CAFSAC Res. Doc. 80/26

Assessment of Redfish in Division 3Ø

by

Carol A. Gavaris
Department of Fisheries and Oceans
Research and Resource Services
Northwest Atlantic Fisheries Centre
P. O. Box 5667
St. John's, Newfoundland
A1C 5X1

Abstract

The status of redfish stock in Div. 3Ø was assessed using catch and standardized effort for 1959-79 in a non-equilibrium general production model. Results from the fitted model suggested that the stock was in a good condition. Fishing above the predicted MSY and two-thirds effort MSY levels of 19000 t and 16000 t respectively might be sustained, in the short term, without damage to the stock.

Résumé

L'état du stock de sébastes de la division 3-0 a été évalué en se fondant sur les prises et l'effort de pêche normalisé des années 1959 à 1979 dans un modèle général de production en condition de non-équilibre. D'après les résultats de ce modèle, la condition du stock serait satisfaisante. Une pêche au-delà du RMS prédit et aux deux tiers de l'effort de RMS, 19,000 t et 16,000 t respectivement, peut être maintenue à court terme sans que le stock en souffre.

Introduction

Catches of redfish in Div. 3Ø have been generally low since the beginning of the fishery in the mid-1950's. Since 1977, catches have been well below the TAC of 16,000 mt in 1977 and 20,000 mt from 1978 to date. One possible factor may be the difficulty in fishing the rough bottom of the greater depths where the larger redfish are found (McKone 1978).

To assess the status of this stock, catch and standardized effort data were used in a non-equilibrium surplus producton model (Fletcher 1978; Rivard and Bledsoe 1978).

Methods

Redfish-directed effort was defined as the effort associated with those catches consisting of 50% or more redfish. Data for all country-vessels types that have been among the main prosecuters of the 3Ø redfish fishery were obtained from ICNAF statistical bulletins for 1959-77 and from Statlant reports for 1978. Preliminary data for 1979 for Newfoundland vessels only were obtained from Economics Branch, Fisheries and Oceans.

Effort was standardized using the multi-linear regression model described by Gavaris (1980). Catch per unit effort, weighted by effort, was regressed against vessel-type, month and year categories. The standardized catch rate obtained from the regression was predicted mean catch rate (with standard error) for a reference vessel type and month for all years. The choice of a standard was based on a low coefficient of variation in mean catch rate, relative to other vessel-month combinations, and a probability of continued involvement in the fishery.

Results

Standardization of effort

Several of the vessel types and months were combined together where no significant differences were found. The results of the regression were significant (multiple $R^2 = 0.93$) with the normality assumptions of the model satisfactorily met. The vessel and month categories chosen as the standard were Canada (Newfoundland and Maritimes-Quebec) TC 4 ottertrawlers and January-May. Canada (Newfoundland) TC 4 otter trawlers have been used as a standard in previous assessments of this stock (Parsons and Parsons 1975; McKone 1978).

The historical catches, catch rates and standardized effort are presented in Table 1. A lack of redfish-directed effort in 1968 prohibited the calculation of a catch rate. The catch and catch rate for 1979 are preliminary; the 1979 catch rate was based on Newfoundland vessels only with a redfish-directed catch of 35% of the total catch.

General production model

The nominal catch and standardized effort for 1959-79 were used in a surplus production model which did not assume equilbrium conditions (Fletcher 1978; Rivard and Bledsoe 1978). A comparison of the observed yields from the stock with those predicted by the model is shown in Fig. 1. The largest difference in the most recent years was in 1979. The catch rate for 1979, almost twice that of 1978, was based only on the Newfoundland catch and may not be representative.

The fitted model suggested that the stock was in a good condition. The equilibrium yield as a function of biomass is shown in Fig. 2. The catch trajectories from 1959 to 1979 would indicate that the stock has not been fished down to its most productive level where surplus production is maximized.

The equilibrium yield curve (Fig. 3) shows most of the fishing has been concentrated at a low effort-low yield level. The catch rates of 1971 to 1979 have been above the expected catch rate at two-thirds effort MSY, given equilibrium conditions.

Some results of the model follow:

	MSY	2/3 MSY EFFORT
Yield (mt)	19000	16000
Effort (hrs)	41000	28000

The non-equilibrium yield for 1980 predicted by the model at the two-thirds effort MSY level was 18,000 mt compared with 16000 mt at equilibrium.

It should be noted that the confidence interval about many of the model paramters (MSY, virgin biomass of stock) would be large as a narrow range of yield/effort levels have been observed in this fishery.

Conclusions

Catch rates in Div. 3Ø redfish fishery have been very stable during the seventies. The surplus production model suggested that the stock was in a better condition than that expected under equilibrium conditions. Fishing above the equilibrium levels of 19000 t and 16000 t at the MSY and two-thirds effort MSY would not appear to be harmful to the stock in the short term.

References

Fletcher, R. I. 1978. On the restructuring of the Pella-Tomlinson system. Fish. Bull. 76(3): 515-521.

Gavaris, S. 1980. Assessment of the cod stock in Div. 3M. NAFO Scr. Doc. 25.

McKone, W. D. 1978. Division 3Ø redfish assessment. CAFSAC Res. Doc. 78/20.

Parsons, L. S. and D. G. Parsons. 1975. An evaluation of the status of ICNAF Division. 3P, 3Ø and 3LN redfish. ICNAF Res. Bull No. 11.

Rivard, D. and L. J. Bledsoe. 1978. Parameter estimation for the Pella-Tomlinson stock production model under non-equilibrium conditions. Fish. Bull. 76(3): 523-534.

Table 1. Historical catches of redfish in Division 3-O. Mean catch rates and standard error of the standard (CanN 4 OT and CanMQ 4 OT, Jan-May) for years 1959-79.

Year	Catch (mt)	CPUE (c/hr)	Standard error	Effort (hours)
1959	9268	0.997	0.090	9296
1960	5030	0.857	0.095	5869
1961	11394	0.845	0.078	13484
1962	7557	0.451	0.036	16756
1963	9194	0.685	0.061	13422
1964	20232	0.549	0.043	36852
1965	22438	0.415	0.033	54068
1966	15305	0.720	0.225	21257
1967	19037	0.915	0.189	20806
1968	6445	0.750[1]	-	8593
1969	15878	0.603	0.054	26332
1970	13192	0.521	0.037	25320
1971	19792	0.659	0.053	30033
1972	16117	0.501	0.047	32170
1973	8797	0.699	0.070	12585
1974	13124	0.659	0.059	19915
1975	15110	0.608	0.065	24852
1976	15348	0.849	0.065	18078
1977	10850	0.778	0.059	13946
1978	6860	0.648	0.053	10603
1979	11968[2]	1.189[3]	0.112	10066

[1] interpolated
[2] preliminary
[3] based on Newfoundland vessels only (directed catch of 35% of total).

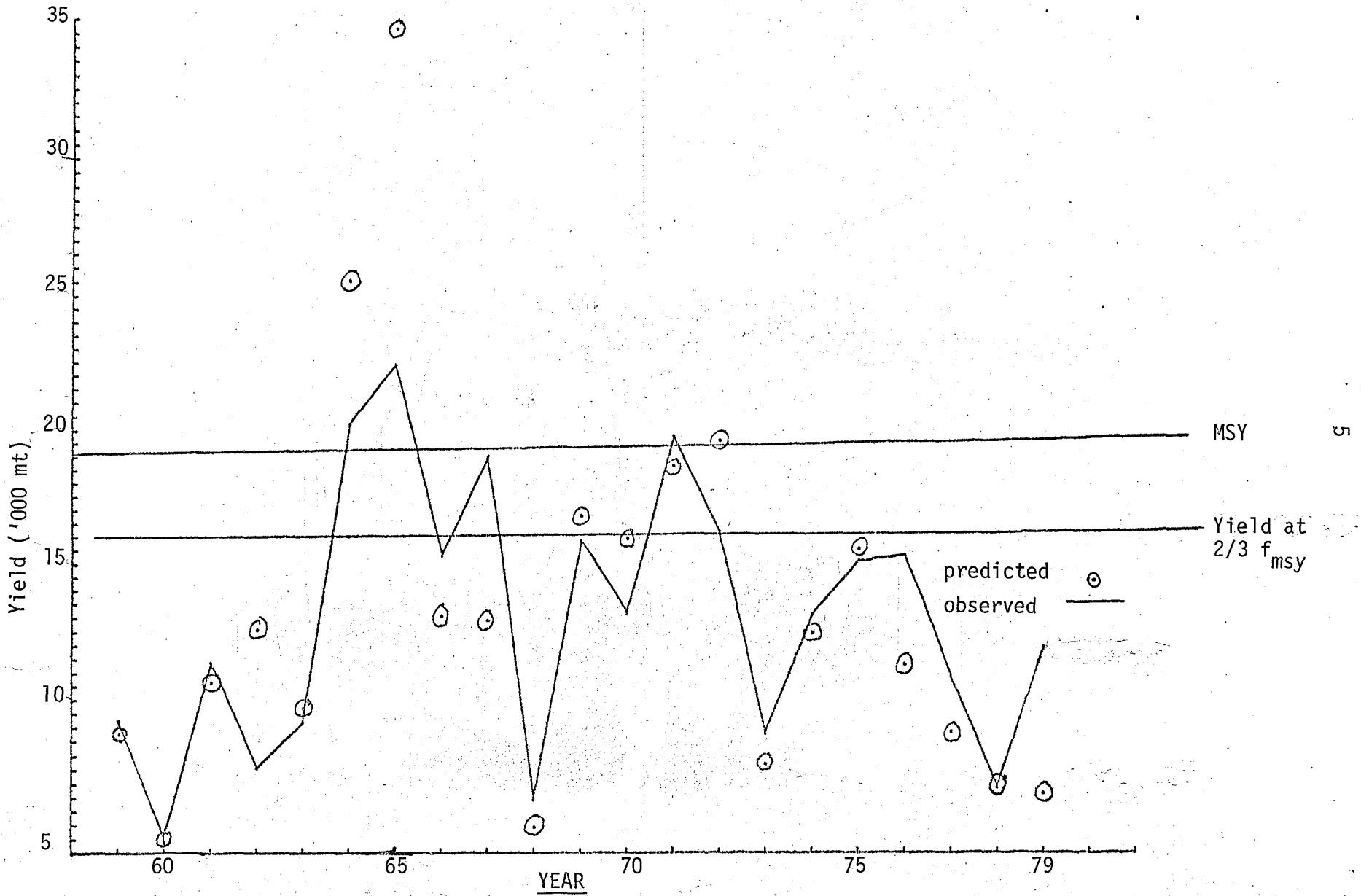

Fig. 1. A comparison of observed yields with those predicted by the nonequilibrium general production model.

2+3K Redfish

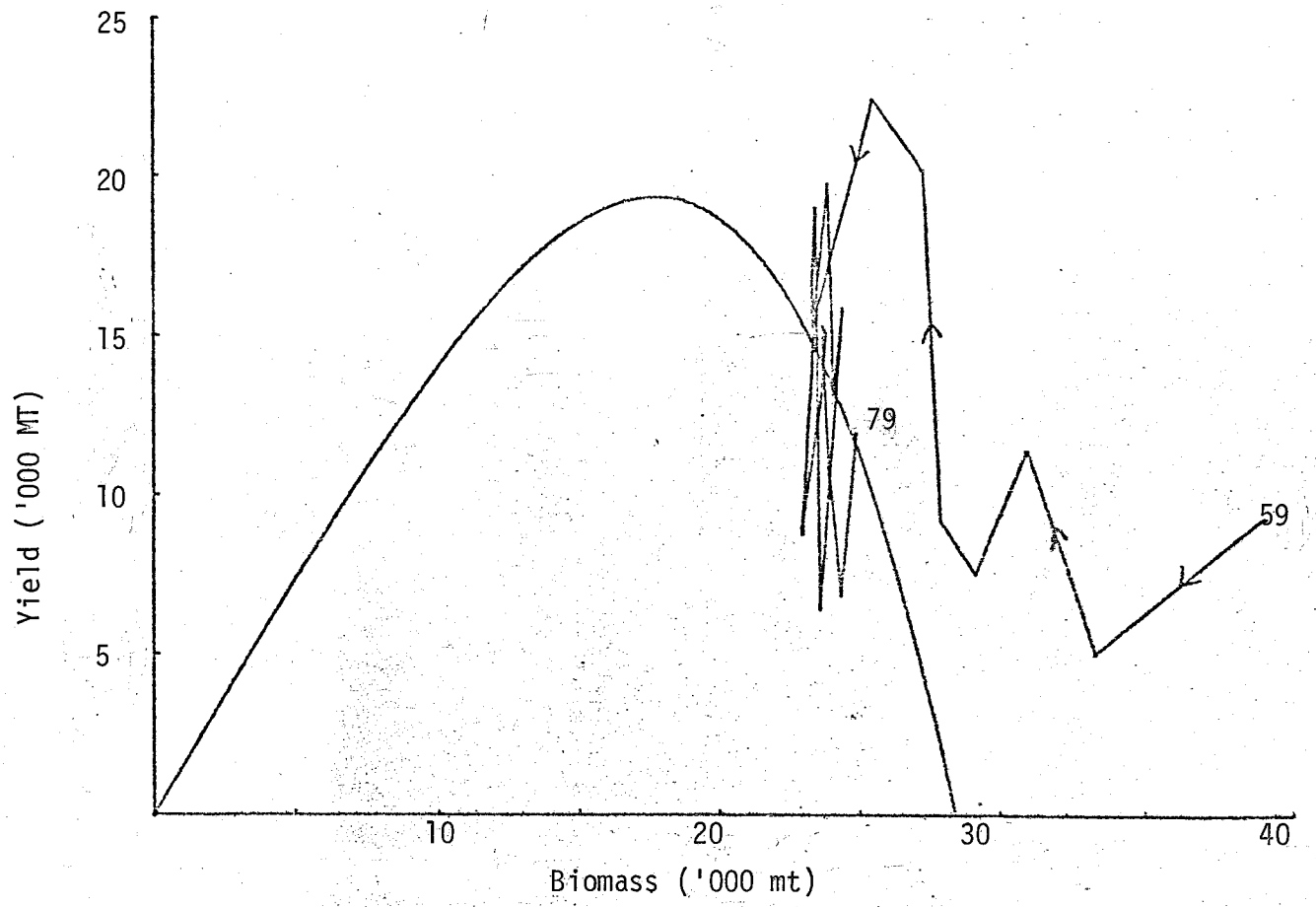

Fig. 2. Yield vs biomass, showing trends in historical catches

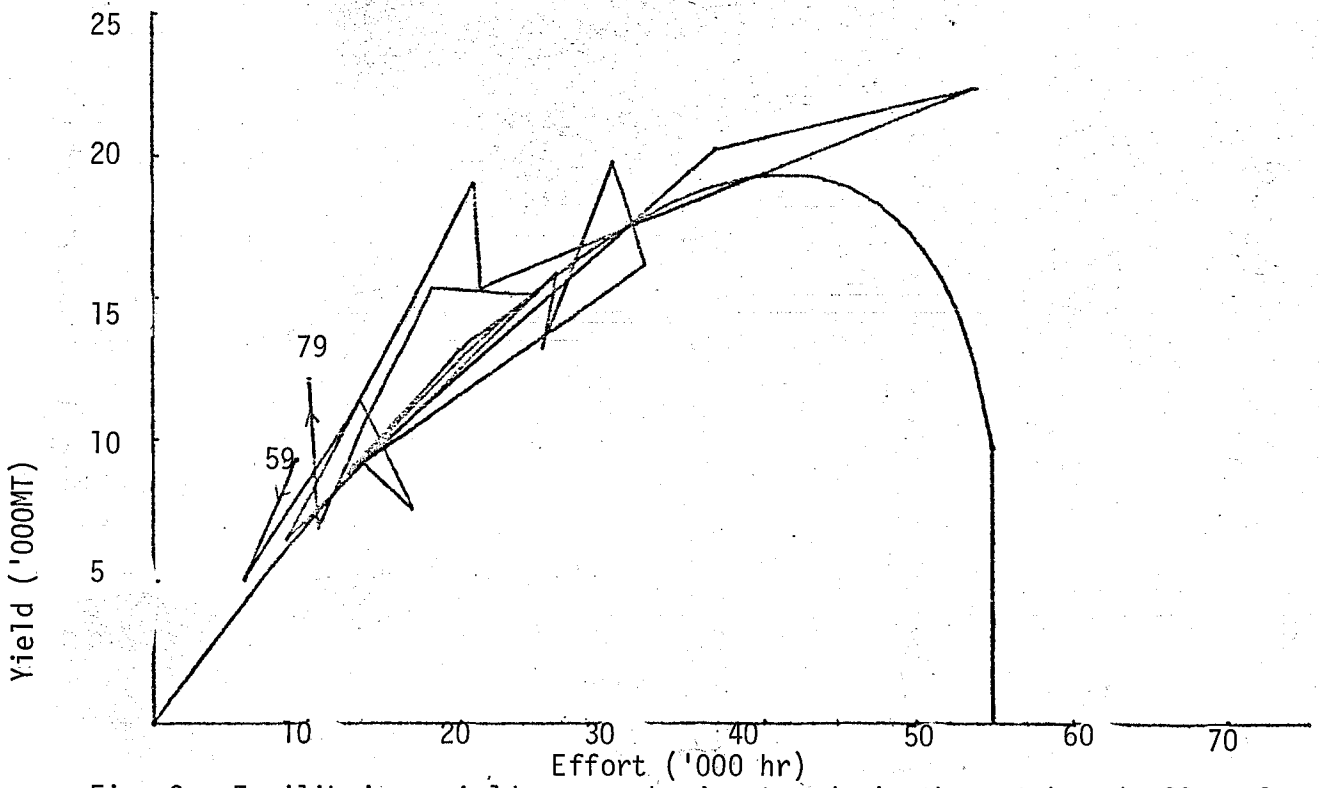

Fig. 3. Equilibrium yield curve showing trends in the catch and effort from 1959 to 1979.