Form 2-102 (Rev. July 1963)

UNITED STATES DEPARTMENT OF THE INTERIOR
FISH AND WILDLIFE SERVICE
BUREAU OF COMMERCIAL FISHERIES

OPERATING PROGRAM

Field Station or Office of Origin	Region or Area	
Woods Hole, Massachusetts	Region 3, Gloucester, Massachusetts	
Subactivity (Symbol and Title)	Program Title:	Program No.
431 Coastal and Offshore Research	Redfish	431 02

PROGRAM COMPONENTS OF COST	Previous Program	This Action	Current Program
10. Personal Services (Detail on reverse side)		24,800	~~24,800~~
21. Travel and Transportation of Persons		400	400
22. Transportation of Things			
23. Rent, Communications & Utility Services			
24. Printing and Reproduction			
25. Other Services			
26. Supplies and Materials		1,000	1,000
31. Equipment		600	600
Other			
Sub Total Program Direct Cost		26,800	~~26,800~~
Program Indirect Cost N/A		12,100	12,100
TOTAL OPERATING PROGRAM		38,900	~~38,900~~

BREAKDOWN BY PROGRAM FEATURE

NUMBER	PROJECT	Previous Program	This Action	Current Program
A	Racial and Distribution Studies (NOTED BY REGIONAL OFFICE)		8,935	~~8,935~~
B	Growth Studies		8,935	~~8,935~~
C	Migration Studies		8,934	~~8,934~~
	Sub Total Program Direct Cost		26,804	~~26,804~~
	Program Indirect Cost N/A		12,100	12,100
	TOTAL OPERATING PROGRAM		38,904	~~38,904~~

ESTIMATE OF EXPENDITURES BY QUARTERS - F.Y. 19

Object Class	First	Second	Third	Fourth
Personal Services				
All Other Expenditures				
Total Operating Program				

Prepared By: Name [signature] Title [signature] Date

Approved By: Herbert W. Graham Laboratory Director 7/19/63 Date

30579

Personnel (name)	Grade	Cost
Kelly	GS 12	11,361
Barker	7	7,359
Chase	6	6,180
Total personal services		24,804

Region #3

Briefing Statement
(In thousands of dollars)

Program Without Increase

Coastal and Offshore Research
(Subactivity)

No.	Title		1965	1964	1963	1962
		$	40.0	40.0	38.1	38.0
431	Redfish	PP	3	3	3	3

Program:

Work plan: Sample commercial catch; sample the actual populations; determine growth and mortality rates and division of stocks.

Objectives: To obtain the biological information required to understand the causes of fluctuations in availability and abundance (see 2nd sheet) of redfish in the Northwest Atlantic.

Accomplishments FY 1963: Effect of tagging on growth rate on a shallow water population was determined. Fluctuations of a number of populations in the Gulf of Maine were related to the fishing pressure.

Base of operations: Woods Hole, Massachusetts.

Briefing Statement
(In thousands of dollars)

Region #3

Program with Increase — Coastal and Offshore Research (Subactivity)

No.	Title		1965	Increase	1964	1963	1962
		$	30.0	30.0	- -	- -	- -
131	Redfish	PY	- -	- -	- -	- -	- -

Increase:

Need: Redfish is one of the most important groundfish in the Northwest Atlantic being one of the four species singled out for intensive study by the International Commission for the Northwest Atlantic Fisheries. The program has been supported by S-K funds but increases are needed to intensify the attack on this deepwater fish which is difficult to study.

Work plan: Extensive sampling of adult, juvenile, and larval stages throughout a wide area by means of bottom trawls, midwater trawls, and plankton collectors using the ALBATROSS IV as the principal floating equipment.

Objective: To attack the vexing problem of the relationship of the many stocks of redfish in the Northwest Atlantic.

Additional positions: None

Program:

Objective: To obtain the biological information required to understand the causes of fluctuations in abundance or availability of redfish.

Accomplishments FY 1963: Effects of tagging on growth rate on a shallow water population was determined. Fluctuations of a number of populations in the Gulf of Maine were related to the fishing pressure.

Base of operations: Woods Hole, Massachusetts.

Review of Knowledge of Redfish (Sebastes) in the Northwest Atlantic

Introduction

A large international fishery for redfish (Sebastes) developed in the North Atlantic about 1930, increased to a peak of 1.4 billion pounds landed in 1959, and has begun to decline. Prior to the start of the commercial fishery, knowledge of Sebastes was limited to fragmentary observations of specimens taken during deep water explorations in various parts of the North Atlantic. Landings statistics from the commercial fishery have provided much of our distributional information for remote areas of the redfish range. As the fishery expanded, new forms of redfish were found which led to new interpretations of the systematics of the genus. As a result, redfish research has had difficulty in keeping pace with the expansion of the fishery, and most of the problems encountered in redfish studies are related closely to difficulties in defining species, races, and stocks of Sebastes across the whole North Atlantic Ocean.

Distribution

North Atlantic Sebastes stocks are distributed on the deep water fishing banks from the southern slope of Georges Bank, off southern New England, northeastward to the northern coast of Norway. Redfish are found generally in depths between 50 and 300 fathoms, and are confined to the temperature zone between 35° and 52° F. The Sebastes range is bounded approximately by the Gulf Stream on the south and Arctic waters on the north.

It has been very difficult to study the biology of redfish because of its deep-water distribution. Significant contributions to knowledge of mid-water distribution of Sebastes in the eastern North Atlantic were made by Nansen (1886), Hjort (1901), Jensen (1922), and Taning (1949). In the western Atlantic, Bigelow and Welsh (1925) and Bigelow and Schroeder (1953) summarized the general distribution of redfish in their excellent review of redfish general biology. Schroeder (1955) investigated the maximum depth distribution of redfish along the Nova Scotia shelf. Kelly and Barker (1961) obtained information on the minimum depth requirements of redfish with the rediscovery of a shallow water redfish population at Eastport, Maine, first recorded by Verrill (1871). Templeman (1959) published a comprehensive review of Sebastes distribution in the whole North Atlantic. He cites many of the problems encountered in larval distribution and systematics studies.

Systematics

Three closely allied species of the genus Sebastes have been described from the eastern North Atlantic; S. marinus (Linnaeus), 1758, S. viviparus (Kroyer), 1844-45, and S. mentella (Travin), 1951. S. marinus is the type species for the genus in the family Scorpaenidae. Recent fishing has disclosed many redfish intermediate in form between marinus and mentella, and the validity of S. mentella as a species has been questioned (Andriiashev, 1954). The commercial fishery has exploited only the marinus and mentella types of redfish to the present time. S. viviparus is a smaller species that is probably not sufficiently numerous to be fished commercially.

In the western North Atlantic, the name Sebastes marinus was used for redfish by early authors such as Storer (1839 and 1846), Jordan and Gilbert (1882), Goode and Bean (1895) and Jordan and Evermann (1898), implying that a single species existed across the whole North Atlantic. In 1854, Storer described a new redfish species, S. fasciatus, from a single small specimen taken near Provincetown, Mass. This specimen was lost in a fire many years ago and its true taxonomy will never be known. However, with our present knowledge of young redfish pigmentation, it is apparent that Storer's description of fasciatus could apply equally well to many young specimens of the common New England redfish.

Ginsburg (1953) and Bigelow and Schroeder (1953) both continue to class redfish of the Gulf of Maine region as Sebastes marinus.

A cooperative program was organized by ICNAF in 1957 to obtain specimens from all major North Atlantic redfish populations for meristic and morphometric examination by U.S. investigators at Woods Hole. The results were reported at the Redfish Symposium in 1959 (Kelly, Barker and Clarke, 1961) indicating that objective measurements of a large number of characteristics did not separate marinus-type and mentella-type redfish into identifiable groups, even in areas where both were said to occur. Fish from eastern and western Atlantic were not taxonomically separable despite considerable differences in size composition and growth rate.

At the Redfish Symposium, several promising studies were reported employing biochemical or chromatographic techniques for separating Sebastes groups according to differences in sera, mucus or blood type (O'Rourke, 1961, Schaefer, 1961, Sindermann, 1961). The results of these new techniques were sufficiently encouraging to suggest that work of this nature be given greater emphasis. Some other studies reported at the same meetings employed differences in vertebral numbers and variations in otolith shape and size as possible specific characteristics. None of these studies showed adequate differences for species separation. Since that time no additional studies have been reported which have helped to clarify the confused Sebastes taxonomy.

Larval distribution

The distribution of redfish larvae has been investigated in many parts of the Sebastes range. In his studies of the plankton and hydrography of the Gulf of Maine, Bigelow (1914) obtained much information on horizontal distribution of redfish larvae. Dannevig (1919) and Jensen (1922) studied the drift of redfish larvae in the Gulf of St. Lawrence and coast of Greenland respectively. Taning (1949) continued study of the oceanic distribution and drift of redfish larvae in the Iceland-Greenland area with special reference to the existence of a large, bathypelagic population of breeding adults.

High-speed samplers have been employed recently by several investigators to study vertical distribution of larvae, Einarsson (1960) used the Gulf III around Iceland, Kelly and Barker (1961) sampled the Gulf of Maine with the Isaacs-Kidd mid-water trawl, and Henderson (1961 and 1962) reported the routine use of the Hardy Continuous Plankton Recorder on the shipping lanes between the United Kingdon, Iceland, Greenland and North America.

Problems in the identification of pelagic Sebastes larvae have arisen. Taning (1961) contains the posthumous publication of descriptions and drawings of S. marinus and S. viviparus larvae and post-larvae based on work done many years earlier. Templeman and Sandeman (1959) reported the caudal pigmentation of preextrusion Sebastes larvae in the Newfoundland area showing mentella larvae to bear caudal pigment. No larvae from the type locality of mentella (Barents Sea) were found to have caudal pigment.

Age and growth

Redfish age and growth studies have occupied much of the time of investigators in the past. The earliest studies by Smaragdova (1936), Veshchezerov (1944) and Perlmutter and Clarke (1949) in different parts of the range all indicated Sebastes to be slow-growing, long-lived fish. Kotthaus (1952) suggested that previous studies had interpreted age incorrectly and redfish were in reality quite fast-growing, and a controversy developed. Validation of the ageing technique on young of the year redfish was undertaken in the Gulf of Maine and on the Norwegian coast. Papers by Bratberg (1956) and Kelly and Wolf (1959) showed the growth of young redfish to be very slow, and nearly the same, on both sides of the Atlantic. The extensive collections of young of the year in the plankton, at mid-depth and on the bottom in the Gulf of Maine was a major factor in resolving this dispute.

The first successful tagging and recapture of redfish at Eastport, Maine, (Kelly and Barker, 1961) offered the final proof to non-believers that redfish could actually grow as slowly as growth studies had indicated. Subsequent tagging studies (Kelly and Barker, 1963) showed that growth rate could be critically altered by the use of certain tag types. Repeated recapture of the same tagged fish showed that individuals whose growth had been totally arrested for several years could resume near normal growth with the removal of the old tag and replacement with a different type.

Parasite infestation

Little study has been given to the general infestation of parasites in and on redfish, but a considerable bulk of data has been accumulated about Sphyrion lumpi, a copepod ectoparasite that is very abundant and costly to the fisherman in the areas where it occurs. Wilson (1919) established the new copepod family and classified the parasite properly. With the start of the redfish fishery in the Gulf of Maine, Herrington, Bearse and Firth (1940) reported on the life-history and occurrence of Sphyrion in the Gulf of Maine, and on the incidence of the parasite's remains in redfish fillets. Sindermann (1961) lists this species as a possible tag for marking redfish populations. Templeman and Squires (1960) reported on the incidence of the parasite in the western Atlantic, primarily around Labrador and Newfoundland. Kelly and Barker (Ms.) have newly completed a summary of the detailed incidence of Sphyrion in the Gulf of Maine to be presented at the ICES/ICNAF/FAO Environmental Symposium to be held at Rome, Italy late in January, 1964.

Gear selectivity

Gear selectivity has been comparatively small attention with respect to redfish trawling. Small mesh nets have been favored by the fishermen to minimize the amount of "meshing" of small redfish below the size preferred by the fishery. Clark (1957) reported the results of mesh experiments done in the Gulf of Maine. Increasing mesh size increased the size of redfish retained, and also increased the quantity of commercial sized redfish that were entangled in the meshes of the net.

Population dynamics

The first redfish population dynamics study was done by Davis and Taylor (1957) using Gulf of Maine growth rate and landings statistics from the U. S. fishery. This rather elementary study suggested a low natural mortality rate for Gulf of Maine redfish. An assessment committee appointed by ICNAF reported on the theoretical, probable effects of increasing mesh size on the redfish fishery in each statistical subarea of the ICNAF area (Beverton, 1961). The effect of increasing mesh size from about 2 3/4" to 4 1/2" would be substantial immediate losses of redfish landings in all subareas, and only small long-term gains in a few areas with long-term losses in most areas. No further studies along these lines have been undertaken.

When a recommendation was made that 4 1/2" mesh be used for all species in the ICNAF subareas north of the Grand Banks, there was no evidence that it would benefit the redfish fishery, but it was approved on the grounds that the regulation would do no harm to the redfish stocks.

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