locations of the hauls made in the reduction fishing of cyprinids by seining at Lake Båtsjön and at Lake Getryggen in autumn 2021. The layout depth map is by Husshållningssällskapet, Ola Helmerson.*

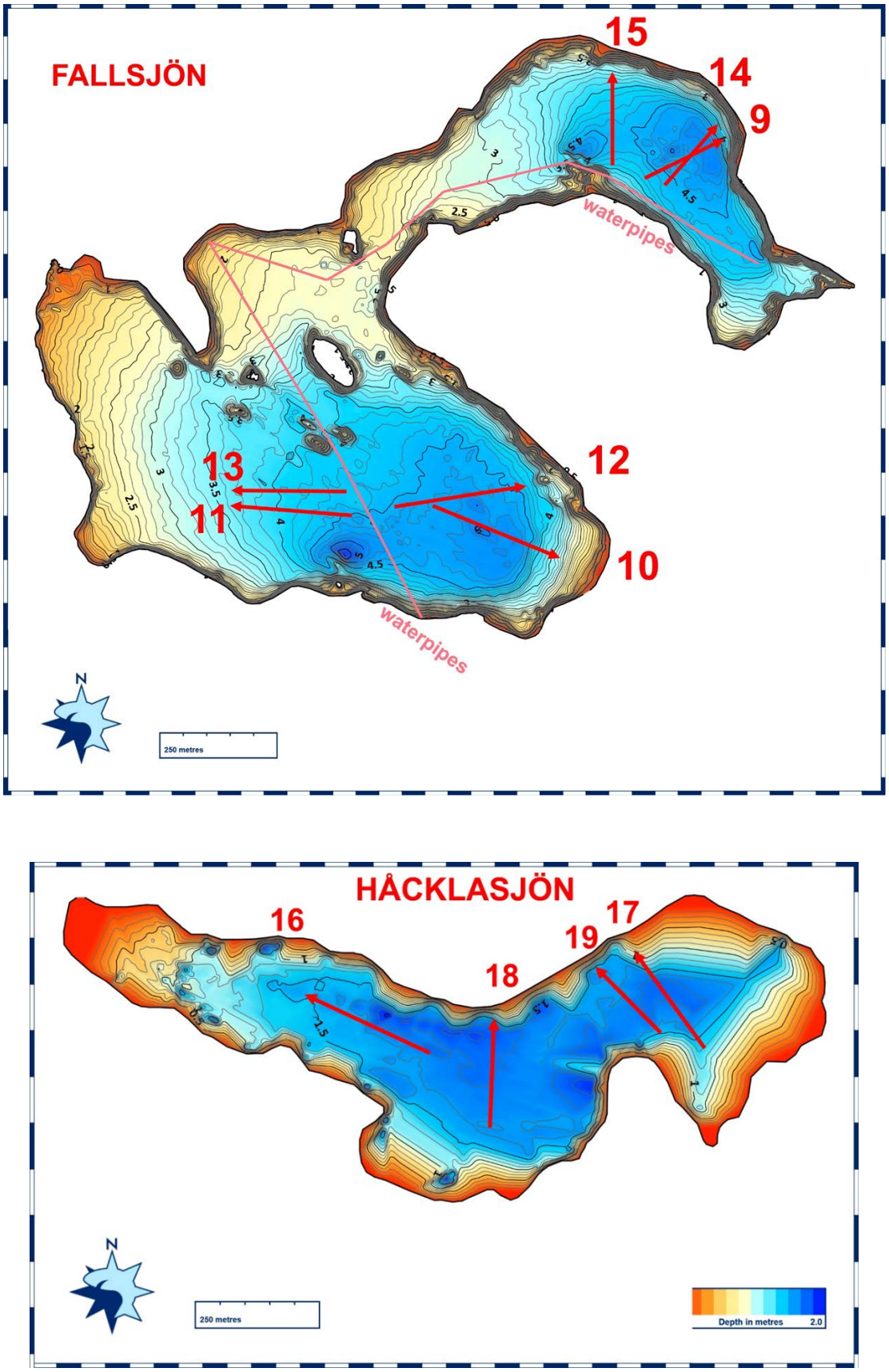


Figure 4. *The locations of the hauls made in the reduction fishing of cyprinids by seining at Lake Fallsjön and at Lake Håcklasjön in autumn 2021. The layout depth map is by Husshållningssällskapet, Ola Helmerson.*