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MIGRATION OF RIVER-SPAWNING WHITEFISH IN THE GULF OF FINLAND

by

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Abstract

The migratory whitefish (Coregonus lavaretus (L.) s.str. spawns in the River Kymi in October-November. The spawners overwinter in the river or the river mouth and migrate.in May or early June to the feeding areas in the sea, mainly located within a radius of 100 km from the river mouth. The fry migrate down the river to the sea soon after hatching, in late April or early May. The main direction of the feeding migration in the Gulf of Finland (sub-division 32) is south-east from the mouth of the River Kymi. Spawning migration begins in August and lasts till November, when all the adult whitefish which will spawn in that year have reached the spawning areas in the River Kymi.

Résumé

Le corégone migrateur (Coregonus lavaretus (L.) s.str.) fraye dans le fleuve Kymi en octobre-novembre. Après avoir frayé les individus hivernent dans le fleuve ou dans l'embouchure, et en mai ou au début de juin ils font la migration jusqu'aux eaux alimentaires situés dans la mer principalement à cent kilomètres de rayon de l'embouchure. Vers la fin d'avril ou au début de mai, bientôt après l'éclosion, le frai fait la migration au fil du courant jusqu'à la mer. Dans le Golfe de Finlande (sous-division 32), la direction principale de la migration aux eaux alimentaires est au sud-est de l'embouchure du fleuve Kymi. La migration pour frayer commence en août et continue jusqu'à novembre où tous les adultes de corégone migrateur qui frayeront cette année sont dans les frayères dans le fleuve KYmi.

Introduction

The river-spawning whitefish (Coregonus lavaretus (L.) s.str.) occurs in many rivers emptying into the northern part of the Baltic Sea (sub-divisions 32, 29, 30, 31), though the number of these whitefish rivers has been lessened by the influence of man (damming, regulation of rate of flow, pollution, etc.). The Finnish waters also contain whitefish that spawn off the coast (Coregonus nasus (Pallas) sensu Svärdson), and both these forms are fished in the Gulf of Finland. They differ from each other in their migration pattern, the character of the spawning area and the higher growth rate of the river-spawning whitefish. Migratory whitefish stocks occur in the River Kymi and some other smaller rivers emptying into the Gulf of Finland.

The Migration behaviour of the whitefish in the River Kymi has been studied by tagging mature whitefish in the river mouth. The object of this study was to discover the extent of the migration area, the seasonal pattern of migration, and the feeding and wintering areas.

Material and methods

In 1958-1969 2 201 tagged river-spawning whitefish were released in the western most distributary of the River Kymi (Ahvenkoski outlet). All these mature whitefish were caught with gill nets during the spawning run. After egg and milt stripping they were marked with Carlin tags and released in the river mouth in November of each year. The age of the tagged fish varied between 4 and 13 years. The most common age groups was that of six years (36 %), and the fish of this group had a mean length of 46 cm and a mean weight of 890 g. The recapture percentage was 25.4.

The River Kymi flows into the Gulf of Finland trough five outlets, all of which have been dammed. In the Ahvenkoski outlet the first dam is located right in the river mouth and prevents migratory species from reaching the river. The Langinkoski outlet, situated about 35 km east of Ahvenkoski outlet, has the longest (6 km) open reach between the sea and the first dam. The coordinates of the mouth of the Ahvenkoski outlet are $29^{\circ}\ 29'E\ 60^{\circ}\ 29'N$.

Results

The migration area of the Kymi River whitefish is rather limited compared with, for example, the migration area of Baltic salmon. Most of the recaptures were made within a radius of 70 km from the releasing place, and more than 70 % of all the recaptures were made within 10 km of the river mouth (Fig. 1). The longer migrations were mainly directed westward, only a few were directed east or south (Fig. 2).

The behaviour of the river-spawning whitefish reveals no clear wintering migration. During winter, from spawning in November to the following April, most of the recaptures were made near the river mouth (Fig. 3). Of the whitefish spawning during that season, only a few had migrated outside this area.

Feeding migration begins in May. In this month half of the recaptures were still made in the Ahvenkoski area but the other half was distributed evenly between 10 and 70 km from the river mouth. In June and July the whitefish are in their feeding areas, which are often situated fairly far from the coast in the vicinity of small islands or shallows (Fig. 4). More than 70 % of the recaptures during June, July and August were made in these areas.

The spawning run begins in late July or August. In September the number of recaptures made in the feeding areas is smaller than in summer, but near the coast, close to and in the Ahvenkoski area, the number of recaptures is on the increase. The River Kymi whitefish normally spawns between 20 October and 15 November. Spawning begins when the water temperature in the river sinks below 5° C. In October and November most of the recaptures were made in the Ahvenkoski area near the river mouth (Fig. 3).

Discussion

The migration of anadromous whitefish has been studied by tagging adult fish, most of the taggings being done during the spawning migration (LINDROTH 1957, SORMUNEN et al. 1963, SORMUNEN 1969, HURME 1970, JUNTUNEN et al. 1972, LIND & KAUKORAN-

TA 1974, OLSSON 1978). The migration of river-spawning whitefish has also been investigated by catching whitefish in different areas and seasons, most during the spawning run (PIROZHNIKOV 1971, GAYGALAS 1872, SÕRMUS 1976, RASMUSSEN 1979).

The wintering of river-spawning whitefish lasts from spawning in Novermber to April or May. During that time most of the whitefish seem to stay in the river or near the river mouth in the sea (LINDROTH 1957, SORMUNEN et al. 1963, HURME 1970, RASMUSSEN 1979).

In the River Kymi the feeding migration begins in May. In the River Indalälven the majority of the whitefish also migrated to the feeding areas in May, but some migrated in the preceding winter (LINDROTH 1957).

The most important feeding areas of the River Kymi whitefish lie within a radius of 100 km from the river mouth. Neva whitefish migrated 150-200 km west from the river mouth to the longitude 27° E (PIROZHNIKOV 1971, SMIRNOV 1972). The longest eastward migration of the River Kymi whitefish was to Kronstadt Bay on the eastern shore of the Gulf of Finland. These observations indicate that the migratory whitefish of the rivers Kymi and Neva have partly the same feeding areas, because the main feeding area of the River Kymi whitefish is situated at 60°20′N 27°10′E.

In the Gulf of Bothnia the whitefish of the Bothnian Bay rivers migrate as far as 600-700 km from the spawning area, southward along the Finnish coast to the Archipelago Sea (WIKGREN 1962, SORMUNEN 1969, JUNTUNEN et al. 1972, LIND & KAUKORANTA 1974).

In the Bothnian Sea the whitefish of the Indalälven mainly migrated 50-100 km southward from the river mouth (LINDROTH 1957). The currents in the Gulf of Bothnia flow northward along the eastern side and southward along the western shore. The whitefish in the river emptying into the Bothnian Bay migrate against the current (WIKGREN 1962). The whitefish of the Indalälven, which empties into the Bothnian Sea, migrated south-

ward with the current (LINDROTH 1957). In contrast, 65 % of the whitefish of the Ångermanälven were captured north of the river (OLSSON 1978). The mouth of the Ångermanälven is situated about 100 km north of the mouth of the Indalälven. It is commonly believed that when whitefish fry are flushed out of the river they are carried to the feeding areas by the sea currents. Later, as mature fish, they migrate between this feeding area and the home river. However, off the Finnish coast the whitefish migrate against the current to the feeding areas and with the current to the home river. Sea trout smolts (Salmo trutta m. trutta L.) on the Finnish side of the the Gulf of Bothnia migrate with the current when they have descended the river to the sea and againgst the current during the spawning migration (TOIVONEN & TUHKUNEN 1975). In the Gulf of Finland the majority of the River Kymi whitefish migrated southeast or east, thus travelling against the current, whose direction is westward on the northern side of the Gulf.

It is difficult to say why the feeding migrations are so long (up to 700 km) in the Bothnian Bay area, when they are normally less than 100 km (max about 300 km) in the Bothnian Sea and the Gulf of Finland. A limiting factor might be the salinity of the sea. The boundary of the feeding area of the Neva whitefish may be the 7 $^{o}/_{oo}$ isohaline (PIROZHNIKOV 1971). However, some of the River Kymi whitefish migrated westward to the Archipelago Sea, where the salinity lies above this limit. RASMUSSEN (1979) reports that the Nissum Fjord whitefish migrate to the inner part of the Fjord when the salinity rises above 20-25 $^{o}/_{oo}$ in the outer part. Temperature and food supplies might also be factors responsible for the different feeding migration patterns.

In the River Kymi the spawning run begins in August. The start of the spawning run varies widely between the different whitefish populations. In the River Tornionjoki, for instance, some of the whitefish ascend the river as early as June, the rest during July, August and September

The homing behaviour of migratory whitefish is well developed. None of the whitefish tagged in the River Kymi were recaptured

in the wrong river, or in the wrong outlet of the River Kymi, though the branching point of the outlets lies no further than 15 km from the sea. Nor have other whitefish taggings made in the northern Baltic revealed spawning migration into the wrong river.

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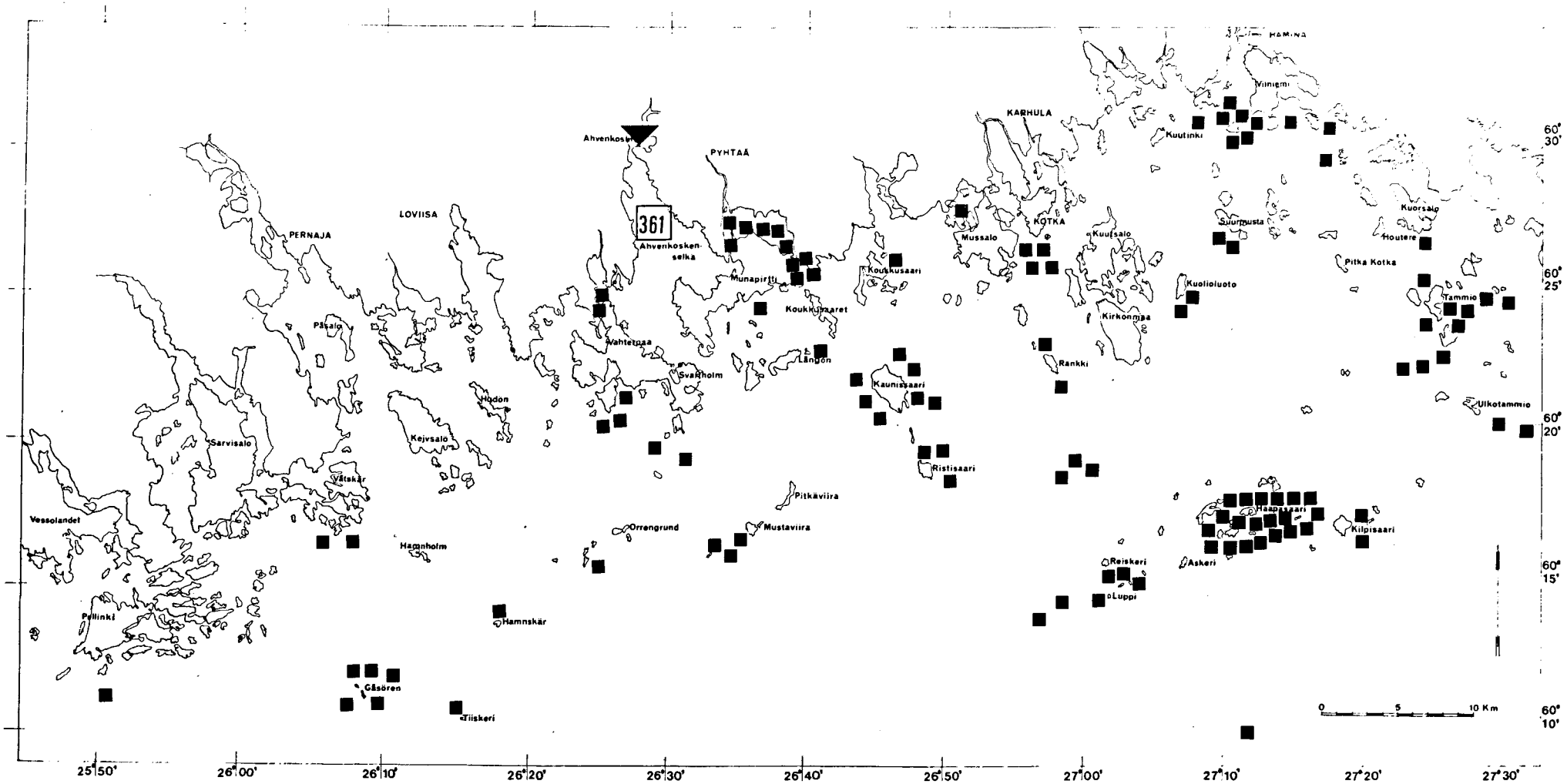

Fig. 1. Recaptures of the migratory whitefish (Coregonus lavaretus L. s.str.) tagged in the mouth of the River Kymi. The numeral in the Ahvenkoski area show the number of recaptures. Releasing place (▼).

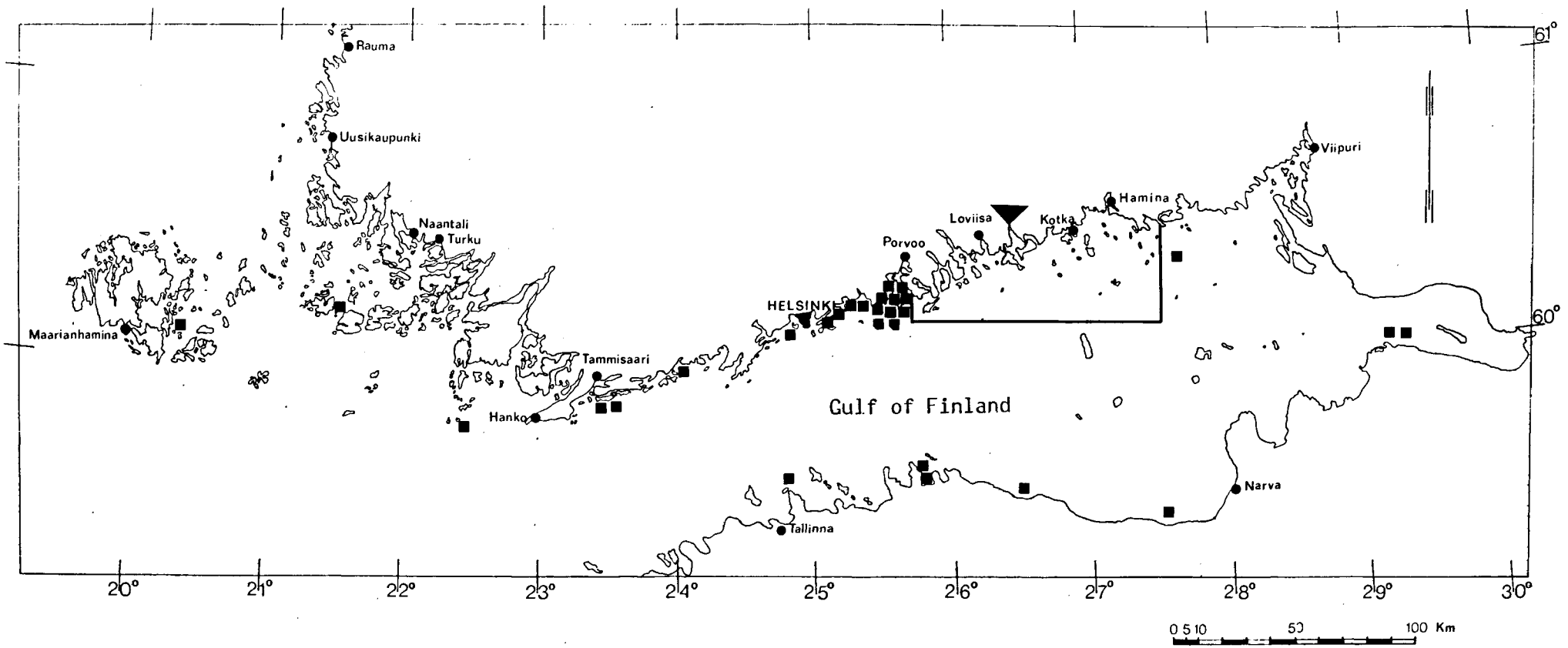

Fig. 2. Recaptures of the migratory whitefish (Coregonus lavaretus L. s.str.) at some distance from the river mouth, (▼) releasing place.

Distance km	XI	XII	I	II	III	IV	V	VI	VII	VIII	IX	X
10	(40)	(31)										
	90	43	38	30	16	23	20	1	1	3	40	58
15		(1)										
20			1		1		1	2		1	6	
30							1		1		1	1
	(1)						3	4	1	2		1
40						2	2	2		1		
				1			4	3	1	1		1
50			1				1	3	3	1		1
			2				2	4		3	2	1
60	1	1					4	6	3	4	2	
		1		1		1	1	3	1			1
70		(1)					2	4	3			
				1			1	2	2			
80		1										
90								1				
100										2	1	
110												
120												
130							1		1			
140												
150				1								
160				1								
170					1							
180									1	1		
190												
200												
210												
230												1
270											1	
340									1			

Fig. 3. Distribution of monthly recaptures by distance from the releasing place. Recaptures made in tagging year in brackets.

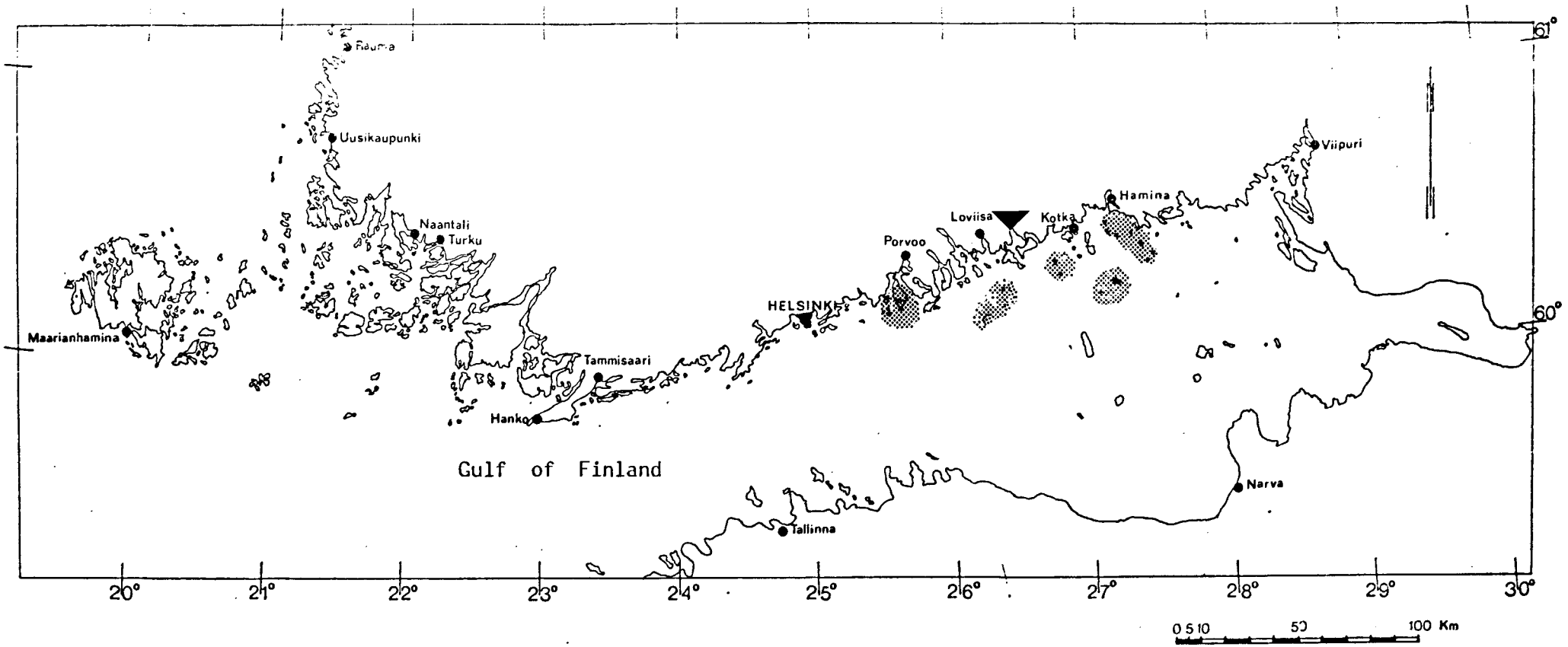

Fig. 4. The most important feeding areas of the migratory whitefish tagged in the mouth of the River Kymi, (▼) releasing place.