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.**
131 Coastal and Offshore Research	Cod	131.33

PROGRAM COMPONENTS OF COST	Previous Program	This Action	Current Program
10. Personal Services (Detail on reverse side)		16,165	16,165
21. Travel and Transportation of Persons		100	100
22. Transportation of Things			
23. Rent, Communications & Utility Services			
24. Printing and Reproduction			
25. Other Services			
26. Supplies and Materials		300	300
31. Equipment		600	600
Other			
Sub Total Program Direct Cost — ~~T/A~~		17,165	17,165
Program Indirect Cost — ~~Alb IV~~		6,500	6,500
TOTAL OPERATING PROGRAM		23,100	23,100
		18,765	18,765

BREAKDOWN BY PROGRAM FEATURE

NUMBER	PROJECT	Previous Program	This Action	Current Program
A	Migrations and Definitions of Stocks		8,582.50	8,582.50
B	Age and Growth		8,582.50	8,582.50
	Sub Total Program Direct Cost — ~~T/A~~		17,165.00	17,165.00
	Program Indirect Cost — ~~Alb IV~~		6,500.00	6,500.00
	TOTAL OPERATING PROGRAM		~~23,100.00~~	~~23,100.00~~
			18,765.00	18,765.00

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 Date

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

Personnel (name)	Grade	Cost
Jensen, Al	GS 11	9,500
Murray	6	6,665
Total personal services		16,165

Briefing Statement
(In thousands of dollars)

Region #3

Program without Increase

Coastal and Offshore Research
(Subactivity)

No.	Title		1965	1964	1963	1962
		$	46.6	50.0	49.0	49.5
131	Cod	PP	2	2	2	2

Program:

Work plan: Collection of blood samples, scales, and otoliths and subsequent study and analysis from the four principle stocks of cod in the area between Nova Scotia and New Jersey. Determination of distinctness of stocks and growth rates.

Objective: To obtain biological information regarding cod stocks in the New England area which is essential to the management of the fishery.

Accomplishments FY 1963: Blood samples were collected from a number of stocks for stock identification. Growth rates indicate no appreciable change from rates determined 30 years ago. Information valuable to assessment of effects of fishing.

Base of operations: Woods Hole, Massachusetts

Cod Program - Review of Past Work

by A. C. Jensen

The world landings of cod (Gadus morhua) in the North Atlantic are on the order of 8 billion pounds per year (Wise, 1961) clearly making it the most important fish in these waters. Because of its importance as a food fish, and with a history of exploitation that antedates the written record, a vast body of literature has been built on the subject of the cod. A synopsis of cod biology prepared by Wise (1961) attempted to present the more important biological details in outline form. A listing of selected references complemented the biological data. An exhaustive bibliography published recently (Wise, 1963a) lists more than 1000 references on cod biology and represents an invaluable tool for the researcher interested in the species.

In the United States, the early cod studies leaned heavily on European experience but soon, distinctly American contributions were being added to the literature. Much of the work was concerned with seeking pragmatic solutions to what appeared to be a very real problem. How can man achieve the maximum, long-term benefit from the marine resource? (The problem basically is the same nearly a century later.) One solution seemed to be to stock the oceans with young cod and other fishes raised in hatcheries at Gloucester and Woods Hole. Thus, Earll (1880), at Gloucester, reported not only the production of eggs and larvae but also the fecundity and maturity, condition factor and length-weight relationships, food and feeding habits, and predators of the cod in local Massachusetts waters.

At the Woods Hole laboratory, cod larvae liberated in Eel Pond in 1899 grew a total of 4 centimeters during April-June (Smith, 1902). The first cod tagging experiment on the American coast was reported by Smith (1902) who tagged brood cod at the Woods Hole hatchery. The emphasis, however, was directed toward hatchery work.

The question of the fate of naturally spawned and hatched cod larvae was examined by Fish (1928). He used plankton nets and drift bottles to determine that fry from north of Cape Ann in Massachusetts Bay are carried out before they hatch, perhaps eventually to the offshore banks.

Schroeder (1930) tagged nearly 25,000 adult cod on Nantucket Shoals in the summer. The recaptured fish (3 percent) were from the Cape Cod - Nantucket area in the summer and as far away as New Jersey in the winter.

Following Schroeder's work, little cod biological research took place in Woods Hole until the 1950's. Bigelow and Schroeder (1953) revised an earlier work and summarized our knowledge of the species in the Gulf of Maine. The cod program was reactivated in 1955 with the emphasis again on migrations but also differentiation of stocks (Wise, 1958b, 1959). Some confusion about the correct scientific name of the cod was removed by Cohen (1959) who, supplied with information from the Woods Hole laboratory, reported it to be G. morhua. A literature review (Wise, 1958c) critically examined the effect of hydrographic conditions on the important aspects of the species' life history.

Parasites of cod were investigated (Wise, 1958a) including one that gave evidence of being a natural tag (Sherman and Wise, 1961). An overview of cod stocks in the Northwest Atlantic (Wise and Jensen, 1960) was later incorporated into a more detailed paper by Templeman (1962). Finally, the accumulated evidence of the previous studies was supplemented by returns (Wise, in press) from nearly three thousand tagged cod to separate four cod groups in New England waters (Wise, 1963b).

Recent research in cod biology is directed toward age and growth problems and techniques for their solution. Schroeder (1930) had back-calculated lengths from cod scales collected during his tagging experiments. These data were used in a theoretical study by Taylor (1958) who suggested that the maximum size and life span of cod might be affected considerably by slight changes in water temperature.

Otoliths and scales were examined from cod kept in aquaria (Jensen, ms. 1962a) and from cod in the open ocean. Growth zones in the otoliths (Jensen, ms. 1962b) are more clearly defined than those in the scales (Jensen, ms. 1963).

The goal of our research today is the same as it was in the late 19th Century - to gain the maximum benefit from the ocean resources. But we have added the conservationist's maxim of wise use. Some of the old ways of harvest (Jensen and Brigham, 1963) for example, helped to perpetuate the cod fishery. Our studies today must work toward making modern methods of harvest compatible with the avowed goal of wise use.

Cod Biology Review

Selected References

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