

PREDICTION OF YEAR-CLASS STRENGTH OF COASTAL COD (*GADUS MORHUA*) FROM BEACH SEINE CATCHES OF 0-GROUP.

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ABSTRACT

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The validity of a beach seine 0-group index as a measure of year-class strength of cod in exposed areas along the Norwegian Skagerrak coast was tested. Fishing with trammel-nets was performed during November and December each year from 1984 to 1990. There was a statistically significant correlation between the two methods for estimation of year-class strength.

INTRODUCTION

Beach seine catches of 0-group cod (*Gadus morhua*) have been used for estimating year-class strength along the Norwegian Skagerrak coast (Dannevig 1949, 1954, 1959, Dannevig 1963, Tveite 1971, 1984, Gjørseter and Johannesen 1988, Johannesen and Tveite 1989, Johannesen and Gjørseter 1990, Gjørseter and Danielssen 1990). Ever since Dannevig (1906) tried to prove and Dahl (1906) to disprove any beneficial effects of the release of artificially propagated yolksac larvae, it has been assumed that beach seine catch rates of 0-groups can be used as predictor of year-class strength as observed at I-group stage or later. This assumption was considered valid after comparisons of beach seine 0-group indices and beach seine I-group indices (Dannevig 1963, Tveite 1971, Gjørseter and Danielssen 1990), and also between 0-group beach seine indices and trap catches of II-IV group cod in Søndeledfjord and Topdalsfjord from 1922 to 1942 (Tveite 1971).

Comparisons between beach seine and trap catches were restricted to sheltered localities. The present study examined the validity of beach seine indices as predictors of year-class strength in more open coastal areas.

MATERIAL AND METHODS

Every year from 1984 to 1990 fishing by trammel-nets was carried out for 8 to 14 days during November - December. At that time of the year cod is abundant in shallow water. During the first year of study three different mesh-sizes (39, 45 and 52 mm square mesh) in the small-mesh inner net were used. No significant differences in the catch or length frequency distribution of the cod caught in the different nets was found. Therefore 45 mm square mesh nets were chosen for the rest of the study period.

From 1984 to 1990 surveys were carried out at Vasser, Jomfruland and Flødevigen. From 1985 onwards Høvåg was also included as sampling locality (Fig 1). Every year, nets were set at random at each locality,

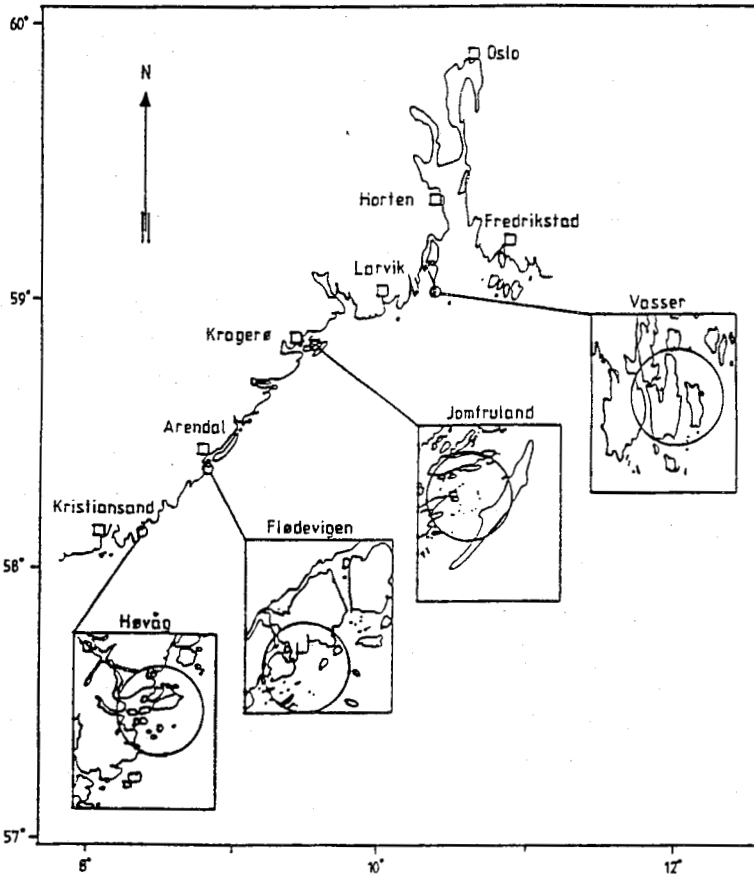


Fig. 1. Locations of trammel-net sampling areas

though some exposed sites were inaccessible in rough weather. At depths from 5 to 25 m twelve to sixteen 28 m long and 1.5 m high trammel-nets were set at dusk and hauled just after dawn the next morning.

The number of specimens collected per locality ranged from 61 to 201 individuals, as a result of 1 to 4 nights fishing. A total of 3177 cod were collected during the 7 year study. Length, weight, maturity stage and stomach contents were recorded. Ages of the cod were determined by reading annuli of broken ground otoliths (Rollefsen 1933). Abundance indices of 0-group cod were obtained from the routine beach seine surveys performed annually since 1917 (Tveite 1971). Every year in September around 100 hauls are performed at fixed localities along the coast. The seine is 38 m long and 3.8 m deep with a 6 mm square mesh. The 0-groups are separated from the older fish on the basis of their separate length frequency distribution (Tveite 1971, Gjørseter and Danielssen 1990).

The total number of 0-group cod caught in the beach seine were used as 0-group abundance indices. For older fish, a relative number based on the daily catch per trammel-net was calculated.

RESULTS AND DISCUSSION

Year-class strength varied greatly during the period of study (Fig. 2). The year-classes of 1985, 1987 and 1989 were the strongest both measured as 0-group, I-group and II-group. The 1988 year-class was nearly absent in the beach seine catches in September, most probably because of the lethal effect of a *Chrysochromulina polylepis* bloom (Johannessen and Gjørseter 1990). The small size of this year-class was confirmed by subsequent catches of I- and II-groups.

The combined length frequency distribution for each of the four youngest age-groups caught by the trammel-net throughout the study period at all sampling stations is shown in Fig. 3. The 0-group had a symmetrical unimodal length distribution. The small numbers caught indicated that most fish passed through the mesh with only a minority getting entangled. According to the beach seine investigations, 0-groups were abundant in the areas and depth ranges sampled.

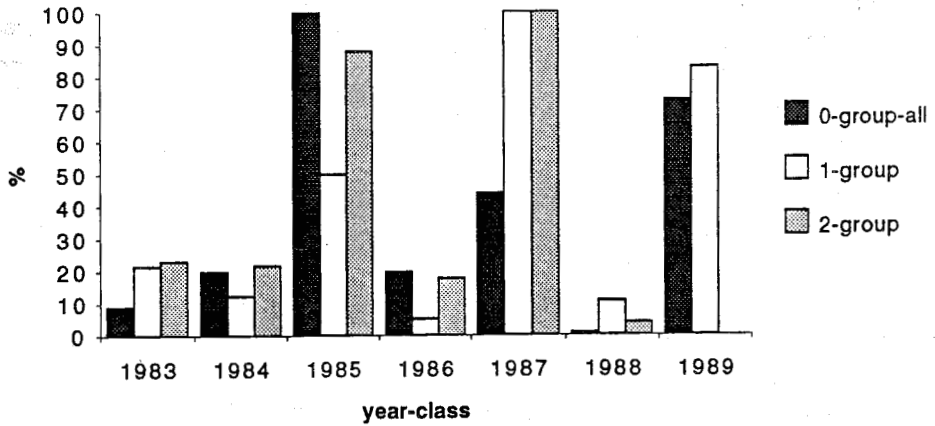


Fig. 2. Year-class strength, as percentage of maximum numbers caught, for 0-group beach seine catches and trammel-net catches for I- and II-group.

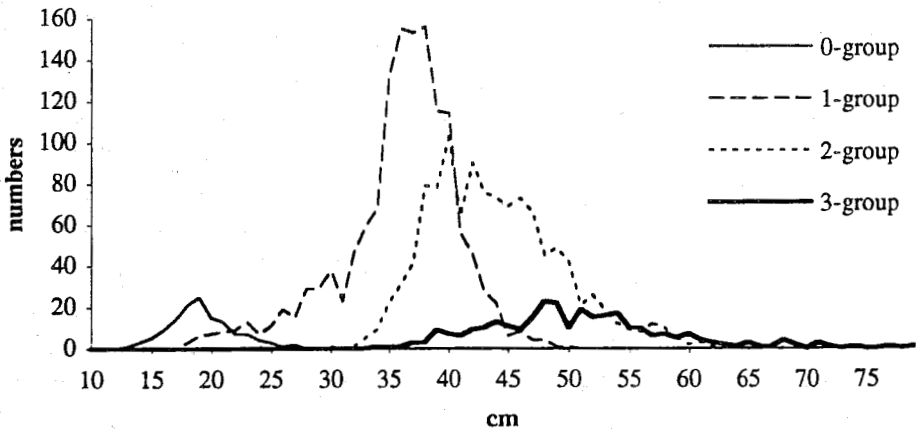


Fig. 3. The combined length frequency distribution for each of the four youngest age-groups caught by trammel-net throughout the study period at all sampling stations.

The I-group showed a skewed distribution with a rather flat portion up to about 30 cm. A considerable proportion of the smaller individuals of this age-group probably passed through the meshes. The catches of the larger fish were probably more representative of the population. The II-group again had a more symmetrical distribution.

The correlation (R^2 by analysis of variance) between beach seine 0-group indices and trammel-net indices for the year-classes involved were positive (Table 1). For I- and II-group, correlation improved when beach

Table 1

Correlation (R^2) matrices for indices of beach seine caught 0-group, and trammel-net caught I-, II- and III-group cod, based on N numbers sampled and the probability (p) by simple regression.

	All beach seine stations							Coastal seine stations only		
	0-group			I-gr.		II-gr.		0-gr.		
	N	R^2	p	R^2	p	R^2	P	N	R^2	p
0-group	6766	1.00						1175		
I-group	1397	0.39	0.13	1.00				1397	0.52	0.07
II-group	1146	0.66	0.03	0.85	0.01	1.00		1146	0.74	0.01
III-group	293	0.66	0.05	0.13	0.55	0.26	0.30	293	0.55	0.09

seine hauls in the most sheltered areas were omitted, i.e. when only catches from areas similar to those where the trammel-net fishing took place were included (Table 1). The correlation between I-group and 0-group indices was somewhat poorer than those between 0-group and older age-groups.

The poor correlation between I-group and III-group, and II-group and III-group, may indicate that the III-group cod was sampled in insufficient numbers or not representatively occurring at the stations.

0-group estimates from beach seine hauls close to the trammel-net locations were compared to I- and II-group estimates from the trammel net fishery. Great variation in the correlation coefficients was observed. Some deviated from 0 only at the 40% level of significance. This indicated that the sampling was too limited to reveal local variations of abundance.

The observation that correlation was improved when locations were combined indicates that some common factors, probably environmental, influence the year-class strength of cod on a larger spatial scale (Johannessen and Tveite 1990). This may be so even though tagging experiments have shown that the coastal cod is quite stationary (Danielssen, 1969) and even if recruits primarily originate from local spawning (Johannessen and Gjørseter 1990).

The trammel-net fishery showed that beach seine indices of 0-group cod may be used as predictors of year-class strength, even in exposed coastal areas.

Fishing at one or two locations with approximately the same effort as used in this study would seem sufficient for further testing of this relationship. A study of local variations would require considerably more effort.

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