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On Possible Assessment of Relative TAC Value After the Example of the Scotian Silver Hake (Div. 4VWX)

by

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ABSTRACT

After the example of the Scotian silver hake, possibility of assessment of the relative value of the total allowable catch (TAC) is considered for cases, when the use of analytical methods fails to give desirable results. The conditions have been outlined under which the suggested procedure can be used for producing the TAC values in absolute expression a year in advance.

INTRODUCTION

In the recent years, at the NAFO Scientific Council Sessions the situations often arose when any attempts to use analytical assessment methods relative to well studied species turned out to be unsuccessful. The 4VWX silver hake is a striking example of the kind. Similar occasions may certainly take place in the activities of other international fishery bodies as well. The estimation of the terminal fishing mortality rate (F_t) is usually the stumbling-stone. If the reliability of the F_t value cannot be proved, one has to resort to various indirect methods in order to determine the TAC a year in advance*one way or another, the element of subjectivity being in this case quite strong which casts doubt on reasonability of such attempts.

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* Certainly in some cases the use of the method of direct account may be of assistance. However here the species are implied to which such methods are inapplicable or the technique of their application has not been developed yet.

In the present paper one of the ways of assessment of the relative TAC value is considered after the example of the 4VWX silver hake which, probably, will allow to somewhat reduce the above-mentioned element of subjectivity.

MATERIALS AND METHODS

The calculation routine presented below is not new. It was used first in 1974 (Rikhter, 1974) for assessment of the absolute TAC value for the red hake from the southern New England (5ZW+6). In the given case the same calculation routine is used for assessment of the relative TAC value for the 4VWX silver hake. The initial data adopted from the papers by Waldron and Fanning (1986 a,b) are as follows:

$F_{0.1} = 0.4738$; $\frac{Y_w}{R}$ at $F_{0.1} = 63$ g

Abundance indices for year classes at age 1 from the Canadian survey data are:

Year class	1977	1978	1979	1980	1981	1982	1983	1984	1985
Abundance (000)	26774	86755	14787	32930	191964	117816	427311	102496	552598

The mean percentage of commercial exemption of the year classes biomass by age has been calculated from the data of Table 10 of the NAFO SCR Doc. 86/62 based on the assumption that on the average it is close to that of the annual catch. The statistics on the catches of the silver hake at ages 2-6 that constitute over 90% of the annual yield were used for subsequent calculations (table 1).

RESULTS

According to adopted procedure, the catch sizes of each year class were first determined for the entire exploitation period at the fishing mortality rate corresponding to $F_{0.1}$. The formula used in computations was:

$$Y_w = R \cdot 63$$

where Y_w is the index of the catch taken from a year class during the entire exploitation period;

R is the index of abundance of the year class at age 1.

Year class	1977	1978	1979	1980	1981	1982	1983	1984	1985	1986
Index of catch	1.7	5.5	0.9	2.1	12.1	7.4	26.9	6.4	34.8	10.9

The next stage of the work involved the calculation of the catch by age with regard for the mean percentage of exemption and subsequent pooling by year for the period from 1983 to 1988 inclusive (table 2).

The given data indicate that when the fishing mortality rate is permanent, the TAC value sharply increases after 1983, which is mainly caused by the recruitment of the strong 1981 and 1983 year classes. The data of the trawling surveys of the juvenile and adult silver hake show that the 1985 year class is nearly as strong as the 1983 year class. The estimate of the 1986 year class based on the juvenile silver hake survey data is also indicative of a high abundance of the latter (Fanning et al., 1987). However, taking into consideration the preliminary character of the information, the size of the 1986 year class for calculations was taken to be at the level of mean abundance of the 1977-1985 year classes at age 1.

The comparison between the relative TAC value and those actually recommended is of interest:

Years	1983	1984	1985	1986	1987	1988
Actual TACs, thous.tons	80	100	100	100	100	167
Ratio of actual TACs	1.00	1.25	1.25	1.25	1.25	2.01
Relative TACs	3.99	6.53	10.81	13.87	16.58	19.26
Ratio of relative TACs	1.00	1.64	2.71	3.48	4.16	4.83

The results of the comparison make it possible to assume that the TAC values recommended for 1986-1987 were much overestimated if they had been, as earlier, estimated at the fishing mortality rate approaching $F_{0.1}$. The same can be said about the values for 1988.

DISCUSSION

The obtained results seem to give reason for suggesting the possibility of increasing the TAC for 1988 almost 5 times compared with the actual level observed in 1983. However now a question arises whether the calculated ratios are reliable, for the reliability is known to be first of all dependent on the precision of indices of abundance of year classes at corresponding ages. If the ratio of the latter is close to real, the above-stated procedure may be used to gain a guidelight for forecasting the TAC a year in advance. In fact confidence intervals of abundance indices based on the trawling survey data are mostly quite significant. The actual rate of exploitation during the considered years should be also taken into account. If it notably exceeds the calculated level, the assessment of the TAC by the suggested method will yield an overestimated value. As far as the silver hake is concerned, this fact can be neglected as the fishing intensity was low during the period under consideration, and the fishing mortality rate was, evidently, below the $F_{0.1}$ level. Certainly the use of the averaged data on the percentage of commercial exemption of the year classes by age can be attributed to drawbacks of the calculations made. As is evident from table 1, fluctuations by year, particularly among the fish at age 2-4, may be quite considerable. Ignoring of this fact may result in a somewhat distorted value of actual catch ratio by year.

SUMMARY

The results of the studies presented in this paper make it possible to express an opinion that the suggested procedure can be used as a subsidiary tool in the analysis of the TAC dynamics, and may be useful in assessment of the relative and, under definite conditions, absolute TAC sizes a year in advance.

REFERENCES

1. Fanning L.P., D.E.Waldron and C.Bourbonnais, 1987. Scotian Shelf silver hake population size in 1986. NAFO SCR Doc. 87/56, 31 p.

2. Rikhter V.A., 1974. A forecasting method and an approximate estimate of total allowable catch of red hake from Southern New England in 1974-75. ICNAF Res. Doc. 74/64, 9 p.

3. Waldron D.E. and L.P.Fanning, 1986(a). Assessment of the Scotian Shelf silver hake population in 1985. NAFO SCR Doc. 86/62, 27 p.

4. Waldron D.E. and L.P.Fanning, 1986(b). Calibration of Divisions 4VWX silver hake VPA including calculations of yield-per-recruit. NAFO SCR Doc. 86/88, 15 p.

Table 1 Per cent of exempted silver hake biomass by age and year

Age	Years									Mean per cent
	1977	1978	1979	1980	1981	1982	1983	1984	1985	
2	17.4	21.0	14.5	19.1	6.8	12.7	31.8	8.0	35.4	19.1
3	44.6	32.8	27.0	39.1	52.3	24.9	29.8	48.9	17.9	35.1
4	23.3	20.4	22.3	22.5	23.3	32.0	19.8	24.1	28.4	23.0
5	7.5	11.6	16.5	11.0	11.0	19.1	11.2	7.2	8.2	11.6
6	2.8	5.9	11.4	5.1	5.0	5.9	4.6	2.6	3.8	5.2

Table 2 Relative annual catch of the 4VWX silver hake

Years	Age					Total	Catches relative to 1983 level
	2	3	4	5	6		
1983	2.31	0.74	0.21	0.64	0.09	3.99	1.00
1984	1.41	4.25	0.48	0.10	0.29	6.53	1.64
1985	5.14	2.60	2.78	0.24	0.05	10.81	2.71
1986	1.22	9.44	1.70	1.40	0.11	13.87	3.48
1987	6.65	2.25	6.19	0.86	0.63	16.58	4.16
1988	2.08	12.21	1.47	3.12	0.38	19.26	4.83