

Reduction of cyprinid fish populations by seining at five lakes in Åtvidaberg in autumn 2022; Glan, Bysjön, Håcklasjön, Fallsjön and Gettryggen

General

Glan, Bysjön, Håcklasjön, Fallsjön and Gettryggen 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 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 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 per hectare were calculated according to late summer total phosphorus. The target catch should be achieved in a relatively short time, usually within 1-2 years. Three of the five lakes Håcklasjön, Fallsjön and Gettryggen, were already seined in autumn 2021 while for Glan and Bysjön autumn 2022 was the first year of reduction fishing. The joint target catch for the 2022 seining was about 32 tons. (Table 1).

In 2021 the three lakes were seined in late October- early November. During that period water in all lakes was already so clear that no dark refuge was available for the fishes. Roach and other small cyprinids were hiding in littoral vegetation and the catches from the open seining areas were mainly big bream. Therefore the seining period in 2022 was decided to take place earlier when secchi depth might preferably be about 1 m.

Seining 2022 and its circumstances

The seining of the lakes took place on 14th September – 3rd October including 20 days of fishing and 34 seine hauls (Table 2, Figures 4, 5 and 6). 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 decreased slightly from 15 to 13 °C during the fishing (7,5...7,8 °C in 2021). Secchi depth varied from lake to lake between 0,5...1,3 m (2...2,6 m in 2021). A dark daytime refuge in deep water is generally achieved when water depth is more than twice the Secchi depth. Unlike in 2021, dark refuge was now available for the fishes in all five lakes.

At Glan and specially at Bysjön several vertical large logs were observed in the lake which restricted the seining areas (Figure 5). The logs were typically about 6-8 m long, about 2-3 m of the log was inside the bottom (set in to the lake actively) and tip of the log was typically 50-100 cm from the water surface. The

logs were observed both in echosounders and when seine stuck to them. At Glan the number of observed logs was about 5-7 and at Bysjön at least 40 from which 15 were lifted up and removed. We assume that the logs did not cause any marked escape of the fishes from the hauls but the time used for fixing of the broken seine nets decreased the number of hauls.

Catches

The total catch was 34400 kg and consisted mainly of roach (mört, 46 %) and bream (braxen 45 %). Other species noticed in the catch but with very small portions were rudd (sarv), ruffe (gers), small perch (små abborrar), bleak (benlöja), white bream (björkna), tench (sutare) and crucian carp (ruda). (Table 2, Figures 1, 2 and 3). The average catches per seine haul and per fishing day were 1012 and 1720 kg.

About 2200 kg predatory fishes were released back to the lake in good condition. They consisted of pikeperch (gös, 717 individuals, 1035 kg), pike (gädda, 790 ind., 1088 kg) and predatory perch (abborre >15 cm, 573 ind., 103 kg) (Table 2). The prey-predator ratio (kg/kg) in the total catch was 15.

Notices and conclusions

The timing for the fishing was good in both years 2021 and 2022. The conditions in 2021 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. 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 joint target catch 31450 kg for the five lakes was exceeded. Individual target catches were achieved well in Gettryggen (catch 2021-2022 3200 kg vs. target 1800 kg), Fallsjön (14600 vs. 11500 kg) and Glan (8450 vs. 7400 kg) while not in Håcklasjön (6550 vs. 7450) and Bysjön (7900 vs. 9900 kg).

The catch of big bream from Fallsjön in 2021 and 2022 is about 10 000 kg and 123 kg/ha which is a very high number per area. After our experience the highest level is usually about 100 kg/ha. Thus we suspect that a portion of the lake's bream had moved there from Håcklasjön for the winter.

When catches from Båtsjön in 2020 and 2021 are also added, the total catch 2020-2022 is 58 tons. The biomass of cyprinid fishes contains 0,8 % phosphorus and 2,5 % nitrogen of wet weight. Therefore, the fishing in these lakes has removed directly 460 kg phosphorus and 1450 kg nitrogen from the headwaters of River Storån. The cost for this removal is 1140 SEK/kgP and 360 SEK/kgN (just our fishing, without other possible costs).

The fishing cost for the catch was in 2020 about 5,8 SEK/kg (just Båtsjön), in 2021 14,3 SEK/kg (Båtsjön, Håcklasjön, Fallsjön, Gettryggen, Båtsjön), now in 2022 8,7 SEK/kg, and altogether 8,9 SEK/kg (just our fishing). With these figures seining has been cost-effective and is a suitable method for reduction fishing in these lakes. After our 30 years' experience, 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.

Now, as the target catches has mostly been achieved, one might still plan some effort for the fishing in 2023. The effort, for example 10-15 days, should be allocated between the lakes according to water quality observations in summer 2023. A most suitable time for the fishing is September.

One might even reserve three days for removing logs from Glan (1 day) and Bysjön (2 days). Some logs may cause danger for injuries during routine recreational activities. The removal is rather inexpensive when done with the seining equipment that is already brought to the place for fishing.

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.

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Good catches of roach from Glan (above left), bream from Håcklasjön (above right) and logs from Bysjön (under)

Table 1. Target catches for the reduction fishing of cyprinids at five Åtvidaberg lakes in 2022.

	Area	Total_P	Target catch ¹⁾		Catch	Target catch
Lake	ha	ug/l	kg/ha	kg total	2021	2022 kg
Glan	64	40	115	7400	0	7400
Bysjön	100	30	99	9900	0	9900
Håcklasjön	40	100	185	7450	250	7200
Fallsjön	81	60	142	11500	4550	6950
Getryggen	15,6	40	115	1800	1500	300
				38050	6300	31750
1) Target catch (kg/ha) = 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 2022. An excel file with a more complete fishing diary has been sent separately for the client.

DRAG															FÄNGST kg										ROVFIŠKAR									
nummer	sjön	datum	längd m	ytan ha		braxen	mört	sarv	gers	abborre <15 cm	benlöja	björkna	sutare	ruda	total vtfisk fångst kg	check	Gös		Gädda		Abborre >15 cm		rovfisk < fångst kg											
1	Häcklasjön	14.9.	160	3,2		480	590	50	0	20	0	0	40	20	1200	1200	17	1	33	66	14	2	69											
2	Häcklasjön	14.9.	200	5,0		410	490	30	0	30	0	0	30	10	1000	1000	56	6	42	63	7	1	70											
3	Häcklasjön	15.9.	250	2,5		1150	150	45	5	20	0	0	10	20	1400	1400	23	46	44	66	8	1	113											
4	Häcklasjön	15.9.	120	2,4		420	100	40	2	20	0	0	8	10	600	600	9	4	41	62	8	1	67											
5	Häcklasjön	16.9.	170	4,3		150	200	10	5	10	0	0	10	15	400	400	14	1	22	44	5	1	46											
6	Häcklasjön	16.9.	360	9,0		750	250	40	10	20	0	0	20	10	1100	1100	50	3	54	108	11	2	112											
7	Häcklasjön	17.9.	350	8,8		330	5	2	5	10	0	0	40	8	400	400	34	2	40	80	2	0	82											
8	Häcklasjön	17.9.	160	4,0		115	30	0	5	20	0	0	20	10	200	200	9	0	25	50	5	1	51											
9	Glan	18.9.	160	4,0		250	2450	0	8	0	290	0	2	0	3000	3000	1	3	70	56	32	10	69											
10	Glan	19.9.	350	8,8		788	800	0	10	40	60	0	2	0	1700	1700	4	0	73	58	32	6	65											
11	Glan	19.9.	120	3,0		70	200	0	3	7	20	0	0	0	300	300	2	0	22	18	5	1	18											
12	Glan	20.9.	300	7,5		235	650	0	5	50	10	0	0	0	950	950	2	6	89	45	21	4	55											
13	Glan	21.9.	160	4,0		400	400	0	10	90	100	0	0	0	1000	1000	0	0	44	44	36	5	49											
14	Glan	21.9.	150	3,8		200	1200	0	0	40	60	0	0	0	1500	1500	0	0	20	20	4	1	21											
15	Bysjön	22.9.	250	6,3		500	1300	0	30	120	50	0	0	0	2000	2000	10	30	14	35	11	2	67											
16	Bysjön	23.9.	290	7,3		350	950	5	0	35	5	0	50	5	1400	1400	10	30	23	23	22	6	59											
17	Bysjön	24.9.	220	5,5		480	272	1	2	40	5	0	0	0	800	800	9	27	20	30	5	1	58											
18	Bysjön	24.9.	250	6,3		450	247	0	8	45	0	0	0	0	750	750	5	15	12	18	3	0	33											
19	Bysjön	25.9.	250	6,3		348	400	0	2	50	0	0	0	0	800	800	7	21	8	12	10	2	35											
20	Bysjön	26.9.	120	3,0		500	100	0	1	49	0	0	0	0	650	650	10	35	13	26	12	3	64											
21	Bysjön	27.9.	240	6,0		700	250	0	10	130	10	0	0	0	1100	1100	11	33	4	6	35	5	44											
22	Bysjön	27.9.	120	3,0		350	0	0	0	50	0	0	0	0	400	400	4	12	4	10	15	2	24											
23	Fallsjön	28.9.	300	6,0		270	1150	63	0	0	0	0	15	2	1500	1500	36	18	9	23	9	1	42											
24	Fallsjön	28.9.	250	5,0		550	72	5	0	0	1	70	2	0	700	700	38	8	2	3	11	2	12											
25	Fallsjön	29.9.	180	3,6		80	300	10	0	0	0	0	10	0	400	400	2	6	15	30	32	6	42											
26	Fallsjön	29.9.	250	5,0		950	1100	55	5	30	0	0	60	0	2200	2200	101	202	11	22	45	7	231											
27	Fallsjön	30.9.	320	6,4		535	450	150	10	40	0	0	15	0	1200	1200	31	62	1	3	20	3	68											
28	Fallsjön	30.9.	300	6,0		1100	100	50	5	41	0	0	4	0	1300	1300	78	156	1	1	19	3	160											
29	Fallsjön	1.10.	250	5,0		700	220	50	5	13	0	0	10	2	1000	1000	16	32	1	2	45	7	41											
30	Fallsjön	1.10.	300	6,0		100	95	0	0	5	0	0	0	0	200	200	9	18	1	2	6	2	22											
31	Fallsjön	2.10.	250	5,0		140	44	2	1	1	0	0	10	2	200	200	11	28	5	10	6	1	38											
32	Fallsjön	2.10.	200	4,0		1050	250	25	5	10	0	0	10	0	1350	1350	13	26	18	36	67	13	75											
33	Getryggen	3.10.	250	6,3		550	600	20	4	1	0	20	5	0	1200	1200	65	130	3	6	5	1	137											
34	Getryggen	3.10.	100	2,0		138	350	10	1	1	0	0	0	0	500	500	30	75	6	12	5	1	88											
					kg	15589	15765	663	157	1038	611	90	373	114	34400	34400	717	1035	790	1088	573	103	2226											
					%	45,3	45,8	1,9	0,5	3,0	1,8	0,3	1,1	0,3	100																			
						Båtsjön																												
					kg	0	0	0	0	0	0	0	0	0	0	0		15,45																
					%	#####	#####	#####	####	#####	#####	#####	#####	#####	#####	#JAKO/O!																		
						Getryggen																												
					kg	688	950	30	5	2	0	20	5	0	1700																			
					%	40	56	2	0	0	0	1	0	0	100																			
						Fallsjön																												
					kg	5475	3781	410	31	140	1	70	136	6	10050																			
					%	54	38	4	0	1	0	1	1	0	100																			
						Häcklasjön																												
					kg	3805	1815	217	32	150	0	0	178	103	6300																			
					%	60	29	3	1	2	0	0	3	2	100																			
						Bysjön																												
					kg	3678	3519	6	53	519	70	0	50	5	7900																			
					%	47	45	0	1	7	1	0	1	0	100																			
						Glan																												
					kg	1943	5700	0	36	227	540	0	4	0	8450																			
					%	23	67	0	0	3	6	0	0	0	100																			
						All six lakes 2020-2022 (412 ha)																												
						34400	kg seining 2022 (Getryggen, Fallsjö, Häcklasjö, Bysjö, Glan)																											
						10460	kg seining 2021 (Häcklasjö, Fallsjö, Getryggen, Båtsjö)																											
						13100	kg seining 2020 (Båtsjö)																											
						57960	kg																											
						141	kg/ha																											
						Båtsjön (111 ha)																												
						4160	kg seining 2021																											
						13100	kg seining 2020																											
						17260	kg																											
						155	kg/ha																											
						Getryggen (15,6 ha)																												
						1700	kg seining 2022																											
						1500	kg seining 2021																											
						3200	kg																											
						205	kg/ha																											
						Fallsjön (60 ha)																												
						10050	kg seining 2022																											
						4550	kg seining 2021																											
						14600	kg																											
						243	kg/ha																											
						Häcklasjön (40 ha)																												
						6300	kg seining 2022																											
						250	kg seining 2021																											
						6550	kg																											
						164	kg/ha																											
						Bysjön (100 ha)																												
						7900	kg seining 2022																											
						79	kg/ha																											
						Glan (64 ha)																												
						8450	kg seining 2022																											
						132	kg/ha																											

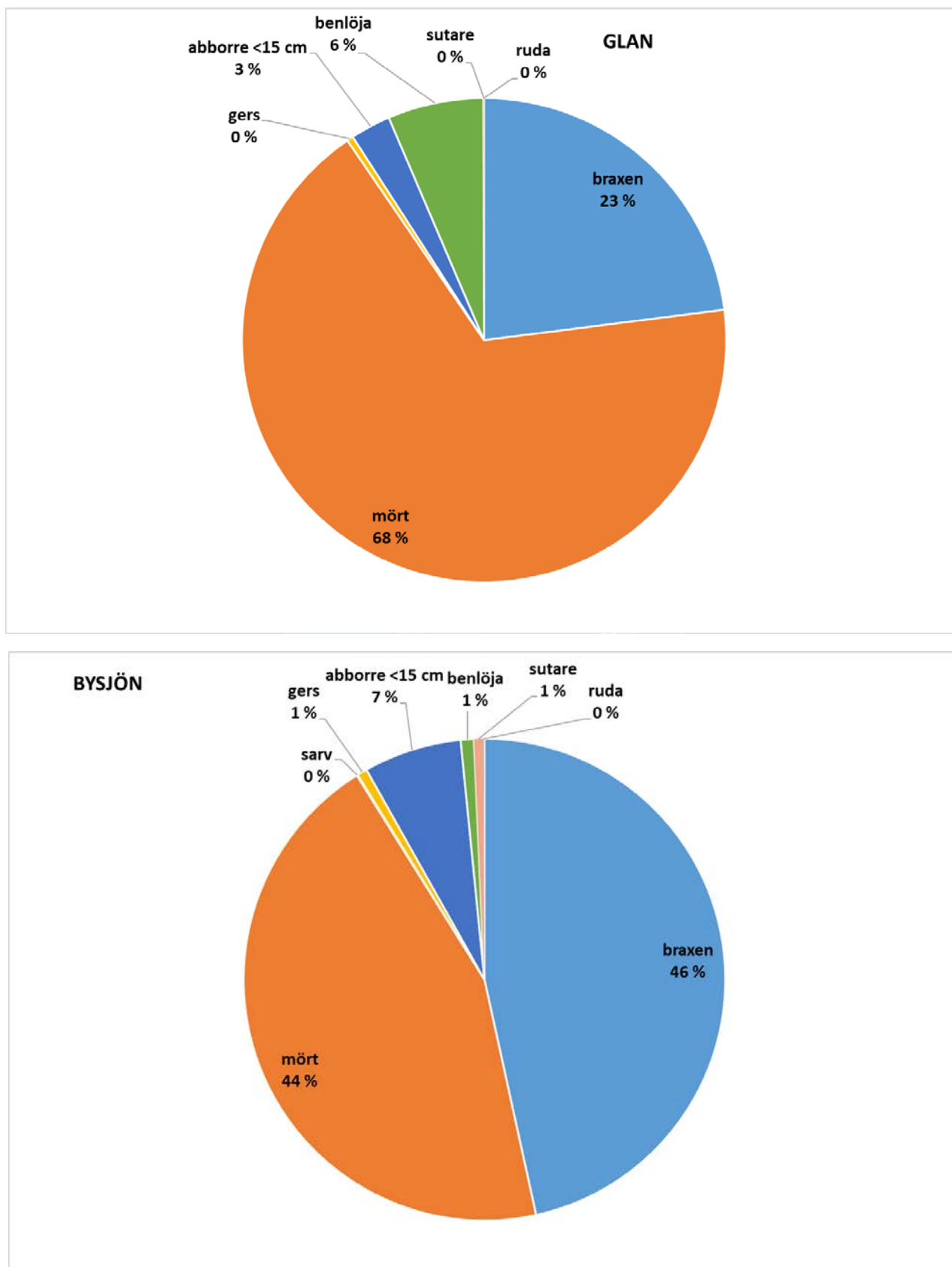


Figure 1. The composition of catch in the reduction fishing of cyprinids by seining in Lake Glan and Lake Bysjön in autumn 2022

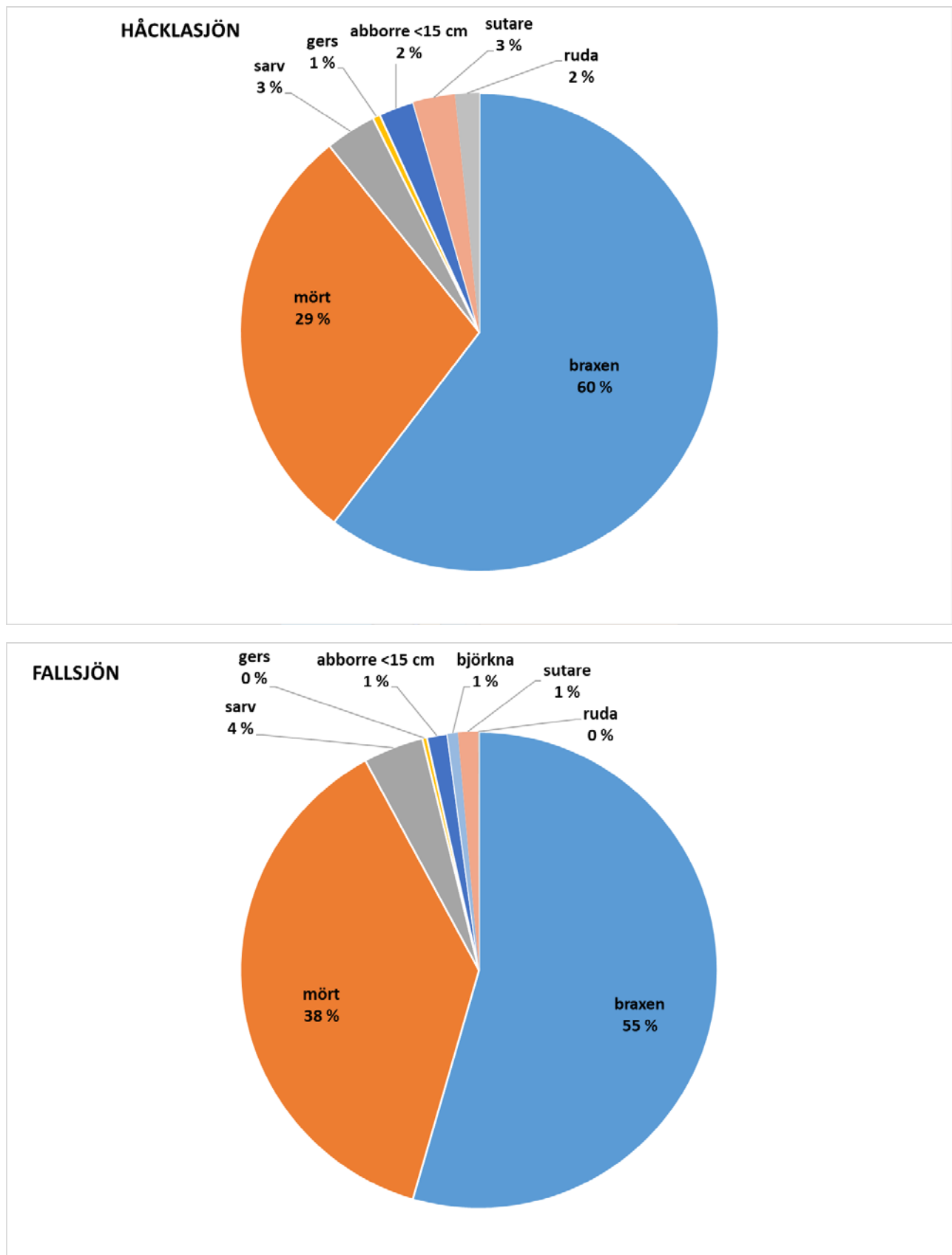


Figure 2. The composition of catch in the reduction fishing of cyprinids by seining in Lake Håcklasjön and lake Fallsjön in autumn 2022

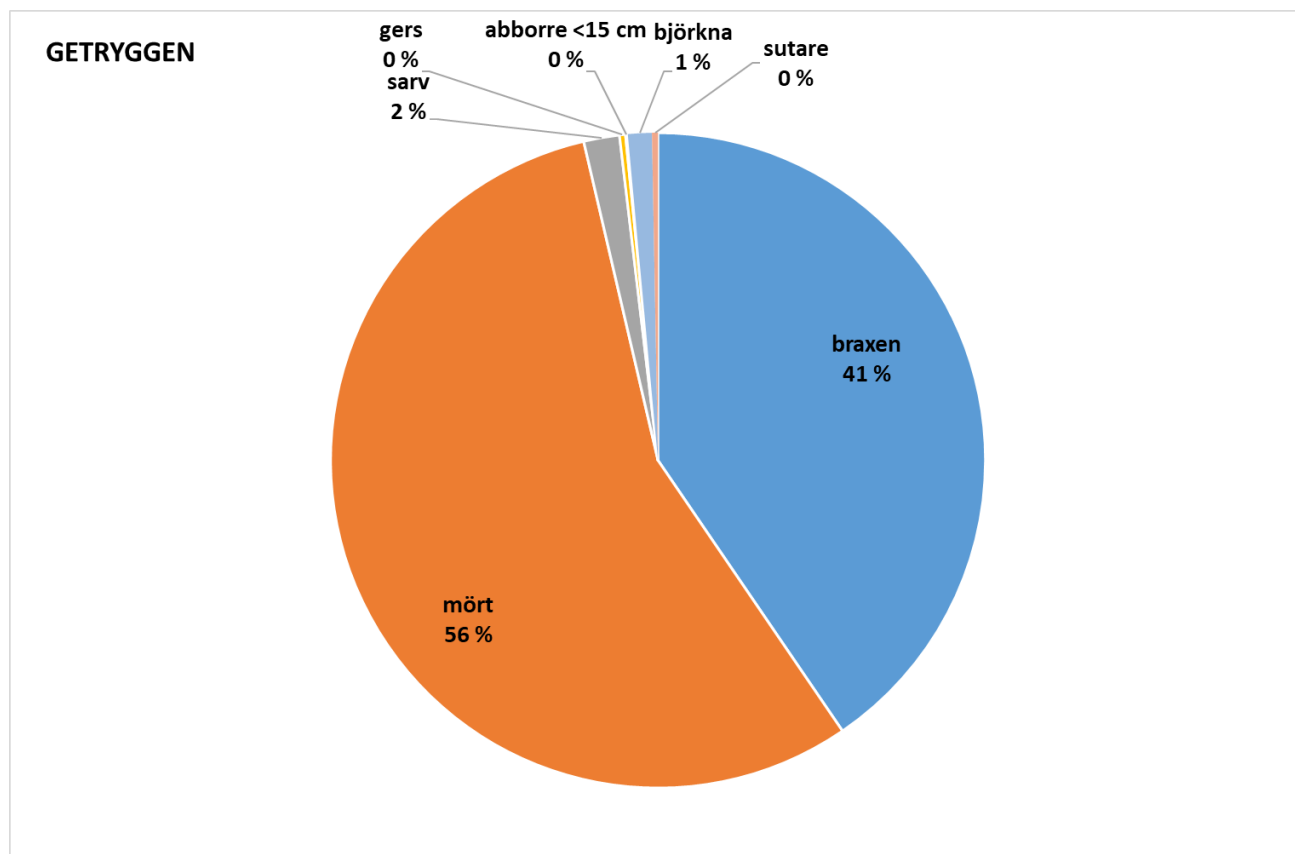


Figure 3. The composition of catch in the reduction fishing of cyprinids by seining in Lake Getryggen in autumn 2022

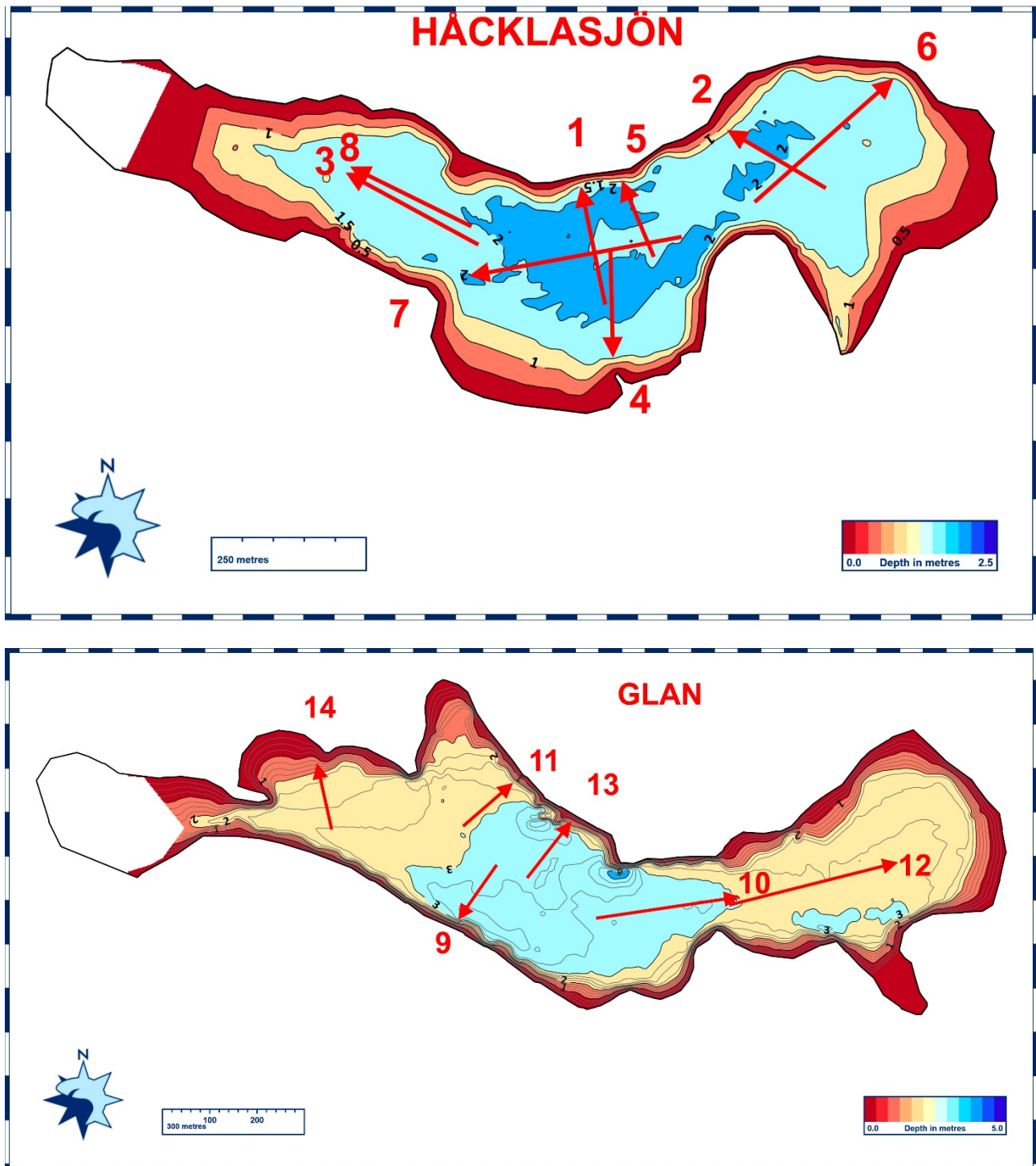


Figure 4. The locations of the hauls made in the reduction fishing of cyprinids by seining at Lake Håcklasjön and at Lake Glan in autumn 2022. The layout depth map is by Husshållningssällskapet, Ola Helmersson.

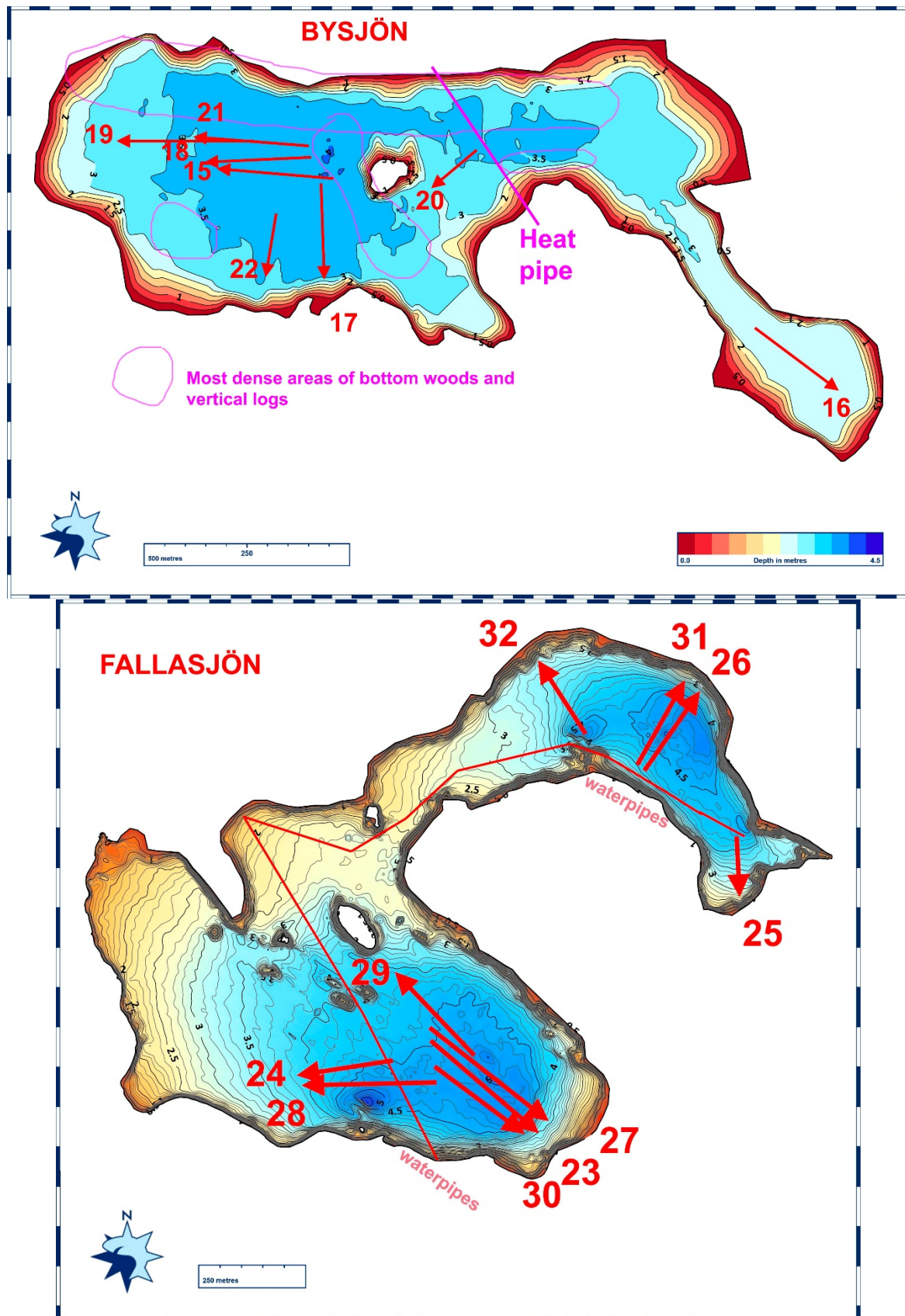


Figure 5. The locations of the hauls made in the reduction fishing of cyprinids by seining at Lake Bysjön and at Lake Fallsjön in autumn 2022. The layout depth map of Fallsjön is by Husshållningssällskapet, Ola Helmersson.

Gettryggen

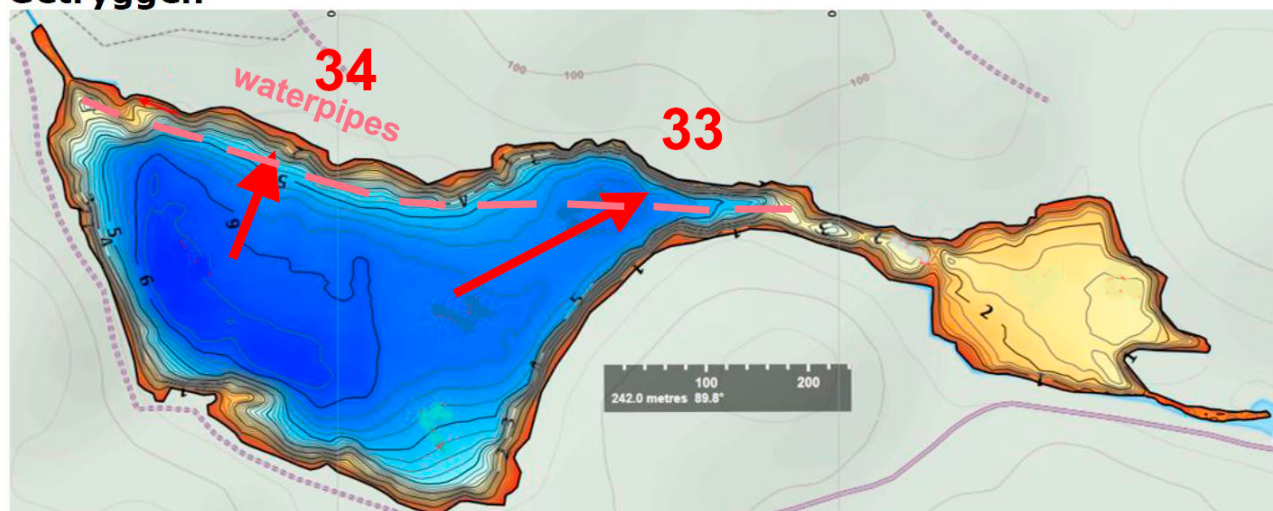


Figure 6. The locations of the hauls made in the reduction fishing of cyprinids by seining at Lake Gettryggen in autumn 2022. The layout depth map is by Husshållningssällskapet, Ola Helmersson.