

International Council for
the Exploration of the Sea

C.M.1987/M:24
Anadromous and
Catadromous Fish
Committee

COMPARISON OF SIX TAG TYPES IN SEA-TROUT TAGGING
EXPERIMENTS IN THE BALTIC SEA

by

R. Bartel¹⁾, H. Auvinen²⁾, E. Ikonen²⁾ and R. Sych³⁾

- 1) Inland Fisheries Institute, River Fishery Laboratory,
Bytowska Str. 5, 80-328 Gdansk, Poland
- 2) Finnish Game and Fisheries Research Institute,
Fisheries Division, P.O. Box 193, SF-00131 Helsinki, Finland
- 3) Inland Fisheries Institute, River Fishery Department,
Zabieniec, 05-500, Piaseczno, Poland

Abstract

In the international Baltic Sea trout tagging experiment 27 753 hatchery reared sea trout smolts were tagged in Denmark, Finland, Poland and Sweden in 1979 and 1980. The fish were tagged with the original Carlin tag, two modified Carlin tag types (Canadian and Finnish polythene), streamer and Floy tags and Polish tags attached with Monel metal wire. The tag returns were affected by the place of release and smolt quality. The best results were obtained in the case of tags attached with double wire or thread -original Carlin, Canadian and Finnish polythene. The poorest results were obtained with streamer tags.

1. Introduction

The results of Baltic sea trout and salmon taggings are usually highly variable and depend on many factors.

The necessity of comparing the results of sea trout tagging with different methods was discussed during the 23rd and 24th meetings of the Baltic Salmon Working Group. The methods of salmonid tagging used in Canada, Finland, Poland and Sweden were also discussed at the 24th meeting of the Working Group (Anon. 1978).

At the 24th meeting of the Baltic Salmon Working Group, it was decided that an experiment should be carried out on tagging of sea trout smolts, in order to find out the best tag for use with salmonids and the tag ensuring the highest tag returns (Anon. 1978).

2. Material and methods

Observations were carried out on a few populations differing in growth rate and behaviour. It was assumed that tag losses might differ between the populations used in the experiments: widely migrating Polish sea trout (Backiel & Bartiel 1967) and stationary Danish, Finnish (Ikonen et al. 1983a) and Swedish populations, inhabiting mainly coastal waters and differing in the growth rate.

The taggings were carried out from March till May in 1979 in Denmark, Finland, Poland and Sweden. Five types of tags were used. The fish were tagged by qualified Danish, Finnish, Polish and Swedish personnel. In Sweden, some of the fish were tagged with micro tags as well (Anon. 1979, 1980, Ikonen et al. 1981). A total of 26 761 tagged sea trout were released (Table 1). In addition, in 1980 the Danish team tagged 3 992 trout with four different type of tags (Ikonen et al. 1981, 1983, Table 1).

2.1 Tags used in the experiment

Six types of tags were used in the experiment (Fig. 1 and 2).

1. Swedish type - the original Carlin tag attached with a double stainless steel wire.
2. Canadian type - Carlin tag attached with a double polythene monofilament.
3. Finnish type 1 - Carlin tag attached with a fourfold polythene monofilament.
4. Finnish type 2 - a streamer tag passed directly through the back of the fish.
5. Polish type - a plastic tag attached with a single Monel metal wire.
6. Floy tag - the original Floy tag - a plastic T-bar attached by a pistol grip tag gun.

The methods of attaching the tags are presented in Fig. 2. The procedure used in attaching the Canadian Carlin and Finnish 1 tags has been described by Carlin (195), Ikonen (1979) and Porter (1979).

In order to eliminate the effect of tag colour on the result of tagging, the tags used were of more or less the same colour: The Danish tags were green, the Finnish type 1 polythene and the Swedish Carlin tags were light green, and the Finnish type 2 streamer and the Polish tags were yellow.

2.2 Place and date of fish tagging and release

The experiments were started in Poland, in a hatchery of the National Union of Fisheries Cooperative at Podkomorzyce, located on the River Lupawa (Fig. 3). Two-year old hatchery reared widely migrating sea trout smolts originating from the Vistula River were used. The fish were tagged on 6-8 March, 1979 by skilled personnel from Finland, Poland and Sweden. The length of the tagged smolts ranged from 15.0 to 24.9 cm, averaging 18.6 and 18.7. cm (Table 2) and 2 000 smolts were tagged with each tag type: Carlin, Finnish 1 polythene, Finnish 2 streamer, and Polish

Monel. The fish were sorted into length classes some days before tagging.

In addition, the Polish team tagged 2 000 randomly selected smolts with Polish Monel tags, on 6 April 1979. These fish were not subjected to any previous handling. Their average length was to 17.2 cm, the length range being 15-25.9 cm (Table 2). After tagging they were kept briefly in concrete tanks. All the fish were transported by car to the Vistula River and released on 10-11 April 1979, some 2 km upstream from the river mouth (Anon. 1979, Fig. 3).

Another fish group was tagged in Sweden in the Salmon Research Institute in Alvkarleby on 14-15 May 1979. Two-year old smolts were used, originating from the River Dalälven and reared at the Alvkarleby Fish Farm in River Dalälven water (Fig. 4). Their length ranged from 15.0 to 24.9 cm, averaging 20.1 - 20.6 cm (Table 3). Teams from Finland, Poland and Sweden used four types of tags, tagging 2 000 smolts with each type: Swedish Carlin, Finnish 1 polythene, Finnish 2 streamer, and Polish Monel. Some of the fish were also subjected to additional tagging with coded wire microtags: 1 000 smolts were tagged with Carlin tags and 1 000 smolts with Polish Monel tags and 1 400 smolts with Finnish streamer tags (Anon. 1979, Table 1). On 17 May 1979, i.e. 2-3 days after tagging, the smolts were released through a pipe from the hatchery to the Dalälven River.

The third fish group was tagged by a Finnish team in the Hanka Taimen Oy Hatchery, located at Hankasalmi in the water course of the Kymi River. The fish originated from Dalälven stock. Sea trout from the Dalälven River had been transferred from Sweden to Finland in the early 1970s (J. Toivonen, pers. com.). The two-year old reared fish, ranged in length from 19.6 to 28.9 cm, the average length being 23.0 and 23.1 cm (Table 4). They were tagged on 24-25 April 1979 with three types of tags: Carlin, Finnish 1 polythene, and Finnish 2 streamer. Tagged fish were kept in fibre-glass basins, 4 m² in area. They were released on 5 May

1979 near Velkua Island, on the coast of the Archipelago Sea (Anon. 1980, Fig. 5).

The fourth series of experiments was carried out in Denmark. Sea trout smolts originating from the Blaesborg pond farm were transported to the Freshwater Fisheries Laboratory at Silkeborg (Fig. 6). The length of the two-year-old smolts was 13.0 - 22.9 cm, averaging 15.4 and 16.5 cm (Table 5). They were tagged on 26-27 April and 8 May 1979. On 9 May the fish were transported the River Skjern, where they were released. In 1979 the Danish team used three types of tags: original Carlin, Canadian Carlin and Finnish 1 polythene (Table 1) and in 1980 the team used also Floy-tags (Anon. 1979).

All the tagged fish were anaesthetized with MS 222 solution. The fish were released when the water temperature reached 7 - 8 °C.

3. Results and discussion

After tagging, the fish were kept in fibre-glass or concrete basins. In Sweden they were released 2-3 days after tagging, in Finland 10-11 days, in Denmark 13-14 days and in Poland 4-5 days and 33-36 days. The fish losses during this period were negligible and did not exceed 0,5 ‰. Only in Denmark were considerable losses recorded, due to poor fish quality and small size (Anon. 1979). It was observed that streamer tags were easily lost, even during handling and transportation. In the Podkomorzyce hatchery, Poland, four streamer tags were lost almost immediately, while 10 other tags were lost during fish transportation. As regards the other tags, only one Carlin tag was lost during this time.

The tag returns varied considerably, depending on the place of tagging and release. This factor affected the results most significantly. The poorest results were obtained from the experiments carried out in Poland. Almost as weak results were obtained from fish tagging in Denmark in 1979.

Some trends were noted suggesting superiority of the Carlin tag in the experiments in Poland and the Canadian tag in the experiments in Denmark, it is very difficult to draw definite conclusions from these results (Table 1, Figs 7 and 8).

In 1980 Floy tags were used in Denmark along with the three other types: original Carlin, Canadian Carlin and Finnish 1 polythene. As in 1979, the highest returns were obtained for the Canadian type, slightly poorer results for the original Carlin tags and the poorest for the polythene and Floy tags (Table 1, Figs. 7 and 8).

Much better results were obtained from the two other tagging places in 1979. These point to considerable superiority of the Carlin tag and polythene Carlin tag. Markedly poorer results were obtained with streamer tags. Polish Monel tags gave better results but were poorer than Carlin and polythene Carlin tags (Table 1, Figs. 7 and 8).

The yield was calculated as the weight (kg) of the fish caught per 1 000 released smolts. In the experiments carried out in Poland and Denmark (in 1979), the yield was very low, amounting to 0.4-6.5 kg (Table 1, Fig. 8).

As regards the fish released in Sweden, and especially those released in Finland, much better results were obtained with Carlin and polythene tags. The best result, 784 kg/1 000 smolts released, was obtained with Carlin tags and a somewhat lower yield with polythene ones - 543 kg (Table 1, Fig. 8). The length of the period during which tagged fish were caught depended on the place of release. In Denmark and Poland tagged fish were caught during a relatively short period (about two years). In the experiments carried out in Sweden and Finland, tagged fish were caught during a much longer time, especially in the Finnish experiments, in which fish tagged with Carlin and polythene tags were caught for as long as six and seven years. In Sweden, the life of the Carlin polythene, Carlin and Monel tags was more or less the same, but

in some years tag returns were lower for Monel tags and higher for polythene tags (Table 1).

All handling causes stress to the fish, which can increase the losses. Similarly, longer keeping of fish which are ill or not in good condition can cause additional mortality (Polish experiments 4 and 44, Table 1). Stress may also be caused by tagging. It was expected that the stress would be increased by additional tagging with a coded wire nose tag in Sweden, this was not reflected in lower returns (Table 1, Figs. 7 and 8). In the Swedish experiment, some tags were returned by people who found loose tags in nets or in colonies of the caspian tern (Table 1).

Tag returns were affected by several factors. It was observed that the results did not depend so much on the place of fish release as on fish quality. The smolts in Poland and Denmark were of poorer quality due in part to the existence of disease. The situation was made even worse by the tagging procedure. The wounds made to attach the tags frequently became infected, and the tag inhibited their healing. The severity of the wounds is usually related to the material from which the tags are made. Saunders (1968) reported that worse wounds were observed when the tags were attached with wire instead of polythene, but the returns were higher when wire was used. The tag returns may have been affected by the fishing intensity and migrations of the tagged fish. It was also expected that the origin of the fish would affect the results. Polish sea trout migrate long distances (Backiel and Bartel 1967, Sych 1972), while Finnish, Swedish and Danish trout do not travel so far (Ikonen et al. 1983a). Of the sea trout tagged in Denmark, 98.1 % were caught at or nearby the place of release. During the two subsequent years only a few fish migrated further than Rinkobing Fjord (Fig. 6). Trout released in Sweden and Finland were most frequently caught at greater distances from the place of release, in the Gulf of Bothnia or in the Main Basin. The returns from these areas being 14.9 and 5.6 % respectively, of the from Swedish and Finnish recoveries. Returns from the place of release or its vicinity amounted to 64.4 % and 77.7 % of the recoveries respectively (Figs. 4 and 5). The Vistula sea trout were also

caught mostly at the place of release (Fig. 3), although this is a widely migrating variety. This was due the fact that the returns covered only two years and over 1/3 of them were made in the first month after the release. However, this was of no importance, as the results agreed with those of the Baltic Sea trout transfer experiments, in which trout from both the Isojoki and the Vistula gave better returns in the case of polythene Carlin tags than in taggings with Polish Monel (Ikonen et al. 1983b). Fish growth may affect the tag life. The growth of tagged fish was calculated for the period November-March. In the first year it appeared to be similar for sea trout from Denmark, Finland and Poland and poorer for Swedish sea trout (Table 6). Vistula sea trout grow much better than Dalälven sea trout (Larsson, pers. comm., and Sych 1972, table 7), but in the few recoveries made in this experiment, the growth of Vistula sea trout was similar to that of the Finnish and Danish fish (Table 6).

The results different considerably between the four localities of fish release. They were undoubtedly affected by the place of release, fishery exploitation, fish growth, and fish migration.

The results were compared by ranking the recaptures in pairs (Table 8). Polythene and Carlin tags did not differ significantly from the other five types of tags (chi-squared, 1 df, 1.923 and 0.038 respectively). Canadian tags, used in only one place, differed significantly from the other three tag types (chi-squared, 1 df, 5.0). The poorest results were obtained with streamer tags. Tags attached with double wire or double polythene (Carlin, polythene, Canadian) gave better results than those attached with single Monel wire and Floy tags. The superiority of Carlin tags is most noticeable when the yield in kg/1 000 smolts is compared. This is due to the longer life of these tags. This can be seen by comparing the results of tagging with Carlin tags in Sweden and in Denmark in 1980. Although the returns from the Swedish experiment were half the Danish recoveries, the yield in kg/1 000 smolts was almost 3 times as high (Table 1, Fig. 8). However, it is difficult to decide whether any of the tags attached with double bonds is superior to the others. Although the returns of

Canadian tags were twice as high as those than of polythene and Carlin, they remained attached for 2 years only, but this tag was used in only one experiment. In the Finnish and Swedish experiments, in which Canadian tags were not used, Carlin and polythene tags remained attached for as many as 7 and 6 years, and for 4 and 5 years, respectively.

4. Conclusion

The results suggest that the highest returns are obtained with tags attached with double bonds: Carlin, polythene and Canadian. Carlin and polythene tags were characterized by a long life, but the results are not comprehensive enough to justify the conclusion that Canadian tags are lost earlier than the others.

References

- Anon. 1978: Report on the 24th meeting of the Working Group on Baltic Salmon, Copenhagen, October 2, 1978. An international document of the Council, ICES.
- 1979: Report by the Baltic Salmon Working Group on cooperative sea trout tagging. - ICES C.M. 1979/M:11.
 - 1980: Appendix to the Report on the Cooperative Sea Trout taggings. - ICES C.M. 1980/M:11.
- Backiel, T., Bartel, R. 1967: O efektach zarybiania smoltami troci na tle wynikow ich znakowania. (Effects of trout stocking in the light of tagging results) - Rocz-ki Naik Roln. (Polish Agricul. Annual) 90,H,3, : 365-388.
- Ikonen, E., Toivonen, J. and Auvinen, J. 1981: Report on the results of the Baltic Sea trout tagging experiment. - ICES C.M. 1981/M:13.

- Ikonen, E., Toivonen, J. and Auvinen, H. 1983a: Report on the results of the Baltic Sea trout tagging experiment. - ICES C.M. 1983/M:29, 21-26.
- Ikonen, E., Toivonen, J. and Auvinen, H. 1983b: Annual report on the results of the Baltic Sea trout transfer experiment. - ICES Ana. Cttee C.M. 1983/M:29, 27-36.
- Porter, T.R. 1979a: Atlantic salmon smolt tagging. - An internal document of BSWG, ICES.
- Porter, T.R. 1979b: Factors affecting the rate of return of tagged Atlantic salmon smolts and effects of tagging on the fish. - An internal document of BSWG, ICES.
- Roberts, R.J., Mc Queen, A., Shearer, W.M., Young, H. 1973: The histopathology of salmon tagging. III. Secondary infections associated with tagging. - J. Fish. Biol. 5: 621-623
- Saunders, R.L. 1968: An evaluation of two methods of attaching tags to Atlantic salmon smolts. Progress Fish. - Culturist. 30,2, 104-109.
- Sych, R. 1972: A numerical model of the commercial exploitation of fish. - ICES, Ana Cat. Cttee C.M. 1972/M:9.

Table 1. - Sea trout tagging recoveries.

| Code number | R E L E A S E | | | R E C A P T U R E S | | | | | | | | | | | | | | | | | Other tags reported | | |
|-------------|---------------------|----------------------|--------------------------------|---------------------|---------|------|---------|------|---------|------|---------|------|---------|------|---------|------|---------|------------------|-------|-------|---------------------|------|---|
| | Place of release | Tag type | Number of tagged fish released | 1 | | 2 | | 3 | | 4 | | 5 | | 6 | | 7 | | Total | | No. | % | | |
| | | | | % | kg/1000 | % | kg/1000 | % | kg/1000 | % | kg/1000 | % | kg/1000 | % | kg/1000 | % | kg/1000 | kg/1000 released | No. | | | % | |
| 1979 | | | | | | | | | | | | | | | | | | | | | | | |
| 1 | Poland, Świbno | Carlin | 1994 | 0.65 | 0.4 | 0.25 | 3.6 | - | - | - | - | - | - | - | 0.05 | 2.5 | - | - | 19 | 0.95 | 6.5 | - | - |
| 2 | Poland, Świbno | Streamer | 1979 | 0.15 | 0.4 | - | - | - | - | - | - | - | - | - | - | - | - | - | 3 | 0.15 | 0.4 | - | - |
| 3 | Poland, Świbno | Polythene | 1964 | 0.05 | 0.0 | 0.10 | 1.1 | - | - | 0.05 | 2.5 | - | - | - | - | - | - | - | 4 | 0.20 | 3.7 | - | - |
| 4 | Poland, Świbno | Monel | 1997 | 0.15 | 0.2 | 0.10 | 0.7 | - | - | - | - | - | - | - | - | - | - | - | 5 | 0.25 | 0.9 | - | - |
| 44 | Poland, Świbno | Monel | 1995 | 0.40 | 1.8 | 0.15 | 2.8 | - | - | - | - | - | - | - | - | - | - | - | 11 | 0.55 | 4.6 | - | - |
| Total | | | 9929 | | | | | | | | | | | | | | | | | | | | |
| 5 | Sweden, Alvkarleby. | Carlin | 995 | 0.80 | 3.4 | 2.01 | 16.6 | 2.41 | 55.8 | 0.70 | 28.5 | - | - | - | - | - | - | 59 | 5.93 | 104.3 | 27 | 2.71 | |
| 55 | - " - | Carlin + Nose tag | 997 | 0.90 | 4.8 | 1.71 | 15.4 | 3.01 | 80.1 | 0.80 | 31.7 | - | - | - | - | - | - | 64 | 6.42 | 131.9 | 33 | 3.31 | |
| 6 | - " - | Streamer | 1399 | - | - | 0.14 | 0.9 | - | - | - | - | - | - | - | - | - | - | 2 | 0.14 | 0.9 | 10 | 0.71 | |
| 66 | - " - | Streamer + Nose tag | 600 | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | 4 | 0.67 | |
| 7 | - " - | Polythene | 600 | 1.00 | 4.0 | 2.67 | 19.4 | 4.83 | 138.3 | - | - | - | - | - | - | - | - | 51 | 8.50 | 161.7 | 22 | 3.67 | |
| 77 | - " - | Polythene + Nose Tag | 1400 | 0.64 | 2.6 | 2.57 | 20.5 | 5.79 | 145.1 | 1.43 | 57.8 | 0.29 | 10.7 | - | - | - | - | 148 | 10.57 | 236.7 | 42 | 3.00 | |
| 8 | - " - | Monel | 1000 | 0.2 | 0.7 | 1.60 | 13.6 | 2.30 | 70.8 | 0.10 | 4.8 | - | - | - | - | - | - | 42 | 4.20 | 89.9 | 19 | 1.90 | |
| 88 | - " - | Monel + Nose tag | 1000 | 0.5 | 2.9 | 1.70 | 19.5 | 2.50 | 77.0 | 0.70 | 28.7 | - | - | - | - | - | - | 54 | 5.40 | 128.1 | 21 | 2.10 | |
| Total | | | 7991 | | | | | | | | | | | | | | | | | | | | |
| 13 | Finland, Velkua | Carlin | 999 | 4.70 | 25.5 | 6.11 | 93.5 | 8.61 | 267.2 | 5.61 | 294.3 | 1.00 | 56.3 | 0.50 | 34.8 | 0.10 | 12.0 | 266 | 26.63 | 783.6 | 3 | 0.3 | |
| 14 | Finland, Velkua | Streamer | 989 | 1.82 | 4.4 | - | - | - | - | - | - | - | - | - | - | - | - | 18 | 1.82 | 4.4 | - | - | |
| 15 | Finland, Velkua | Polythene | 994 | 3.10 | 8.8 | 4.40 | 62.8 | 5.20 | 162.8 | 3.80 | 184.5 | 1.70 | 104.2 | 0.20 | 19.5 | - | - | 184 | 18.40 | 542.7 | 1 | 0.10 | |
| Total | | | 2982 | | | | | | | | | | | | | | | | | | | | |
| 9 | Denmark, Lonborg | Carlin | 951 | 0.53 | 0.2 | 0.10 | 1.3 | - | - | - | - | - | - | - | - | - | - | 6 | 0.63 | 1.5 | - | - | |
| 12 | Denmark, Lonborg | Canadian | 956 | 1.15 | 0.4 | 0.10 | 1.3 | - | - | - | - | - | - | - | - | - | - | 12 | 1.25 | 1.7 | - | - | |
| 16 | Denmark, Lonborg | Polythene | 952 | 0.63 | 0.4 | - | - | - | - | - | - | - | - | - | - | - | - | 6 | 0.63 | 0.4 | - | - | |
| Total | | | 2859 | | | | | | | | | | | | | | | | | | | | |
| 1980 | | | | | | | | | | | | | | | | | | | | | | | |
| 17 | Denmark, Lonborg | Carlin | 999 | 10.31 | 26.3 | 1.10 | 11.6 | - | - | - | - | - | - | - | - | - | - | 114 | 11.41 | 38.0 | 1 | 0.10 | |
| 18 | Denmark, Lonborg | Canadian | 999 | 9.71 | 26.8 | 2.80 | 27.8 | - | - | - | - | - | - | - | - | - | - | 125 | 12.51 | 54.6 | 3 | 0.30 | |
| 19 | Denmark, Lonborg | Polythene | 996 | 6.83 | 15.1 | 1.20 | 15.2 | - | - | - | - | - | - | - | - | - | - | 80 | 8.03 | 30.2 | 2 | 0.20 | |
| 20 | Denmark, Lonborg | Floy | 998 | 6.51 | 18.5 | 0.90 | 6.4 | - | - | - | - | - | - | - | - | - | - | 74 | 7.41 | 22.8 | 1 | 0.10 | |
| Total | | | 3992 | | | | | | | | | | | | | | | | | | | | |
| Grand Total | | | 27753 | | | | | | | | | | | | | | | | | | 1349 | 189 | |

Table 2. Sea trout smolts tagged in Poland in March and April 1979.

| Total length cm | Percentage of fish with each tag type | | | | |
|-------------------------------------|---------------------------------------|--|--|--------------------------------------|---------------------------------------|
| | Swedish type ^x Carlin | Finnish type ^x (1) Carlin | Finnish type ^x (2) Streamer | Polish type ^x Monel | Polish type ^{xx} Monel |
| 15.0 - 15.9 | 7.8 | 5.0 | 5.6 | 5.4 | 29.7 |
| 16.0 - 16.9 | 18.1 | 16.4 | 17.7 | 17.5 | 22.1 |
| 17.0 - 17.9 | 18.0 | 20.0 | 19.7 | 21.8 | 16.9 |
| 18.0 - 18.9 | 19.6 | 21.4 | 19.0 | 20.9 | 9.0 |
| 19.0 - 19.9 | 14.8 | 12.7 | 15.2 | 13.9 | 7.4 |
| 20.0 - 20.9 | 8.5 | 10.3 | 8.7 | 9.2 | 4.8 |
| 21.0 - 21.9 | 6.7 | 6.5 | 6.7 | 6.0 | 3.7 |
| 22.0 - 22.9 | 3.4 | 4.4 | 3.9 | 2.7 | 2.8 |
| 23.0 - 23.9 | 2.6 | 2.7 | 2.2 | 2.4 | 2.3 |
| 24.0 - 24.9 | 0.7 | 0.7 | 1.1 | 0.5 | 0.9 |
| 25.0 - 25.9 | - | - | - | - | 0.4 |
| Mean length, cm | 18.6 | 18.7 | 18.6 | 18.6 | 17.2 |
| No. of fish tagged | 2,000 | 2,000 | 2,000 | 2,000 | 2,000 |
| Colour of tags and attachment | light green; silver | light-green; green | yellow; - | yellow; silver | yellow; silver |
| No. of fish released | 1,994 | 1,994 | 1,981 | 1,997 | 1,995 |

^x Fish tagged in March

^{xx} Fish tagged in April

Table 3. Sea trout smolts tagged in Sweden in May 1979.

| Total length cm | Percentage of fish with each tag type | | | |
|-------------------------------------|---------------------------------------|-----------------------|-----------------|-------------------|
| | Swedish type | Finnish type(1) | Finnish type(2) | Polish type |
| 15.0 - 15.9 | 0.0 | 0.1 | 0.1 | 0.1 |
| 16.0 - 16.9 | 0.2 | 0.5 | 0.8 | 0.1 |
| 17.0 - 17.9 | 2.8 | 3.2 | 3.8 | 1.9 |
| 18.0 - 18.9 | 11.4 | 14.8 | 16.8 | 9.4 |
| 19.0 - 19.9 | 24.1 | 26.0 | 27.6 | 23.3 |
| 20.0 - 20.9 | 27.4 | 28.3 | 24.3 | 29.6 |
| 21.0 - 21.9 | 20.1 | 18.2 | 18.4 | 22.0 |
| 22.0 - 22.9 | 10.3 | 6.7 | 7.1 | 10.9 |
| 23.0 - 23.9 | 3.3 | 2.0 | 1.7 | 2.5 |
| 24.0 - 24.9 | 0.4 | 0.2 | 0.2 | 0.3 |
| Mean length, cm | 20.5 | 20.1 | 20.6 | 20.6 |
| No. of fish tagged | 1,992 | 2,000 | 2,000 | 2,000 |
| Colour of tags and attachment | light-green; silver | light-green; green | yellow; - | yellow; silver |
| No. of fish released | 1,992 | 1,994 | 1,997 | 2,000 |

Table 4. Sea trout smolts tagged in Finland in April 1979.

| Total length, cm | Percentage of fish with each tag type | | |
|----------------------------------|---------------------------------------|------------------------------------|-------------------------|
| | Carlin | Finnish (1) Carlin Polythene | Finnish (2) Streamer |
| 19.5 - 19.9 | 0.1 | 0.1 | 0.2 |
| 20.0 - 20.4 | 0.7 | 0.9 | 0.3 |
| 20.5 - 20.9 | 1.3 | 2.1 | 1.5 |
| 21.0 - 21.4 | 4.1 | 4.1 | 2.5 |
| 21.5 - 21.9 | 8.5 | 8.1 | 8.7 |
| 22.0 - 22.4 | 12.6 | 14.5 | 15.9 |
| 22.5 - 22.9 | 17.3 | 18.8 | 17.1 |
| 23.0 - 23.4 | 18.7 | 16.2 | 19.1 |
| 23.5 - 23.9 | 14.8 | 14.6 | 16.0 |
| 24.0 - 24.4 | 9.5 | 11.4 | 9.6 |
| 24.5 - 24.9 | 6.1 | 5.9 | 4.3 |
| 25.0 - 25.4 | 4.4 | 2.0 | 3.7 |
| 25.5 - 25.9 | 1.1 | 0.7 | 0.8 |
| 26.0 - 26.4 | 0.6 | 0.1 | 0.1 |
| 26.5 - 26.9 | | 0.2 | 0.1 |
| 27.0 - 27.4 | | | |
| 27.5 - 27.9 | | | |
| 28.0 - 28.4 | | | |
| 28.4 - 28.9 | 0.1 | 0.2 | |
| Mean length, cm | 23.1 | 23.0 | 23.0 |
| No. of tagged fish | 1000 | 1000 | 1000 |
| Colour of tags and attachment | light-green silver | light green green | yellow - |
| No. of fish released | 999 | 994 | 989 |

Table 5. Sea trout smolts tagged in Denmark in May 1979.

| Total length, cm | Percentage of fish with each tag type | | |
|----------------------------------|---------------------------------------|---------------------|-----------------------|
| | Swedish type | Canadian type | Finnish type (1) |
| | Carlin | | Carlin polythene |
| 13.0 - 13.9 | 0.0 | 0.0 | 0.3 |
| 14.0 - 14.9 | 36.7 | 24.3 | 22.7 |
| 15.0 - 15.9 | 41.7 | 28.2 | 28.6 |
| 16.0 - 16.9 | 18.5 | 14.5 | 17.2 |
| 17.0 - 17.9 | 2.8 | 9.5 | 9.6 |
| 18.0 - 18.9 | 0.2 | 10.3 | 10.9 |
| 19.9 - 19.9 | 0.0 | 7.3 | 6.2 |
| 20.0 - 20.9 | 0.0 | 4.1 | 3.5 |
| 21.0 - 21.9 | 0.0 | 1.6 | 0.7 |
| 22.0 - 22.9 | 0.0 | 0.2 | 0.2 |
| Mean length, cm | 15.4 | 16.5 | 16.5 |
| No. of fish tagged | 996 | 998 | 998 |
| Colour of tags and attachment | dark-green; silver | dark-green black | light-green; green |
| No. of fish released | 951 | 956 | 952 |

Table 6. Growth of sea trout tagged in Denmark, Finland, Poland and Sweden.

| Year | Finland | | Sweden | | Denmark | | Poland | |
|------|---------|--------|--------|--------|---------|--------|--------|--------|
| | length | weight | length | weight | length | weight | length | weight |
| | cm | g | cm | g | cm | g | cm | g |
| I | 43.0 | 903 | 37.4 | 552 | 42.5 | 896 | 41.5 | 1075 |
| II | 58.2 | 2387 | 52.1 | 1596 | | | | |
| III | 70.5 | 3658 | 64.7 | 3233 | | | | |
| IV | 76.9 | 5059 | | | | | | |

Table 7. Growth rate of Dalälven and Vistula sea trout as shown from some previous taggings (Larsson pers.comm. and Sych 1972).

| Years after tagging | Average weight in kg | |
|------------------------|----------------------|-------------------|
| | Dalälven sea trout | Vistula sea trout |
| 1 | 0.7 | 1.3 |
| 2 | 1.1 | 2.8 |
| 3 | 2.3 | 3.9 |
| 4 | 3.4 | 6.6 |
| Weighted averages | 1.52 | 3.74 |

Table 8. Ranking of recaptures in pairs.

| Pair | No. of pairs | Frequency |
|----------------------|-----------------|------------------------|
| Carlin - Polythene | 5 | Carlin > Polythene 3 |
| | | Carlin = Polythene 1 |
| | | Carlin < Polythene 1 |
| Carlin - Streamer | 3 | Carlin > Streamer 3 |
| Polythene - Streamer | 3 | Polythene > Streamer 3 |
| Polythene - Monel | 2 | Polythene > Monel 1 |
| | | Polythene < Monel 1 |
| Carlin - Monel | 2 | Carlin > Monel 2 |
| Carlin - Canadian | 2 | Carlin < Canadian 2 |
| Canadian - Polythene | 2 | Canadian > Polythene 2 |
| Carlin - Floy | 1 | Carlin > Floy 1 |
| Canadian - Floy | 1 | Canadian > Floy 1 |
| Polythene - Floy | 1 | Polythene > Floy 1 |

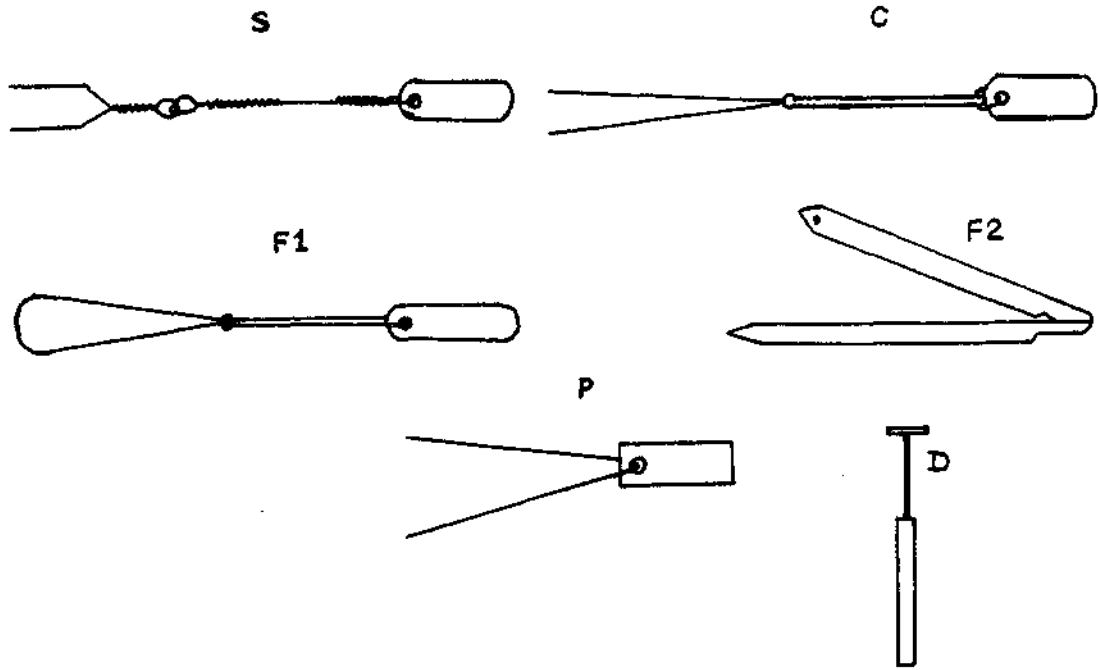


Fig. 1. The tags used in the experiment: Swedish (S), Canadian (C), Finnish 1 (F1), Finnish 2 (F2), Floy (D) and Polish (P).

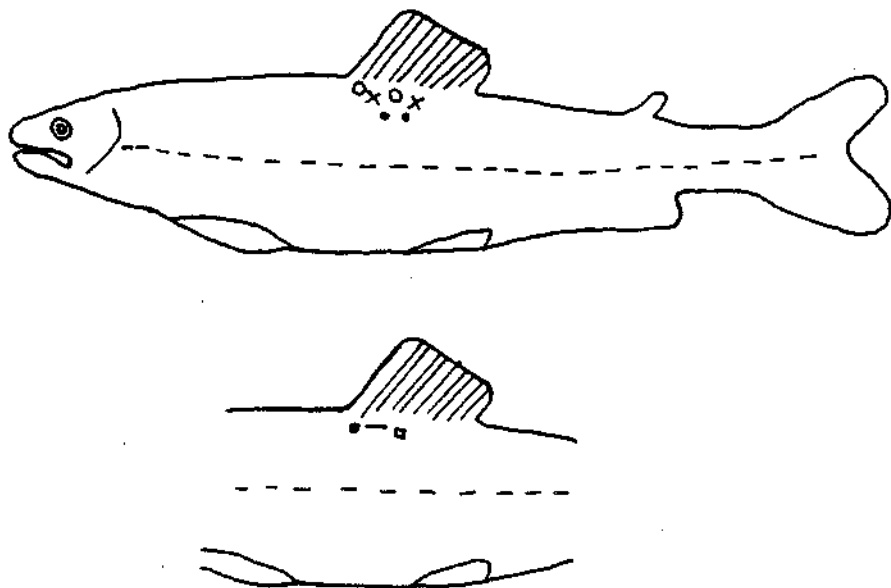


Fig. 2. Scheme of punctures made in fish body during tagging. In upper part double holes for the tags of type: S(..), C(xx), and F1(oo). In lower part single holes for the tags: F2(-), P(.) and D(□).

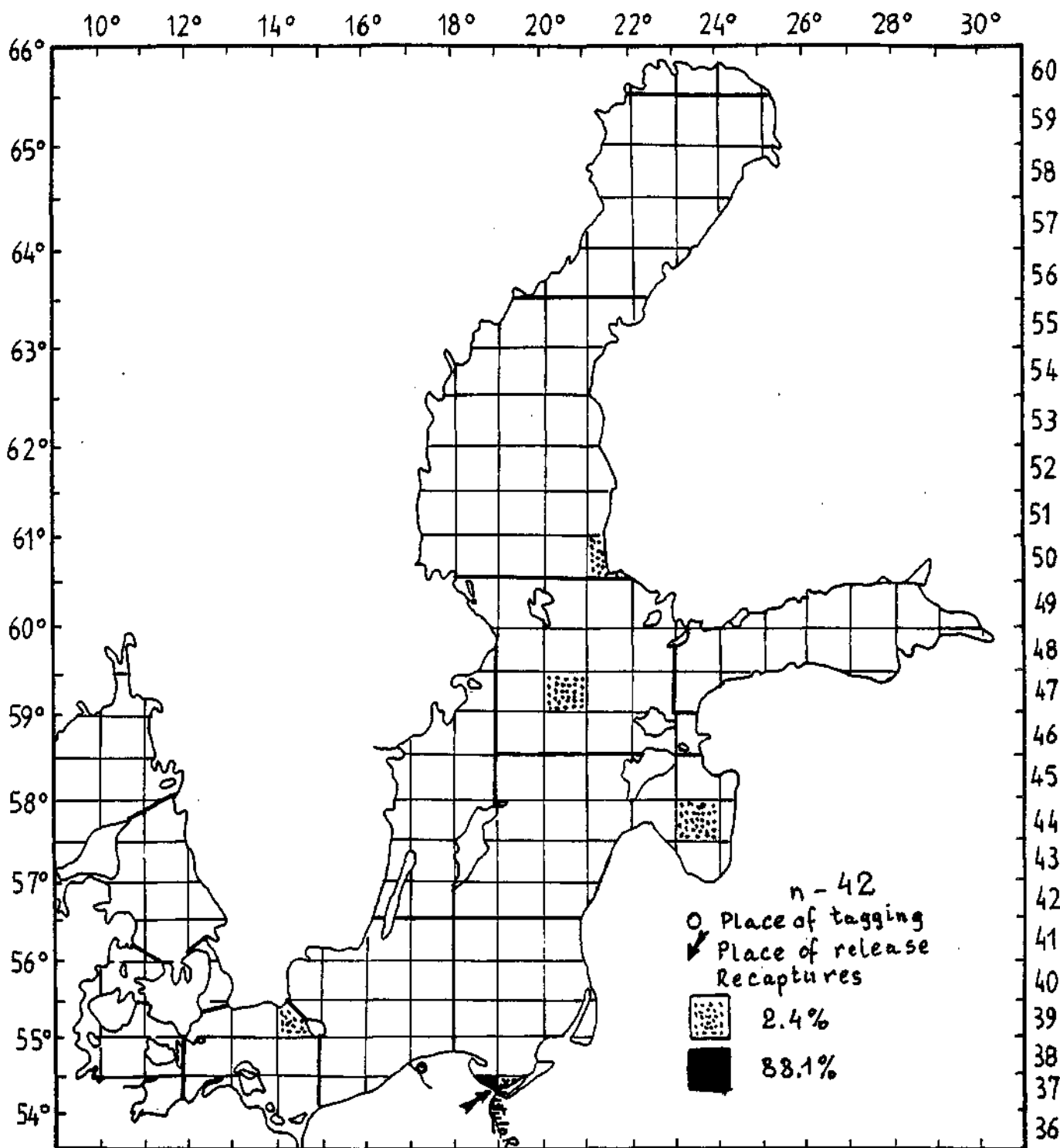


Fig. 3. Places of tagging, release and recaptures of sea trout tagged in Poland.

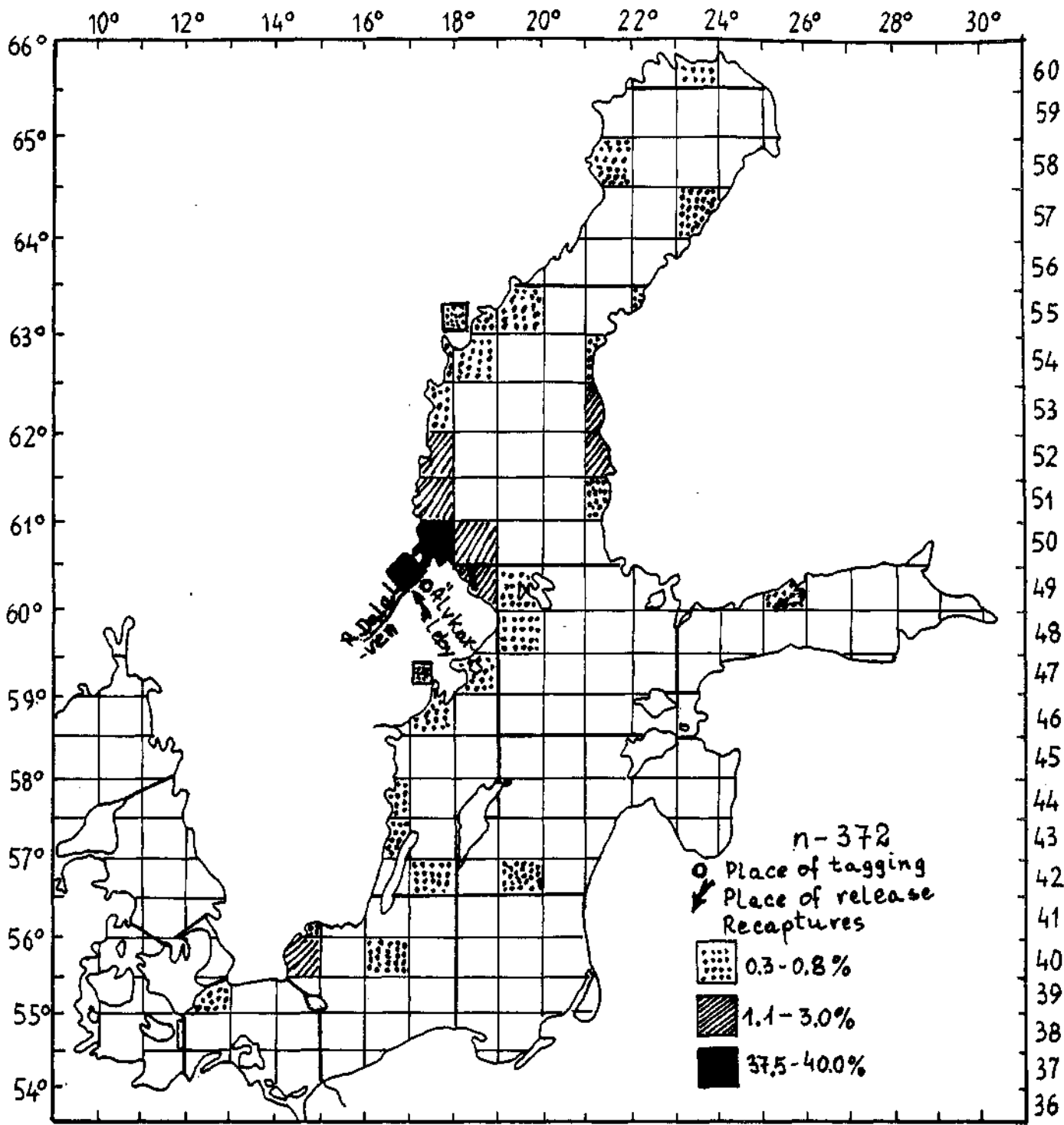


Fig. 4. Places of tagging and recaptures of sea trout tagged in Sweden.

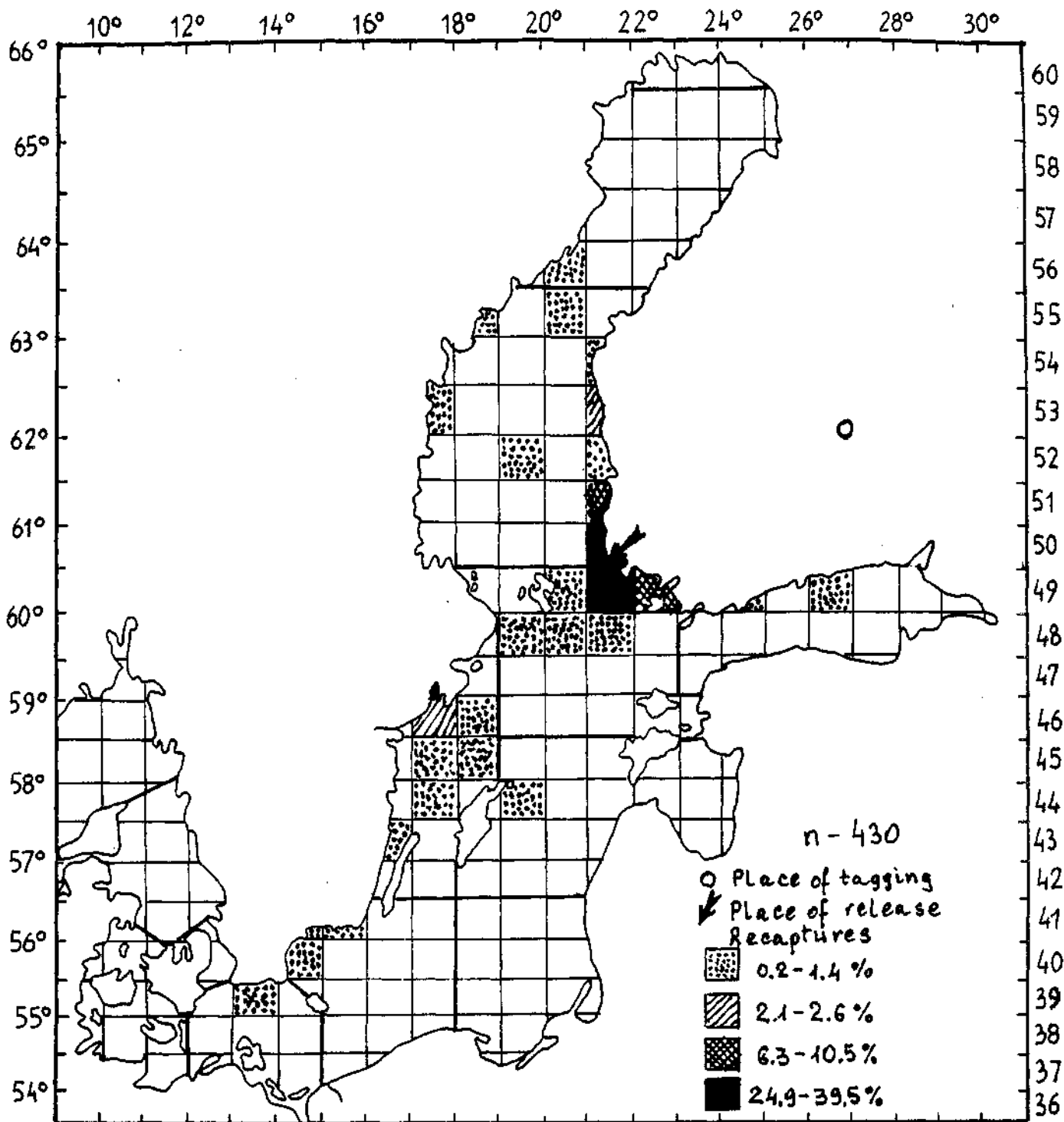


Fig. 5. Places of tagging and recaptures of sea trout smolts tagged in Finland.

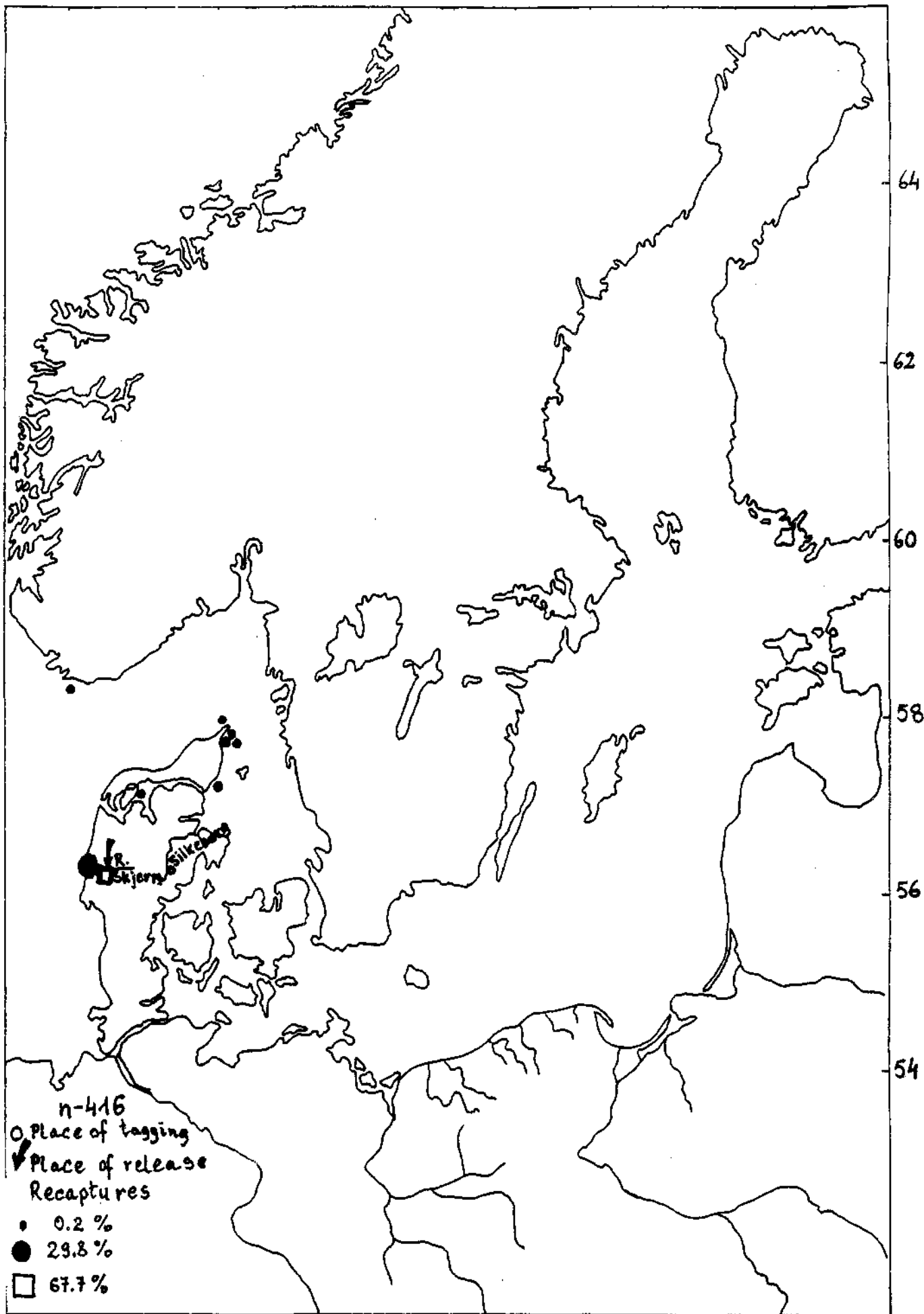


Fig. 6. Places of tagging, release and recaptures of sea trout smolts tagged in Denmark.

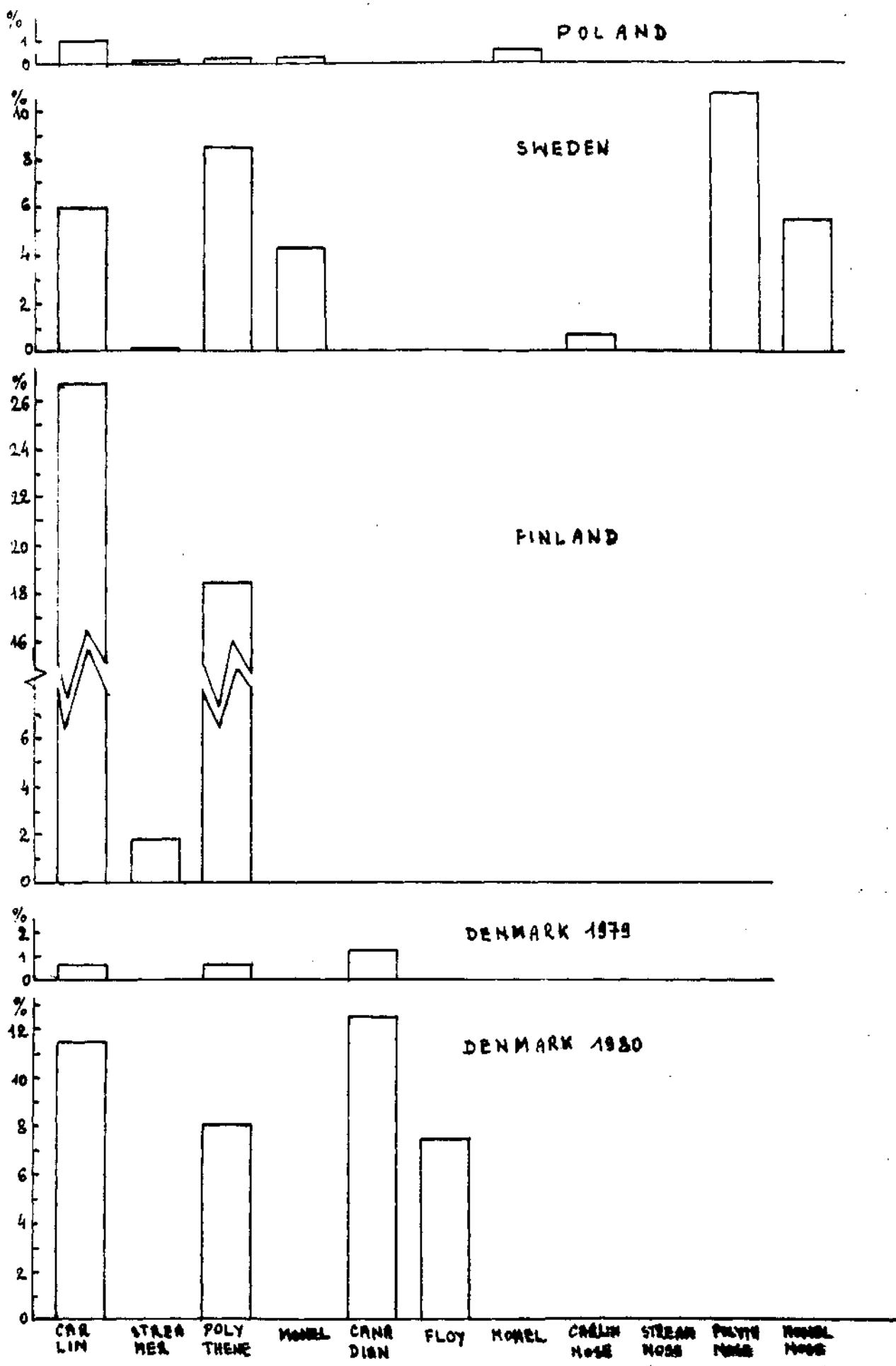


Fig. 7. Percentage of recoveries from sea trout tagging experiments carried out in Finland, Poland and Sweden in 1979 and in Denmark in 1970 and 1980.