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Coastal Fish Monitorin
In Baltic Reference Areas

Helsinki 2000

RIISTAN- JA KALANTUTKIMUS

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Abstract

The fourth annual report on monitoring of coastal fish presents catches of perch, roach and viviparous blenny in six international reference areas; Kvädöfjärden at the Swedish coast of the Baltic Proper, Hiiumaa in the Estonian Sea of Straits, Brunskär in the Archipelago Sea, Finbo at northwestern Åland, Holmöarna in the northern Quark and Råneå in the Bothnian Bay. Year class strength, growth of perch and catches of perch and roach in terms of biomass are also discussed.
Progressing eutrophication is indicated in the Archipelago Sea by increasing catches of perch and roach and decreasing Secchi disk depths. Perch catches have also increased in the area of northwestern Åland. The perch stock in the Sea of Straits was overexploited and the catches have been very small since 1996. Year-class-strength was weak in 1993 in all areas except in the Northern Quark, where it was relatively good. Catches of perch and roach estimated in terms of biomass correlated with catches estimated in terms of numbers. Reproduction failures of viviparous blenny were low in all investigated areas.

Key words

Coastal monitoring, eutrophication, perch, roach, viviparous blenny

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Contents

1. Introduction

Monitoring of coastal fish is carried out in six Baltic reference areas within an internationally established system covering Sweden, Finland, Åland and Estonia (Fig. 1). It involves annual monitoring of biological key variables at fixed stations using standardised methods. The methods have been adopted by HELCOM to be used in the whole Baltic Sea. The system of international reference areas is supplemented by monitoring in regional reference areas and "hot spots", including Latvia and Lithuania. The objectives of an integrated monitoring programme design for coastal fish have been presented by Neuman and Sandström (1996 a, b).

The monitoring in reference areas is co-ordinated by COBRA (The Coordination Organ for Baltic Reference Areas), with a secretariat at the Provincial Government of Åland. Members of COBRA are appointed by the participating institutes, the Estonian Marine Institute, the Fisheries Division at the Provincial Government of Åland, the Finnish Game and Fisheries Research Institute and the Swedish National Board of Fisheries, Institute of Coastal Research.

A report, summarising stock development of the dominant species perch and roach, year-class strengths of perch and reproduction success of viviparous blenny, is produced annually (Ådjers et al. 1997, 1998, 1999). CPUE (catch per unit effort), expressed as numbers and biomass, is presented for perch and roach.

2. Study areas

The reference areas are located to Kvädöfjärden in the Archipelago of Gryt at the Swedish east coast of the Baltic Proper, to Hiiumaa in the Sea of Straits in western Estonia, to Brunskär in the southern Archipelago Sea in south-western Finland, to Finbo in north-western Åland, to Holmöarna in the Northern Quark and to the bay of Råneå in the northernmost Bothnian Bay (Fig. 1). Detailed maps of the reference areas are presented in earlier annual reports (Ådjers et al. 1997; Ådjers et al. 1998). General geographic and biotic characteristics of the areas have been described in Ådjers et. al (1996).

Secchi disk depth is determined during the test fishing in August and is used as a general indicator of eutrophication in the area. The Secchi disk depths showed significantly decreasing trends in Råneå and Brunskär reference areas (Fig. 1) despite deviating values in 1999 in both areas. No trends appeared in the other areas.

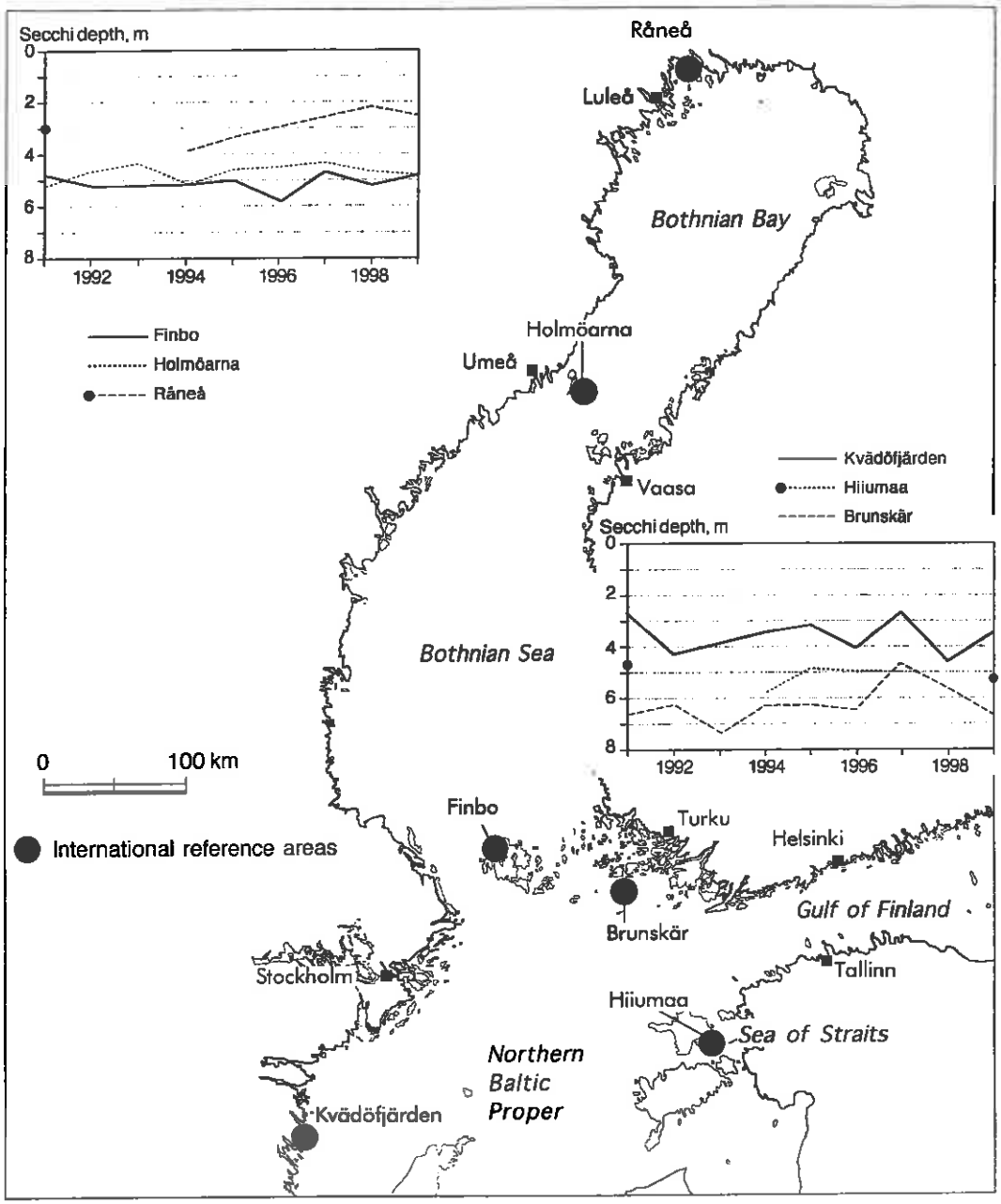

Figure 1. International reference areas (•) in the Baltic Sea with Secchi disk depths.

3. Material and methods

The test fishing methods, which are available as HELCOM guidelines for monitoring of coastal fish in the Baltic Sea, are described in Neuman et al. (1997). More detailed descriptions of the test fishing methods and the monitoring of viviparous blenny appeared in Ådjers et al. (1997, 1998, 1999).

Gill covers of female perch were sampled for age and growth analyses. Sampling was carried out by taking 50 samples from each 2.5 cm length group starting from fish with a length of 12.6 cm and 25 samples or all fish caught from length groups >27.5 cm. After age determination length-at-age data were combined with the test fishing results to produce an age distribution for the total catch. Year-class strength was calculated by summarising the CPUE of the individual cohorts during ages 3 – 6 over the whole sampling period. A minimum of five growth observations was required to be presented in the growth rate figures.

CPUE, expressed as number of individuals, is usually presented as monitoring result. According to Kurkilahti (1999) however, catches in gill nets may be more suitable for estimating CPUE in terms of biomass. The variance is lower and the effort required for detecting differences is hence lower. Biomass is registered only at Kvädöfjärden within the monitoring system. It is possible, however, to calculate the biomass CPUE by using a mean weight for an individual of each length group for each species. The mean weight is multiplied by the number of fish caught in each length group. Biomass CPUE has been calculated for perch and roach with this length/weight relation. The correlation of number CPUE and biomass CPUE is discussed and the development of the catches of perch and roach in terms of biomass is presented.

Trends in the development of the Secchi depth and species abundance were analysed by Mann-Kendall nonparametric trend analysis with 95 % confidence level. Six observations per year (one for each fishing night) are included in the Secchi depth trend analyses. The observations for trend analyses in species abundance are obtained from each station and fishing night. The total number of observations varies between 30 and 54 per year and area.

4. Results

4.1. Catches of perch and roach

The catches of both perch and roach were on a low lewel at Kvädöfjärden in 1999 (Fig. 2). The catches of roach decreased significantly during the period 1989 - 1998. The mean bottom temperature was about 16°C, which is normal in the area.

Perch was caught in very low numbers at Hiiumaa in 1999 (Fig. 2). The significant decreasing trend, starting in 1995, had continued. The decrease is a result of overexploitation of the stock (Kangur, 1996). The roach catches also were low in 1999. Trends could not be detected. The mean bottom temperature was high during the test fishing.

The catches of both perch and roach have increased since 1992 at Brunskär and the catch of perch in 1999 was the highest so far recorded (Fig. 2). The increase was significant for perch but not for roach. The Secchi disk depth showed a significant decreasing trend during the same period (Fig. 1). These parameters indicate progressing eutrophication in the area. The mean bottom temperature in 1999 was relatively low. Despite the low water temperature the catches of both perch and roach remained high.

Perch catches at Finbo in 1999 were also the highest so far recorded (Fig. 2). No trends have been detected until 1998, but with last year catches included the increasing trend became significant. The catches of roach were also high. A significant increasing trend was detected in the material 1992 – 1999, but not for the period 1987 - 1999. The mean bottom temperature was high during the test fishing period in 1999, which probably enhanced the catches.

Perch was caught in high numbers and roach in low numbers at Råneå (Fig. 2). No trends were noted. The mean bottom temperature was at a moderate level in the area.

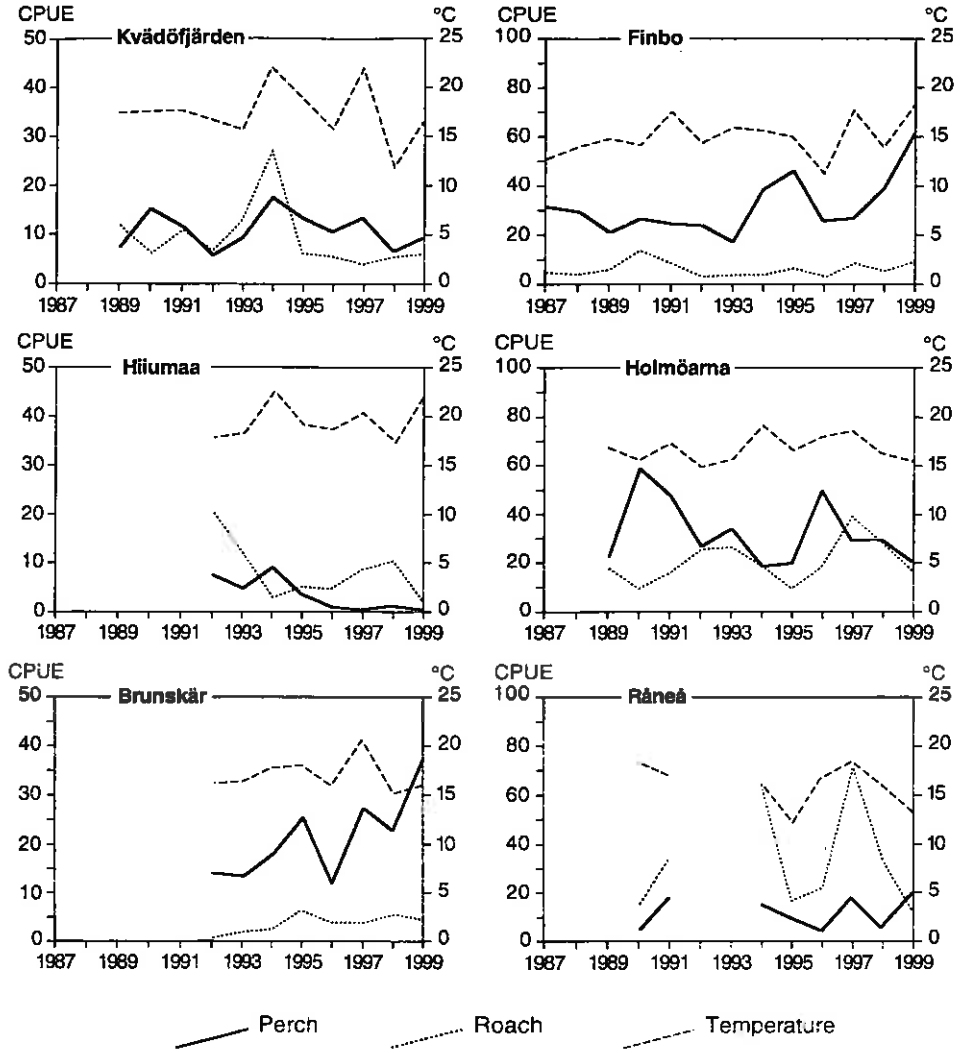

Figure 2. Catches of perch and roach expressed as catch-per-unit-effort (numbers) with mean bottom temperatures in the Baltic reference areas.

4.2. Year-class strength of female perch

Year-class strength has been shown to vary according to a common pattern in areas with low anthropogenic influence in the Baltic Sea (Böhling et. al. 1991). This can be verified by an analysis based on CPUE data from the reference areas, where fish of ages 3 - 6 years are included (Fig. 3). There was a common pattern with strong year-classes in 1988 and 1992 and weak or normal year-classes in 1989, 1990, 1991 and 1993. Year-classes deviating from the pattern appeared at Brunskär with a strong year-class in 1991, at Holmöarna with strong year-classes in 1990 and 1993 and at Hiiumaa with a stronger year-class in 1991. Only three years are available from Råneå, but the year-class pattern is deviating, with a weak year-class in 1992 and a strong one in 1993.

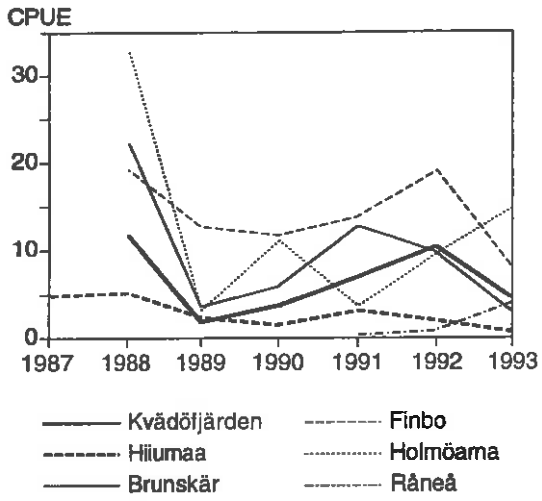

Figure 3. Year-class strength of female perch (*CPUE x 2).

4.3. Growth of female perch

The growth rate for 2 year old fish appeared to increase with time. Trends were few for 4 and 6 year old fish (Fig. 4). An increasing trend was noted for 4 year old fish in Råneå. It may be noted that the annual growth in 1997 was good in all areas, except Hiiumaa, due to the very warm summer, while the poor growth in 1998 can be explained by low temperatures.

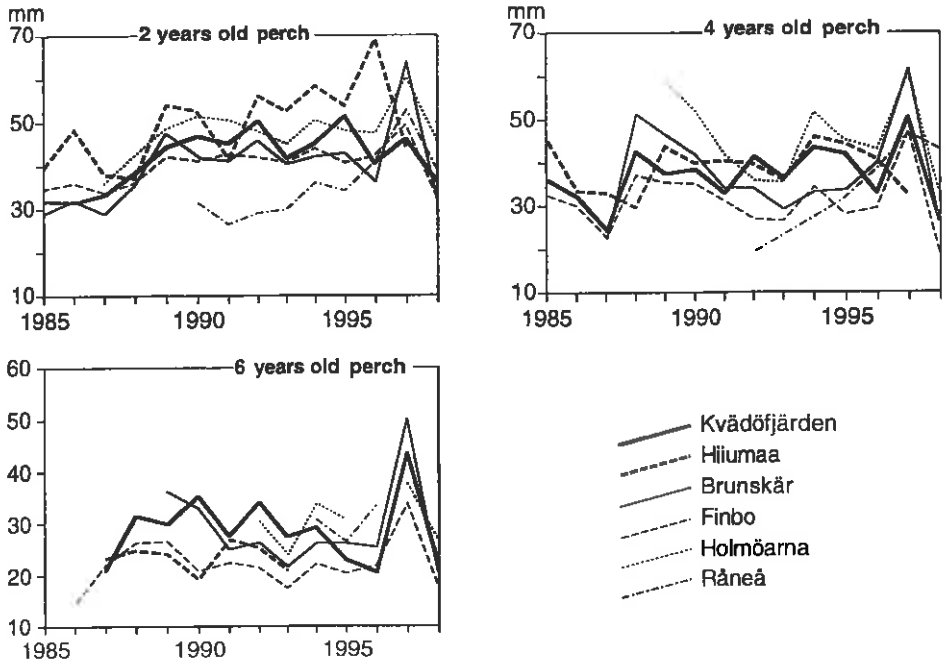

Figure 4. Annual growth of 2, 4 and 6 year old female perch.

4.4 Biomass CPUE

Biomass CPUE correlates well with number CPUE for both perch and roach. The area with the highest (Brunskär; perch, r = 0.97; roach, r = 0,98) and lowest (Holmöarna; perch, r = 0,94; roach, r = 0,84) correlation values is presented in figure 5. According to Kurkilahti (1999) gillnet selectivity causes larger biases in the estimates of number CPUE compared with estimates of biomass CPUE. This effect is largest in small length classes. The good correlation seen in our comparison is probably due to the fact that the coastal net series, where the smallest mesh size in 17 mm, do not catch small fish is such amounts that an obvious difference appears between biomass CPUE and number CPUE.

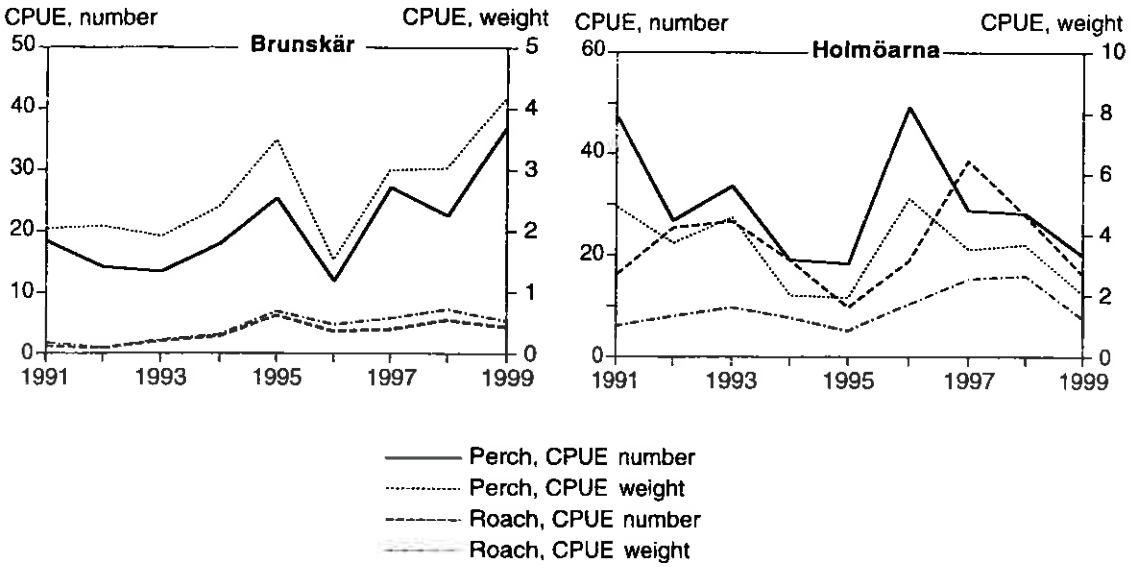

Figure 5. Correlation between number CPUE and biomass CPUE for perch and roach.

The development of the catches of perch and roach in terms of biomass CPUE is presented in figure 6. The variations of biomass CPUE between years correlated strongly with the number CPUE (compare figure 6 with figure 2).

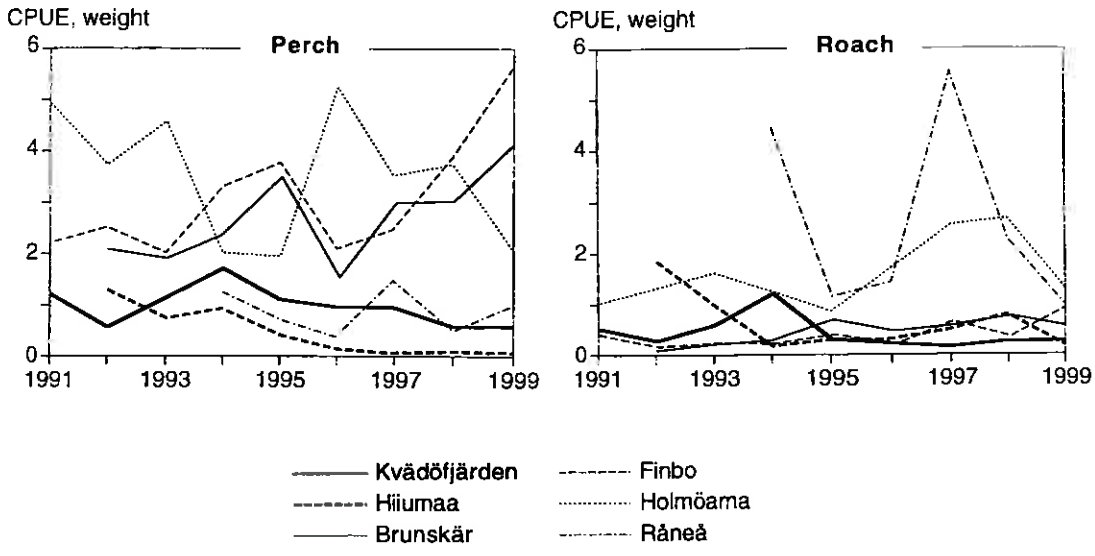

Figure 6. Catches of perch and roach in terms of biomass CPUE.

4.5 The viviparous blenny

The time series of monitoring viviparous blenny are still too short for performing trend analysis. Similar variations of CPUE and reproduction indexes, such as the share of retarded fry and share of late dead fry, between years over a larger geographical area were indicated (Fig. 7). Kvädöfjärden deviated in several parameters from the common pattern. The share of malformed fry was high compared with the other areas in 1998 and the share of females with late dead fry and the share of late dead fry were higher than in other areas in Kvädöfjärden in 1997.

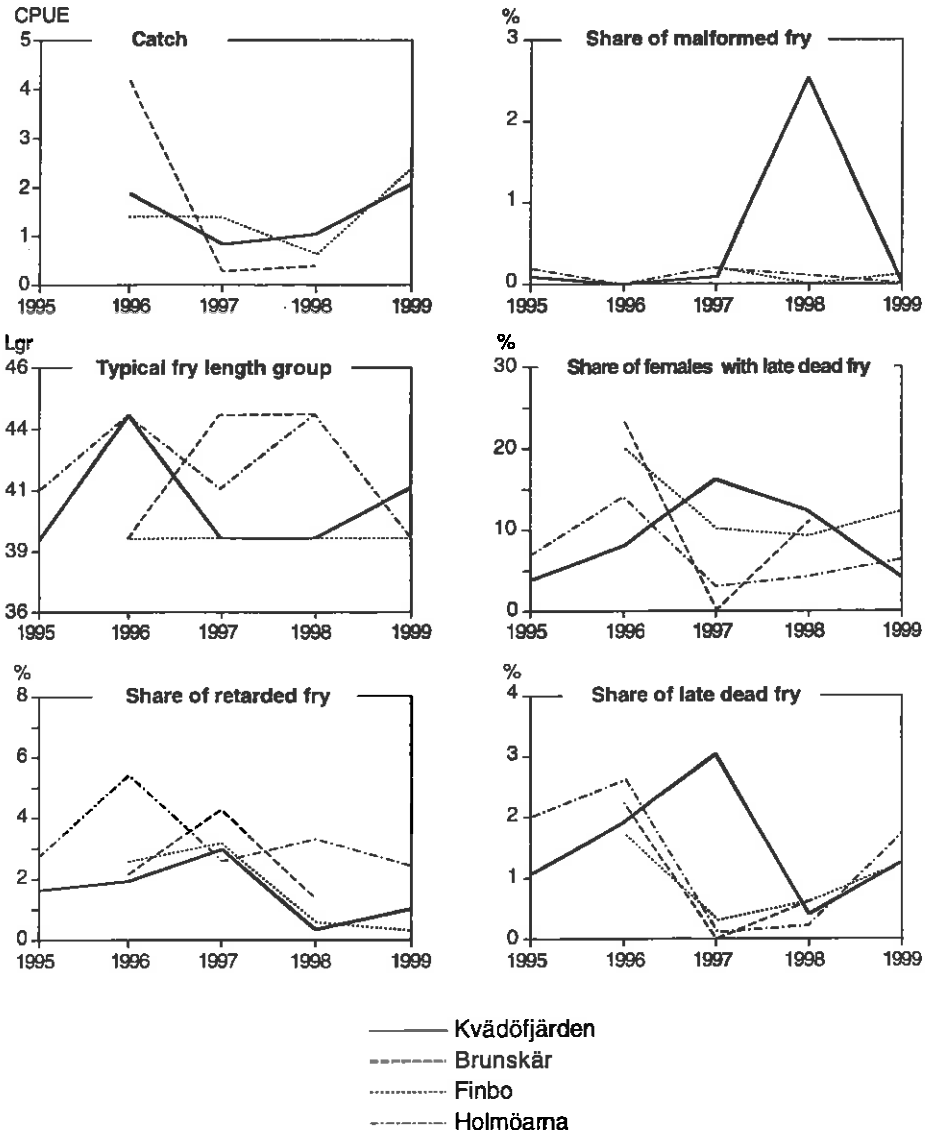

Figure 7. Catch-per-unit-effort and reproduction indexes of viviparous blenny.

5. Conclusions

Increasing trends of perch and roach stocks in Finbo and Brunskär reference areas and decreasing Secchi disk depths in Brunskär reference area were tentatively attributed to eutrophication. The perch catches in Hiiumaa have been very small since 1996 due to overexploitation and a recovery of the stock is probably not to be expected unless fishing is regulated. Perch growth rate was favoured by the warm summer in 1997 and repressed by the cold summer in 1998. CPUE values based on biomass and CPUE values based on number correlated well, as the proportion of small-sized (<15 cm) fish is low in the catches of the coastal survey nets. The results indicated that accurate estimates of biomass CPUE can be calculated from weight/length relations and number CPUE. Indications of impaired reproduction for viviparous blenny were few and gave no reason for concern.

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