INTERNATIONAL COMMISSION FOR THE NORTHWEST ATLANTIC FISHERIES

ANNUAL MEETING - JUNE 1973

Evaluation of Research Survey Indices of Abundance for Cod Stocks in ICNAF Subareas 2 and 3

by

A. T. Pinhorn

and

R. Wells
Fisheries Research Board of Canada
Biological Station, St. John's, Nfld.

Introduction

One of the most critical factors in the calculation of future total allowable catches at various levels of fishing is the prediction of the contribution of year-classes which have entered or will enter the fishery in years beyond the year of the last estimated stock size from virtual population analyses. These predicted contributions can only be calculated from known correlations between pre-recruit survey indices of abundance and stock sizes at first entry to the fishery.

Such correlations are presented in this paper for cod stocks in ICNAF Divisions 2J-3L and 3Ps.

Materials and Methods

Divisions 2J-3L

Pre-recruit indices of abundance for the stock complex in Divisions 2J-3L were derived from the USSR young fish surveys in Divisions 3K and 3L as reported in USSR Research Report for 1971 (ICNAF Res. Doc. 72/42) for Division 3K and from Bulatova (1970) for Division 3L. Stock size estimates at first entry to the fishery (age 4) were derived from updating the assessment by Pinhorn and Wells (1972).

Division 3Ps

Pre-recruit indices of abundance for the stock in Division 3Ps were derived from USSR young fish surveys in Division 3P (ICNAF Res. Doc. 72/42) and from Canada (Nfld.) research surveys in Division 3Ps. For the latter, the surveys were conducted using the standard line system up to 1970 as reported by Pinhorn (1971) and these were post-stratified by assigning sets to the strata in which the standard positions occurred. The strata used were those shown by Pinhorn (1972a) for Division 3Ps. In 1972 the survey was conducted using the stratified-random survey method. In 1961, 1966 and 1971 no Canada (Nfld.) surveys were conducted in Division 3Ps and the numbers per standard set at each age for these years were estimated by applying average ratios to the numbers per standard set for these same year-classes in the adjacent years. Since only two strata on the seaward slope of St. Pierre Bank (Strata 311 and 317) contained most of the pre-recruit cod during the season of the survey (March-June), these two strata were selected for purposes of correlation with stock sizes. Stock size estimates at first entry to the fishery were derived from Pinhorn (1972b).

Results

Divisions 2J-3L

Three sets of pre-recruit data at age 3 were correlated with stock sizes at age 4: Division 3K, Division 3L and Divisions 3K + 3L (Fig. 1). The arithmetic correlation was highest with survey indices of abundance in Division 3K (r = 0.80) and Divisions 3K + 3L (r = 0.82) and lowest in Division 3L, the

latter not being significant. Table 1 shows the basic data used in the correlation and indicates the variation in predicted stock sizes of year-classes beyond those estimated from the virtual population analyses.

Division 3Ps

The arithmetic correlation between the numbers of 2 + 3-year-old cod per standard set from USSR surveys and Canada (Nfld.) surveys was significantly high with correlation coefficient (r) = 0.93 (Fig. 2). Of the 9 year-classes compared, only the 1966 year-class was obviously far outside the range of the correlation. The Canada (Nfld.) survey in 1968 greatly overestimated the 1966 year-class because the cruise was of very short duration and only lines of known abundance of young cod were fished. Therefore the number per hour for this year-class from Canada (Nfld.) surveys was not considered representative of the abundance of this year-class in relation to the others.

There was also a high log-log correlation (r = 0.91) between age 2 + 3 cod from Canada (Nfld.) surveys and stock size at age 4 from virtual population assessments (Fig. 2). Again one year-class (1958) was obviously outside the range of the correlation, being overestimated in the Canada (Nfld.) survey cruises.

Comparisons between USSR survey data and stock sizes could only be made for 6 year-classes where overlap between the two sets of data occurred. For these 6 year-classes the log-log correlation coefficient (r = 0.89) was significant. Table 1 shows the basic data used in the correlation and indicates the variation in year-class predictions for the 1966-68 year-classes by the different methods. The figures in the third column represent the USSR index of abundance converted to Canada (Nfld.) index of abundance and the latter used to predict year-class contributions using the correlations in Fig. 2.

References

Bulatova, A. Y. 1970. Abundance of young cod in the waters of Newfoundland. Int. Comm. Northw. Atlant. Fish., Redbook 1970, Part III: 56-64.

Pinhorn, A. T. 1971. Objectives and characteristics of existing and proposed groundfish surveys by Fisheries Research Board of Canada, Biological Station, St. John's, Newfoundland. Annu. Meet. int. Comm. Northw. Atlant. Fish. 1971, Res. Doc. No. 71/86, Serial No. 2527.

1972a. Proposed stratification scheme for ICNAF Division 3Ps. Annu. Meet. int. Comm. Northw. Atlant. Fish. 1972, Res. Doc. No. 72/60, Serial No. 2776.

1972b. Virtual population assessment of ICNAF Division 3Ps cod. Annu. Meet. int. Comm. Northw. Atlant. Fish. 1972, Res. Doc. 72/4, Serial No. 2683.

Pinhorn, A. T. and R. Wells. 1972. Combined virtual population assessment for ICNAF Divisions 2J, 3K and 3L cod. Int. Comm. Northw. Atlant. Fish., Redbook 1972, Part III: 35-38.
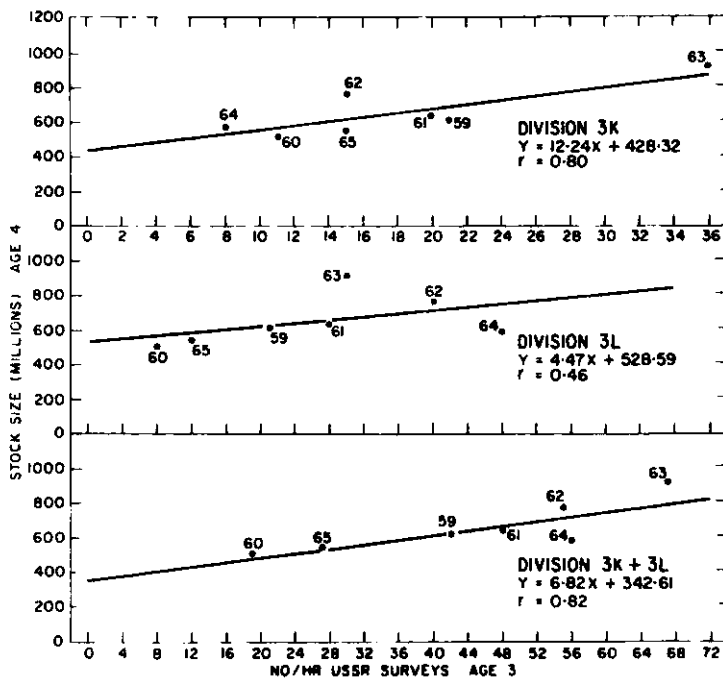
Fig. 1. Correlation of indices of abundance of pre-recruit year-classes of cod at age 3 from research surveys and stock sizes of same year-classes at age 4 from virtual population analyses. Divisions 2J-3L cod stock complex.
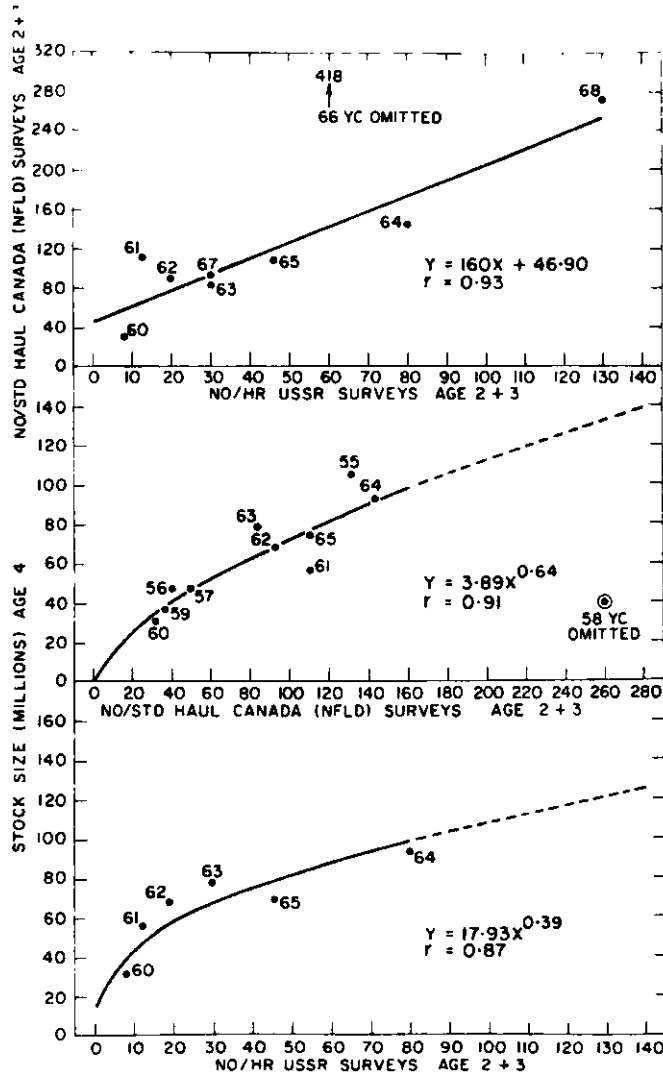
Fig. 2. Correlation of indices of abundance of pre-recruit year-classes at age 2+3 from research surveys and stock sizes of same year-classes at age 4 from virtual population analyses. Division 3Ps cod stock.

Table 1. Research indices of abundance and predicted stock sizes of year-classes later than those estimated from the virtual population analyses. Those underlined were used in calculation of total allowable catch for 1974.

Divs. 2J-3L

Year-class	No./hr. USSR surveys age 3			Stock size from virtual population assessment
	Div. 3K	Div. 3L	Divs. 3K + 3L	
				age 4
1959	21	21	42	612
1960	11	8	19	506
1961	20	28	48	629
1962	15	40	55	762
1963	36	31	67	908
1964	8	48	56	581
1965	15	12	27	543

				Predicted stock size from surveys in:		
				Div. 3K	Div. 3L	Divs. 3K + 3L
1966	27	43	70	<u>758</u>	720	820
1967	34	(51)[1]	(85)[1]	<u>844</u>	(756)[1]	(923)[1]
1968	40	(60)[1]	(100)[1]	<u>918</u>	(797)[1]	(1025)[1]
1969	(25)[2]			<u>(734)</u>[2]		
1970				<u>(800)</u>[3]		

[1]Survey indices of abundance (No./hr. of 3-year-olds) not available for 3L from USSR young fish surveys after 1966 year-class. No./hr. in 3L calculated from average ratio of No./hr. in 3K: No./hr. in 3L for 1959-66 year-classes.

[2]No./hr. 3-year-olds estimated from No./hr. 2-year-olds reported in Res. Doc. 72/42 and average ratio 3-year-olds to 2-year-olds for 1959-68 year-classes.

[3]Stock size estimated as average of 1966-68 year-classes.

Div. 3Ps

Year-class	Surveys ages 2 + 3		Stock size from virtual population assessment
	CAN(N)	USSR	
			age 4
1955	131		104
1956	40		47
1957	49		47
1958	(261)		40
1959	36		37
1960	32	8	31
1961	115	12	56
1962	92	19	68
1963	83	30	79
1964	145	80	94
1965	110	46	69

			Predicted stock sizes from surveys by:		
			CAN(N)	USSR	USSR→CAN(N)
1966	(418)	60	(179)	<u>89</u>	94
1967	91	30	68	<u>68</u>	<u>70</u>
1968	276	130	<u>137</u>	<u>120</u>	<u>130</u>
1969	(144)[2]	(109)[1]	<u>91</u>	(110)[1]	<u>(119)</u>[1]
1970	(117)[2]		<u>(80)</u>[2]		

[1]3-year-olds estimated from No./hr. 2-year-olds reported in Res. Doc. 72/42 and average ratio 3-year-olds to 2-year-olds for 1959-68 year-classes.
[2]Adjusted for stratified-random versus standard line surveys.