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# On Probable Relation Between Scotian Cod, Haddock, Pollock Recruitment and Silver Hake Abundance in the Area

by

V. A. Rikhter

Atlantic Scientific Research Institute of Marine Fisheries and Oceanography (AtlantNIRO)
5 Dm. Donskoy Str., Kaliningrad 236000, Russia

## INTRODUCTION

Scientifically substantiated management of main commercial fish species evidently should consider the impact of specific biotic and abiotic factors upon their year-classes abundance. Therefore, interspecies relations acting via food competition and predation deserve special attention. In particular, an interesting situation occures in the Scotian Shelf area where such abundant and poorly exploited during the latest years species as silver hake is distributed. Besides, the latter stock size seems to increase rapidly from 1996. The related species such as cod, pollock and haddock also distribute in the shelf area. Besides, areas of all species mentioned overlapped more or less, therefore, competition for food and uptake of one species young fish by other species adults is possible. In this paper an atempt is made to provide a general idea on silver hake importance as one of the most abundant demersal species (or even the most abundant one) in formation of above Gadoid species year-classes in the Scotian shelf area.

## MATERIAL AND METHODS

Information for appropriate analysis was obtained from Clay and Beanlands (1980), Showell (1996), Fanning et al (1996), Zwanenburg et al., (1995) and Neilson and Perley (1995). Probable relation between silver hake population 4VWX (1 year old and older) and that of cod 4VsW and haddock 4TVW (1 year old) and pollock 4VWX+5ZC (2 year old). The period from 1969 to 1992 (including) was covered. Total hake abundance for each year was compared to other species year-classes abundance, as appeared in the same year.

## RESULTS

Fig. 1, 2 and 3 present a general idea on probable hake abundance impact upon cod, haddock and pollock recruitment. Let's start with Fig. 1 where it could be seen,

though not apparently that during some years hake population abundance and cod recruitment were in oposite phases, particularly in 1979-1984. Fig. 2 shows the inverse relation more clearly. Two periods may be specified there 1969-1973 and 1980-1987. Another relatively long-term period (1977-1987) observed in Fig. 3. It should be mentioned, that curves presented in all the figures reveale one similar feature, i.e. starting from 1989/90 almost simultaneous decreas of hake abundance and recruitment of other species has been observed.

Correlation coefficients (r) were estimated for entire period discussed, excluding the last 2 years, and for year intervals when the oposite trend was observed most often, to understand the extent of quantitative relation (Table 1). The data presented show that within the observation period some shorter periods were revealed when the negative correlation actually occured between hake population abundance and cod, pollock and haddock recruitment. Besides, in the latter case the relation was statistically reliable with 95% confidence limits.

## DISCUSSION

The results obtained, certainly, provide no reasons to state that the above Gadoid species recruitment depends on silver hake abundance in Scotian Shelf area. However, the facts presented do not reject such relation existence which seems to be significant in some years. Concerning probable causes of the inverse relation observed, they should be certainly relevant to peculiarities of feeding and trophic relations between hake and other species. According to Vinogradov (1993), hake of 12-25 cm in length (1-2 years old) consumes mainly copepods and euphausiides. The same food items are consumed by young (0-group) cod, haddock and pollack (Leim and Scott, 1966) which assumes probable food competition between appropriate age-groups of hake and other species. It seems possible to state an analogy between food relations of silver hake and red hake in Georges Bank (Vinogradov, 1984), since food similarity in juveniles is rather high and decreases sharply further due to large differences in adults feeding pattern. Probable predation of juvenile cod, haddock and pollock by large silver hake also should be considered. However, according to Waldron (1992) per cent occurence of gadoids in silver hake stomachs was insignificant. Nevertheless it should be accounted that food sampling was carried out mainly during canadian trawling surveys of demersal fishes and from foreign fishing vessels. Since randomly stratified

method of station selection, as known, provides no local hake aggregations revealing, dense hake concentrations feeding for fish, including juvenile cod and haddock, were likely not covered by the method. As regards foreign fishing vessels, the latter operated only along the shelf slope southwards of SMGL where cod and haddock abundance is insignificant. Pollock though sometimes occures in large amount, is represented *mainly* by large individuals which may be predators relevant to silver hake. It was mentioned in Leim and Scott (1966) and Vinogradov (1984). Besides, foreign fishermen had to avoid the areas with relatively high abundance of above species due to strict restriction of their by-catch. Based on the above said, it may be assumed that quantitative characteristics of hake feeding upon Gadoids, presented by Waldron, hardly reflect the real situation.

Certainly, in natural conditions fish year-classes abundance, as a rule, form under the impact of several factors, and one of them is likely the conclusive one. Thus, abundance depression, covered actually all important commercial species and populations of Gadoids in NAFO Subdivisions 2-4 during early 1990s, was stipulated by unfavourable environment impact. Besides, it seems that a temperature factor is the most important one. Anomalies of physical features of areas where several relative fish species distribute are likely to depress biotic factors impact, *including* feeding competition and predation. However, in the cases when anomalies are of random nature, one species impact (silver hake) with sharply increased abundance upon another species may be significant.

No doubt that any other situations may occure in nature which promote the above impact.

We think that the problem, considered in the paper, is worth of scientists attention and requires more profound study, including that to reveal a conclusive factor in each particular case. Evidently, ecosystem researches are meaned, and the Scotian Shelf area is very convinient study area.

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Table 1

Correlation (r) between silver hake population abundance and other species recruitment in the Scotian Shelf area

| Years | Cod | Haddock | Pollock |
|---|---|---|---|
| 1969-1990 | 0.22 | -0.28 | |
| 1979-1990 | -0.37 | | |
| 1980-1990 | | -0.42 | |
| 1972-1989 | | | -0.30 |
| 1977-1987 | | | -0.64 |

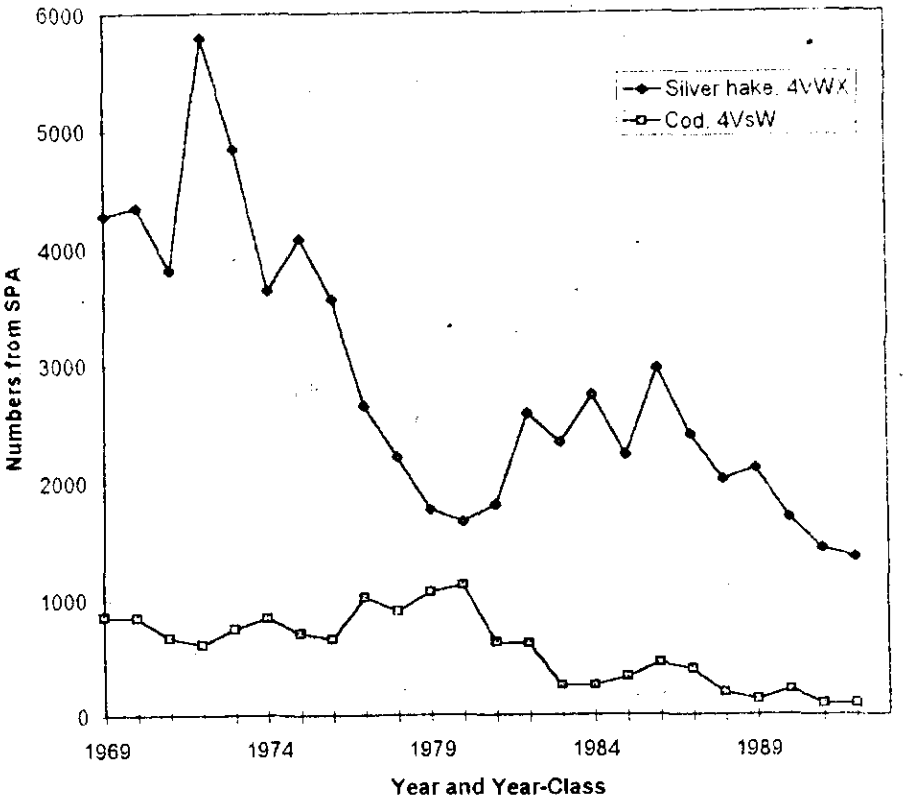


Fig. 1. Silver hake population abundance by years and one-year old cod abundance by year-classes.

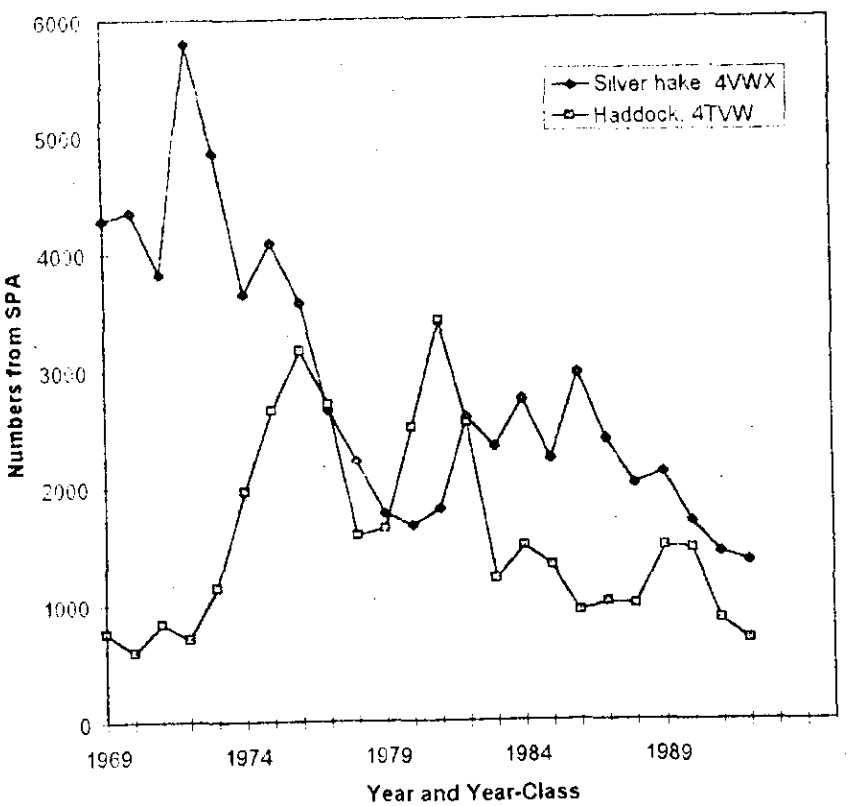


Fig. 2. Silver hake population abundance by years and one-year old haddock abundance by year-classes.

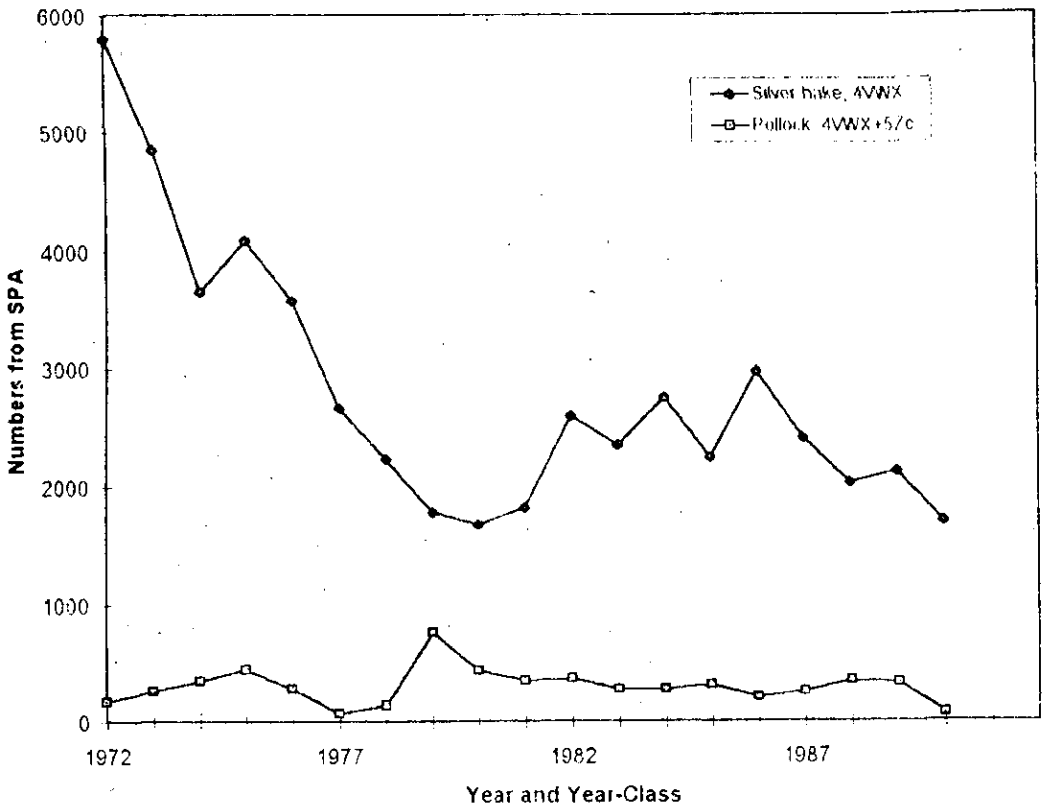


Fig. 3. Silver hake population abundance by years and two-year old pollock abundance by year-classes.