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On Dependence Between Pollock, Cod and Haddock By-catches and Soviet CPUE Estimates
for the Nova Scotian Silver Hake Between 1977 and 1990

by

V. A. Rikhter

Atlantic Scientific Research Institute of Marine Fisheries and Oceanography (AtlantNIRO)
5 Dmitry Donskoy Street, Kaliningrad 236000, Russia

ABSTRACT

Possible influence of pollock, cod and haddock by-catches on the
status of the Scotian silver hake fishery was studied. Success
of the latter was defined basing CPUE estimates. Negative statis-
tically significant dependence between pollock, cod and haddock
by-catches and silver hake catches per day of fishing was found
throughout the fishing period (data for some years were excluded
from the calculations). High negative correlation between cod by-
catch and standardized silver hake catches per hour was obtained.
Haddock influence on estimate of catch-per-unit-effort was insig-
nificant. By-catches of other species were supposed to be one of
the factors that decreased reliability of the CPUE estimates as an
abundance index for the species under investigation.

INTRODUCTION

Some events taking place in the silver hake fishery from

April to June 1992 stimulated me to write this paper. The fishery

situation at that time was extremely unfavourable and the fishermen

explained the fact by high pollock abundance to the south of SMGL.

As a rule by-catch of pollock considerably exceeded the allowable

5% level and that forced the fishing fleet to search for areas

with lower abundance of pollock. Cod and haddock abundance in the

area was never high within the mentioned period but these species

could limit intensity of silver hake fishery due to the fact that

their allowable by-catch only accounted for 1%. In this paper an

attempt was made to analyse long-term data and obtain more reliable

information as to the influence of pollock, cod and haddock by-catches

on success of silver hake fishery defined by estimates of catch-

per-unit-effort.

MATERIALS AND METHODS

Percentage of by-catch was calculated as ratio of pollock,

cod and haddock catches and Soviet silver hake catches by year,

month and for the whole fishing season. The NAFO statistical

bulletins for 1977-1988 and circular letters for 1990 and paper

by D.Waldron (1990) containing data on the species under discussion

for 1989 were used as a source of information. Correlation between
by-catches of pollock, cod and haddock and estimate of catch-per-
unit-effort for silver hake was calculated as well. Field data on
catch values per "vessel-day" of fishing and standardized catches
per hour were used as CPUE estimates (Waldron, 1992). When data
on by-catch were not available, possibly, due to low abundance of
the species under discussion by-catch was taken to be at 0.01%
level. Symbols (* or **) under the correlation coefficients
indicate statistical significance at 5 and 1% levels, respectively.

RESULTS AND DISCUSSION

Field data on silver hake catches per "vessel-day" of fishing
by year and month are presented in Table 1. Data on by-catch of
pollock, cod and haddock for the same period are given in Table 2.
As it can be seen the least by-catch falls to April when silver
hake was caught at the depths often exceeding 200 m. Later silver
hake migrated upwards where abundance and by-catch of pollock, cod
and haddock increased. Relationship between values under discus-
sion can be characterized by the correlation coefficients calculat-
ed basing data mentioned above (Tables 3 and 4).

As far as pollock is concerned a comparatively high correla-
tion coefficient in April does not mean that the species created
the greatest problems for silver hake fishery at that period.
High silver hake catches and low by-catch of pollock, often coincided
in April. We can not say this in respect of cod and haddock.
On the whole throughout the season correlation "without exclusion
of data" was weak in all cases. However, exclusion of data for
some years resulted in considerable increase of the correlation
coefficients for pollock and cod (Table 3). Data were excluded only
in those cases when hypothesis of inverse relation between CPUE
estimates and by-catch of this or that species was violated. Though
subjectivity of the approach is evident we can not deny the fact
that during the rest 11 years negative correlation between silver
hake catches and by-catches of pollock and cod is found to be
statistically significant. Due to its extremely low abundance to the
south of SMGL haddock, possibly, could not seriously influenced
the silver hake fishery with the exception of July when silver hake
was caught at small depths in the vicinity of SMGL. Data presented
in Table 4 corroborate the conclusion on the whole.

Data obtained only give general insight into the interactions under discussion. Abundance of the by-catch species varies in different years. Sometimes this variation is considerable. It means that influence of pollock, cod and haddock by-catch on silver hake catches varies too. It can be supposed that high pollock abundance resulted in decrease of CPUE estimates in April-May 1992.

So far as this index is one of the input-parameters for the analytical model used to obtain retrospective estimates of the silver hake stock size the problem of their reliability is questionable. In this connection CPUE estimates are regarded as abundance indices for the species under investigation and studying factors influencing their precision becomes of vital importance. Too low level of allowable by-catch for this or that species can be one of the factors mentioned above and it forces fishing boats to leave the areas with good aggregations of silver hake when a threat to exceed this level becomes evident.

REFERENCES

1. NAFO Statistical Bulletins 1979-1991. Fishery statistics for 1-77-1986.

2. Waldron D.E., M.C.Bourbonnais and M.A.Showell. 1989. Size of the Scotian Shelf silver hake population in 1988 with projection to 1990. NAFO SCR Doc. 89/48, 36 p.

3. Waldron D.E., M.A.Showell and P.A.Comeau. 1990. Scotian Shelf silver hake. 1989 commercial fishery description. NAFO SCR Doc. 90/21, 19 p.

4. Waldron D.E., M.A.Showell and M.C.Bourbonnais. 1992. Status of the Scotian Shelf silver hake (whiting) population in 1991 with projections to 1993. NAFO SCR Doc. 92/50, 22 p.

Table 1 Soviet Silver Hake Catches per "Vessel-Day" of Fishing (t)

Year	Month				Mean catch per fishing season
	April	May	June	July	
1977	32.7	25.0	39.5	35.4	31.3
1978	20.3	16.8	17.1	26.9	23.5
1979	21.8	25.9	25.8	36.5	27.4
1980	22.8	20.6	21.0	23.7	20.9
1981	14.1	27.9	22.9	30.6	26.6
1982	49.7	37.9	37.4	31.9	37.2
1983	37.8	33.9	21.3	14.3	30.5
1984	44.8	34.3	35.8	43.1	38.4
1985	41.9	42.2	33.2	40.5	38.9
1986	-	50.2	42.0	42.4	44.3
1987	49.2	37.0	34.6	12.3	32.6
1988	43.8	40.4	33.5	15.3	36.8
1989	44.0	44.0	34.7	31.0	40.7
1990	36.1	24.1	25.6	33.0	24.5

Table 2 By-catches (%) of Pollock, Cod and Haddock for the Soviet Direct Silver
Hake Fishery between 1977 and 1990

Year	Pollock				Whole season	Cod				Whole season	Haddock				Whole season
	April	May	June	July		April	May	June	July		April	May	June	July	
1977	0.4	1.7	0.1	0.0	0.4	0.1	0.3	0.0	0.2	0.3	0.1	0.1	0.1	0.0	0.0
1978	0.4	1.3	1.2	0.9	1.1	0.1	0.5	0.1	0.1	0.5	0.0	0.0	0.1	0.1	0.3
1979	0.4	5.4	0.4	0.8	2.2	0.0	0.2	0.7	3.1	1.5	0.0	0.3	0.2	0.1	0.2
1980	8.0	5.7	2.0	0.3	2.3	0.1	0.7	1.3	1.2	1.0	0.0	0.4	0.6	0.9	0.6
1981	7.9	7.9	0.9	0.6	0.9	0.0	0.1	2.8	1.6	1.5	0.0	0.1	1.0	0.3	0.4
1982	0.0	0.9	0.4	0.7	0.6	0.0	0.1	0.2	0.0	0.1	0.0	0.1	0.1	0.1	0.1
1983	0.3	1.5	0.1	0.0	0.8	0.3	1.0	0.6	0.0	0.7	0.2	0.6	0.9	0.0	0.6
1984	0.0	0.2	0.3	0.1	0.2	0.0	0.1	0.1	0.3	0.2	0.0	0.1	0.5	0.2	0.3
1985	0.0	1.5	0.7	0.1	0.6	0.0	0.1	0.1	0.0	0.0	0.0	0.4	0.4	0.4	0.5
1986	0.0	0.8	1.0	0.4	0.8	0.0	0.0	0.1	0.0	0.0	0.0	0.2	0.8	0.3	0.5
1987	0.0	0.3	1.3	0.4	0.8	0.0	0.0	0.1	0.1	0.1	0.0	0.4	0.6	0.3	0.5
1988	0.4	1.9	2.0	14.0	1.6	0.1	0.2	0.0	0.7	0.2	0.1	0.3	1.2	3.7	0.6
1989	2.3	5.3	1.2	0.6	1.6	0.2	0.3	0.4	0.5	0.1	0.6	1.1	0.8	0.9	2.4
1990	0.8	2.1	0.8	0.0	1.8	0.2	0.0	0.0	0.0	0.3	0.1	0.7	0.7	0.0	0.5

Table 3 Correlation Between Silver Hake Catches per "Vessel-Day" of Fishing and
By-catches of Pollock, Cod and Haddock (%)

Species	Month [1]				Whole season		Notes
	April	May	June	July	Without exclusion of data	With exclusion of data for some years	
Pollock	-0.56 *	-0.30	-0.25	-0.41	-0.36	-0.73 *	Data for 1981, 1988, 1989 are excluded
Cod	0.04	-0.45	-0.50	0.07	-0.37	-0.61 *	Data for 1984, 1987, 1990 are excluded
Haddock	0.26	0.31	-0.10	-0.41	0.30	–	–

1) Monthly correlation coefficients were
   calculated without exclusion of data

Table 4 Correlation Between Standardized Catches of Silver Hake
per Trawling Hour and By-Catches of Pollock, Cod and Haddock (%)
for the Whole Fishing Season

Species	Without exclusion of data	With exclusion of data for some years	Notes
Pollock	-0.28	-0.50	Data for 1988 and 1989 are excluded
Cod	-0.74 **	–	–
Haddock	0.43	–	–