

**BUREAU OF COMMERCIAL FISHERIES**

**FEDERAL AID  
PROGRAM  
ACTIVITIES**

**1969**



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



UNITED STATES DEPARTMENT OF THE INTERIOR

U.S. FISH AND WILDLIFE SERVICE  
BUREAU OF COMMERCIAL FISHERIES

**Bureau of Commercial Fisheries  
Federal Aid Program Activities  
1969**

Prepared by

Division of Federal Aid Staff

Circular 322

Washington, D.C.

July 1969



# CONTENTS

	<u>Page</u>
Introduction-----	1
The Acts-----	1
Commercial Fisheries Research and Development Act of 1964-----	1
Anadromous Fish Act of 1965-----	1
Jellyfish Act of 1966-----	1
Distribution of Federal funds-----	2
Project titles-----	3
Project analysis-----	24
Construction-----	24
Fish culture facilities-----	24
Fish landing facilities-----	25
Fish screens and stream improvement and passage facilities-----	25
Hatcheries and hatchery facilities-----	26
Laboratory-----	27
Research vessel-----	29
Coordination and planning-----	29
Economics-----	32
Exploratory fishing and gear development-----	32
Extension service-----	34
Market development-----	35
Operation and maintenance-----	36
Research-----	36
Environment-----	36
Estuarine-----	37
Fresh-water-----	37
Marine-----	38
Finfish(fresh-water)-----	38
Channel catfish and bullhead-----	38
Lake herring-----	40
Lake trout-----	40
Rainbow trout-----	40
Walleye-----	40
Others-----	40
Finfish(marine)-----	44
Alewife and blueback herring-----	44
American shad-----	45
Groundfish-----	46
Pacific salmon-----	46
Steelhead trout-----	51
Striped bass-----	51
Sturgeon-----	52
Others-----	52

Jellyfish-----	53
Shellfish-----	54
Clam-----	54
Crab-----	55
Lobster-----	56
Mussel-----	56
Oyster-----	57
Shrimp-----	61
Others-----	62
Statistics-----	62
Technology-----	64
Resource disaster projects-----	67
Publications-----	68
Cooperators-----	73
Administrative organization-----	76

# Bureau of Commercial Fisheries Federal Aid Program Activities

1969

BY  
DIVISION OF FEDERAL AID STAFF

## INTRODUCTION

This is the second of a series of annual publications on project activities under the Federal Aid Program of the Bureau of Commercial Fisheries. It covers fiscal year 1969.

Information presented is intended to provide State program coordinators and administrators, Federal people, project personnel, and others concerned with research, development, conservation, and management of our commercial fishery resources with a convenient reference to the Bureau of Commercial Fisheries grant-in-aid program.

This publication will facilitate planning, coordination, and integration of State, Federal, and other activities concerned with the commercial fishery resources.

## THE ACTS

The Bureau's Federal Aid Program is authorized under three Acts.

1. The Commercial Fisheries Research and Development Act of 1964 (P.L. 88-309) - Authorizes the Secretary of the Interior to cooperate with the 50 States, the Commonwealth of Puerto Rico, and the Governments of the Virgin Islands, Guam, and American Samoa in carrying out research and development of the Nation's commercial fisheries. Projects eligible for funding include research, development, construction, and coordination. Cost-sharing projects are funded at either a 50 percent or 75 percent level of Federal participation, whereas projects to alleviate resource disaster and for establishment of new commercial fisheries may be financed with 100 percent Federal funds. State-matching funds must be new monies not previously used for other commercial fishery research and development.

This Act would have expired June 30, 1969; however, it is extended by the 90th Congress for an additional 4 years under Public Law 90-551.

2. The Anadromous Fish Act of 1965 (P. L. 89-304) - Authorizes the Secretary of the Interior to enter into cooperative agreement with States and other non-Federal interests for the conservation, development and enhancement of the anadromous fishery resources of the Nation and the fish in the Great Lakes that ascend streams to spawn. The program is administered at the Federal level jointly by the Bureau of Commercial Fisheries and the Bureau of Sport Fisheries and Wildlife. Federal funds up to 50 percent may be used to finance project costs. State fishery agencies, colleges, universities, private companies and other non-Federal interests in 31 States bordering the oceans and the Great Lakes may participate under the Act. All projects must be approved by the State fishery agency concerned.

3. The Jellyfish Act of 1966 (P. L. 89-720) - Authorizes the Secretary of the Interior to cooperate with and provide assistance to the States and the Commonwealth of Puerto Rico in controlling and eliminating jellyfish and other such pests in such coastal waters. The costs of projects are funded equally by the Federal Government and by the State. State agencies responsible for the management or administration of fish and shellfish resources or water-based recreation programs may participate under the Act.

## DISTRIBUTION OF FEDERAL FUNDS

Allocation of funds, excluding 4(b) monies under the Commercial Fisheries Research and Development Act, to States and other non-Federal interests by the Bureau of Commercial Fisheries under the Federal Aid Program in fiscal year 1969 with cumulative total under each Public Law since enactment of the legislation is listed in the following table.

State and others	Fiscal Year 1969			Cumulative total			Grand total
	P.L. 88-309	P.L. 89-304	P.L. 89-720	P.L. 88-309	P.L. 89-304	P.L. 89-720	
Alabama	\$ 47,100	\$ 15,000	\$ 0	\$ 175,300	\$ 35,000	\$ 0	\$ 210,300
Alaska	246,000	441,850	0	984,000	1,066,850	0	2,050,850
Arizona	20,500	0	0	82,000	0	0	82,000
Arkansas	20,500	0	0	82,000	0	0	82,000
California	246,000	285,000	0	984,000	810,000	0	1,794,000
Colorado	20,500	0	0	82,000	0	0	82,000
Connecticut	20,500	19,250	0	82,000	41,250	0	123,250
Delaware	20,500	15,000	0	109,500	35,000	0	144,500
Florida	246,000	15,000	20,000	984,000	35,000	20,000	1,039,000
Georgia	94,300	14,000	0	371,900	34,000	0	405,900
Hawaii	33,600	0	0	135,400	5,000	0	140,400
Idaho	20,500	0	0	82,000	0	0	82,000
Illinois	22,400	5,000	0	93,100	10,000	0	103,100
Indiana	20,500	0	0	82,000	5,000	0	87,000
Iowa	20,500	0	0	82,000	0	0	82,000
Kansas	20,500	0	0	82,000	0	0	82,000
Kentucky	20,500	0	0	82,000	0	0	82,000
Louisiana	246,000	15,000	0	984,000	35,000	0	1,019,000
Maine	186,200	29,000	0	816,500	59,000	0	875,500
Maryland	165,600	60,000	0	693,300	175,000	50,000	918,300
Massachusetts	246,000	18,000	0	984,000	51,000	0	1,035,000
Michigan	20,500	35,000	0	87,900	60,000	0	147,900
Minnesota	20,500	0	0	82,000	23,000	0	105,000
Mississippi	107,700	17,500	21,414	474,900	37,500	33,681	546,081
Missouri	20,500	0	0	82,000	0	0	82,000
Montana	20,500	0	0	82,000	0	0	82,000
Nebraska	20,500	0	0	82,000	0	0	82,000
Nevada	20,500	0	0	82,000	0	0	82,000
New Hampshire	20,500	25,000	0	82,000	30,000	0	112,000
New Jersey	141,900	20,000	0	616,900	50,000	0	666,900
New Mexico	20,500	0	0	82,000	0	0	82,000
New York	174,000	0	0	710,900	29,000	11,000	750,900
North Carolina	60,800	47,500	0	224,800	118,500	0	343,300
North Dakota	20,500	0	0	82,000	0	0	82,000
Ohio	68,000	20,000	0	216,400	43,000	0	259,400
Oklahoma	20,500	0	0	82,000	0	0	82,000
Oregon	131,100	444,725	0	497,100	1,002,725	0	1,499,825
Pennsylvania	59,300	7,500	0	215,400	27,500	0	242,900
Rhode Island	24,900	20,000	0	103,000	45,000	0	148,000
South Carolina	22,500	15,000	0	88,300	35,000	0	123,300
South Dakota	20,500	0	0	82,000	0	0	82,000
Tennessee	20,500	0	0	82,000	0	0	82,000
Texas	246,000	0	0	984,000	5,000	0	989,000
Utah	20,500	0	0	82,000	0	0	82,000
Vermont	20,500	0	0	82,000	5,000	0	87,000
Virginia	179,700	80,000	50,000	711,100	213,000	69,247	993,347
Washington	187,300	464,175	0	827,700	1,089,175	0	1,916,875
West Virginia	20,500	0	0	82,000	0	0	82,000
Wisconsin	20,500	21,500	0	82,000	41,500	0	123,500
Wyoming	20,500	0	0	82,000	0	0	82,000
American Samoa	77,100	0	0	241,000	0	0	241,000
Guam	20,500	0	0	82,000	0	0	82,000
Puerto Rico	246,000	0	8,736	871,600	0	8,736	880,336
Virgin Islands	20,500	0	0	82,000	0	0	82,000
<b>TOTAL</b>	<b>\$4,100,000</b>	<b>\$2,150,000</b>	<b>\$100,150</b>	<b>\$16,400,000</b>	<b>\$5,252,000</b>	<b>\$192,664</b>	<b>\$21,844,664</b>

## PROJECT TITLES

All 50 States, the Commonwealth of Puerto Rico, and the Governments of American Samoa, Guam, and the Virgin Islands are participating in the program. They are carrying out projects concerned with research, development, improvement, conservation, and/or management of commercial fishery resources. Since the start of the program, 372 projects have been approved and funded. Of this total, 117 have been completed and 255 are continuing. A list of projects, by State, funded under each Act, including title, estimated total cost (both non-Federal and Federal), and other pertinent information follows:

Public law	Project number and title	Date initiated	Estimated duration	Estimated total cost	Date completed	Reference
		Year	Years	Dollars	Year	Page
88-309	<u>ALABAMA</u> 2-18-R. Oyster raft production	1966	3	25,650	1968	57
	2-29-C. Construction of public oyster landing facilities	1966	1	13,000	1967	25
	2-30-D. Shell planting for oyster cultch	1966	1	18,100	1967	57
	2-31-C. Oyster rearing pond construction	1966	2	8,000	1968	24
	2-34-R. Cooperative Gulf of Mexico estuarine inventory - Alabama	1966	3	195,000	Extended	37
	2-58-D. Gulf of Mexico estuarine film	1967	2	7,900	Extended	34
	2-83-R. Survey of the live bait-shrimp industry in Alabama	1969	1	9,000		63
	2-64-D(4b). Restoration of Alabama's supply of seed oysters	1968	1	45,000		67
89-304	AFC-1. Research on striped bass in Alabama rivers	1967	3	70,000		51
88-309	<u>ALASKA</u> 5-1-S. Coordination and planning	1966	4	140,400		29
	5-3-D. Expansion of current and development of additional commercial fisheries catch, production, and gear statistics	1966	4	43,800		63
	5-4-R. Pink salmon forecast research	1966	4	225,400		46
	5-5-R. Kvichak River smolt study	1966	4	102,200		46
	5-6-R. Cook Inlet sockeye salmon investigations	1966	4	205,000		47
	5-7-R. Investigations of factors limiting the production of introduced sockeye in lakes	1966	2	49,400	1968	47

Public law	Project number and title	Date initiated	Estimated duration	Estimated total cost	Date completed	Reference
		<u>Year</u>	<u>Years</u>	<u>Dollars</u>	<u>Year</u>	<u>Page</u>
88-309	ALASKA(CON.)					
	5-8-R. Monitoring the effects of land use on salmon production	1966	4	73,300		47
	5-9-R. Investigation of ecological factors limiting production of the Alaska Pandalid shrimp	1966	4	103,000		61
	5-10-R. Dungeness crab research in Southeastern Alaska	1966	4	84,800		55
	5-11-R. Reproduction of king crab ( <u>Paralithodes camtschatica</u> ) in the Kodiak Island area	1966	4	138,100		55
	5-12-C. King salmon headquarters - architectural plans	1967	1	15,000	1967	27
	5-13-D. Commercial feasibility of Alaskan scallop fishery	1968	1	40,000	1968	62
89-304	5-14-D. Southeastern and Kodiak Island, Alaska, stream catalogs	1968	1	4,000	1968	29
	AFC-2. Sockeye salmon migration behavior and biological statistics collection, Southeastern Alaska	1967	4	250,000		47
	AFC-3. Restoration and rehabilitation of earthquake damaged pink and chum salmon spawning areas in Prince William Sound	1967	4	250,000		47
	AFC-4. Offshore salmon abundance index	1967	4	560,000		47
	AFC-6. Bristol Bay intermediate high seas inshore test fishing program	1967	4	280,000		47
	AFC-7. Arctic-Yukon-Kuskokwim River anadromous fish investigations	1967	4	290,000		47
	AFC-8. Kodiak Island sockeye salmon investigations	1967	4	389,000		48
	AFC-9. Identification of red salmon stocks taken in the Cape Kumlik-Aniakchak Bay fishery(Chignik area)	1967	1	40,000	1968	48
	AFC-10. Copper River sockeye salmon investigations	1967	4	220,000		48
	AFC-11. Planning and coordination	1967	4	178,400		30
	AFC-12. Forecast of Kodiak Island pink salmon runs from abundance of juveniles in estuaries	1968	1	44,400	1968	48
	AFC-13. Optimum escapement studies of Chignik sockeye salmon	1968	1	67,400	Extended	48
	AFC-14. Pink salmon forecast research	1963	3	120,000		48

Public law	Project number and title	Date initiated	Estimated duration	Estimated total cost	Date completed	Refer- ence
		Year	Years	Dollars	Year	Page
	<u>ALASKA (CON.)</u>					
89-304	AFC-15. Computer simulation model of the Dixon Entrance salmon stocks	1968	2	35,000		48
	AFC-16. Escapement enumeration investigations	1968	3	127,400		48
	<u>ARIZONA</u>					
88-309	6-1-R. Investigation of commercial fishery potentials in reservoirs	1966	3	27,463		40
	<u>ARKANSAS</u>					
83-309	4-12-D. Commercial fishery industry survey	1966	3	75,000	Extended	63
	4-49-R. Rearing single and multiple species populations of catfishes in cages	1969	1	14,600		38
	<u>CALIFORNIA</u>					
88-309	6-3-R. Fisheries resources sea survey	1966	3	779,000	Extended	52
	6-4-R. Shellfish laboratory operations	1966	3	738,300	Extended	62
	6-5-S. Coordination and planning	1966	3	177,000	Extended	30
	6-6-D. Port sampling at Crescent City	1966	4	24,400		63
	6-7-R. Food habits study of organisms of the California current system	1966	3	210,000	Extended	52
	6-8-D. California shellfish and bottomfish data analysis	1966	3	236,000	Extended	62
89-304	AFSC-1. Mad River hatchery construction	1967	4	499,300		26
	AFC-3. Mad River hatchery fish ladder construction	1967	2	40,000	Extended	27
	AFC-6. Scott Valley fish screen construction	1967	1	70,000	1967	25
	AFC-7. Eel and Mad River anadromous fish water requirements	1967	2	147,000	1968	48
	AFC-8. Delta migration study	1967	1	72,000	1968	49
	AFC-9. Banta-Carbona fish screen construction	1968	3	150,000		25
	<u>COLORADO</u>					
88-309	6-2-D. Raising bait fishes in the Rocky Mountain States	1966	3	113,000	Extended	41

Public law	Project number and title	Date initiated	Estimated duration	Estimated total cost	Date completed	Reference
		<u>Year</u>	<u>Years</u>	<u>Dollars</u>	<u>Year</u>	<u>Page</u>
	<u>CONNECTICUT</u>					
88-309	3-33-S. Coordination and planning	1966	3	7,100	1968	30
	3-44-R. Investigations on the lobster	1966	4	60,000		56
	3-45-R. Investigations of the life histories and potential fishery of river herrings	1966	3	42,100	1968	44
	3-51-D(4b). Disaster relief, Connecticut oyster fishery	1966	1	200,000	1967	67
89-304	AFC-1. A study of the rate and pattern of shad migration in the Connecticut River-utilizing sonic tracking apparatus	1967	2	54,000	Extended	45
	AFC-3. Investigation of the life histories and potential fishery of river herrings in Connecticut	1968	2	33,000		44
	<u>DELAWARE</u>					
88-309	3-8-D. Rehabilitation of the natural seed oyster beds in Delaware	1965	1	40,000	1966	57
	3-49-R. Pilot studies of the spawning and rearing of MSX resistant oysters	1967	2	85,500		57
	3-55-R. A resurvey of the condition and extent of the natural seed oyster beds in Delaware	1967	1	12,000	1968	58
	3-49-R(4b). Pilot studies of the spawning and rearing of MSX resistant oysters	1966	1	28,500	1967	67
89-304	AFCS-1. Feasibility of the restoration of shad runs in the tributaries of the Delaware estuary	1967	1	15,000	1968	45
	AFSC-3. Shad passageway construction on the Brandywine River	1968	3	480,000		25
	<u>FLORIDA</u>					
88-309	2-11-D. Marketing	1965	4	1,200,000		35
	2-10-D. Gulf of Mexico estuarine film	1967	2	7,900	Extended	34
	2-52-D. Construction of artificial oyster reefs	1967	4	250,000		58
	2-53-R. A study of the effects of a commercial hydraulic clam dredge on benthic communities in estuarine areas	1967	4	140,000		37
	2-81-R(4b). Cooperative crab study - South Atlantic States	1969	1	1,000		67
89-314	AFC-2. Investigations on the American whad in the St. Johns River	1968	3	90,000		45

Public law	Project number and title	Date initiated	Estimated duration	Estimated total cost	Date completed	Reference
		Year	Years	Dollars	Year	Page
89-720	<u>FLORIDA (CON.)</u>					
	JF-2-2. Survey of the distribution and abundance of the Portuguese Man-of-War in waters adjacent to Florida	1969	3	120,000		53
88-309	<u>GEORGIA</u>					
	2-10-R. Feasibility study of methods for improving oyster production in Georgia	1965	4	120,900	1968	58
	2-32-R. Preliminary survey of existing and potential marine resources on the Georgia coast	1966	1	3,600	1966	52
	2-35-C. Research vessel construction	1966	2	50,860	1968	29
	2-43-R. Seasonal abundance and biological stability of the commercial shrimp of Georgia	1966	3	105,525	Extended	61
	2-44-R. Survey of a potential hard clam fishery	1966	2	44,080	1968	54
	2-46-R. Economic survey of the marine commercial fishing industry in Georgia	1966	2	25,000	1968	32
	2-68-R. Exploratory study of the commercial marine resources of the Georgia coast	1968	2	102,520		32
	2-74-S. Coordination of P. L. 88-309 program	1968	2	52,000		30
	2-75-R. Habitat improvement and ecological classification of oyster growing areas	1968	2	59,100		33
	2-84-R. A study of the nutritional, physiological, and economic requirements for the production of channel catfish in an intensive running water culture	1969	3	105,000		39
	2-82-R(4b). Cooperative blue crab study - South Atlantic States	1969	1	25,000		67
89-304	AFC-1. Shad fishery of the Altamaha River	1967	1	30,000	1968	45
	AFC-6. A study of the nursery areas and biology of juvenile anadromous fishes of the Altamaha River, Georgia	1968	2	56,000		45
38-309	<u>HAWAII</u>					
	H-1-D. Development of a prawn fishery	1966	2	98,000	Extended	61
	H-2-R. Investigation for the development of a commercial oyster industry	1966	2	39,572	Extended	58
	H-3-R. Central Pacific Tuna Conference	1966	1	4,000	1966	30

Public law	Project number and title	Date initiated	Estimated duration	Estimated total cost	Date completed	Reference
		Year	Years	Dollars	Year	Page
88-309	<u>HAWAII (CON.)</u> H-4-R. Management investigation of the akule or jack mackerel ( <u>Trachurops crumenophthalmus</u> )	1966	3	39,282		52
	H-5-R. Management investigation of two species of spiny lobsters, <u>Panulirus japonicus</u> and <u>P. penicillatus</u>	1966	3	45,027	1969	56
	H-6-R. Management and development investigations of the Kona crab ( <u>Ranina serrata</u> )	1966	3	29,065	1969	56
	H-9-R. Publication of Central Pacific Tuna Conference proceedings and background	1966	1	5,000	1966	30
	H-10-R. Handling baitfish in Hawaii	1966	3	26,000	Extended	52
88-309	<u>IDAHO</u> 1-1-D. Experimental rearing of steel-head trout at Hayden Creek ponds	1966	3	34,666		51
	1-9-C. Construction of Hayden Creek rearing ponds	1966	2	76,424	Extended	24
	<u>ILLINOIS</u> 4-13-R. Clam industry in Illinois	1966	2	16,300	1968	56
88-309	4-32-R. Feeding-out catfish in cages	1967	2	33,093	1969	39
	4-33-R. Investigations of problems associated with the confinement of warmwater fishes in holding tanks	1967	2	32,700	1969	41
	4-35-D. Consumer education and market development	1967	2	21,200	Extended	35
	4-36-R. Physiological and behavioral relationships among species of fishes	1968	2	24,000		41
	4-51-R. Considerations in the commercial production of channel catfish	1969	2	28,200		39
88-309	<u>INDIANA</u> 4-10-R. Mussel research study	1966	2	31,900	1968	57
	4-16-R. Inland waters commercial fisheries studies	1966	2	20,900	1968	41
	4-43-R. Inter-species relationships of fish in Indiana waters of Lake Michigan	1968	2	36,000		41
88-309	<u>ICWA</u> 4-18-R. Industrial and commercial food fish investigations	1966	3	161,000	Extended	41

Public law	Project number and title	Date initiated	Estimated duration	Estimated total cost	Date completed	Reference
		Year	Years	Dollars	Year	Page
88-309	<u>KANSAS</u> 4-1-R. Investigations on digestion and metabolism of channel catfish	1965	3	80,860	1968	39
	4-45-R. Investigations on nutrition and metabolism of catfish and utilization of fisheries products	1969	3	84,000		39
88-309	<u>KENTUCKY</u> 4-19-R. Mussel fishery investigations	1966	3	60,000		57
	4-27-R. Catfish fishery investigations	1967	2	28,000	1968	39
	4-48-R. Influence of the effluent from a concentrated industrial complex on a large river	1969	3	60,000		37
88-309	<u>LOUISIANA</u> 2-20-S. Coordination and planning	1966	4	33,080		30
	2-22-R. Ecology of Louisiana's estuarine waters	1966	2	1,009,900	Extended	37
	2-23-D. Oyster lease control monuments	1966	2	416,400	Extended	58
	2-24-D. Shell planting for oyster cultch	1966	1	25,000	1966	58
	2-54-D. Shell planting for oyster cultch	1967	1	105,000	1967	58
	2-57-D. Gulf of Mexico estuarine film	1967	2	7,900	Extended	34
	2-63-C. Construction of saltwater culture ponds	1968	1	93,756	1969	24
	2-72-R. Evaluation of experimental oyster tonging reefs in Calcasieu Lake	1969	3	45,000		58
	2-27-D(4b). Rehabilitation and restoration of oyster seed grounds	1966	1	100,000	1966	67
89-304	AFSC-1. Ecological factors affecting anadromous fishes of Lake Pontchartrain and its tributaries	1967	3	125,000		51
88-309	<u>MAINE</u> 3-12-R. Northern shrimp - biological and technological research	1966	3	140,928	Extended	61
	3-13-D. Maine marine fisheries extension service	1966	3	125,000	Extended	34
	3-14-R. Lobster research program	1966	3	275,664	Extended	10
	3-15-R. The development of commercial fisheries estuarine resources	1966	2	106,068	Extended	6
	3-16-R. Biological, environmental, and technological research on marine worms	1966	3	234,000	Extended	64

Public law	Project number and title	Date initiated	Estimated duration	Estimated total cost	Date completed	Reference
		Year	Years	Dollars	Year	Page
	<u>MAINE (CON.)</u>					
88-309	3-17-D. Study of the economic and operational feasibility of mechanization of the Maine sardine processing canning operations	1965	2	95,000	1967	64
	3-18-R. Investigation of physical aspects of raw herring	1966	1	7,247	1966	64
	3-24-D. Promotion and market development	1966	3	213,900	Extended	35
	3-70-S. Coordination of research and development	1967	2	89,000	Extended	30
	3-72-C. Laboratory and tank room construction	1967	1	4,000	1968	27
	3-83-C. Marine research laboratory construction	1969	1	124,000		28
	FWAC-1. Statewide comprehensive fish and wildlife management plan	1968	1	5,703	1969	30
	3-94-D. Testing and adapting existing sardine processing equipment	1969	1	8,000		64
89-304	AFC-2. Increased development of the commercial anadromous fishery resources	1967	2	70,000		44
	AFC-6. Stream improvement and fishway construction	1968	1	179,230	Extended	25
	AFSC-11. Statewide comprehensive fish and wildlife management plan	1968	1	24,000	1969	30
	<u>MARYLAND</u>					
88-309	3-20-R. Development of a disease resistant oyster brood stock	1967	1	19,500	1968	58
	3-21-R. Determination of the distribution and abundance of the winter flounder	1966	2	27,200	1967	46
	3-23-R. Study of the effects of thermal pollution on oysters in the Patuxent River estuary	1966	2	17,488	1967	58
	3-26-R. Studies of the physical and chemical properties of the estuarine environment associated with fish kills	1966	1	21,000	1967	37
	3-27-R. Tagging of juvenile striped bass in Chesapeake Bay estuaries	1966	2	50,400	1968	51
	3-29-R. Studies of the physical processes of movement and dispersion of oyster larvae	1966	1	18,000	1967	59
	3-30-R. Suspended sediment in Chesapeake Bay	1966	2	127,000	Extended	38

Public law	Project number and title	Date initiated	Estimated duration	Estimated total cost	Date completed	Reference
		<u>Year</u>	<u>Years</u>	<u>Dollars</u>	<u>Year</u>	<u>Page</u>
	<u>MARYLAND (CON.)</u>					
88-309	3-42-D. An economic study of the fisheries and seafood processing industries with emphasis on the Chesapeake Bay area	1966	2	43,600	Extended	32
	3-56-R. Biologic and environmental control of Eurasian milfoil ( <u>Myriophyllum spicatum</u> L.) in Chesapeake Bay	1967	2	37,645	Extended	38
	3-65-S. Coordination and planning	1967	2	62,000	Extended	30
	3-66-D. Market development for Chesapeake Bay seafoods	1967	2	500,000		35
	3-71-D. Maryland marine fisheries extension service	1967	2	40,100	Extended	34
	3-75-R. Development of disease-resistant oysters ( <u>C. virginica</u> ) under field conditions in lower Chesapeake Bay	1967	2	93,000	Extended	59
	3-81-D. Pasteurization of crabmeat through the use of radio frequency waves	1968	1	41,900	1969	64
	3-86-D. Oyster shucking study	1968	1	30,000	1969	64
	3-93-R. The effects of the Maryland hydraulic clam dredge on populations of the soft shell clam	1969	3	60,000		54
	3-20-R(4b). Development of a disease-resistant oyster brood stock	1965	2	66,000	1967	67
	3-91-R(4b). Blue crab study in Chesapeake Bay - Maryland	1968	1	25,000		67
89-304	AFSC-1. Ecological study of Susquehanna River and tributaries below Conowingo Dam and their contribution to anadromous fish populations of Upper Chesapeake Bay	1967	3	263,000		53
	AFC-3. Stream improvement program for anadromous fish management	1967	3	288,272		41
89-720	JF-3-1. A study of the biology of sea nettles to develop potential methods for control of their abundance	1968	3	300,000		54
	<u>MASSACHUSETTS</u>					
88-309	3-35-R. Marine food science and technology research on sanitation and handling for purpose of improving product quality and shelf-life of Massachusetts commercial fishery products	1967	2	156,000	Extended	64
	3-37-D. Collection, compilation, evaluation, and dissemination of commercial fisheries statistics	1966	2	164,999	Extended	03

Public law	Project number and title	Date initiated	Estimated duration	Estimated total cost	Date completed	Reference
		Year	Years	Dollars	Year	Page
	<u>MASSACHUSETTS (CON.)</u>					
88-309	3-38-R. Identification of winter flounder subpopulations	1966	2	32,000	1969	46
	3-39-C. Cat Cove dike repair	1966	1	29,348	1967	24
	3-40-S. Coordination and planning	1966	3	90,604	Extended	30
	3-50-D. Consumer education and market development	1966	2	360,000	Extended	35
	3-52-C. Cat Cove Pier repair and pool rehabilitation	1966	2	54,000	1968	24
	3-60-D. Shellfish extension	1966	3	41,000		35
	3-73-R. Study of the feasibility and application of Danish seining to the Massachusetts fishing industry	1967	1	45,000	1968	33
	3-74-C. Marine research laboratory construction	1967	2	400,000		28
	3-76-C. Marine research vessel acquisition	1967	2	40,000	1969	29
	3-87-R. Winter flounder investigations	1969	4	100,000		46
89-304	AFC-1. Anadromous fish investigation	1967	4	80,000		25
	<u>MICHIGAN</u>					
88-309	4-2-R. Surveillance of lake trout restoration in Michigan waters of Lake Michigan	1966	4	134,800		40
89-304	AFC-1. Appraisal of stocks of anadromous fishes in the Michigan waters of the Great Lakes	1967	1	20,000	1967	41
	AFC-7. Parasites, disease, and disease control of Great Lakes anadromous and commercial fish	1968	1	120,000	Extended	42
	AFSC-8. Great Lakes fish resource development study	1968	1	40,000		42
	<u>MINNESOTA</u>					
88-309	4-3-R. Minnesota commercial fisheries improvement - Western Lake Superior	1965	3	49,216	Extended	40
	4-22-D. Development of under-ice horizontal sonar scanning equipment and technique for locating fish schools	1966	2	11,500	1969	33
	4-38-R. Lake Superior commercial fisheries assessment studies	1968	3	30,000		40
	4-39-R. Minnesota commercial fisheries improvement - Lake of the Woods	1968	3	105,978		42
	4-44-R. A physiological study of thermal stress in channel catfish	1968	2	14,500		39

Public law	Project number and title	Date initiated	Estimated duration	Estimated total cost	Date completed	Refer- ence
		<u>Year</u>	<u>Years</u>	<u>Dollars</u>	<u>Year</u>	<u>Page</u>
89-304	<u>MINNESOTA (CON.)</u> AFC-2. Anadromous fish habitat development	1967	1	16,000	1968	42
88-309	<u>MISSISSIPPI</u> 2-25-R. Cooperative Gulf of Mexico estuarine inventory study - Mississippi	1966	2	385,000	Extended	38
	2-28-R. A study of coliform bacteria and <i>E. coli</i> on polluted and unpolluted oyster bottoms of Mississippi and a study of depuration by rebedding	1966	3	111,500		59
	2-42-R. A seasonal study of nektonic and benthic faunas of the shallow gulf off Mississippi out to the fifty fathom curve	1966	3	120,000		38
	2-59-D. Gulf of Mexico estuarine film	1967	1	7,900	Extended	34
	2-61-R. A study of bacterial spoilage patterns in iced <i>Penaeus</i> shrimp	1967	2	62,900	Extended	65
89-304	AFC-1. A study of the striped bass in Mississippi waters	1967	4	210,000		51
89-720	JF-2-1. Population studies of Mississippi Sound and inshore Gulf coelenterates with special emphasis on noxious planktonic forms	1967	2	102,080	Extended	54
88-309	<u>MISSOURI</u> 4-3-R. Research and management of commercial fisheries	1966	2	170,000	Extended	63
	4-34-D. Palatability of Missouri fish	1967	1	15,200	1969	65
88-309	<u>MONTANA</u> 1-19-D. Fort Peck Reservoir fishery investigations	1966	3	60,000		42
	1-20-C. Construction of fishery research vessel for Fort Peck Reservoir fishery investigations	1966	1	20,000	1967	29
	1-45-R. An economic study of market- ing Montana commercial fisheries products	1967	2	20,400	1969	32
88-309	<u>NEBRASKA</u> 4-4-R. Establishment of the seasonal distribution and availability of com- mercial fish species in the waters of Nebraska	1967	2	75,300		42
	4-17-D. Design and construction of facilities relative to trapping and handling of commercial species	1966	1	54,000	1967	24
88-309	<u>NEVADA</u> 6-9-D. Rearing bait fishes in the desert southwest	1968	4	107,778		42

Public law	Project number and title	Date initiated	Estimated duration	Estimated total cost	Date completed	Reference
		<u>Year</u>	<u>Years</u>	<u>Dollars</u>	<u>Year</u>	<u>Page</u>
88-309	<u>NEW HAMPSHIRE</u> 3-31-R. Soft-shell clam population study in Hampton-Seabrook Harbor, New Hampshire	1966	3	12,000		55
	3-32-R. An investigation of the possibility of seed oyster production in Great South Bay, New Hampshire	1966	3	74,767		59
89-304	AFC-1. Commercial fisheries development	1968	3	230,000		25
	<u>NEW JERSEY</u>					
88-309	3-1-D. Shell planting program Maurice Cove (Delaware Bay) and Mullica River	1965	3	500,000		59
	3-2-R. Evaluation of the menhaden and shad fishery in Delaware Bay and adjacent waters	1966	2	38,002	1968	53
	3-3-R. Disease resistant oyster program - Delaware Bay	1967	2	100,000		59
	3-78-R. Inventory of major estuarine systems	1968	2	180,600		30
	3-3-R(4b). Disease resistant oyster program - Delaware Bay	1965	2	75,000	1967	67
89-304	AFCS-1. Population and migration study of major anadromous fish	1967	1	59,500	1968	45
	<u>NEW MEXICO</u>					
88-309	6-11-R. Investigation of commercial fishery potential of rough fish species	1968	3	41,000		42
	<u>NEW YORK</u>					
88-309	3-9-D. Management planning for New York freshwater commercial fisheries	1966	3	180,000	Extended	31
	3-10-C. Construction of a marine research and development laboratory	1966	3	383,000	1969	28
	3-11-D. Pilot plant depuration of hard clams	1965	1	39,000	1966	55
	3-63-R. Pond culture of oyster seed in a controlled natural environment	1967	3	99,400		59
	3-68-D. Studies of problems involved when hard clams in commercial quantities are subjected to the depuration process	1967	2	66,000	1968	55
	3-84-S. Coordination and planning	1968	3	56,476		31
	3-95-D. Operation and maintenance of marine laboratory	1969	3	86,000		36
89-304	AFC-4. Evaluation of present and potential sturgeon fisheries of the St. Lawrence River and adjacent waters	1968	2	80,000		52
89-720	JF-3-3. A study of the overwintering germinating stages of floating marine algae in Great South Bay, New York	1967	3	51,500		54

Public law	Project number and title	Date initiated	Estimated duration	Estimated total cost	Date completed	Reference
		Year	Years	Dollars	Year	Page
88-309	<u>NORTH CAROLINA</u> 2-6-R. Oyster studies	1965	3	68,000	Extended	60
	2-8-R. A study of the quality of North Carolina scallops	1965	3	37,500	1968	65
	2-9-R. Studies on macroplankton crustaceans and ichthyoplankton of the Pamlico Sound complex	1965	2	20,683	1967	37
	2-26-R. Shrimp studies	1966	3	106,000	Extended	61
	2-51-C. Equipping exploratory fishing vessel	1967	1	25,000	1968	29
	2-73-C. Equipping exploratory fishing vessel to increase research capabilities	1968	1	16,000	1969	29
	2-76-R. Studies on the effects of processing on the quality of seafood products	1968	1	16,700		65
	2-80-R(4b). Cooperative blue crab study - South Atlantic States	1969	1	10,000		67
89-304	AFC-1. The status, abundance, and exploitation of striped bass in the Roanoke River and Albemarle Sound, North Carolina, and the spawning of striped bass in the Tar River, North Carolina	1967	3	60,000		51
	AFC-4. Factors affecting survival of immature striped bass	1968	3	41,212		51
	AFC-5. Offshore anadromous fish exploratory fishing program	1968	3	150,000		51
88-309	<u>NORTH DAKOTA</u> 4-15-R. Garrison reservoir commercial fishery investigations	1966	4	26,000		43
	4-20-D. Commercial fish market for North Dakota fisheries	1966	2	10,000	1968	32
	4-23-D. A survey of commercial fisheries on the mainstem reservoir of the Upper Missouri River system	1966	1	4,500	1967	43
	4-30-R. A study of the commercial fishery potential of Lake Ashtabula	1967	3	29,000		43
	4-54-R. Investigations of gonadotropins in stimulating spawning in white suckers	1969	2	3,000		43
88-309	<u>OHIO</u> 4-6-R. Lake Erie commercial fisheries research	1966	4	199,000		39
	4-26-R. Value of whole fish meal in breeding gestation ration for swine	1967	3	75,000		65

Public law	Project number and title	Date initiated	Estimated duration	Estimated total cost	Date completed	Reference
		<u>Year</u>	<u>Years</u>	<u>Dollars</u>	<u>Year</u>	<u>Page</u>
88-309	<u>OHIO (CON.)</u> 4-28-R. Mussel fisheries investigations	1967	3	114,500		57
	4-47-R. The status of whirling disease in Ohio waters	1969	1	16,000		43
89-304	AFCS-1. A study of the physical characteristics of the major reef areas in the Western Basin of Lake Erie	1967	3	118,000		37
88-309	<u>OKLAHOMA</u> 4-24-R. Commercial fisheries investigations	1966	4	104,400		43
	4-25-D. Commercial fisheries statistics	1967	2	83,600	Extended	63
88-309	<u>OREGON</u> 1-3-R. Study on the distribution and abundance of pink shrimp in the Pacific Ocean off Oregon	1965	3	113,813	Extended	62
	1-4-R. Investigation of the abundance and recruitment of bottomfish off Oregon with emphasis on Dover sole	1965	3	138,866	Extended	46
	1-5-R. Controlled rearing of Dungeness crab larvae and the influence of environmental conditions on their survival	1965	3	51,174	Extended	56
	1-8-S. Coordination and planning	1965	3	24,182	Extended	31
	1-10-D. Development of the shad industry	1966	3	55,521	Extended	65
	1-12-R. Utilization of hake, dogfish, and by-products of the fillet industry for protein supplements	1966	3	116,167		65
	1-15-R. Processed hake in feed for mink	1965	3	18,153	1968	66
	1-27-R. Laboratory hatching and rearing of Pacific Coast clams and oysters	1967	2	36,333		55
	1-34-R. Preparation of marine protein concentrate from hake	1967	2	60,000		66
	1-38-R. Biology of Columbia River shad and the development of selective commercial fishing gear	1967	3	80,000		45
89-304	1-46-R. Boat charter	1967	1	36,000	1968	53
	AFC-10. Shad and striped bass management study	1968	2	33,000		45
	AFC-11. Rearing ponds - North Nehalem River salmon hatchery	1967	1	120,000	1968	27

Public law	Project number and title	Date initiated	Estimated duration	Estimated total cost	Date completed	Reference
		<u>Year</u>	<u>Years</u>	<u>Dollars</u>	<u>Year</u>	<u>Page</u>
89-304	<u>OREGON (CON.)</u>					
	AFC-12. Planning and coordination	1967	4	26,000		31
	AFC-17. Construction of the Elk River salmon hatchery	1967	1	462,000	1968	27
	AFC-18. Development and improvement of hatchery techniques for Pacific salmon and steelhead trout	1967	4	589,000		49
	AFC-19. Management of the troll salmon fishery with emphasis on the collection of data on shore and at sea for regulation formulation	1967	3	92,600		49
	AFC-20. Evaluate, coordinate, and plan Pacific salmon research and management activities on a coastwide basis	1967	4	236,000		31
	AFC-21. Increased production of anadromous salmonids in Oregon coastal streams and lakes	1967	1	48,200	1968	49
	AFC-22. Production and distribution of anadromous salmonids from the Alsea River salmon hatchery	1967	1	67,505	1968	36
	AFC-23. Effects of logging on salmon populations in coastal streams	1968	3	57,200		49
	AFC-25. Remove culvert and construct bridge to provide anadromous fish passage on Clear Creek, tributary to the Kilchis River	1968	1	10,000	1968	26
	AFC-26. Research and management on wild and hatchery produced salmon and steelhead in Oregon south coastal streams	1968	3	204,000		49
	AFC-30. Hatch, rear, and release salmonids at the North Nehalem River salmon hatchery	1968	3	95,000		36
	AFC-35. Provide passage for salmonids on Oregon coastal streams	1968	1	31,500		26
AFC-39. Salmon investigations on the Northern Oregon Coast	1968	2	91,000		49	
88-309	<u>PENNSYLVANIA</u>					
	3-67-R. A study to establish a program to increase the production of high value commercial fishes in Lake Erie	1967	3	198,996		43
	3-85-R. Mussel investigation	1968	1	20,000		57
89-304	AFC-1. Feasibility of the restoration of shad runs in the Brandywine Creek and its tributaries	1967	2	30,000	Extended	46

Public law	Project number and title	Date initiated	Estimated duration	Estimated total cost	Date completed	Reference
		<u>Year</u>	<u>Years</u>	<u>Dollars</u>	<u>Year</u>	<u>Page</u>
	<u>PENNSYLVANIA (CON.)</u>					
89-304	AFC-4. Restoration of shad runs in the Brandywine Creek and its tributaries	1969	2	300,000		46
	<u>RHODE ISLAND</u>					
88-309	3-43-R. Investigation of the deep sea red crab	1966	3	43,500		56
	3-46-R. Investigation of the basic life history of the red crab	1966	3	55,100		56
	3-53-R. Testing one-boat pelagic trawls on small draggers	1966	1	20,000	1967	33
	3-57-R. Mollusk environmental modification and control studies	1966	3	11,275	1967	62
	3-79-C. Wickford marine laboratory dock repairs	1968	1	4,000	1968	28
	3-80-D. Development of a management plan for the sea scallop in Rhode Island	1968	1	14,000		31
	3-90-R. Assessment of the efficiency of the Danish Vinge trawl over conventional New England drag nets	1968	1	12,900	1969	33
89-304	AFSC-1. Construction of fish ladders	1967	4	430,000		26
	<u>SOUTH CAROLINA</u>					
88-309	2-2-R. Charting of subtidal oyster beds and experimental transplanting of seed oysters thereto from polluted seed oyster beds	1965	3	53,583	1968	60
	2-3-R. To manage and practice aquaculture in shrimp farm ponds and in large tanks under controlled conditions	1966	3	45,385	Extended	62
	2-36-C. To add a refrigerating unit to existing system for temperature control of saltwater culture tanks	1966	1	2,387	1967	28
	2-69-R. Investigations into supplemental feeding of oysters	1968	2	25,000		60
	2-79-R(4b). Cooperative blue crab study - South Atlantic States	1969	1	25,000		67
89-304	AFC-1. Survey of sturgeon fishery of South Carolina	1967	1	10,000	1968	52
	<u>SOUTH DAKOTA</u>					
88-309	4-18-D. Commercial fishery industry survey	1966	2	70,000	Extended	63
	4-21-D. Missouri reservoir fisheries product development and evaluation	1966	2	37,667	1968	66

Public law	Project number and title	Date initiated	Estimated duration	Estimated total cost	Date completed	Reference
		<u>Year</u>	<u>Years</u>	<u>Dollars</u>	<u>Year</u>	<u>Page</u>
	<u>SOUTH DAKOTA (CON.)</u>					
88-309	4-29-R. Effects of intensive bullhead removal in selected lakes in eastern South Dakota	1967	3	20,000		39
	4-37-D. Commercial fishing gear research and development for lakes and reservoirs in South Dakota	1968	2	20,000		34
	<u>TENNESSEE</u>					
88-309	4-5-R. Development of improved fishing methods for use in south-eastern and south central reservoirs	1965	3	37,356	1968	34
	4-31-R. Evaluation of whole fish meal as a protein supplement for swine	1967	1	5,000	1968	66
	4-40-D. Formula development and acceptability evaluation of selected seafood entrees	1968	1	13,993	Extended	66
	4-46-R. Freshwater mussel ecology - Kentucky Lake, Tennessee	1969	3	56,868		57
	<u>TEXAS</u>					
88-309	2-12-R. An evaluation of the effects of estuarine engineering projects	1966	3	75,115	Extended	37
	2-13-C. Construction of a Gulf research vessel	1966	1	122,300	1967	29
	2-14-C. Coastal fisheries experimental station	1966	3	514,000	Extended	28
	2-47-R. Northern Gulf of Mexico marine fisheries investigation	1967	3	200,000		53
	2-48-D. Gulf of Mexico estuarine film	1967	2	9,500	Extended	34
	2-49-R. Commercial fishery landings statistical program	1967	3	51,100		64
	2-55-R. Study of migratory patterns of fish and shellfish through a natural pass	1967	3	140,000		62
	2-62-D. Seafood marketing	1967	3	195,000		35
	2-66-R. Experimental pond research planning	1968	1	6,400	1968	31
	2-77-C. Construction of storage building, coastal fisheries experiment station	1968	1	25,000		28
	2-78-R. Saltwater pond research	1968	3	198,000		53
	2-88-C. Dredging boat and water intake channels	1969	1	22,500		36
	2-65-D(4b). Oyster rehabilitation in San Antonio Bay	1968	1	50,000		67

Public law	Project number and title	Date initiated	Estimated duration	Estimated total cost	Date completed	Reference
		Year	Years	Dollars	Year	Page
	<u>UTAH</u>					
88-309	6-10-R. Investigation of the intensity of natural selection upon different phenotypes (blood types) of rainbow trout in commercial trout rearing ponds and reservoirs	1967	2	23,235	Extended	40
	<u>VERMONT</u>					
88-309	3-59-R. Investigation of the commercial fisheries potential of Lake Champlain	1967	2	75,000		43
	<u>VIRGINIA</u>					
88-309	3-5-D. Investigation of potential for expansion of the industrial fishery of the mid-Atlantic bight	1965	4	310,731		53
	3-6-R. Production of disease resistant oysters	1967	2	124,325		60
	3-7-R. Investigation of oyster larvae and spat and certain environmental factors in an horizontally stratified estuary	1965	1	140,800	1966	60
	3-19-R. Characterization of coastal and estuarine fish nursery grounds as natural communities	1965	2	82,645	1967	37
	3-62-D. Propagation of disease resistant oysters	1967	1	290,000	Extended	60
	3-69-D. Consumer education and market development	1967	2	56,000		36
	3-77-R. A study of the soft and hard clam resources of Virginia	1967	2	81,200		55
	3-6-R(4b). Production of disease resistant oysters	1965	2	103,669	1967	67
	3-91-R(4b). Blue crab study in Chesapeake Bay - Virginia	1968	1	25,000		67
89-304	AFC-1. Biology and utilization of anadromous alosids	1967	4	418,000		44
89-720	JF-3-2. An ecological study of the jellyfish ( <i>Chrysaora quinquecirrha</i> ) in lower Chesapeake Bay	1968	3	85,266		54
	<u>WASHINGTON</u>					
88-309	1-17-S. Coordination and planning	1965	2	24,000	1968	31
	1-18-R. Investigation of effects of specific areas of Grays Harbor on the emigration of yearling coho salmon from the rivers emptying into that harbor	1966	3	14,000		49
	1-21-C. Construction of small fishways	1966	1	28,000	1967	26

Public law	Project number and title	Date initiated	Estimated duration	Estimated total cost	Date completed	Reference
		<u>Year</u>	<u>Years</u>	<u>Dollars</u>	<u>Year</u>	<u>Page</u>
88-309	WASHINGTON (CON.)					
	1-22-R. Monitor conditions of certain groundfish stocks, Washington trawl grounds	1966	3	227,000		46
	1-24-D. Inspection of oyster seed - new Asiatic sources	1966	1	6,000	1967	60
	1-29-R. Early marine life history, chum and pink salmon	1966	1	16,000	1967	50
	1-30-R. Field recovery, coded wire tag	1966	2	36,600	1968	50
	1-31-R. Willapa oyster studies	1966	2	56,000	1968	61
	1-32-R. Hatchery coho salmon, contribution to the fishery	1966	3	64,000		50
	1-33-D. Evaluation of dry feed for hatchery salmon	1966	3	135,000		50
	1-37-R. Analysis and publication of coded wire tag research data	1966	2	44,000	1968	50
	1-39-R. Mid-water trawl fisheries	1967	2	35,500		34
	1-40-R. Larval and estuarial studies, pink and chum salmon populations	1967	2	65,000		50
	1-41-R. Determination of the nutritive value of North Pacific fish meal for poultry	1967	3	54,000		66
	1-42-D. Subtidal hardshell clam fisheries development	1967	3	60,000		55
	1-43-R. Oyster drill ( <u>Ocenebra japonica</u> ) control	1967	2	30,000		61
	89-304	1-44-C. Construction of Puget Sound research laboratory	1968	2	438,000	
1-49-C. Bivalve larvae experimental rearing pond construction		1968	1	14,000		24
AFC-1. Salmon rearing operations		1967	1	392,000	1967	36
AFC-4. Planning and coordination		1967	4	22,000		31
AFC-5. Construction of Soleduck salmon hatchery		1968	3	1,666,000		27
AFC-8. Stream improvement planning		1967	1	20,000	1968	31
AFC-9. Samish salmon hatchery supplemental water supply and rearing pond system		1967	2	98,000	1969	27
AFC-12. Port Susan-Port Gardner pink salmon studies - stock separation and identification	1967	1	18,500	1968	50	

Public law	Project number and title	Date initiated	Estimated duration	Estimated total cost	Date completed	Refer- ence
		Year	Years	Dollars	Year	Page
89-304	<u>WASHINGTON (CON.)</u>					
	AFC-13. Measurement of spawning success and fry quality of chum salmon utilizing natural and controlled spawning areas at Big Beef Creek, Washington	1967	1	200,298	Extended	50
	AFC-14. Gill net drop out study	1968	3	45,100		50
	AFC-15. Nooksack hatchery coho yearling pond construction	1968	1	28,000	1969	27
	AFC-16. Simpson hatchery rearing pond construction	1968	1	92,000	1969	27
	AFC-17. Issaquah hatchery coho yearling pond construction	1968	1	22,000	1969	27
	AFC-23. Cascade River stream improvement	1968	1	11,000	Extended	26
	AFC-24. Mashel River stream improvement	1968	1	11,000		26
	AFC-28. Skagit hatchery holding and rearing ponds	1969	1	106,384		Not funded in FY 1969
	AFC-32. Mill Creek fish passage facility	1969	1	15,000		26
AFC-33. Upper Mashel River stream improvement	1969	1	5,000		26	
88-309	<u>WEST VIRGINIA</u>					
3-58-R. Investigations of the commercial potential of fishery resources in West Virginia	1966	3	46,500		43	
88-309	<u>WISCONSIN</u>					
	4-7-R. Assessment of lake trout restoration in the Wisconsin waters of Lake Michigan	1965	3	117,999	Extended	40
	4-41-D. A study of the contribution of bait dealers and private fish hatchery operators to the commercial fish industry of Wisconsin	1968	2	12,000		32
	4-42-D. The alternatives for Lake Superior trout management - a system analysis	1968	1	11,600		31
39-304	AFC-2. Walleye population study in respect to a possible commercial fishery	1967	1	15,064	1967	40
	AFC-4. A comparative study of thyroidal, interrenal, and gonadal activity in the alewife	1968	1	14,000	Extended	44
	AFC-5. An investigation of the reproductive cycle of the alewife in Lake Michigan	1968	3	55,930		44

Public law	Project number and title	Date initiated	Estimated duration	Estimated total cost	Date completed	Reference
		<u>Year</u>	<u>Years</u>	<u>Dollars</u>	<u>Year</u>	<u>Page</u>
89-304	<u>WISCONSIN (CON.)</u> AFC-6. Study of the population dynamics of juvenile alewife and coregonids in Green Bay, Lake Michigan	1968	1	30,577		44
88-309	<u>WYOMING</u> 1-48-R. The commercial potential of non-game fish species in impounded waters	1968	3	82,000		44
88-309	<u>AMERICAN SAMOA</u> H-8-D. A determination of the feasibility of developing offshore commercial fishing in American Samoa	1966	3	178,500		32
88-309	<u>GUAM</u> H-7-D. A study to determine the feasibility of developing a deep-sea commercial fishing industry on Guam	1966	3	104,000		33
88-309	<u>PUERTO RICO</u> 2-37-S. Coordination and planning	1966	3	142,000	Extended	31
	2-38-C. Design and construction of an improved fishing boat	1966	2	7,600	1968	29
	2-39-R. Gear research and testing of improved commercial fishing boats	1966	3	205,000		33
	2-40-C. Construction of commercial fisheries laboratory	1966	2	250,000	Extended	28
	2-41-C. Construction of fishing port facilities	1967	2	250,000	Extended	25
	2-56-R. Fisheries statistical program	1967	2	200,000		63
	2-70-R. Exploratory and test fishing for tuna	1968	2	240,500		33
	2-71-D. Training of fishermen for the tuna industry	1968	1	44,000		35
89-720	JF-2-6. Investigation of the biology and control of noxious Coelenterates occurring in the coastal waters of Puerto Rico	1969	2	46,805		54
88-309	<u>VIRGIN ISLANDS</u> 2-33-R. Study of the fisheries potential of the Virgin Islands	1966	3	103,333		34





Remove culvert and construct bridge to provide anadromous fish passage on Clear Creek, tributary to the Kilchis River - A culvert was removed and replaced with a precast concrete slab and wood piling bridge across to permit upstream passage of chinook, chum, and coho salmon in Clear Creek near Tillamook, Tillamook County.

Oregon AFC-35

Austin Magill

\$31,500

Provide passage for salmonids on Oregon coastal streams - Nine logjams and other obstructions are removed on Oregon coastal streams to provide access to 62 miles of spawning and nursery area for salmonids. A "steep-pass" type fishway is constructed and six are repaired and modified to maintain passage of salmonids to about 60 miles of fish habitat and one salmon hatchery.

Rhode Island AFSC-1

John Cronan

\$40,000

Construction of fish ladders - To construct fish ladders and/or removal of obstructions to provide upstream passage of alewife, American shad, and sea-run trout in Hunt River, Kent County, Annaquatucket River, Washington County, and Saugatucket River, Washington County.

Washington AFC-23

Marshall Thayer

\$9,200

Cascade River stream improvement - To alter stream bed in two areas through blasting and removal of rock to create water flow patterns and velocities favorable to passage of chinook and coho salmon with minimum delay to the upper Cascade River, Skagit County.

Washington AFC-24

Marshall Thayer

\$11,000

Mashel River stream improvement - To provide adequate fish passage for upstream migrant salmon through the area of an existing log jam obstruction. Clearance of the log jam will make about 20 miles of stream area that will be used primarily by chinook and coho salmon for spawning and rearing.

Washington 1-21-C

Robert Kramer

Completed 1967

Construction of small fishway - Fishway was constructed and log jam removed on Hutchins Creek, tributary of Nooksack River in Whatcom County, to make available additional spawning and rearing areas to fall chinook and coho salmon.

Washington AFC-32

Marshall Thayer

\$15,000

Mill Creek fish passage facility - Provides for construction of a fish passage facility through a 9-foot falls in Mill Creek, tributary to the Bogachiel River, to open up about 5 miles of spawning and nursery areas to coho salmon. The site is near Forks in Clallam County.

Washington AFC-33

Marshall Thayer

\$5,000

Upper Mashel River stream improvement - To provide passage for chinook, coho, and pink salmon to upstream spawning and nursery areas in Mashel River, tributary to the Nisqually River. Removal of logjams and reduction of stream gradient at cascades and small falls will assure opening about 20 miles of stream area.

#### Hatcheries and Hatchery Facilities

California AFSC-1

Robert Macklin

\$1,108,900

Mad River hatchery construction - To construct a salmon and steelhead trout hatchery on the Mad River near Arcata, Humboldt County. When fully operative, the hatchery will have potential annual production of 3 million yearling ch. salmon and 1 million yearling chinook salmon.

California AFC-3

C. S. Kabel

\$40,000

Mad River hatchery fish ladder (Formerly Caspar Creek egg-taking station) - To construct fish passage facility to provide entry of adult chinook and coho salmon and steelhead trout into egg-taking station of Mad River hatchery. (See California AFSC-1)

Oregon AFC-11

Ernest R. Jefferies

Completed 1968

Rearing ponds, North Nehalem River salmon hatchery - Six additional rearing ponds for yearling coho and fall chinook salmon and a three-bedroom residence were constructed at the State-owned North Nehalem River salmon hatchery in Clatsop County.

Oregon AFC-17

Jim Von Domelen

Completed 1968

Construction of the Elk River salmon hatchery - The hatchery was constructed on the Elk River in Curry County. It was put into operation in the fall of 1968 and, when fully operative, will be capable of rearing about two million coho and fall chinook annually for release in the State's southern coastal drainages.

Washington AFC-5

Marshall Thayer

\$608,316

Construction of Soleduck salmon hatchery - To construct a salmon hatchery on the Soleduck River in Clallam County. When fully operative, the hatchery will have a potential annual production of about 115,500 pounds of young salmon which is calculated to yield about 58,000 salmon (435,000 pounds) to the fishery.

Washington AFC-9

Marshall Thayer

Completed 1969

Jamish salmon hatchery supplemental water supply and rearing pond system - Pump and transport facilities for supplemental hatchery well water supply and a denitrification tower were installed at the State-owned Samish Salmon Hatchery near Burlington. Also, a rearing pond was constructed.

Washington AFC-15

Marshall Thayer

Completed 1969

Nooksack hatchery coho yearling pond construction - A  $\frac{1}{2}$ -acre yearling coho salmon rearing pond was added to the Nooksack State Salmon Hatchery located about 20 miles northeast of Bellingham, Whatcom County.

Washington AFC-16

Marshall Thayer

Completed 1969

Simpson hatchery rearing pond - At the State-owned Simpson Salmon Hatchery on the Satsop River, Grays Harbor County, an additional rearing pond was constructed for fall chinook and yearling coho salmon.

Washington AFC-17

Marshall Thayer

Completed 1969

Issaquah hatchery yearling coho rearing pond construction - To extend the time yearling coho salmon can be reared, a new rearing pond was added to the State-owned Issaquah Hatchery located in King County.

#### Laboratory

Alaska 5-12-C

G. L. Ziemer

Completed 1969

King Salmon headquarters - architectural plans - Master plan and specifications for the formation of a headquarters at King Salmon for the important Bristol Bay fishing area were completed. The plans were developed to enable construction over a period of years.

Maine 3-72-C

Phillip L. Giggins

Completed 1969

Laboratory and tank room construction - This project provides for construction and installation of needed equipment for investigators to carry out U. L. 88-309 projects at the State's Fisheries Research Station, Boothbay Harbor.

Maine 3-83-C	Richard P. Choate	\$103,000
<u>Marine research laboratory construction</u> - The first unit of a new marine research laboratory is under construction at Boothbay Harbor. The two-story building will consist primarily of office space, dry laboratories, and related space to carry out research studies on lobster, marine worms, and shrimp.		
Massachusetts 3-74-C	A. Russell Geurvels	\$400,000
<u>Marine research laboratory construction</u> - This project provides for construction of a marine research laboratory and installation of needed equipment at Cat Cove, Salem. The single-story structure will be about 60 feet by 90 feet and will provide research space for shellfish larviculture.		
New York 3-10-C	David H. Wallace	\$383,000
<u>Construction of a marine research and development laboratory</u> - The objective of this project is to expand the marine research and development facilities in New York by construction of a seaside laboratory equipped with a salt-water system and other essential utilities. The construction site is located in the village of Old Field, adjacent to Flax Pond, which is a salt-water estuary off Long Island Sound.		
Puerto Rico 2-40-C	Rolf Juhl	\$250,000
<u>Construction of commercial fisheries laboratory</u> - This project provides for construction of a laboratory and center for biological studies, exploratory fishing, gear research, technology studies, and economic and statistical studies for the research and development of commercial fisheries of Puerto Rico. The facility will be located in Mayaguez, relatively close to the Puerto Rico College of Agriculture and Mechanic Arts, the Inter-American University, and the Institute of Marine Biology.		
Rhode Island 3-79-C	John M. Cronan	Completed 1968
<u>Wickford Marine Laboratory dock repairs</u> - To assure adequate and safe facilities for marine fisheries research, sections of the dock which support laboratory tanks and sundry equipment are under repair. The laboratory is located in North Kingston.		
South Carolina 2-36-C	G. Robert Lunz	Completed 1967
<u>To add a refrigerating unit to existing system for temperature control of saltwater culture tanks</u> - Refrigerating units to control temperature were installed in six large volume experimental salt-water tanks used for research in pond cultivation of shrimp and supplementary feeding of oysters at Bears Bluff Laboratory.		
Texas 2-14-C	Terrance R. Leary	\$385,500
<u>Coastal fisheries experiment station</u> - This station is under construction on north shore of Matagorda Bay near Well Point, Calhoun County. It consists of the station, 21 ponds, and related structures to provide controlled habitat for marine research and demonstration. The ponds range in size from $\frac{1}{4}$ acre to 4 acres, totaling 23 acres.		
Texas 2-77-C	Terrance R. Leary	\$25,000
<u>Construction of storage building, coastal fisheries experiment station</u> - A storage building of about 1,600 square feet will be designed and constructed on the site of the salt-water pond experiment station near Palacios. This structure will provide space for storage of fish food, vehicles, equipment, and limited office space.		
Washington 1-44-C	Russell Jones	\$438,000
<u>Construction of Puget Sound laboratory</u> - This project is for the construction of a fisheries research laboratory at Tumwater. The laboratory will provide the needed facilities and space to adequately study the commercial fishery resources of the State.		

## Research Vessels

Georgia 2-35-C Charles M. Frisbie Completed 1968

Research vessel construction - Plans and specifications for construction of a vessel for conducting research on commercial fish species along the coast were completed. However, due to unavailability of construction funds, a modified trawler was purchased for the stated purpose.

Massachusetts 3-76-C Frank Grice Completed 1969

Marine research vessel acquisition - A 40-foot vessel was purchased for research on lobster and winter flounder in coastal waters. The vessel is equipped with radio communication, electronic sounding and navigation gear, and various types of research equipment.

Montana 1-20-C James H. Posewitz Completed 1966

Construction of fishery research vessel for Fort Peck Reservoir fishery investigations - A 35-foot vessel was constructed for research on fish of commercial potential, such as the guldeye, in Fort Peck Reservoir in northeastern Montana.

North Carolina 2-51-C James Sterling Completed 1968

Equipping exploratory fishing vessel - The following equipment was installed on North Carolina's new research vessel Dan Moore for exploratory fishing at sea: "Capac" impressed current system for corrosion control, air conditioning system, refrigeration equipment for two insulated fish holds, and outriggers for "double-rigging."

North Carolina 2-73-C James S. Sterling Completed 1969

Equipping exploratory fishing vessel to increase research capabilities - The following equipment was purchased: Simrad fish scope, bathythermograph, winch and davit, midwater trawl, and shrimp pots.

Puerto Rico 2-38-C Rolf Juhl \$7,600

Design and construction of an improved fishing boat - This project provides for design and construction of an improved fishing boat, about 20 feet in length, for research on the local commercial fishery.

Texas 2-13-C Henry W. Compton, Jr. Completed 1967

Construction of a Gulf research vessel - This 72-foot steel hull shrimp trawler, Western Gulf, was delivered in the spring of 1967. It is currently used in studying shrimp and industrial fish resources of the Texas coast.

## COORDINATION AND PLANNING

Twenty-seven coordination and planning projects have been approved and funded under the Federal Aid Program. Of these, 20 are continuing and 7 have been completed. The project activities are concerned primarily with fish resource and habitat inventories, development of resource management and research plans, and administration and supervision of the State's Federal Aid Program.

Alaska 5-1-S Gary Finger \$34,300

Coordination - Provides for coordination and planning of Public Law 88-309 projects.

Alaska 5-14-D James W. Parker Completed 1968

Southeastern and Kodiak Island, Alaska, stream catalogs - Salmon escapement catalogs for southeastern Alaska Districts 10-15 for 1965-66 and for Kodiak 1965-67 are published.

Alaska AFC-11	Gary Finger	\$81,200
<u>Coordination</u> - Provides for supervision and administration of Public Law 89-304 projects.		
California 6-5-S	Stanley S. Kobel	\$27,300
<u>Coordination</u> - Provides for coordination and planning of Public Law 88-309 projects.		
Connecticut 3-33-S	Richard L. Homes	Completed 1968
<u>Coordination</u> - Provided for coordination and planning of Public Law 88-309 projects in fiscal years 1966-69.		
Georgia 2-74-S	Charles M. Frisbie	\$17,000
<u>Coordination</u> - Provides for coordination and planning of Public Law 88-309 projects.		
Hawaii H-3-R	Michio Takata	Completed 1966
<u>Central Pacific Tuna Conference</u> - Provided for conference to outline research needs and program on bigeye, skipjack, and yellowfin tunas.		
Hawaii H-9-R	Michio Takata	Completed 1966
<u>Publication of Central Pacific Tuna Conference proceedings and background papers</u> - Provided for publication of proceedings of the Governor's conference on Central Pacific fishery resources, as well as background papers utilized during the conference.		
Louisiana 2-20-S	T. B. Ford	\$7,414
<u>Coordination</u> - Provides for coordination and planning of Public Law 88-309 projects.		
Maine FWAC-1	Robert L. Dow	\$5,703
<u>Statewide comprehensive fish and wildlife management plan</u> - Inventory of the commercial fishery resources as the initial activity leading to the development of an overall management plan for fish and wildlife resources of the State.		
Maine 3-70-S	Richard P. Choate	\$32,000
<u>Coordination of research and development</u> - Provides for coordination and planning of Public Law 88-309 projects.		
Maine AFC-11	Robert L. Dow	\$2,851
<u>Statewide comprehensive fish and wildlife management plan</u> - To amass knowledge and ideas on the anadromous fishery resources as the initial step leading to an overall management plan for fish and wildlife resources of the State.		
Maryland 3-65-S	George Murphy	\$26,000
<u>Coordination</u> - Provides for coordination and planning of Public Law 88-309 projects.		
Massachusetts 3-40-S	W. Leigh Bridges	\$30,604
<u>Coordination of research and development</u> - Provides for coordination and planning of Public Law 88-309 projects.		
New Jersey 3-78-R	Paul E. Hamer	\$18,000
<u>Inventory of major estuarine system</u> - Provides for inventories of fish in estuarine waters and the habitat in which the fish occur.		

New York 3-9-D William G. Bentley \$24,000

Management planning for New York freshwater commercial fisheries - Provides for the development of plans for better utilization of New York fresh-water fish resources, including expansion of fisheries for underutilized species.

New York 3-84-S Samuel L. Finkelstein \$22,500

Coordination of research - Provides for supervision and administration of Public Law 88-309 projects.

Oregon 1-8-S Robert E. Loeffel \$7,091

Coordination - Provides for coordination and planning of Public Law 88-309 projects.

Oregon AFC-12 Austin R. Magill \$3,500

Coordination - Provides for supervision and coordination of Public Law 89-304 projects.

Oregon AFC-20 Leon A. Verhoeven \$39,340

Evaluate, coordinate, and plan Pacific salmon research and management activities on a coast-wide basis - Provides for the Pacific Salmon Inter-Agency Council's coordination of salmon research and its application to management and to update the Salmon Compendium.

Puerto Rico 2-37-S Rolf Juhl \$39,000

Coordination - Provides for coordination and planning of Public Law 88-309 projects.

Rhode Island 3-80-D George W. Gray \$14,100

Development of a management plan for sea scallops in Rhode Island waters - To provide needed biological and statistical data to effectively manage the sea scallop resource. Beds are being sampled on a monthly basis to determine meat yield, length, weight, and growth. Catch records are being collected, also.

Texas 2-66-R William R. Moore Completed 1968

Experimental pond research planning - Research program is developed for salt-water pond experiments at the newly constructed Seabrook Laboratory as Public Law 88-309 activity.

Washington 1-17-S Marshall Thayer Completed 1968

Coordination - Provided for coordination and planning of Public Law 88-309 projects in fiscal years 1965-68.

Washington AFC-4 Marshall Thayer \$6,000

Coordination - Provides for coordination and planning of Public Law 89-304 projects.

Washington AFC-8 Robert Kramer Completed 1968

Stream improvement planning - Coastal streams are surveyed, and priorities assigned to each one for improvement based on needs and cost-benefit analysis.

Wisconsin 4-42-D William B. Lord \$5,800

The alternatives for Lake Superior trout management - Provides for investigation of the problems inherent in the lake trout management program involving the interrelation of sport and commercial fishing interests and for establishment of evaluated alternatives for the resource manager.

## ECONOMICS

Five projects dealing with economic aspects of the commercial fisheries have been funded. Of these, three are completed and two are continuing.

Georgia 2-46-R D. J. Purcell Completed 1968

Economic survey of the marine commercial fishing industry of Georgia - The survey of the economic importance of the seafood industry from the fisherman to the consumer has been completed. The survey also included the effect of physical and socio-economic factors on the consumption of seafoods and the future demand.

Maryland 3-42-D Richard E. Suttor \$15,600

An economic study of the fisheries and seafood processing industries with emphasis on the Chesapeake Bay - This study is undertaken to: (1) analyze the demand for seafood by Region in the United States, (2) analyze the supply of seafood from the Chesapeake Bay fisheries, and (3) determine the economic factors affecting the size and location of the seafood processing industries in the Chesapeake Bay area. The work is at the University of Maryland, College Park.

Montana 1-45-D Glenn R. Barth Completed 1969

An economic study of marketing Montana commercial fisheries products - Markets for selected classes of goldeye, carp, and buffalo fish were identified and evaluated.

North Dakota 4-20-D David C. Nelson Completed 1968

Commercial fish markets for North Dakota fisheries - The market demand, alternate uses, and potential demand for North Dakota fisheries have been identified. The State estimates that about 14 million pounds of fish is available to the commercial markets.

Wisconsin 4-41-D Sydney D. Staniforth \$6,000

A study of the contribution of bait dealers and private fish hatchery operators to the commercial fish industry of Wisconsin - This study will provide needed information on the bait dealers and private fish hatchery industry, including species of fish used, value, volume, capital investment, and other related data. This information will be tabulated and reports prepared to assist in the development of long-range planning and operation of resource agencies.

## EXPLORATORY FISHING AND GEAR DEVELOPMENT

Thirteen exploratory fishing and gear development projects have been approved and funded. Of these, eight are continuing and five have been completed. These projects are designed to develop underutilized resources, and to develop or apply new gear not now used by the industry.

American Samoa H-8-D James R. Holloway, Sr. \$68,000

A determination of the feasibility of developing offshore commercial fishing in American Samoa - Around the island of American Samoa, commercial fishing for the local fresh fish market is practically nonexistent and the demand for fresh fish exceeds the supply. This project is undertaken to determine the techniques, vessels, and fishing gear most suitable for developing offshore commercial fishing; to conduct exploratory fishing for marine animals of potential commercial value; and to study the economic potential for the fishery products in the Island and elsewhere.

Georgia 2-68-R Walter F. Goodwin \$34,185

Exploratory study of the commercial marine resources of the Georgia coast - Exploratory cruises are conducted on a seasonal basis to evaluate the commercial potential of pelagic and

demersal food fish, calico scallops, and hard clams inside 10 fathoms off the Georgia coast. This study is being coordinated with the Bureau of Commercial Fisheries Exploratory Fishing Station, St. Simons Island. Industry receives the results from each cruise.

Guam H-7-D

Isaac I. Ikehara

\$39,000

A study to determine the feasibility of developing a deep-sea commercial fishing industry on Guam - Guam's commercial production of fresh fish comes almost entirely from the inshore reef areas. The inshore fish populations are being rapidly depleted while the offshore fish stocks are virtually untapped. Purposes of this study are to investigate the feasibility of adopting the Hawaiian-type sampans for suitable fishing vessel for use offshore around Guam, to determine the relative potential importance of the various fish groups, and to test the marketability of the various species of fish that can be produced in commercial quantities from offshore waters.

Massachusetts 3-73-R

R. Barry Fisher

Completed 1968

Study of the feasibility and application of Danish seining to the Massachusetts fishing industry - Comparative fishing trials have been completed using a Danish seine and an otter trawl in the coastal waters of Massachusetts. Results of this study are inconclusive as to the application of this new gear to the industry.

Minnesota 4-22-D

Charles R. Burrows

Completed 1969

Development of under-ice horizontal sonar scanning equipment and technique for locating fish schools - The development of gear and methods for locating schools of fish under the ice with sonar scanning equipment has been completed. As a result of this study, the industry has purchased this equipment which will save many man-hours of needless searching for concentrations of commercial fish species.

Puerto Rico 2-39-R

Rolf Juhl

\$59,500

Gear research and testing of improved commercial fishing boats - To determine the most suitable commercial fishing gear and boats needed for upgrading the fisheries of Puerto Rico, a Florida-type 37-foot lobster boat powered with a 160-hp. diesel has been outfitted and is fishing experimentally on the bottom with pots and longlines. The project also provides for test trolling and gill net fishing.

Puerto Rico 2-70-R

Rolf Juhl

\$120,500

Exploratory and test fishing for tuna - Limitations imposed by tuna conservation measures and foreign restrictions on traditional fishing grounds have created a need for developing other fishing areas. Exploratory cruises are underway to determine if the Central Atlantic and Caribbean areas have enough tuna to support a purse seine fishery. The Bureau of Commercial Fisheries has provided a predetermined cruise track to give maximum coverage of the area.

Rhode Island 3-53-R

Richard W. Eurton

Completed 1967

Operational testing of two pelagic trawls on two small draggers - This study off Point Judith has been completed, and recommendations have been made to the New England fishing industry relative to the nets, doors, and transducer system.

Rhode Island 3-90-R

David B. Thomson

Completed 1969

Assessment of the efficiency of the Danish Vinge trawl over conventional New England drag nets - Fishing trials have been completed with the Danish Vinge trawl in Rhode Island waters. The trawl was modified to fish off-bottom primarily for sea herring and alewife. Daily catches averaged 40,000 pounds per vessel and exceeded the catches of the conventional New England bottom trawl. Vessel owners were impressed over the catches with the vinge trawl and have ordered several trawls. Results of this study have been made available to the New England fishing industry.

South Dakota 4-37-D Donald Warnick \$1,800

Commercial fishing gear research and development for lakes and reservoirs in South Dakota - The catch data from floating trap nets constructed in 1968 will be compared with catches from gill nets and frame nets normally used by commercial fishermen. These data will be evaluated to determine the most efficient methods of harvesting buffalo, carp, carpsucker, and bluesucker.

Tennessee 4-5-R Harry L. Hargis Completed 1968

Development of improved fishing methods for use in south-eastern and south central reservoirs - Haul seines and trap nets were tested to determine their effectiveness in harvesting commercial fish species such as carp, buffalofish, and suckers.

Virgin Islands 2-33-R Arthur E. Dammann \$27,333

Study of the fisheries potential of the Virgin Islands - Very little basic ecology and oceanography have been done on the fisheries in the Virgin Islands. The commercial fishery is still carried on by a high percentage of "pot" fishermen, and the quality of the product they supply the consumer is nearly always substandard. Under this project, methods of harvesting and handling that have practical value in improving the fishery are investigated. Also, the extent to which long-range fishing is feasible is considered.

Washington 1-39-D Allan E. Millikan \$13,750

Mid-water trawl fisheries management investigation - A new commercial fishery for Pacific hake began along the Washington coast during the fall of 1965. This project provides for the collection of statistical data on the fishery off the Washington coast, and continuing experimental and exploratory fishing with mid-water trawl for harvesting hake and other species in commercial quantities in Puget Sound.

#### EXTENSION SERVICE

Nine extension-type projects have been approved and funded under the Federal Aid Program. Of these, five deal with the preparation and distribution of an estuarine film and four provide industry with current information.

Alabama 2-58-D	Johnie Crance	\$7,900
Florida 2-50-D	Harmon Shields	7,900
Louisiana 2-57-D	Theodore Ford	9,100
Mississippi 2-59-D	William Demoran	7,900
Texas 2-48-D	Terrance Leary	9,500

Gulf of Mexico estuarine film - The five Gulf States and the Bureau of Commercial Fisheries are cooperating in the preparation and distribution of a 28-minute, color, sound motion picture film showing the values and problems facing our nation's estuaries. A 12-minute film is also being prepared.

Maine 3-13-D Donald M. Harriman \$20,000

Maine marine fisheries extension service - There is much fisheries research, in progress and completed, of which industry is unaware. This project is undertaken to disseminate information about the various commercial fisheries to the fishing industry along the coast of Maine and to potential members of the industry.

Maryland 3-71-D William Sieling \$22,200

Maryland marine fisheries extension service - The purpose of this project is to disseminate to the fishing industry of tidewater Maryland and the elected legislative officials of the State current information relating to: (1) applicable results of scientific investigations, (2) technological developments, (3) marketing opportunities, and (4) managerial policies and the reasons for their adoption. The State feels that the potential productivity of Maryland waters greatly exceeds the \$13 million dockside value of fishery products harvested in 1965.

Massachusetts 3-60-D H. Arnold Carr \$16,100

Shellfish extension - The aim is to improve the shellfish resources along the Massachusetts coast. Technical assistance and advice are provided to town and regional shellfish management programs. This project encourages management practices such as raft culture of oysters, collection and redistribution of spat, reseeding operations, predator control, and other activities designed to increase harvests.

Puerto Rico 2-71-D Rolf Juhl \$9,000

Training of fishermen for the tuna industry - The purposes of this project are to train Americans for commercial tuna fishing and create a cadre of fishermen for high-seas and distant water fishing operations. Arrangements have been made with the Puerto Rican-based purse seine fleet operators to employ trainees for a period of 6 months. Trainees will work in all phases of tuna fishing.

#### MARKET DEVELOPMENT

Seven projects have been approved and funded under the Federal Aid Program. These projects are designed to develop and promote the consumption of fishery products.

Florida 2-11-D H. W. Shields \$333,625

Marketing - This project is promoting greater consumption of Florida seafood throughout the Southeast and other areas of the Country through distribution and development of visual educational materials, new products, and new recipes. The main seafood resources in need of new markets are shrimp, crab, mullet, and Spanish mackerel.

Illinois 4-35-D Maxine Walzer \$7,200

Consumer education and market development - The general aims of this project are to develop and disseminate materials showing nutritional and economic advantages of feeding fishery products in State institutions, hospitals, and volume-feeding establishments; and provide consumer education for the purpose of increasing consumption and demand for domestically produced fishery products.

Maine 3-24-D George H. Taylor \$45,000

Promotion and market development - Three steps are being taken to promote public knowledge and awareness of a variety of Maine seafoods, particularly sardines, shrimp, and soft-shell clams, and to develop the industry through expanded markets and increased sales. These are: (1) production of a promotion and educational film featuring Maine seafoods, (2) expansion of food shows and related exhibitions, and (3) distribution of educational materials to chain stores, supermarkets, and other retail outlets.

Maryland 3-66-D Gordon P. Hallock \$185,000

Market development for Chesapeake Bay seafoods - Under this project, Maryland is working closely with the seafood industry and users to effect greater use of Chesapeake Bay seafoods by volume-feeding establishments and the general consumer. Educational materials such as video tapes, films, and recipe booklets suitable for restaurant and retail store seafood promotions are developed.

Massachusetts 3-50-D Frank Grice \$120,000

Consumer education and market development - The overall object of this project is to promote greater national use of northwest Atlantic seafoods and thus improve the economy of the New England fishing industry. A major effort is being made through a program of consumer education that is patterned after the highly successful promotion of the sea scallops landed in New Bedford.

Texas 2-62-D Terrance Leary 65,000

Seafood marketing - To promote greater sale of Gulf seafoods, Texas is undertaking a combined

consumer educational, market development, and market promotional program in cooperation with industry, Federal agencies, and other State agencies. This program will be accomplished mainly through the development and distribution of educational materials such as video tapes, films, recipe leaflets, cookery demonstrations, and exhibits.

Virginia 3-69-D Fred W. Rawlinson \$40,000

Consumer education and market development - Through the use of newspapers, radio, and TV media, promotional materials, and public relations, the Virginia Commission of Fisheries is promoting greater use of Central Atlantic seafoods on a national and area basis, and thereby improving the economic position of the seafood industry.

#### OPERATION AND MAINTENANCE

Four operation and maintenance projects have been approved and funded, of which three are for Pacific salmon hatcheries and one for a marine laboratory.

New York 3-95-D David Wallace \$28,300

Operation and maintenance of marine laboratory - This project provides operational funds for the newly constructed marine laboratory at Flax Pond. The laboratory, built under project 3-10-C, includes wet and dry laboratories along with salt- and fresh-water systems and related equipment.

Oregon AFC-22 Austin Magill Completed 1968

Production and distribution of anadromous salmonids from the Alsea River salmon hatchery - Unfed fingerlings and excess adult salmon from the Alsea River hatchery in Lincoln County are released to populate areas made available by the State's stream clearance program and other areas having rearing potential.

Oregon AFC-30 Austin Magill \$44,000

Hatch, rear, and release salmonids at the North Nehalem River salmon hatchery - This project supports operational costs of the North Nehalem salmon hatchery, which was expanded by the addition of six rearing ponds as a P. L. 89-304 activity. The North Nehalem River hatchery is located about 70 miles west of Portland in Clatsop County and is operated for production of coho and fall chinook salmon and for the distribution of the fingerlings into the North Nehalem River and adjacent waters.

Texas 2-88-C Terrance R. Leary \$22,500

Dredging boat and water intake channels - This project provides for dredging the boat and water intake channels at the Coastal Fisheries Experiment Station near Palacios, Calhoun County. The station was constructed under the Federal Aid Program. (Texas 2-14-C)

Washington AFC-1 Marshall Thayer Completed 1967

Salmon rearing operations - This project permitted full operation of 11 State-owned salmon hatcheries from July 1, 1966, to June 30, 1967. The Cooperator estimated that 264,375 coho and 145,425 chinook salmon thus would be made available to the fisheries which would otherwise have been lost.

#### RESEARCH

A total of 209 research projects has been approved and funded. Of these, 14 are concerned with research on the environment, 44 deal with fresh-water finfish, 80 involve marine finfish, six are concerned with jellyfish, and 65 are concerned with research on shellfish. To date, 50 research projects have been completed and 59 are continuing.

##### Environment

Fourteen research projects, mainly concerned with inventories of the estuaries and the effect alteration of the environment has on the fish and other communities, have been approved and funded.

Estuarine:

Alabama 2-34-R Johnnie H. Grance \$77,000

Cooperative Gulf of Mexico estuarine inventory (Alabama) - This study of the estuarine area of Alabama is part of a Gulf of Mexico estuarine inventory in cooperation with other Gulf States and the Bureau of Commercial Fisheries. The inventory includes the physical and biological characteristics of each estuarine zone to the 10-fathom isobath and consists of four phases: area description, hydrology, sedimentology, and biology.

Florida 2-53-R Edwin A. Joyce, Jr. \$24,000

A study of the effects of a commercial hydraulic clam dredge on benthic communities in estuarine areas - In Tampa Bay, Indian River, Apalachicola Bay, and Ten Thousand Islands, the effects by hydraulic dredging on finfish, crustaceans, and invertebrates important in the fisheries food chain in estuarine areas are investigated.

Louisiana 2-22-R J. D. Broom \$244,700

Ecology of Louisiana's estuarine waters - This project is undertaken to: (1) study the composition, general distribution, and relative abundance of the commercially (or potentially) important marine fauna in the estuaries and near offshore waters of the Louisiana coast, as well as ecological factors influencing this fauna, and (2) to determine possible means of preserving the estuarine areas.

Maryland 3-26-R D. W. Pritchard Completed 1967

Studies of the physical and chemical properties of the estuarine environment associated with fish kills - A monitoring program by the Johns Hopkins University provided several hundred temperature, salinity, dissolved oxygen, and pH observations on upper Chesapeake Bay. Also, surveys of fish kills and studies of blue crab movements were made in cooperation with the monitoring program.

North Carolina 2-9-R Austin R. Williams Completed 1967

Studies on macroplanktonic crustaceans and ichthyoplankton of the Pamlico Sound complex - Data are obtained on how relative abundance and movement of larval shellfish and marine finfish are related to environmental changes caused by phosphate mining and other engineering projects.

Texas 2-12-R Roy B. Johnson, Jr. \$21,647

An evaluation of the effects of estuarine engineering projects - Physical and biological data are obtained on how various engineering projects affect the ecology of Galveston Bay.

Virginia 3-19-R Edwin B. Joseph Completed 1967

Characteristics of coastal estuarine fish nursery ground as natural communities - The features of low-salinity nursery areas of the York River estuary suitable for larval and juvenile fishes of the coastal area are described. Also, the distribution and abundance of several important species were determined.

Fresh-water:

Kentucky 4-48-R Hunter M. Hancock \$9,000

Influence of the effluent from a concentrated industrial complex on a large river - Murray State University has undertaken a 2-year study to determine how effluent released into the Tennessee River affects the distribution of fish, water quality, and the chemical composition of bottom muds, benthos, and fish tissue.

Ohio AFCS-1<sup>1/</sup> C. E. Herdendorf \$40,000

A study of the physical characteristics of the major reef areas in the western basin of Lake Erie - The Ohio Geological Survey, in cooperation with the Geological Survey of Canada,

<sup>1/</sup> Jointly administered and funded by Bureau of Commercial Fisheries and Bureau of Sport Fisheries and Wildlife

is making a marine seismic profiling survey in the western basin of Lake Erie. Seismic coverage, totaling 818 miles, is obtained about every 5 minutes of latitude and longitude west of Point Pelee in both Canada and United States waters.

Marine:

Georgia 2-75-R Charles M. Frisbie \$28,800

Habitat improvement and ecological classification of oyster growing areas - This project is undertaken for development of oyster beds on barren mud flats by substrate stabilization. Ecological classification of the beds is based on physiological effects of water temperature, salinity, and organic content upon oyster growth.

Maryland 3-30-R Gerald Schubel \$34,000

Suspended sediments in the Upper Chesapeake Bay - Suspended materials are collected monthly at the surface, middepth, and near the bottom at each of 31 stations in the Upper Chesapeake Bay from the Susquehanna River mouth to Pooles Island. The properties of the suspended materials are used to determine the relative importance of the several origins. Chesapeake Bay Institute, Annapolis, does the field work.

Maryland 3-56-R Charles H. Southwick \$14,800

Biologic and environmental control of Eurasian milfoil (Myriophyllum spicatum L.) in Chesapeake Bay - Excessive milfoil growth is an environmental problem that affects fish population abundance and growth and the proper utilization of fishery resources. This project is a biological study of Eurasian milfoil in upper Chesapeake Bay and tributaries, including Middle River, Seneca Creek, Back River, Saltpeter Creek, West River, and Rhode River. The aim is to find a means of biologic control.

Mississippi 2-42-R J. Y. Christmas \$46,500

A seasonal study of nektonic and benthic faunas of the shallow Gulf off Mississippi out to the fifty fathom curve - Monthly semiquantitative collections are made of the benthic fauna and the floating components, chiefly neuston, in the water layer of the Gulf off the Mississippi Gulf out to 50 fathoms. Together with the current work in the bays and sounds, this study will cover the marine-estuarine littoral and shore fishes and crustaceans of economic importance on the Mississippi coast.

Mississippi 2-25-R J. Y. Christmas \$108,000

Cooperative Gulf of Mexico estuarine inventory and study, Mississippi - This study of the estuarine areas of Mississippi is part of a Gulf of Mexico estuarine inventory in cooperation with other Gulf States and the Bureau of Commercial Fisheries. The inventory includes the physical and biological characteristics of each estuarine zone to the 10-fathom isobath and consists of four phases: area description, hydrology, sedimentology, and biology.

Finfish(fresh-water)

Forty-four research projects have been approved for work on fresh-water finfish. Of these, 37 are continuing and seven have been completed. Emphasis is on channel catfish and in pond and reservoir fish culture.

Channel catfish and bullhead:

Arkansas 4-49-R Richard A. Collins \$14,600

Rearing single and multiple species populations of catfish in cages - The application of cage-rearing techniques to large reservoir lakes and smaller private lakes is the purpose of this study. Channel and blue catfish are stocked in the same cage and in individual cages to determine growth, oxygen levels, food conversion, and behavior of mixed populations. State College of Arkansas is making this study at Lake Beaverfork.

A study of the nutritional, physiological, and economical requirements for the production of channel catfish in an intensive running water culture - This study at Skidaway Institute of Oceanography, University of Georgia, is designed to evaluate the interactions of environmental and dieting factors on growth, health, body composition, and economic aspects of channel catfish production. Environmental variables will include water flow, aeration, stocking rates, water temperature, and light conditions. An attempt will be made to estimate the dietary requirements of various nutrients in this type of production.

Illinois 4-32-R

William M. Lewis

\$15,593

Feeding-out catfish in cages - The University of Southern Illinois has this project underway to determine the feasibility of stocking yearling channel catfish in cages in infertile lakes such as stripmine lakes and producing marketable size fish by feeding them daily.

Illinois 4-51-R

William M. Lewis

\$14,100

Considerations in the commercial production of channel catfish in cages - Channel catfish are reared in cages anchored in ponds at Southern Illinois University to determine the carrying capacity of different size ponds, optimum number of fish per cubic yard, optimum cage depth, value of mechanical aeration, and variations in fish growth.

Kansas 4-1-R

Roy E. Schoonover

Completed 1968

Investigation on digestion and metabolism of the channel catfish - Six ponds at the Tuttle Creek Fisheries Research Laboratory near Manhattan are each stocked with 300 age class II channel catfish. Fish in three ponds are fed formulated fresh-water fish meal, and fish in the other three ponds are fed formulated marine fish meal. At 2-week intervals the fish populations are sampled to study growth under various feeding regimes during various seasons.

Kansas 4-45-R

Roy E. Schoonover

\$28,000

Investigations on nutrition and metabolism of catfish and utilization of fisheries products - This study, subcontracted to Kansas State University, will provide additional information on the nutritional factors affecting channel catfish. Carbohydrate and energy utilization during feeding, during the period of nonfeeding, and under varying temperature conditions are being studied. Experiments on protein metabolism are also underway.

Kentucky 4-27-R

Hunter M. Hancock

\$14,000

Catfish fishery investigations - Murray State University Biological Station is making these studies on Kentucky Lake from Kentucky Dam to the Tennessee State line. Various size hoop nets are fished under different conditions to determine how efficient and selective these nets are in catching channel and blue catfishes. The station is also studying the growth and abundance of these fish.

Minnesota 4-44-R

Charles Burrows

\$5,000

A physiological study of thermal stress in channel catfish - This study is primarily concerned with how temperature changes in rivers affect the catalytic properties of heptic catalase enzyme in channel catfish. An attempt is made to characterize this enzyme in the livers of fish taken from thermally unpolluted waters.

Ohio 4-6-R

Russell Scholl

\$16,200

Lake Erie commercial fisheries research - Studies are underway in Sandusky Bay of Lake Erie to investigate methods of predicting the harvestable crops of channel catfish and white bass, and properly harvesting these resources. Biological data and life history information are collected, and gill net selectivity is investigated.

South Dakota 4-49-R

Charles Backlund

\$3,700

Effects of intensive bullhead removal in selected lakes in eastern South Dakota - The shallow fertile lakes in counties east of the Missouri River are fished continuously with bullhead pickets to reduce the bullhead populations to the lowest level possible. Measurements are

made to determine how their removal affects their population structure and to determine what percentage of the younger bullheads must be removed to produce a vigorous population.

Lake herring:

Minnesota 4-8-R Charles R. Burrows \$9,200

Minnesota commercial fisheries improvement - western Lake Superior - The University of Minnesota is making this study to obtain life history information on species associated with the lake herring. Of special interest are food habits, distribution, and abundance.

Lake trout:

Michigan 4-2-R Myrl Keller \$32,780

Surveillance of lake trout restoration in Michigan waters of Lake Michigan - This project is undertaken to assess and describe conditions of lake trout stocks. Investigations are confined to the northerly areas of the Lake where hatchery-produced lake trout are being released and where sea lamprey control efforts began.

Minnesota 4-38-R Charles Burrows \$12,500

Lake Superior commercial fisheries assessment studies - The primary aim of this work is to ascertain the condition of the lake trout and other commercial fish stocks in Minnesota waters of Lake Superior. To meet this aim, the progress and effectiveness of sea lamprey control in local areas and the survival and dispersal of stocked lake trout are investigated. The abundance and distribution of other commercial fish populations, as well as the commercial production, are also investigated.

Wisconsin 4-7-R Ronald Doff \$30,000

Assessment of lake trout restoration in the Wisconsin waters of Lake Michigan - This project is a part of the broad assessment of fish populations, including lake trout, in Lake Michigan. Fish samples, scales, stomachs, and other biological data, as well as statistical records of the fisheries, are collected in Wisconsin waters of Green Bay and Lake Michigan.

Rainbow trout:

Utah 6-10-R Clair B. Stalnaker \$18,840

Investigation of the intensity of natural selection upon different phenotypes (blood types) of rainbow trout in commercial trout rearing ponds and reservoirs - The work is carried out at the Utah Fish and Game Department's Experimental Fish Hatchery at Logan and the Utah State University Fisheries laboratory. Information is obtained on blood groups among the breeding stock of rainbow trout used as brood stock for the fingerlings that are given commercial trout farmers. Also established are tests that will provide information on the genetic control of the blood types found. The major aim is to eliminate undesirable genotypes from the breeding population.

Walleye:

Wisconsin AFC-2 Russell Daly Completed 1967

Walleye population study in respect to a possible commercial fishery - Walleye were tagged and released between Port Wing and Superior Harbor on Lake Superior to estimate population size and to observe migration. Age and growth determinations were made by examination of scales.

Others:

Arizona 6-1-R W. L. Minckley \$9,363

Investigation of commercial fishery potential in reservoirs - This project is undertaken to investigate populations of buffalofish, carp, and threadfin herring in reservoirs in central

Arizona and lower Colorado River. The purpose is to determine the feasibility of harvesting these fishes on a sustained commercial basis. Production and marketing possibilities for the products are surveyed.

Colorado 6-2-D

Robert E. Vincent

\$26,250

Raising bait fishes in the Rocky Mountain States - The fathead minnow, Pimephales promelas, which is native to Colorado, is considered for commercial production and sale as bait minnow in the Rocky Mountain area. Growth and mortality of this species as influenced by population density in experimental ponds are investigated.

Illinois 4-33-R

William M. Lewis

Completed 1969

Investigation of problems associated with the confinement of warm-water fishes in holding tanks - The purposes of this study are to determine whether oxygen levels affect the occurrence of epizootics of pathogens in holding tanks and whether temperature manipulation may control the epizootics. Fisheries Research Laboratory of Southern Illinois University, Carbondale, does this work.

Illinois 4-36-R

George W. Bennett

\$12,070

Physiological and behavioral relationships among species of fishes - Channel catfish, golden shiner, and tilapia are isolated as individual species, as well as combined in separate combinations, to observe growth rate. Conditions of direct antagonistic behavior and of metabolic or hormonal action within and between these species are observed, also. Sam A. Parr Fisheries Research Center, Marion County, does this work.

Indiana 4-16-R

Darryl Christensen

Completed 1968

Inland waters commercial fisheries studies - Studies were completed on the Wabash and White Rivers to evaluate the efficiency, extent, and harvest by commercial fisheries. Tests were also made of the harvest potential of D-nets and hoop nets.

Indiana 4-43-R

James J. Barry

\$34,300

Inter-species relationships of fish in Indiana waters of Lake Michigan - This project is designed to determine how long salmon inhabit the Indiana waters of Lake Michigan and to determine their behavioral pattern with other fish species. Collections of fish will be made with gill nets and trawls, and fish will be inspected aboard commercial vessels.

Iowa 4-11-R

Harry M. Harrison

\$27,334

Industrial and commercial food fish investigations - Evaluations are made of utilization of carp and buffalofish as food fish and gizzard shad and suckers as pet food or for protein additive in livestock feed.

Maryland AFC-3

Ralph A. Bitely

\$108,950

Stream improvement program for anadromous fish management - This project includes activities that range from a basic survey of all Maryland streams that provide or have a potential for providing spawning habitat for anadromous fish to their ultimate improvement and maintenance. Obstructions to free passage of fish are corrected where practicable. For streams where biological information is lacking or perhaps obsolete, an inventory of biological productivity is obtained.

Michigan AFC-1

Myrl Keller

Completed 1967

Appraisal of stocks of anadromous fishes in the Michigan waters of the Great Lakes - Scientific gear was purchased for the Michigan Department of Conservation's new research vessel Steelhead for research on commercial species in Lake Michigan.

Michigan AFC-7	L. N. Allison	\$105,110
<u>Parasites, diseases, and disease control of Great Lakes anadromous and commercial fish</u> - This project is a part of a large research program on fish parasites and fish diseases at Michigan's State Fish Pathology Laboratory at Grayling. It is a study of red worm of yellow perch and of bacteria associated with seasonal mortality of the alewife.		
Michigan AFCC-3 1/	Raymond D. Schofield	\$40,000
<u>Great Lakes fish resource development study</u> - This project is undertaken to develop a study outline for an evaluation of the current fisheries management programs on Lakes Huron, Michigan, and Superior.		
Minnesota 4-39-R	Charles Burrows	\$12,427
<u>Minnesota commercial fisheries improvement</u> - Factors determining the commercial catch of burbot, sauger, tullibee, and yellow pike in the American waters of Lake of the Woods are investigated. Catches are examined to determine the condition of the fish and size groups harvested.		
Minnesota AFC-2	Richard Hassinger	Completed 1968
<u>Anadromous fish habitat development</u> - A survey was made of the needs for improvements of spawning habitat and streams used by Great Lakes fish that enter streams tributary to the North Shore of Lake Superior.		
Montana 1-19-D	James L. Cooper	\$27,000
<u>Fort Peck Reservoir fishery investigation</u> - This project provides for complete inventory of the fish populations in the Fort Peck Reservoir and an investigation of methods for selective fishing by local fishermen. Commercial species harvested include carp, buffalofishes, goldeye, catfish, burbot, suckers, and yellow perch.		
Nebraska 4-4-R	Robert E. Thomas	\$27,334
<u>Establishment of the seasonal distribution and availability of commercial fish species in the waters of Nebraska</u> - An electrical barrier and trap are used to collect fish on the North Platte River about 2 miles upstream from McConaughy Reservoir. Numbers, weight, time of capture, age composition, and sexual maturity are recorded for all species captured.		
Nevada 6-9-R	James E. Deacon	\$107,778
<u>Rearing bait fishes in the desert Southwest</u> - This project is designed to determine the present volume and value of baitfish by species and the present sources and capability for expansion and to estimate future market needs based on present and projected visitor-use of the Lake Mead Recreation Area. Nevada Southern University is making this study.		
New Mexico 6-11-R	Douglas B. Jester	\$15,000
<u>Investigation on commercial fishery potential of rough fish species</u> - New Mexico State University is gathering and analyzing data to determine the feasible utilization of underused fish species in Elephant Butte and Caballo Reservoirs. The population structure, growth characteristics, seasonal movement, concentrations, and harvest methods for the buffalofishes, river carpsucker, carp, and gizzard shad are being investigated.		
New York 3-9-D	Fred Tingley	\$24,000
<u>Management planning for New York freshwater commercial fisheries</u> - The purpose of this project is to develop plans for expanding the fisheries for whitefishes, lake herring, American eel, American smelt, carp, American shad, striped bass, and bait minnows in the St. Lawrence River, Lake Erie, and interior waters.		

1/ Jointly administered and funded by Bureau of Commercial Fisheries and Bureau of Sport Fisheries and Wildlife

North Dakota 4-17-R John Owen \$8,000

Garrison Reservoir commercial fisheries investigations - The life history of bullheads, goldeye, and yellow perch are being studied. Also investigated is the behavior of these fish in response to physical factors, such as turbidity, which are associated with reservoirs.

North Dakota 4-23-D Dean Hildebrand Completed 1967

A survey of commercial fisheries on the mainstem reservoirs of the Upper Missouri River System - To determine possible expansion of the commercial fisheries, the University of North Dakota has investigated Fort Peck Reservoir of Montana, Garrison Reservoir of North Dakota, and Oahe and Fort Randal Reservoirs of South Dakota.

North Dakota 4-30-R John Owens \$12,000

A study of the commercial fishery potential of Lake Ashtabula - This study is designed to study the movements, growth, and population structure of bullheads and yellow perch. Population density and rate of growth before and after harvesting are investigated also.

North Dakota 4-54-R John Owens \$3,000

Investigation of gonadatrophins in stimulating spawning and white suckers - North Dakota University has underway studies of the development of techniques for using pituitrin to induce spawning of white suckers.

Ohio 4-47-R William M. Tidd \$16,000

The status of whirling disease in Ohio waters - This project is designed to determine if whirling disease exists in Ohio salmonids in private and public waters, if spores are present, and by what methods the disease is transmitted.

Oklahoma 4-24-R Robert Summerfelt \$26,300

Commercial fisheries investigations - The relation between sediment type and the distribution and abundance of invertebrates and fishes is studied at Lake Carl Blackwell. Sediment surveys are made semiannually at five selected sites along each of 30 transects across the lake. Biological and hydrographic data are also collected. In addition, the food habits of commercial fishes from five reservoirs are being studied.

Pennsylvania 3-67-R Keen Buss \$60,000

A study to establish a program to increase the production of high value commercial fishes in Lake Erie - This project involves a study of the life history of the walleye, attempts to locate and propagate blue pike, and to conduct experimental coho salmon stocking program. It also provides equipment for a research vessel to study these fish and their environment in the Eastern Basin of Lake Erie.

Vermont 3-59-R Jon K. Anderson \$5,000

Investigation of commercial fisheries potential of Lake Champlain - Information is obtained on the number and activities of live bait supplies along the lake to determine the economic value of the bait industry and seasonal demand for specific types of bait. This study is also concerned with the relative distribution and abundance by species and weight of existing fish populations which may be harvested commercially.

West Virginia 3-58-R Roger Schoumacher \$10,250

Investigation of the commercial potential of fishery resources in West Virginia - This study is designed to investigate the commercial potential of channel catfish and mussels along the Ohio and Kanawha Rivers. The catch of nets set at selected locations along the Ohio River is evaluated for size and age composition of the catfish population. The source and type of pollution that affects the flavor of these fish are also being studied.

Commercial potential of non-game species in impounded waters - University of Wyoming is making population studies at Ocean Lake and Seminoe Reservoir to estimate the potential abundance of nongame fish species, primarily carp and white sucker.

### Finfish(marine)

Eighty projects have been approved and funded for research on marine finfish. Of these, 18 have been completed and 62 are continuing. Emphasis is on Pacific salmon, American shad, alewife, and striped bass.

#### Alewife and blueback herring:

Connecticut AFC-3 William Lund, Jr. \$14,500

Investigation of the life histories and potential fishery of river herrings in Connecticut - Alewife and blueback herring are captured by 500-foot seine in lower Connecticut River, marked with polystyrene dye, and released to observe migratory behavior. Ovarian samples are collected before and after spawning for fecundity studies. Observations are made also on growth and distribution of the young fish in fresh water.

Connecticut 3-45-R William Lund, Jr. Completed 1968

Investigation of the life histories and potential fishery of river herrings - This project, initially funded under P. L. 88-309, has been transferred for funding under P. L. 89-304. See Connecticut AFC-3.

Maine AFC-2 Frederick T. Baird, Jr. \$24,000

Increased development of the commercial anadromous fishery resources of Maine - Published material on the condition and potential for improvement of the State's anadromous fishery resources, especially alewife and blueback herring, is updated through physical reconnaissance and biological field survey on coastal streams.

Virginia AFC-1 Jackson Davis \$160,000

Biology and utilization of anadromous alewife - Life history, biology, and utilization of alewife and blueback herring are studied in the tidal rivers of Virginia, including the James, York, and Rappahannock, to determine the additional fishing pressure the stocks can withstand without endangering the resource.

Wisconsin AFC-4 Maria V. Boyles \$8,000

A comparative study of the thyroid, interrenal, and gonadal activity in alewife - Histological examination is made of thyroid tissue of fresh-water alewife to observe seasonal change in activity in the gland. Seasonal variations in interrenal activity and blood serum hormonal concentrations are investigated also.

Wisconsin AFC-5 Carroll R. Norden \$18,500

An investigation of the reproductive cycle of the alewife in Lake Michigan - The growth and maturation of the gonads of alewife collected from Lake Michigan are studied. Histological preparations of the gonads are used to describe and compare developmental stages as they occur in young-of-the-year, age group I, age group II, and older fish.

Wisconsin AFC-6 A. M. Beeton \$16,052

Study of the population dynamics of juvenile and coregonids in Green Bay, Lake Michigan - This project provides for construction and testing of experimental trap nets for determination of distribution and relative abundance of juvenile alewife and coregonids throughout Green Bay of Lake Michigan.

American shad:

- Connecticut AFC-1 William Leggett \$4,000  
A study of the rate and pattern of shad migration in the Connecticut River utilizing sonic tracking apparatus - Twenty-seven shad were marked with acoustic tags and tracked for varying distances in the Connecticut River to determine their rates and patterns of movement. Tracking emphasis was in the outfall area of the Connecticut Yankee Atomic Power Company atomic plant at Haddam Neck located in the center of the commercial fishing area. Individual fish were tracked continuously for periods up to 56 hours; contact was reestablished with some fish after initial tracking had been discontinued.
- Delaware AFCS-1<sup>1/</sup> Charles Lesser Completed 1968  
Feasibility of the restoration of the shad runs in the tributaries of the Delaware estuary - Fertilized shad eggs from the Susquehanna River stock were hatched in boxes placed in Brandywine Creek, tributary to Delaware River, to determine suitability of the stream for shad restoration. This creek originates in Pennsylvania and enters the Delaware at Wilmington.
- Florida AFC-2 Martin Moe, Jr. \$30,000  
Investigations on the American shad in the St. Johns River - Abundance, seasonal migration, spawning activities, and other pertinent biological information are determined for American shad in the St. Johns River. An assessment of the possible effects of silt, pollution, physical disturbances, and fishing pressure is attempted also.
- Georgia AFC-1 Walter F. Goodwin Completed 1968  
Shad fishery of the Altamaha River, Georgia - The estimated weight of the shad population entering the Altamaha River, the fishing rate, and age composition of the commercial catch are determined. Factors affecting production are investigated also.
- Georgia AFC-6 Walter F. Goodwin \$28,000  
A study of the nursery areas and biology of juvenile anadromous fishes of the Altamaha River, Georgia - The distribution and relative abundance of juvenile anadromous fish, primarily American shad, in the Altamaha River system are determined. Also, primary and secondary nursery areas are mapped.
- New Jersey AFCS-1<sup>1/</sup> Ronald White, Jr. Completed 1968  
Population and migration of major anadromous fish - American shad were captured with gill nets in upper Delaware Bay and lower Delaware River, marked with Peterson disc tags, and released to obtain information on migration and origin of the stocks in the fishery. Most of the recaptures were made outside Delaware Bay and as far north as the St. John River, New Brunswick, Canada.
- Oregon 1-38-R Arthur L. Oakley \$12,000  
Biology of Columbia River shad and the development of selective commercial fishing gear - Since little is known about shad in the Columbia River and no studies have been made since the early 1950's, this study will provide current information on the status of this available resource. Studies of life history and of the reproductive potential and natural mortality of this species are being made. Development of selective commercial fishing gear and methods also will be necessary to allow the salmon to escape.
- Oregon AFC-10 Robert Loeffel \$8,800  
Shad and striped bass management study - Data needed to manage the shad and striped bass fisheries, such as catch, effort, age and sex composition of the catch, and spawning history, are obtained in Oregon coastal streams. In addition, about 1,000 adult shad in the Umpqua and Smith Rivers are marked with spaghetti tag to obtain information on upstream migration.

<sup>1/</sup> Jointly administered and funded by Bureau of Commercial Fisheries and Bureau of Sport Fisheries and Wildlife

Feasibility study of the restoration of shad runs in the tributaries of the Delaware River estuary - Fertilized shad eggs were placed in hatching boxes throughout the Pennsylvania section of Brandywine Creek, tributary to Delaware River, to determine the suitability of the stream for restoration of American shad.

Pennsylvania AFC-4

David Daniels

\$15,000

Restoration of shad runs in the Brandywine Creek and its tributaries - This is a joint study with the State of Delaware to restore shad runs in Brandywine Creek by building ladders at dams and transplanting fertilized eggs in upper reaches of the stream.

Groundfish:

Maryland 3-21-R

Ted S. Y. Koo

Completed 1967

Determination of the distribution and abundance of the winter flounder, Pseudopleuronectes americanus - Adult winter flounder were caught from November through May in deep or channel hauls with trawl throughout Chesapeake Bay and river mouths, except in lower Patuxent River.

Massachusetts 3-38-R

Allen Petersen

Completed 1969

Identification of winter flounder subpopulations - Tagging information is evaluated and experimental otter trawl data are analyzed to define the limits of the winter flounder populations along Massachusetts coast.

Massachusetts 3-87-R

Phillip W. Coats

\$23,400

Winter flounder investigations - Knowledge of the contribution of estuarine winter flounder to the offshore fishery is needed to effectively manage and regulate this important fishery. Populations of juvenile and subadult flounders will be estimated by mark-and-recapture methods. Stratified random sampling with an otter trawl and plankton samples will be made in a selected area in Nantucket. Several types of tags for juvenile winter flounder will be evaluated under controlled conditions.

Oregon 1-4-R

Robert L. Demery

\$27,977

Investigation of the abundance and recruitment of bottomfish off Oregon, with emphasis on Dover sole - Data on fluctuations in abundance and year-class strength of Dover, English, and petrale soles and Pacific ocean perch are evaluated. Techniques for determination of spawning success and abundance are investigated also.

Washington 1-22-R

Gene DiDonato

\$72,000

Monitor condition of certain groundfish stocks, Washington trawl grounds - To obtain information on stock identity and migratory behavior of English sole, Pacific cod, and petrale sole, 5,000 to 10,000 fish of each species are tagged and released and biological data collected. The information obtained will be useful in international fishery negotiations.

Pacific Salmon:

Alaska 3-4-R

Daniel F. Hennick

\$70,500

Pink salmon forecast research - Each season the abundance of preemergent fry of pink salmon is sampled in about 20 streams in Kodiak area, 12 in Cook Inlet area, and 10 in southeastern Alaska. Based on an abundance index, annual forecasts are made of size of returning adult runs. The optimum escapement for selected streams is also studied.

Alaska 3-3-R

Robert Panfili

\$23,000

Kvichak River escapement study - Smoltling units are made as index for predicting the size of the returning sockeye salmon run and for estimating the optimum escapement for the Kvichak River and Bristol Bay area.

Methods, such as continued fyke net and metal trap fishing at index sites and operation of nets in the lower river, to evaluate the index project are considered.

Alaska 5-6-R Allen Davis \$47,000

Cook Inlet sockeye salmon investigation - Research is continued on annual downstream migration of sockeye salmon smolt, time of migration, and condition of the fish in the Kenai and Kaslof Rivers in an attempt to better understand the carrying capacity of the river systems. Information is obtained, also, on spawning grounds, age and sex composition of the catch, and escapement of sockeye salmon in Cook Inlet drainages.

Alaska 5-7-R Martin F. Eaton Completed 1967

Investigation of factors limiting the production of introduced sockeye in lakes - Sockeye salmon are introduced into Frazer Lake by installing ladders at obstructions in outlet streams and by planting adult fish and eyed eggs in potential spawning areas of inlet streams. Survival and growth of juveniles are investigated to evaluate factors limiting production in the lake system.

Alaska 5-8-R Kenneth Dewley \$22,800

Monitoring the effects of land use on salmon production - The U.S. Forest Service and the Alaska Department of Fish and Game have developed a monitoring program designed to detect environmental changes in streams before, during, and after logging. This project provides for continued monitoring of selected pink salmon streams in Southeastern Alaska.

Alaska AFC-2 Lyle Simpson \$49,000

Sockeye salmon migration behavior and biological statistics collection, Southeastern Alaska - Weirs are operated at Hugh Smith, Helta, Klawock, Chilkat, and Salmon Bays, and at Tahltan, Klakas, and Redfish Lakes to obtain racial and age data on sockeye salmon stocks and to make counts of the escapement. As a result of small catches, tagging studies to obtain information on migratory routes of the marked fish were abandoned after the 1967 season.

Alaska AFC-3 Robert S. Roys \$102,800

Restoration and rehabilitation of earthquake-damaged pink and chum salmon streams in Prince William Sound, Alaska - Restorative work has been completed on 28 of the 181 salmon streams that were damaged by violent topographic changes during the March 1964 earthquake in southeastern Alaska. Survivals of eggs and alevins are correlated with hydraulic data in the damaged zones and compared with similar data from "normal" zones.

Alaska AFC-4 James L. Mauney \$150,000

Offshore salmon abundance index - Gill nets and longline gear are fished 15 to 30 miles offshore between Yakutat Bay and Dixon Entrance to make short-term forecasts of the timing and size of the runs of chum, pink, and sockeye salmon as they near the inshore fisheries. The information provides industry with lead time for adjusting plant operations and disposition of the fishing fleet and gives the States data on which to base decisions for management of the runs.

Alaska AFC-6 Kenneth R. Middleton \$47,400

Bristol Bay intermediate high seas inshore test fishing program - Gill nets are fished between Port Moller and Cape Newenham to sample the sockeye salmon stocks and determine size, time, and age composition of the runs 6 to 8 days before the fish enter the inshore commercial fisheries. The study provides information useful for regulating the runs.

Alaska AFC-7 Michael F. Geiger \$94,600

Arctic-Yukon-Kuskokwim anadromous fish investigations - Tag and recovery projects are conducted in the Arctic-Yukon-Kuskokwim management areas to determine population sizes and escapements, destination, movements, and timing of different stocks of king and chum salmon and sheefish.

Alaska AFC-8

Roger F. Blakett

\$120,600

Kodiak Island sockeye salmon investigations - Research is continued on the five major Kodiak Island sockeye salmon stocks, which originate in Karluk, Red, Upper Station, Akalura, and Frazer Lakes. The purposes of the studies are to identify stocks, count escapements and smolts, and obtain data on such life history features as timing of runs and age and sex of adults. In addition, adult fish, fry, and eyed eggs are transplanted to tributary streams of Frazer Lake to supplement natural reproduction.

Alaska AFC-9

Jack Lechner

Completed 1968

Identification of red salmon stocks in the Cape Kumlik-Aniakchak Bay fishery (Chignik area) - Information was obtained on the origin of the red salmon stocks harvested by the Cape Kumlik purse seine fishery at Aniakchak Bay. In addition, data were collected on age composition of the fish runs and on the Aniakchak spawning system and stocks.

Alaska AFC-10

Robert S. Roy

\$96,400

Copper River sockeye salmon investigations - Salmon are tagged and released below and above Wood Canyon to assess escapement. Aerial and ground surveys of spawning areas are made to estimate the escapements and the use of the spawning areas. Sites for installation of electronic fish counters were surveyed also.

Alaska AFC-12

Richard W. Tyler

Completed 1968

Forecast of Kodiak Island pink salmon from abundance of juveniles in estuaries - This project is part of an overall study of the pink salmon runs to the Kodiak area by the Fisheries Research Institute of the University of Washington. Sampling methods currently used in forecasting were tested. Also, the feasibility of marking pink and chum salmon fingerlings was tested using sprayed fluorescent pigment.

Alaska AFC-13

Duane E. Pinney

\$33,700

Optimum escapement studies of Chignik sockeye salmon - Studies were extended to investigate the ecological association of young sockeye salmon and competitor species in two physically and biologically dissimilar lakes in the Chignik River system. The University of Washington does the work at their field station on Chignik Lake.

Alaska AFC-14

Daniel P. Hennick

\$34,000

Pink salmon forecast research - About 15 streams in the Chignik area of the Alaska Peninsula are sampled to obtain an index of the annual production of pink salmon fry. This index is useful in the forecast of the size of returning runs.

Alaska AFC-15

Robert C. Francis

\$24,000

Computer simulation model of the Dixon Entrance salmon stocks - A computer simulation model technique is used in a study of the Canada and United States salmon stocks and fisheries in the Dixon Entrance area of Southeastern Alaska and Northern British Columbia. It will be used as a tool to design tagging studies, to refine techniques for analyses of such tagging studies, and to test hypotheses of patterns of actual migrations.

Alaska AFC-16

Allen E. Davis

\$50,000

Escapement enumeration investigations - An electric fish counter is used to evaluate and improve counts of salmon escapements in clear water streams in Bristol Bay and the turbid waters of Kenai and Kasilof Rivers Cook Inlet. Counts from towers or the air are compared with those made by the electric counter.

California AFC-7

John Hayes

Completed 1968

Eel and Mad River anadromous fish water requirements - Surveys of salmon and steelhead trout

spawning and nursery areas in Van Duzen River and North Fork of Eel River were completed. Water requirements for seaward migratory juvenile salmonids and the relation between water discharge and usable spawning gravel were investigated.

California AFC-8

Richard Hallock

Completed 1968

Delta migration study - Behavior pattern of adult king salmon as influenced by stream flow and other selected physical factors were observed by electronic tracking during the movements of the fish through the San Joaquin River Delta. Eighty-eight fish were captured with trammel net in the lower river, marked with sonic tags, and released. Their upstream migration was observed by fixed recording stations. Dissolved oxygen and temperatures were recorded at key locations.

Oregon AFC-18

Wallace Hublou

\$235,000

Development and improvement of hatchery techniques for Pacific salmon and steelhead trout - Research is undertaken to improve the nutritional qualities and physical characteristics of pellets used to feed Pacific salmon and to develop methods for fish disease prevention, detection, and control in hatcheries. The work is being done at the Fish Commission's laboratory at Clackamas and at Oregon State University.

Oregon AFC-19

Robert Loeffel

\$38,600

Management of the troll salmon fishery with emphasis on the collection of data on shore and at sea for regulation formulation - The use of barbless hooks as a management tool in the troll salmon fishery and the radionuclide Zn<sup>65</sup> as an identification mark of Oregon-Washington coho salmon when mixed with salmon from other areas are investigated. In addition, catch statistics for the troll chinook and coho salmon fishery are collected and analyzed.

Oregon AFC-21

Ernest R. Jeffries

\$12,200

Increased production of anadromous salmonids in Oregon coastal streams and lakes - Coastal streams and lakes are surveyed to locate potential sources of hatchery water and salmon spawning and nursery areas, and to map barriers to fish migration. The streams and lakes are sampled, also, to determine numbers of young coho and chinook salmon in the nursery areas and to observe how the planted adults have survived and grown.

Oregon AFC-23

James D. Hall

\$22,400

Effects of logging on salmon populations in coastal streams - Data on spawning populations, juvenile survival, production, and yield of smolts from three coastal streams during one 7-year prelogging inventory are summarized for publication. Field data were collected on abundance of juvenile salmon after the area was logged. Also, studies began on factors that affect the rearing capacity of selected streams.

Oregon AFC-26

Robert Loeffel

\$81,000

Research and management on wild and hatchery-produced salmon and steelhead in Oregon south coastal streams - The status of Elk River fall chinook salmon stocks is studied to determine the effects of hatchery-produced fish on natural stocks. Coincident and similar studies are made on the adjacent Sixes River, which is the experimental control. Estimates of juvenile abundance are made in the streams in July and in the estuary in October. Size of spawning populations is calculated from tag and recovery program. Biological data such as growth of juveniles, age, composition, and timing of runs are collected. Competitive relation of young chinook and coho salmon is investigated, also.

Oregon AFC-39

Robert Loeffel

\$32,600

Salmon investigations in the Northern Oregon Coast - Results of hauling hatchery-produced adult and fry coho salmon to barren coastal streams and lakes and the planting of coho smolts into nonhatchery streams are evaluated.

Washington 1-18-R

Harry Senn

Investigation of effects of Grays Harbor waters on coho emigration - Marked yearling coho salmon are released in drainages of Grays Harbor to determine the differential in harvest

between the river systems. Marked coho are released, also, above and below suspected environmental "blocks" in the Grays Harbor Estuary to measure how the blocks affect fish emigration through such areas.

Washington 1-29-R Ray C. Johnson Completed 1967

Early marine life history - chum and pink salmon - Visual observations, beach seine, and traps were used to obtain information on distribution and abundance of pink and chum salmon fry in Puget Sound estuaries. A technique for mass marking of salmon fry with fluorescent dyes was investigated.

Washington 1-30-R Earle D. Jewell Completed 1968

Field recovery coded wire tag - This study has improved magnetic detectors for recovery of coho salmon marked by coded wire tag and developed tools and techniques to improve tag extraction. Field recovery tests have been conducted over a broad range of conditions in Puget Sound.

Washington 1-32-R Harry Senn \$16,000

Hatchery coho salmon--contribution to the fishery - As part of a hatchery evaluation program, the Washington Department of Fisheries released fin-clipped smolt coho salmon at 22 hatcheries on tributaries to Puget Sound and Columbia River. Stations participating in the evaluation program mark about 10 percent of their yearling production. Marked adult fish are recaptured at the hatchery racks by the hatchery personnel.

Washington 1-33-D Richard E. Noble \$32,000

Evaluation of dry feed for hatchery salmon - Dry fish feeds formulated from raw materials, including nonfood fish and kelp, as well as byproducts from milling and other food production, are tested and evaluated for hatchery-reared salmon.

Washington 1-37-R Peter K. Bergman Completed 1968

Analysis and publication of coded wire tag research data - Data on retention of coded wire fish tags are processed, and the information placed on data processing cards. Preliminary analyses are performed on most aspects of the study.

Washington 1-40-R Ray C. Johnson \$22,000

Larval and estuarial studies - pink and chum salmon populations - Egg and preemergent fry are sampled in Puget Sound streams and rivers to assess survival of chum salmon alevins to the swim-up stage. Density and abundance of the fry provide information for the prediction of the size of the adult run.

Washington AFC-12 Earle D. Jewell Completed 1968

Port Susan-Port Gardner pink salmon studies - During August and September 1967, 3,201 pink salmon were marked with Petersen disc tags and released in the Puget Sound (Port Susan-Port Gardner) commercial fishery near Everett. Tags from 657 recaptures were returned. Returns are analyzed to provide information on the origin, timing, and movement of the marked fish.

Washington AFC-13 Ernest Salo \$108,350

Measurement of spawning success and fry quality of chum salmon utilizing natural and controlled spawning areas in Big Beef Creek, Washington - A spawning channel is developed by modifying a small stream located at the University of Washington's Fisheries Research Institute station on Big Beef Creek about 2.5 miles north of Seabeck on Hood Canal in Kitsap County. It provides controlled conditions for studies of the survival rate and quality of salmon from egg deposition to emergence in areas where the ecological conditions of the spawning beds have been manipulated.

Washington AFC-14 Earle D. Jewell \$27,000

Gill net drop out study - Objectives of the original projects were, first, to determine the rate of salmon dropout for gill nets of various sized mesh and survival of salmon that escape gill nets, and, second, to develop a net to reduce such dropout. Only the first objective is accomplished for chinook and coho salmon in the Puget Sound fishery.

Steelhead trout:

Idaho 1-1-D Terry Holubetz \$14,400

Experimental rearing of steelhead trout at Hayden Creek ponds, Idaho - To determine maximum stocking density for ponds under varied conditions, smolts from eggs of the spring mid-Snake River steelhead trout runs are stocked at rate of 132,000 and 240,000 per acre and reared over a 1-year period at the Hayden Creek ponds. Additional research is underway on production of chinook salmon at the same facility.

Striped bass:

Alabama AFC-1 E. Wayne Shell \$30,000

Research on striped bass in Alabama Rivers - Methods of culturing fingerling striped bass for mass stocking at minimum costs are investigated at Auburn University. Fingerlings are reared on pelleted trout food and forage minnows in earthen ponds and metal troughs. About 575 of the hatchery-produced fingerlings were marked with spaghetti tags and by fin clips and released in Mobile Bay and Alabama River to study survival, growth, and migration.

Louisiana AFCS-1<sup>1/</sup> James T. Davis \$50,900

Ecological factors affecting anadromous fishes of Lake Pontchartrain and its tributaries - About 8,000 fingerling striped bass were released at four sites in the Tchefuncte River to evaluate the feasibility of establishing runs by planting hatchery-produced fish. Alabama shad and Atlantic sturgeon were collected with trawl and trammel nets in Lakes Pontchartrain, Borgne, and Maurepas, and with hoop net and electrofishing in tributary streams.

Maryland 3-27-R Ted S. Y. Koo Completed 1968

Tagging of juvenile striped bass, *Roccus saxatilis* (Walbaum) in Chesapeake Bay estuaries - Aquarium tests were made on the suitability of Carlin, dart, and straight wire tags for marking young-of-the-year striped bass. Several thousand juvenile striped bass were marked and released in upper Chesapeake Bay, C&D Canal, and Patuxent River to study migratory behavior and homing tendency.

Mississippi AFCS-1<sup>1/</sup> Gordon Gunter \$55,000

A study of striped bass, *Roccus saxatilis*, in Mississippi waters - Experimental stocking of hatchery-produced fingerling striped bass is undertaken in the Pascagoula, Biloxi Bay, St. Louis, and Pearl River systems to determine whether runs can be established in these waters. Some of the released fish are marked with spaghetti tags to obtain life history information.

North Carolina AFC-1 William W. Hassler \$20,000

The status, abundance, and exploitation of striped bass in the Roanoke River and Albemarle Sound, and the spawning of striped bass in the Tar River, North Carolina - About 600 striped bass are tagged and released in lower Roanoke River during the spawning season to estimate population size from catch returns. In addition, egg sampling stations are studied on the Roanoke and Tar Rivers to obtain information on the time, duration, and extent of striped bass spawning in each stream.

North Carolina AFC-4 R. E. Stevens \$20,606

Factors affecting survival of immature striped bass - Fry and fingerling striped bass reared in hatchery ponds fed primarily on *Cyclops*; therefore, the effects of certain chemicals and environmental factors on zooplankton abundance are investigated. The limits of water temperature, pH, and total dissolved solids at which immature striped bass survive are studied.

North Carolina AFC-5 James E. Sterling \$22,000

Offshore anadromous fish exploratory fishing program - Exploratory fishing is conducted along

the Outer Banks to determine the distribution and relative abundance of American shad, striped bass, and other anadromous fish. Fish will be marked and released to obtain information on migration and stock identity. Also, fish are sampled for size, sex, and age composition of the stocks.

Sturgeon:

New York AFC-4 Tom Jolley \$40,000

Evaluation of present and potential sturgeon fisheries of the St. Lawrence and adjacent waters - Condition, utilization, and potential of the sturgeon fisheries of the St. Lawrence River within New York and in the Eastern Basin of Lake Ontario are investigated. Also, information is obtained on nursery and spawning areas.

South Carolina AFC-1 John G. Leland Completed 1968

Survey of sturgeon fishery of South Carolina - Information is gathered on the fresh-water life history of the sturgeon, and an inventory is made of the fisheries in coastal streams and Wyanah Bay.

Others:

California 6-3-R John L. Baxter \$161,100

Fisheries resources sea survey - This project is concerned with the distribution, abundance, and present and potential use of the fishery resources in the coastal waters of California and Baja California, Mexico, south to Bahia Magdalena. The primary fishery resources are anchovy, mackerel, and sardine. Development and evaluation of fishing gear for capturing these species will be investigated.

California 6-7-R Diane Robbins \$55,500

Food habits study of organisms of the California current system - The aim of this study is to determine the food habits and requirements of fishes and cephalopods that inhabit the California current system adjacent to the coast. Stomachs of albacore, bonito, hake, rockfish, and squid are collected for analysis.

Georgia 2-32-R Charles W. Frisbie Completed 1966

Preliminary survey of existing and potential marine resources on the Georgia Coast - The diversity of Georgia's marine finfish and shellfish resources are examined, research needs identified, and project proposals for conservation and development of commercial fisheries are developed.

Hawaii H-4-R Henry M. Sakuda \$5,151

Management investigation of the akule or jack mackerel (Trachurus crumenophthalmus) - About 5,000 young akule are tagged with internal anchor tag and released off the southern coast of Oahu to obtain information on growth and migratory behavior. Commercial akule fishery catch statistics are collected, tabulated, and analyzed to determine trends in abundance.

Hawaii H-10-R Garth L. Murphy \$10,000

Handling baitfish in Hawaii - Physiological studies are continued on concentrations of lactic acid in the muscle of anchovy as a cause of mortality during captivity. Feeding and holding procedures that would permit indefinite confinement of this baitfish are investigated.

Maine 3-1 -R Frank W. Ricker \$23,000

The development of commercial fisheries estuarine resources - An inventory of marine plants and animals having potential for development of commercial fisheries in estuarine and in-shore waters is completed. Project emphasis is now on availability, abundance, and growth of Irish moss, and on the abundance of underutilized mussels.

Ecological study of Susquehanna River and tributaries below Conowingo Dam and their contribution to the anadromous fish populations of upper Chesapeake Bay and the development of methods to eliminate massive fish mortalities below Conowingo Dam - Observations are made on the migratory behavior of adult clupeids during their upstream movement into the Susquehanna River and two major tributaries, Deer Creek and Octopus Creek. Fish are captured by pound net at the river mouth, marked with anchor tag, and released. Weekly measurements are taken at five stations on water temperature, pH, conductivity, dissolved oxygen, and turbidity.

New Jersey 3-2-R

Ronald L. White

Completed 1968

Evaluation of the menhaden and shad fishery in Delaware Bay and adjacent waters - The purpose of this study was to determine whether food fish are taken by the menhaden fishery, if nets damage oyster bottom, whether a "lift period" regulation is desirable for the shad fishery, and if the menhaden fishery attracts sharks.

Oregon 1-46-R

James Meehan

Completed 1968

Boat charter - A 55-foot trawler is chartered on an annual basis for research in the tunas from northern Oregon coast to Cape Mendocino, Calif., and on shrimp and crabs in the coastal waters between Astoria and Newport. Albacore are tagged and released for migration studies.

Texas 2-47-R

Henry W. Compton, Jr.

\$76,650

Northwestern Gulf of Mexico marine fisheries investigations - The aim of this project is to determine the abundance and seasonal and size distributions of shrimp in shallow waters of the Continental Shelf and of shrimp and industrial fish in depths beyond 60 fathoms off the Texas coast. Also, the life histories of red snapper and related reef fishes are studied.

Texas 2-78-R

William R. More

\$66,000

Saltwater pond research - This project will use 21 ponds constructed at the salt-water pond experiment station near Palacios under project 2-14-C to develop and expand mariculture practice and procedures. A variety of fish and shellfish will be reared under various artificial ecological conditions. Chemical and physical factors will be measured to determine the effects on growth and survival of the different species.

Virginia 3-5-D

Jackson Davis

\$34,667

Investigation of potential for expansion of the industrial fishery of the mid-Atlantic Bight - The spatial and seasonal distribution and abundance of fish of shelf waters between Cape May, N. J., and Cape Hatteras, N. C., are determined to ascertain if any fish are sufficiently abundant to support an industrial fishery.

### Jellyfish

Six projects have been approved and funded under the Federal Aid Program.

Florida JF-2-2-R

Frank Kennedy

\$40,000

Survey of the distribution and abundance of the Portuguese Man-O-War in waters adjacent to Florida - This study is designed to obtain basic distribution and abundance data on the Portuguese Man-O-War in the waters adjacent to Florida. Aerial surveys are being made monthly to chart direction and movement of this species in relation to the surface water currents and to make abundance estimates. Life history information is also being obtained from specimens collected during vessel operations.

Maryland JF-3-1-R

David Cargo

\$100,000

A study of the biology of sea nettles to develop potential methods for control of their abundance - The Chesapeake Bay Biological Laboratory is continuing studies to obtain a thorough knowledge of the life history of the sea nettle, determine its relation to various environmental factors, determine the effect of this and related species on other Bay animals, and to develop methods of control.

Mississippi JF-2-1-R

Philip Phillips

\$36,828

Population studies of Mississippi Sound and inshore Gulf coelenterates with special emphasis on noxious planktonic forms - This project investigates the life history and related environmental factors relative to population abundance of the noxious coelenterates. The Gulf Coast Research Laboratory, Ocean Springs, analyzes biological samples and hydrographic data collected from the estuaries to the shallow offshore islands.

New York JF-3-3-R

Kenneth Koetzner

\$22,000

A study of the overwintering and germinating stages of floating marine algae in Great South Bay, New York - The purpose of this project is to find out how to control the abundance of marine algae. Samples of the upper portion of the sediment layer and overlying water are being made and analyzed in the laboratory. Changes in temperature and salinity at selected stations are being recorded. Overwintering stages collected from October to April are germinated in the laboratory to determine species and growth.

Puerto Rico JF-2-6-R

Charles Cutress

\$17,472

Investigation of the biology and control of noxious coelenterates occurring in the coastal waters of Puerto Rico - Little is known of the noxious marine animals in Puerto Rico. A survey is underway to determine the type, incidence, and severity of injury to bathers and the occurrence and distribution of noxious marine invertebrates. Life history studies will be made on those noxious jellyfish of primary importance.

Virginia JF-3-2-R

Dexter Haven

\$138,493

An ecological study of the jellyfish (Chrysaora quinquecirrha) - Research activities are underway in the lower Chesapeake Bay and the James, York, and Rappahannock Rivers to define the distribution and abundance of various stages of the jellyfish. The Virginia Institute of Marine Science, Gloucester Point, will investigate possible predators and other causes of mortality associated with the jellyfish.

#### Shellfish

There have been 65 projects approved and funded under the shellfish category, and 20 have been completed.

#### Clam:

Georgia 2-44-R

Walter Godwin

Completed 1968

Survey of a potential hard clam fishery - A survey along the Georgia coast to determine whether a hard-clam fishery is feasible has been completed. Several types of harvesting techniques were tested.

Maryland 3-93-R

H. T. Pfitzenmeyer

\$20,000

Effects of Maryland hydraulic dredge on soft shell clams - This project will determine how seasonal hydraulic clam dredging affects present populations and recruitment of juvenile soft-shell clams. An area of the Maryland portion of Chesapeake Bay will be used for the removal of clams and mechanical disruption of the bottom. Samples will be taken every 4 months.

New Hampshire 3-31-R

William Ayer

\$3,200

Soft-shell clam population study in Hampton-Seabrook Harbor, New Hampshire - The feasibility of limited commercial use of the soft-shell clam is being investigated through studies of seeding, growth, and mortality. About 85 percent of the clam flats in Hampton-Seabrook Harbor have been surveyed.

New York 3-11-D

Gerald Strobel and James Redman

Completed 1966

Pilot plant depuration of hard clams - A pilot plant to determine whether it is feasible to purify hard clams from moderately polluted waters of Long Island Sound has been built. Evaluations were made of various factors. These factors were salinity, turbidity, temperature, flow rate, recirculation, and dissolved oxygen that affect the depuration process for the hard clam.

New York 3-68-D

Quentin R. Bennett

Completed 1968

Studies of problems involved when hard clams (Mercenaria mercenaria) in commercial quantities are subjected to the depuration process - A study of the economic feasibility of the depuration process for hard-shell clams from moderately polluted areas on Long Island Sound has been completed.

Oregon 1-27-R

Paul Reed

\$17,790

Laboratory hatching and rearing of Pacific Coast clams and oysters - The development of methods to spawn and rear several species of clams and oysters for planting is the major objective of this study. Growth is being observed from spat grown in the laboratory and placed in Netarts and Yaquina Bays.

Virginia 3-77-R

Dexter Haven

\$50,000

A study of the soft and hard clam resources of Virginia - The intent of this research is to evaluate the potential of establishing a soft-shell clam fishery in lower Chesapeake Bay and in the James, York, and Rappahannock Rivers. Studies are underway with a hydraulic soft-shell clam dredge to determine distribution and abundance, the rate at which the dredged areas will repopulate, and the effect of dredging on the substrate.

Washington 1-42-D

Ronald Westley

\$37,300

Subtidal hard-shell clam fisheries investigations - Underwater surveys are made to investigate the presence of clams in Puget Sound and the Strait of Juan de Fuca. Commercial quantities have been found in about half of the 41 acres surveyed. Industry, the Bureau of Commercial Fisheries, and the State are cooperating in the development of an efficient harvesting method.

Crabs:

Alaska 5-10-R

Carl W. Lehman

\$25,000

Dungeness crab research in southeastern Alaska - A tag and recovery project is underway in Duncan Canal near Petersburg to observe growth per molt and migratory behavior of dungeness crab. Size at sexual maturity is investigated. Also, SCUBA gear is being used to observe the effect that log rafting areas have on crab populations. Knowledge of dungeness crab biology and life history is increasingly needed to manage the expanding fishery.

Alaska 5-11-R

John C. McMullen

\$44,300

Reproduction of king crabs (Paralithodes camtschatica) in the Kodiak Island area - This project is undertaken to delineate spawning areas of king crab, both offshore and inshore of Kodiak Island. A sampling program is established to determine size of sexual maturity of male crabs from various areas and to observe other life history and biological characteristics of both larval and adult crabs.

Hawaii H-6-R

Henry M. Sakuda

\$5,464

Management and development investigation of the Kona crab (*Ranina serrata*) - The aims of this project are to develop and manage the Kona crab fishery. The biology is studied as is the extent and abundance of crabs on the fishing grounds. Exploratory fishing and gear development for more effective methods of harvesting the resource are studied.

Oregon 1-5-R

Paul H. Reed

\$15,210

Controlled rearing of dungeness crab larvae and the influence of environmental conditions on their survival - This project at Oregon State University's Marine Science Center at Newport aims to develop techniques for the identification and rearing of dungeness crab larvae and to study how dissolved oxygen concentrations, temperature, and salinity affect the larvae distribution and survival of larvae. The feasibility of hatching and rearing crab larvae on a commercial basis is explored.

Rhode Island 3-43-R

Andreas Holmsen

\$29,500

Investigation of the deep sea red crab (*Geryon quinqueedens*) - The aims of this project are to determine the cost involved in handling the crab, both on a trawler and in a processing plant, and to determine the market characteristics of the crab.

Rhode Island 3-46-R

George W. Gray, Jr.

\$7,700

Investigation of the basic life history of the red crab - The aim of this study is to determine growth, age at sexual maturity, spawning and moulting seasons, migratory behavior, and natural mortality of the red crab. Present work is concerned with finding a satisfactory way of marking the crab, finding a reliable sampling technique, and determining the growth of adult(larger)male crab by using length frequency data.

Lobster:

Connecticut 3-44-R

William Lund, Jr.

\$23,500

Investigations on the lobster - The population structure and ecology of a designated area near Ram Island are being studied with the use of SCUBA gear. Routine observations are made to determine movement, behavior, and bottom type preferred by lobsters. Plankton tows are also made weekly during the spring and summer to define the period when lobster larvae are present.

Hawaii H-5-R

Henry Sakuda

\$4,187

Management investigation of two species of spiny lobsters, *Panulirus japonicus* and *P. penicillatus* - This study is designed to evaluate the catch statistics of the net and trap fishery and to analyze previously collected data relative to migration, molting frequency, growth, and reproduction.

Maine 3-14-R

James Thomas

\$60,000

Lobster research program - This study is concerned with obtaining and analyzing biological and statistical data on the inshore lobster fishery for management purposes. Catch statistics from 152 dealers located throughout the coastal counties are being analyzed. Samples are also taken each month from 10 different locations along the inshore area to determine changes in length, weight, sex ratio, and maturity of the lobster.

Mussel:

Illinois 4-13-R

William C. Starrett

Completed 1968

Clam industry in Illinois - The Department of Conservation has completed a study to formulate a sound basis for managing the mussel industry. The work involved an inventory of the clam fisheries on the Illinois, Mississippi, and Wabash Rivers.

Indiana 4-10-R

Louis A. Krumholz

Completed 1968

Mussel research study - To inventory the mussel resources, the Wabash and White Rivers have been sampled with crowfoot bar at 50 1-mile stations. Biological and life history information, such as reproductive success, age, and growth has been obtained for evaluation of management regulations.

Kentucky 4-19-R

John C. Williams

\$18,000

Mussel fishery investigations - The location and extent of the mussel beds, species composition, population density, harvest, recruitment, and reproduction of mussels in the Tennessee, Green, and Ohio Rivers in Kentucky are investigated. Present work is on the Ohio River from the point where the River enters the State at river mile 313 to Cairo, Ill., river mile 981. Murray State University Biological Station at Murray is doing the work.

Ohio 4-28-R

Henry Van der Schalie

\$60,000

Mussel fisheries investigation - Studies are in progress on the Muskingum River in southeastern Ohio to determine the distribution of the mussel beds and to obtain biological and life history information for the species present. An estimate also is made of the annual harvest by collectors. Later, work will encompass the lower portion of the Scioto and Little Miami Rivers. Information obtained will provide the basis for a management program for the State's mussel resources.

Pennsylvania 3-85-R

John M. Bates

\$20,000

Mussel investigations - The location and extent of the mussel beds, both qualitatively and quantitatively, in the Ohio River drainage within the State are investigated. Samples are being collected to obtain species composition, stage of maturity, and rates of growth. How various harvesting techniques affect the mussel beds will be studied, also.

Tennessee 4-46-R

Paul Yokley, Jr.

\$21,270

Freshwater mussel ecology, Kentucky Lake, Tennessee - This study is designed to evaluate the types of habitat of established mussel beds and to determine the density and species composition at each site. Mussels will be tagged, and the shell erosion, age range, number of species, and their density will be correlated with the water quality and bottom type of the area.

Oyster:

Alabama 2-18-R

Edwin May

Completed 1968

Oyster raft production - The design of a low-cost raft and cultch material is completed. Also, research on spat growth related to a changing environment has been concluded.

Alabama 2-30-D

George Allen

Completed 1967

Shell planting for oyster cultch - An area in Mobile Bay on Point Clear Reef was selected and planted with about 37,309 barrels of shell. A substantial supply of seed oysters resulted from this planting.

Delaware 3-8-D

Ted Ritchie

Completed 1966

Rehabilitation of the natural seed oyster beds in Delaware - The planting of 219,184 bushels of shell has been completed to develop and enlarge several small natural seed oyster beds. A successful spatfall was recorded at each area.

Delaware 3-49-R

Don Maurer

\$29,000

Pilot studies of the spawning and rearing of MSX resistant oysters - Research is continuing to spawn and rear disease-resistant oysters for large-scale plantings. Five stocks presumed MSX "resistant" and six stocks MSX "susceptible" are used in the laboratory experiments. Further work is underway to rear newly hatched oysters in the laboratory and in the field.

Delaware 3-55-R

Ted Ritchie

Completed 1968

A resurvey of the condition and extent of the natural seed oyster beds in Delaware - The survey and evaluation of existing seed oyster beds in Delaware Bay have been completed. Bottom type, abundance of predators and fouling organisms, and abundance and size of oysters present have been recorded.

Florida 2-52-D

Robert Ingle

\$71,300

Construction of artificial oyster reefs - Natural oyster reefs are being established from Tampa Bay north to Choctawhatchee Bay. This project will create permanent areas for oyster attachment and growth, and, consequently, commercial production.

Georgia 2-10-R

Thomas Linton

Completed 1968

Feasibility study of methods for improving oyster production in Georgia - An inventory of the intertidal resources has been completed. Pilot studies to find the best methods of cultivation are completed on pond and raft culture.

Hawaii H-2-R

Henry Sakuda

\$14,229

Investigation for the development of a commercial oyster industry - Seed oysters are collected from West Loch, Pearl Harbor, Oahu, and transplanted into Hilo Bay on the island of Hawaii, Kaneoke Bay on the Island of Oahu, and other selected ponds and estuarine areas. The oysters are sampled routinely for changes in condition, growth, and mortality.

Louisiana 2-23-D

John Loy, Sr.

\$61,000

Oyster lease control monuments - Survey control monuments are being established throughout the oyster-growing areas to aid in accurate surveys of waterbottoms for leasing purposes. The control monuments are constructed of concrete and reinforcing steel rods and placed at about  $\frac{1}{2}$ -mile intervals.

Louisiana 2-24-D

Max Summers

Completed 1966

Shell planting for oyster cultch - This shell planting project was an overall effort to provide additional shells on selected areas within the oyster seed grounds in Bay Boudreaux and Black Bay.

Louisiana 2-54-D

Max Summers

Completed 1967

Shell planting for oyster cultch - This project provided cultch material for planting on Half Moon area and Black Bay, which are oyster seed grounds east of the Mississippi River. About 33,300 cubic yards of clam shell were planted.

Louisiana 2-72-R

Charles J. White

\$41,500

Evaluation of experimental oyster tonging reefs in Calcasieu Lake - The purpose of this project is to evaluate the development of oyster tonging reefs in Calcasieu Lake. About 10,000 to 15,000 cubic yards of clam shell will be planted at predetermined locations. The shell planted will form a mat of about 4 inches in depth. Monthly checks will be made to determine the success of spatfall.

Maryland 3-20-R

Victor Sprague

Completed 1968

Development of a disease resistant oyster brood stock - Various strains of oysters have been tested for relative resistance to diseases. Laboratory and field studies have been made to develop a resistant brood stock. The stocks are tested in pond culture experiments.

Maryland 3-23-R

William Roosenburg

Completed 1967

Study of the effects of thermal pollution on (*Crassostrea virginica*) in the Patuxent Estuary - A study of oyster growth, mortality, gonad development, and condition has been completed in the upper Patuxent estuary. Stations were located 1,000 feet to 7 miles from the heated

water outfall of a new steam electric generating plant. Results showed that growth was lower near the plant than those farther removed. Mortality was low and normal for all stations.

Maryland 3-29-R

Donald Pritchard

Completed 1967

Studies of the physical processes of movement and dispersion of oyster larvae - The major effort of this study was directed toward analysis of the data derived from earlier attempts to use a tracer fluorescent dye to simulate the movement and spread of oyster larvae, and to use this analysis in the design of a field study. The area chosen for the field study was the Manokin River estuary.

Maryland 3-75-R

Fred Sieling

\$42,100

Development of disease-resistant oysters (C. Virginica) under field conditions in lower Chesapeake Bay - Oysters on natural bars in the Manokin River are sampled to obtain basic data on year class abundance, amount of cultch material, fouling organisms, and predators present. The level of MSX incidence is studied throughout the study area and selected samples are examined at the BCF laboratory, Oxford. Spat from disease-resistant brood stock are used to repopulate areas where heavy mortalities have occurred.

Mississippi 2-28-R

David Cook

\$37,800

A study of coliform bacteria and Escherichia coli on polluted and unpolluted oyster bottoms of Mississippi and a study of depuration by rebedding - Bacteriological analyses are made routinely of selected areas in Mississippi Sound to determine their sanitary quality. As suitable locations are found, oysters from polluted areas are moved into the area to define the length of time required for depuration. Studies are also made of the survival rate of coliform bacteria in the estuarine waters and muds.

New Hampshire 3-32-R

William Ayer

\$25,200

An investigation of the possibility of seed oyster production in Great Bay, New Hampshire - Population estimates are being made in selected areas of Great Bay by SCUBA divers. Life history studies are underway to define the time of spawning, survival, and growth. Spat obtained from the BCF laboratory, Milford, has shown excellent growth. Environmental conditions are also being observed.

New Jersey 3-1-D

Christopher Riley

\$119,140

Shell planting program Maurice River Cove (Delaware Bay) and Mullica River (Atlantic Coast) - Oyster shells to serve as cultch have been planted on selected beds in the Delaware Bay and Mullica River. Over two million bushels of shells have been planted to enlarge and rehabilitate seven beds in Delaware Bay and the Mullica River.

New Jersey 3-3-R

Harold Haskin

\$50,000

Disease resistant oyster program - Delaware Bay - This project is a continuing study to provide basic knowledge for consistent production of a disease-resistant stock of oyster seed and to increase the yield of marketable oysters from such seed through control of various causes of mortality. These objectives are being approached by experimental testing of disease resistance in the field, experimental approach to control predators, use of lower Delaware Bay spat as seed oysters, and artificial rearing of disease-resistant strains of oysters at the Cape Shore Laboratory.

New York 3-63-R

Arthur Brand, III

\$30,420

Pond culture of oyster seed in a controlled natural environment - Oyster Pond, in East Hampton, Long Island, is the center of this study. Samples on a semiweekly basis are collected and analyzed to determine the biological, physical, and chemical characteristics of the pond. Data on intensity of spawning, setting, and survival are also obtained from spat set on hard bottom areas and rafts.

North Carolina 2-6-R Howard Marshall \$18,380

Oyster studies - This study has three-dimensional oyster culture experiments in five estuaries along the coast of North Carolina. Shallotte River, Lockwoods Folly River, New River, Back Bay, and Deep Bay are the areas in which types of cultch materials and their time of placement are studied in relation to the success of oyster spat. Data on spat abundance, water temperature, salinity, and tidal cycle are also being collected.

South Carolina 2-2-R Robert Lunz \$17,800

Charting of subtidal oyster beds and experimental transplanting of seed oysters thereto from polluted seed oyster beds - The purpose of this project is to locate subtidal areas of the State that are suitable for oyster growing. About 188 miles of waterways have been surveyed. Oysters from the Wando and Santee Rivers that are subjected to several types of pollution have been moved to unpolluted areas for natural depuration. Samples are taken routinely to study growth, condition, and survival.

South Carolina 2-69-R G. Robert Lunz \$13,400

Investigation into the supplemental feeding of oysters - In an effort to open new areas of increased productivity or new methods of cultivation, this study investigates the value of supplementary feeding of oysters. Different food substances such as molasses, rice chaff, and starches are used to discover a low-cost, readily available product that would produce rapid weight increases and/or growth. This work is carried out in temperature controlled, 3,000 gallon capacity concrete tanks at Bears Bluff Laboratories on Wadmalaw Island.

Virginia 3-6-R Jay Andrews \$64,000

Production of disease resistant oysters - Efforts to breed oysters and speed development of populations resistant to MSX still offer the best hope of returning infested areas to useful production. This goal is being accomplished by testing stocks of oysters for disease resistance, breeding potentially disease-resistant oysters, determining disease agents, and continuing the selection and concentration of potentially disease-resistant stocks. The research is in waters adjacent to the Virginia Institute of Marine Science, Gloucester Point.

Virginia 3-7-R William Hargis, Jr. Completed 1966

Investigations of oyster larvae and spat and certain important environmental factors in an horizontally stratified estuary - The movement and dispersion of oyster larvae and spat have been examined in relation to physical factors such as salinity, density gradients, current direction and velocity, light, temperature, and oxygen. A model of the James River system was used to determine the rate of movement and dispersion.

Virginia 3-62-D Charles Bagnell \$100,000

Propagation of disease resistant oysters - The purpose of this project is to provide cultch on which spat can set in areas where MSX is known to be present. Work is carried out in the waters of the Piankatank and Rappahannock Rivers and Mobjack Bay. About 1,002,714 bushels of cultch material were planted. Since the brood stock was not affected by the MSX disease, the researchers expect that the resultant larvae will also be disease resistant.

Washington 1-24-D Cedric Lindsay Completed 1967

Inspection of oyster seed - new Asiatic sources - Because of the continuing decline of imports of oyster seed from Japan on which the industry depends, a trip was made to Korea and Taiwan to investigate new sources of seed. Oysters were tested for predators and disease to guard against infestation of Pacific oyster grounds. A new oyster seed source that was found in Korea was acceptable under the standards required by the State. The seed sources in Taiwan were not acceptable.

Willapa oyster studies - The growth and fatness of Pacific oysters are studied at the Shellfish Laboratory, Nahcotta. Supplemental feeding with starch and materials containing starch, such as powdered milk and egg products, and fish protein concentrate was provided to determine how it affected the fatness and pumping rate of the Pacific oyster. Hydrographic factors that directly affect the retention of oyster larvae to setting size are being defined to provide the industry with improved prediction of commercial spatfall.

Washington 1-43-R

Ronald Westley

\$12,800

Oyster drill (*Ucinobra japonica*) control - The behavior patterns of Japanese oyster drills and egg cases, and control measures are the main purposes of this study at the Point Whitney Shellfish Laboratory, Brinnon. Investigations in the laboratory and in the field indicate that the male drills are attracted to a water-borne substance released by the female. Further work is underway to define this substance. The testing of chemicals to control the drill is continuing.

Shrimp:

Alaska 5-9-R

Peter R. Jackson and Jerry A. McCrary

\$37,900

Investigation of ecological factors limiting production of the Alaska Pandalid shrimp - Data have been collected in southeastern Alaska for determination of age and growth, length-weight relation, sex changes, and ovigerous period of the pink and the side-striped shrimps; similar, but not as extensive, data have been collected for the humpy and spot shrimps. Life history studies of these shrimp species in the Kodiak area are continued.

Georgia 2-43-R

Charles M. Frishie

\$37,840

Seasonal abundance and biological stability of the commercial shrimp of Georgia - Sampling stations are located offshore in sounds, rivers, and in marshes throughout the shrimp's habitat. Trawl, seine, and plankton net collect adults, postlarval, and larval shrimp throughout the year. Determinations are made on relative and seasonal abundance, growth rate, sex ratio, spawning success, and limiting environmental factors of shrimp.

Hawaii H-1-D

Takuji Fujimuru

\$18,800

Development of a prawn fishery - Laboratory findings indicate that the prawn, *Macrobrachium rosenbergi*, can be held successfully for an indefinite period in tanks. The species will reproduce in captivity, and the larval stages can survive in the laboratory. Work is in progress on the selection, introduction, and establishment of prawns suitable for mass culture and the development of culturing techniques that will lead to a commercial prawn-raising industry. The research is at the Keehi Fishery Station, Division of Fish and Game, Honolulu.

Maine 3-12-R

Ronald G. Rinaldo

\$26,000

Northern shrimp - biological and technical research - Studies are underway on waters adjacent to the Maine coast to determine the relative abundance of species of northern shrimp, particularly *Pandalus borealis*, and life history and seasonal availability of the several species. Technical problems associated with economical and efficient harvesting and marketing these species are also investigated.

North Carolina 2-26-R

Edward G. McCoy

\$32,816

Shrimp studies - Information was obtained on population dynamics, including migratory behavior, for pink, brown, and white shrimp marked with biological stains and fluorescent pigments and released in nursery areas tributary to Core Sound and Lower Cape Fear River estuaries. A combined total of 26,989 shrimps was marked and released, of which 1,671, or 6.2 percent, were recaptured. Mark and recapture studies on brown shrimp are continuing in Pamlico Sound and Beuge Sound estuaries, including Newport River.

Oregon 1-3-R

Gary Milburn

\$15,964

Study on the distribution and abundance of pink shrimp, *Pandalus jordani*, in the Pacific Ocean off Oregon - Sampling of commercial pink shrimp landings at Warrenton, Newport, and Coos Bay has been completed. Length-frequency, catch, and effort data by area of catch are reported. Currently, the vertical distribution and migratory behavior of this species by diel, lunar, and seasonal periods, and the environmental factors which may influence these movements are investigated off the Oregon coast near Astoria and Newport.

South Carolina 2-3-R

G. Robert Lunz

\$22,758

To manage and practice aquaculture in shrimp farm ponds and in large tanks under controlled conditions - Experiments at Bears Bluff Laboratory, Wadmalaw Island, beginning in 1947 have shown that it is possible to culture shrimp from postlarval stages to mature adults in shallow ponds constructed in salt-water marsh. Under this project, shrimp culture is continued in 3,000-gallon tanks in which the environment can be controlled. Attempts are made to hatch brown shrimp eggs and rear them through the larval stages.

Others:

Alaska 5-13-D

Gary Finger

Completed 1968

Commercial feasibility of Alaskan scallop fishery - This project has provided the State with the basic data on abundance and distribution that are needed for management regulations on sea scallop resources in south central coastal areas of Alaska. This project has stimulated a new scallop industry at Seward.

California 6-4-R

H. G. Orcutt

\$163,800

Shellfish laboratory operations - This project provides for research on development of mass culture methods for abalone, clams, crab, oysters, and shrimp. In view of the decline of the San Francisco crab fishery, crab larvae are being tested to determine their short-term tolerances to selected pesticides and long-term tolerances to DDT and endrin. Water from the Bay is bioassayed, and the effluent of two acid barges is also tested for toxicity to crab larvae.

California 6-8-D

H.G. Orcutt

\$79,000

California shellfish and bottomfish data analysis - The purposes of this project are to evaluate management policy and methods and develop a management plan for the crab, shrimp, and bottomfish resources. Catch and effort data and cruise information are compiled, machine processed, programmed for computer analysis, and published. The work is at the California Department of Fish and Game Marine Resources Operations Laboratory at Menlo Park.

Rhode Island 3-57-R

Saul B. Salla

Completed 1967

McIlusk environmental modification and control studies - The State terminated this study during the first year.

Texas 2-55-R

B.D. King

\$39,425

Study of migratory patterns of fish and shellfish through a natural pass - A series of nets are fished in Cedar Bayou Pass to investigate the abundance of larval and postlarval shellfish and fish that move from the Gulf of Mexico into the coastal bays and estuaries.

Statistics

Ten projects have been approved and funded under this section of the Federal Aid Program. These projects will provide the States with data to evaluate effectively their natural resources.

Survey of the live bait-shrimp industry in Alabama - The licensed live bait-shrimp dealers are being surveyed to determine the landings from Alabama waters and composition and distribution of these landings, amount of shrimp being sent to Alabama, capital investment of the dealers, and economic value to State and Gulf Coast region.

Alaska 5-3-D

Barbara Hill

\$12,200

Expansion of current and development of additional commercial fisheries catch, production and gear statistics - This study is underway to increase the accuracy and reliability of current statistics and to compile and publish fishery statistics on an area and individual fishery basis, rather than on the regional or Statewide basis.

Arkansas 4-12-D

William P. Mathis

\$25,000

Commercial fishery industry survey - The purpose of this study is to develop a statistical reporting system for all the commercial fisheries in the State of Arkansas. Fish farmers and commercial fishermen are interviewed to establish the base for refined surveys.

California 6-6-D

H.G. Orcutt

\$11,200

Port sampling - Crescent City, Brookings, Port Orford - This project is undertaken to sample three distinct fisheries--crab, shrimp, and bottomfish--for landings and to collect and analyze biological data. The observations and data are used to determine changes in abundance, size, and age composition or stock status that are prerequisite to effective management of these resources. Catches are sampled in Crescent City, and in the Brookings and Port Orford, Oreg., areas.

Massachusetts 3-37-D

Allen E. Peterson, Jr.

\$18,145

Collection, compilation, evaluation, and dissemination of commercial fisheries statistics - This project provides for new and improved statistics on lobster, alewife, and shellfish fisheries. The landing statistics, including location, catch, effort, and gear for alewife and shellfish, are collected from licensed Massachusetts fishermen and otter trawlers. Statistics are compiled, evaluated, and disseminated in monthly bulletins in cooperation with the Bureau of Commercial Fisheries.

Missouri 4-3-R

John W. Robinson

\$25,000

Research and management of commercial fisheries - This project is carried out on the Mississippi and Missouri Rivers in Missouri to improve the accuracy of commercial fish landings. In addition, the commercial catches are sampled throughout the season for species taken and for size composition of the catch.

Oklahoma 4-25-D

Gary Mensinger

\$3,000

Commercial fishery statistics - Under this project, landing statistics on all marketable and nonmarketable fish taken by commercial gear are compiled. Some information is obtained on the number of each species taken and the size composition of the catch. The Texoma, Eufaula, Ft. Gibson, Grand, and Hudson reservoirs are of prime interest.

Puerto Rico 2-56-R

Rolf Juhl

\$85,000

Fisheries statistical program - This project is undertaken to design and establish a fisheries statistics system that, in addition to assisting the local industry, will also provide the statistical needs of the Bureau of Commercial Fisheries and other interested agencies. Statistical landings include number and types of fishing crafts and number of fishermen.

South Dakota 4-18-D

Donald Warnick

\$21,950

Commercial fishery industry survey - This project provides for the development of a continuous system for the collection of statistics for all commercial fisheries and dealers of fish products in the State.

Commercial fishery landings statistical program - The Bureau of Commercial Fisheries now gathers and compiles data on shrimp landings while the Texas Parks and Wildlife Department gathers and tabulates statistical landings on fish, crabs, and oysters. The Department's statistical system from the coastal areas is upgraded so that landing data can be used to interpret research findings and to evaluate management programs.

### Technology

Nineteen projects have been approved and funded under this section of the Federal Aid Program, of which seven are completed and 12 continuing.

Maine 3-16-R Edwin P. Creaser \$38,000

Biological, environmental and technological research on marine worms - Biological studies are conducted on life history, growth, and mortality rates, and predation and distribution of commercial marine worms (bloodworms and sandworms) and other annelid species of potential commercial use. Development of improved methods of harvesting, handling, and shipping is investigated, also.

Maine 3-17-R Robert L. Dow Completed 1967

Study of the economic and operational feasibility of mechanization of the Maine sardine processing and canning operations - This project developed more efficient and lower cost methods of processing and canning Maine sardines.

Maine 3-18-R Robert L. Dow Completed 1966

Investigation of physical aspects of raw herring - Raw herring, when taken from the nets and landed at the dock, were examined to determine the quality of the resultant canned product as sardines. Factors considered were length and weight of fish used in the investigation, food habits, thickness of belly wall, fat content, and quality of canned product.

Maine 3-94-D Richard E. Reed \$8,000

Testing and adapting existing sardine processing equipment - This project is designed to test processing equipment. Demonstrations are being made to aid in the training of employees of canners interested in such equipment.

Maryland 3-81-D Mahlon C. Tatro \$41,900

Pasteurization of crabmeat through the use of radio frequency waves - This project is underway at the University of Maryland to develop technical controls needed in the commercial operation of rapid pasteurization of crabmeat and other seafoods.

Maryland 3-86-D Frederick W. Wheaton \$30,000

Oyster shucking study - In view of the need for automation in the oyster industry, this study will investigate the application of engineering principles to this industry. An engineering analysis of harvesting, handling, and processing of oysters is underway. The Agricultural Engineering Department of the University of Maryland is studying ways to improve oyster-shucking methods and equipment, and also improve the productivity of labor.

Massachusetts 3-35-R Robert E. Levin \$52,000

Marine food science and technology research on sanitation and handling for purpose of improving product quality and shelf-life of Massachusetts commercial fishery products - The Department of Food Science and Technology of the University of Massachusetts is surveying the bacteriological and sanitary aspects of handling facilities and practices that affect the quality of fish offshore and inshore. The purpose is to establish criteria for the proper handling of seafood products from the producer to the consumer. Technical information is disseminated through leaflets and newsletter.

A study of bacterial spoilage patterns in iced Penaeus shrimp - The primary object of this project is to study the pattern of growth of various bacteria that contribute to the spoilage of Penaeus shrimp stored in crushed ice. Comparisons are made of the development of bacteria in aseptically handled and commercially handled shrimp. Bacteriological changes are compared with the organoleptic quality of the shrimp and the production of trimethylamine in the shrimp. Gulf Coast Research Laboratory, Ocean Springs, does this work.

Missouri 4-34-D

Ruth E. Baldwin

Completed 1969

Palatability of Missouri fish - A trained panel tested cubed, cooked fish fillets to determine the acceptability of different species of fish.

North Carolina 2-8-R

Neil B. Webb

Completed 1968

A study of the quality of North Carolina scallops - As a result of scientific studies, the industry has been given recommendations for handling scallops from the time they are harvested through the various handling and processing stages, to the final packaging. Following these recommendations will ensure a top-quality product.

North Carolina 2-76-R

Neil B. Webb

\$16,700

Studies on the effects of processing on the quality of seafood products - This study, underway at North Carolina State University, is designed to determine how mechanical processing affects the quality of seafood products. Experiments are being made to discover the optimum temperatures for opening the shell by heat shock, for separating the meat and viscera, and for final rinsing and storage of the meats. An evaluation of the finished product quality in relation to standards established for hand-shucked and processed scallop meats will also be made.

Ohio 4-26-R

Howard S. Teague

\$28,500

Value of whole fish meal in breeding-gestation rations for swine - This project is carried out at the Robinson Swine Research Center, Ohio Agricultural Research and Development Center, Wooster. Whole fish meal is fed to sexually mature Duroc gilts to determine the level and length of feeding period required to obtain measurable effects on the reproductive function of swine. Both the fish meal and complete ration are analyzed for protein, fat, fiber, nitrogen-free extract, amino acid, trace minerals, and vitamin content.

Oregon 1-10-D

David L. Crawford

\$16,250

Development of the shad industry - Oregon State University Seafoods Laboratory at Astoria is developing new products using American shad and groundfish. Shad and striped bass have been used to make an acceptable smoked pepperoni product. The shelf-life of this appetizing fish product is being evaluated. A frozen brown-and-serve fish sausage with a fresh pork sausage seasoning has been formulated. Development of a fish loaf of the luncheon meat type is under consideration.

Oregon 1-12-R

Duncan K. Law

\$34,000

Utilization of hake, dogfish, and by-products of the fillet industry for protein supplements - The State of Oregon has a large quantity of hake and dogfish, both sources of animal protein, and, in addition, the bottomfish industry provides fillet scrap that amounts to over 60 percent of trawl fish landed. Oregon State University, Corvallis, and their seafood laboratory at Astoria, are experimenting with these fish to develop stable protein products and to determine possible uses of such products. An 8-week broiler production feeding trial combining herring and hake to improve body weight and decrease food consumption has been completed. Preparations are underway to evaluate hake meal as a source of protein for trout.

Oregon 1-15-R

J.E. Oldfield

Completed 1968

Processed hake in feed for mink - This study was made to determine if Pacific hake could serve as the source of protein in mink ration.

Oregon 1-34-R

James E. Langler

\$20,000

Preparation of marine protein concentrate from hake - Studies at Oregon State University Seafood Laboratory, Astoria, using drum drying to make fish protein concentrate indicate that oil will separate from hake during the drying process. Experiments are in progress to evaluate the use of antioxidants and their effect in preventing deterioration, oxidation, or extractability of lipids.

South Dakota 4-21-D

Kenneth Schneider

Completed 1968

Missouri reservoir fisheries product development and evaluation - Research was performed to determine the chemical and physical factors that affect the use of carp for food.

Tennessee 4-31-D

M. R. Johnston

Completed 1968

Evaluation of whole fish meal as a protein supplement for swine - The University of Tennessee Agricultural Experiment Station, Knoxville, has done research on the value of whole fish meal as a protein supplement to swine at 40 pounds live weight and carried to an average pen weight of 200 pounds.

Tennessee 4-40-D

Grayce E. Goertz

\$13,994

Formula development and acceptability evaluation of selected seafood entrees - The purpose of this project is to test the nutritional value of canned and frozen seafood products. The Department of Food Science and Institute Management, University of Tennessee, will evaluate the acceptability of the seafood in Knoxville elementary schools and other areas of the State.

Washington 1-41-R

Lawrence R. Berg

\$18,000

Determination of the nutritive value of North Pacific fish meals for poultry - Fish meals are recognized as excellent sources of protein, amino acids, vitamins, minerals, and energy for inclusion in rations of various types of poultry. This study is underway to evaluate meals from North Pacific fish, such as anchovy, dogfish, and hake, which will be used in the formulation of feeds for chickens, turkeys, and other egg-laying birds. Also, the relative nutritive work of such fish meals with established fish meals such as herring meal is considered.

## RESOURCE DISASTER PROJECTS

Fourteen projects have been funded under Section 4(b) of the Commercial Fishery Research and Development Act, of which 2 have been completed and 3 transferred to Section 4(a). The remaining studies deal with the declining populations of blue crab along the middle and south Atlantic Coast and the restoration of seed oysters.

Alabama 2-64-D	Johnie H. Crance	\$45,000
----------------	------------------	----------

Restoration of Alabama's supply of seed oysters - To restore and establish a new source of seed oysters for Mobile Bay, about 125 acres of selected bottom in Mississippi Sound will be planted with 500,000 cubic feet of shell. The areas selected are least affected by the hazards of seed production. State biologists will determine the area and rates of planting, and will evaluate the results of this effort.

Connecticut 3-51-D	Ernest Bontya	Completed 1967
--------------------	---------------	----------------

Disaster relief - Connecticut oyster fishery - Fifteen spawning beds in selected locations of Long Island Sound were prepared. Each bed was cleaned, protected with predator control material, and planted with 400 bushels of brood stock oysters. A highly successful set obtained from the first spawning will provide seed oysters and brood stock for several years.

Delaware 3-49-R	Kent Price	Transferred to 4(a) funding
Maryland 3-20-R	Victor Sprague	Transferred to 4(a) funding
New Jersey 3-3-R	Harold Haskin	Transferred to 4(a) funding
Virginia 3-6-R	Jay Andrews	Transferred to 4(a) funding

Disease resistant oyster program - See pages 57, 58, 59, and 60 for project narrative and full title.

Florida 2-81-R	Sean Bollar	\$15,000
Georgia 2-82-R	Robert Mahood	\$25,000
North Carolina 2-80-R	John R. Davis	\$10,000
South Carolina 2-79-R	G. Robert Lunz	\$25,000

Cooperative blue crab study - South Atlantic States - Because of the serious decline in blue crab abundance in the South Atlantic area since 1964, a cooperative research study is underway. Each State is obtaining data on hydrology, occurrence of disease and parasites, and levels of pesticides in their waters.

Louisiana 2-27-D	Max Summers	Completed 1966
------------------	-------------	----------------

Rehabilitation and restoration of oyster seed ground - To rehabilitate the oyster seed grounds damaged by Hurricane Betsy, 630,000 bushels of clam and/or reef shell were planted in selected areas in Bay Boudreaux and Black Bay. Random samples taken in each area showed a spat catch of 92 percent in Black Bay and 46 percent in Bay Boudreaux.

Maryland 3-91-R	Robert Lippson	\$25,000
Virginia 3-91-R	W.A. Van Engel	\$25,000

Blue crab study in Chesapeake Bay - This effort by Maryland and Virginia aims to develop an effective long-term program of study of how environmental and biological factors influence the abundance and distribution of a valuable common resource.

Texas 2-65-D	Robert Hofstetter	\$50,000
--------------	-------------------	----------

Oyster rehabilitation in San Antonio Bay - To increase oyster spat setting as a means of repopulating public reefs damaged by Hurricane Beulah, about 15,000 bushels of oyster brood stock are being dredged from Galveston Bay and transplanted on depleted reef sites in San Antonio Bay.

## PUBLICATIONS

Following is a list of the 73 publications which has resulted from studies financed under the Federal Aid Program. Requests for reprints should be made to the State agency or Cooperator.

BARTH, GLENN R.

1968. An economic study of the processing and marketing of Montana commercial fisheries products. Univ. Mont., School Bus. Admin., 99 pp.

BAYLEY, SUZANNE, HARVEY ROBIN, and CHARLES H. SOUTHWICK.

1968. Recent decline in the distribution and abundance of Eurasian milfoil in Chesapeake Bay. Chesapeake Sci. 9: 173-181.

BENDIX CORPORATION.

1966. Field test report, salmon counter. Electrodynamics Division, 11600 Sherman Way, North Hollywood, Calif., Rep. 92-319, 8 pp.

1966. Field test report, sonar system for salmon counting. Electrodynamics Division, 11600 Sherman Way, North Hollywood, Calif., Rep. 92-329-1, 6 pp.

1967. Field test report of array sonar salmon counter. Electrodynamics Division, 11600 Sherman Way, North Hollywood, Calif., Rep. 92-353, 11 pp.

BLAUFUSS, LAWRENCE GENE.

1968. Commercial market for North Dakota fish. Dep. Agr. Econ., N. Dak. State Univ., 132 pp.

BUREAU OF COMMERCIAL FISHERIES.

1968. Commercial fisheries Federal Aid to States. U.S. Fish Wildl. Serv., Circ. 286, 35 pp.

BURNETT, J.W., J.H. STONE, L.H. PIERCE, JR., D.G. CARGO, E.C. LAYNE, AND J.S. SUTTON.

1968. A physical and chemical study of sea nettle nematocysts and their toxin. J. Invest. Dermatol. 51: 330-336.

CARLEY, D.H.

1968. Economic analysis of the commercial fishery industry of Georgia. Univ. Ga. Agr. Exp. Sta., Res. Bull. 37, 92 pp.

CARLEY, D.H., and C.M. FRISBIE.

1968. The commercial fishing industry of Georgia--an economic evaluation. Univ. Ga. Agr. Exp. Sta., Contrib. 7, 13 pp.

COOK, DAVID W., and CARY W. CHILDERS.

1968. Depuration of Biloxi Bay oysters by relaying. Minutes Gulf States Mar. Fish. Comm., Mar. 26, 1968, 7 pp.

DAVIS, ALLEN S.

1967. Forecast research on 1967 Cook Inlet area pink salmon fisheries. Alaska Dep. Fish Game, Leaflet 98, 13 pp.

1968. Forecast research on 1968 Cook Inlet area pink salmon fisheries. Alaska Dep. Fish Game, Leaflet 117, 13 pp.

1968. Salmon counting by acoustic means. Alaska Dep. Fish Game, Leaflet 113, 28 pp.

DEPARTMENT OF CHESAPEAKE BAY AFFAIRS.

1968. Commercial fisheries news. Fish. Ext. Serv. (1-3), 4 pp.

DEYOE, C.W., and O.W. TIEMEIER.

1968. Nutritional requirements for channel catfish fingerlings. Feedstuffs 40(45): 48-51.

- DEYOE, C.W., O.W. TIEMEIER, and C. SUPPERS.  
1968. Effects of protein, amino acid levels, and feeding methods on growth of fingerling channel catfish. *Progr. Fish-Cult.* 30:187-195.
- EATON, MARTIN F.  
1967. Frazer Lake sockeye investigations, 1966. Alaska Dep. Fish Game, Leaflet 99, 48 pp.  
1968. Frazer Lake sockeye investigations, 1967. Alaska Dep. Fish Game, Leaflet 119, 45 pp.
- FRISBIE, CHARLES M.  
1967. Preliminary studies of the seasonal abundance and biological stability of the commercial shrimp of Georgia. *Ga. Game Fish Comm., Contrib.* 4, 19 pp.
- GODWIN, WALTER F.  
1967. Preliminary survey of a potential hard clam fishery. *Ga. Game Fish Comm., Contrib.* 1, 23 pp.  
1968. The distribution and density of the hard clam, Mercenaria mercenaria, on the Georgia Coast. *Ga. Game Fish Comm., Contrib.* 10, 30 pp.  
1968. The growth and survival of planted clams, Mercenaria mercenaria, on the Georgia Coast. *Ga. Game Fish Comm., Contrib.* 9, 16 pp.  
1968. The shad fishery of the Altamaha River, Georgia. *Ga. Game Fish Comm., Contrib.* 8, 39 pp.
- GODWIN, WALTER F., and L. GLENN MCBAY.  
1967. Preliminary studies of the shad fishery of the Altamaha River, Georgia. *Ga. Game Fish Comm., Contrib.* 2, 24 pp.
- GODWIN, WALTER F., and THOMAS L. VAUGHN.  
1968. An adult pugeheaded American shad, Alosa sapidissima. *Trans. Amer. Fish. Soc.* 97:50.
- HAGER, ROBERT D., and EARLE D. JEWELL.  
1968. Field evaluation of coded wire tag detection and recovery techniques. *Wash. Dep. Fish., Fish. Res. Pap.*, 19 pp.
- HEARN, MARTIN E., and CHARLOTTE R. MENKE.  
1968. Seafood marketing and promotional program of the Florida Board of Conservation. *Bur. Econ. Bus. Res., Univ. Fla.*, 132 pp.
- HENNICK, DANIEL P.  
1967. Forecast research on 1967 Kodiak area pink salmon fisheries. Alaska Dep. Fish Game, Leaflet 100, 22 pp.
- HENNICK, DANIEL P., and LARRY B. EDFELT.  
1969. Forecast research on 1969 Kodiak area pink salmon return. Alaska Dep. Fish Game, Leaflet 131, 18 pp.
- HERDENDORF, CHARLES E.  
1968. Sedimentation studies in the south shore reef area of western Lake Erie. *Proc. 11th Conf. Great Lakes Res.*, pp. 188-205.
- HIDU, HERBERT, KLAUS G. DROBECK, ELGIN A. DUNNINGTON, WILLIAM H. ROSENBERG, and ROBERT L. BECKETT.  
1969. Oyster hatcheries for the Chesapeake Bay region. *Natur. Resourc. Inst. Spec. Rep.* 2, *Contrib.* 382, *Univ. Md.*, 18 pp.
- HILDEBRAND, DEAN C.  
1967. A survey of the commercial fisheries on the mainstem reservoirs of the upper Missouri River System. Thesis submitted to the Faculty of the Graduate School of the University of North Dakota in partial fulfillment of the requirements for the degree of Master of Science, 93 pp.

- HOLMES, ANDEAS.  
1967. Comparative testing of midwater rigs of small draggers. Dep. Food Res. Econ., Coll. Agr., Univ. R. I., Pap. 67-90, 28 pp.
- JACKSON, PETER B.  
1968. Development and growth of the Kodiak Island shrimp fishery. Alaska Dep. Fish Game, Leafl. 120, 16 pp.
- JOHNSON, JAMES E.  
1968. Albinistic carp, Cyprinus carpio, from Roosevelt Lake, Arizona. Trans. Amer. Fish. Soc. 97:209-210.
- LELAND, JOHN G., II.  
1968. Survey of the sturgeon fishery of South Carolina. Bears Bluff Lab., Contrib. 47, 34 pp.
- LEWIS, SUE D.  
1968. Myxobolus argenteus sp. N. (Protozoa: Myxosporida), a parasite of the golden shiner. J. Parasitol. 54:1034-1037.
- LINDSAY, CEDRIC E.  
1967. Potential sources of Pacific oyster seed in Korea and Taiwan. Dep. Fish. Wash., 52 pp.
- LINTON, THOMAS L.  
1968. Proceedings of the Oyster Culture Workshop. Ga. Game Fish Comm., Mar. Fish Div., Contrib. 6, 83 pp.
- MAINE DEPARTMENT OF SEA AND SHORE FISHERIES.  
1967. Fabulous feasts with Maine seafood. State House, Augusta, 32 pp.
- MANAR, THOMAS A. (Editor).  
1966. Proceedings of the Governors Conference on Central Pacific fishery resources. State of Hawaii, Honolulu, 266 pp.
- MASSACHUSETTS SEAFOOD COUNCIL.  
1967. Seafood 'n seaports...a cook's tour of Massachusetts. Mass. Div. Mar. Fish, 32 pp.
- MCCOY, EDWARD G.  
1968. Migration, growth, and mortality of North Carolina pink and brown shrimps. N.C. Dep. Conserv. Develop., Spec. Sci. Rep., 26 pp.
- MCCOY, EDWARD C., and JAMES T. BROWN.  
1967. Migration and growth of commercial penaeid shrimps in North Carolina. N.C. Dep. Conserv. Develop., Spec. Sci. Rep. 11, 29 pp.
- MCMULLEN, JOHN C.  
1968. Investigation of king crab ocean reproduction and brood stock composition, Kodiak Island. Alaska Dep. Fish Game, Leafl. 126, 16 pp.
- MCMULLEN, JOHN C., and HARVEY T. YOSHIHARA.  
1969. Fate of unfertilized eggs in king crabs, Paralithodes camtschatica (Tilesius). Alaska Dep. Fish Game, Leafl. 127, 14 pp.
- NELSON, RICHARD C.  
1968. 1967 Alaska catch and production commercial fishery statistics. Alaska Dep. Fish Game, Leafl. 15, 29 pp.
- NICKERSON, RICHARD B.  
1969. Fish and the big shake. Alaska Sportsman 35:6-9,51-52.
- O'DELL, C.J.  
1969. Department of Chesapeake Bay Affairs conducts stream improvement program. Comm. Fish. News 2(3):1-2.

- PARKER, NEAL M.  
1968. A sedimentologic study of Perdido Bay and adjacent offshore environments. Thesis submitted to the Faculty of the Graduate School of the Florida State University in partial fulfillment of the requirements for the degree of Master of Science, 57 pp.
- PETERSON, ALLEN E., JR.  
1968. 1967 Massachusetts coastal lobster fishery statistics. Mass. Div. Mar. Sci., Tech. Ser. 3, 20 pp.
- PHINNEY, DUANE E., and MICHAEL L. DAHLBERG.  
1968. Chignik lakes and sockeye salmon studies. Univ. Wash., Fish. Res. Inst., Contrib. 280, pp. 10-12.
- POOLE, RICHARD.  
1968. The market crab. Outdoor Calif. 97:1-3.
- PURCELL, J.C., and ROBERT RAUNIKAR.  
1968. Analysis of demand for fish and shellfish. Univ. Ga., Agr. Exp. Sta., Res. Bull. 51, 37 pp.
- REARDON, JIM.  
1969. Salmon do their own counting. Outdoor Life 143(9):16-17, 150.
- SCHOLL, RUSSELL L.  
1968. A rapid decalcifying method for sectioning channel catfish pectoral spines. Trans. Amer. Fish. Soc. 97: 210-211.
- SHRABLE, JOHN BERNARD.  
1969. Effects of temperature on rate of digestion by channel catfish, Ictalurus punctatus (Rafinesque). Thesis submitted to the Faculty of the Graduate School of the Kansas State University in partial fulfillment of the requirements for the degree of Master of Science, 69 pp.
- SMEDLEY, S.C., KENNETH E. DURLEY, and MICHAEL J. MCHUGH.  
1968. Forecast of 1968 pink salmon runs southeastern Alaska, Alaska Dep. Fish Game, Leaflet 118, 17 pp.
- SMEDLEY, S.C., and MELVIN C. SEIBEL.  
1967. Forecast of 1967 pink salmon runs in southeastern Alaska. Alaska Dep. Fish Game, Leaflet 102, 15 pp.
- STEWART, DONALD M.  
1967. 1966 Bristol Bay red salmon smolt studies. Alaska Dep. Fish Game, Leaflet 102, 52 pp.
- STOKES, R.J., E.A. JOYCE, JR., and R.M. INGLE.  
1968. Initial observation on a new fishery for the sunray venus clam, Macrocollista nimbose (Solander). Fla. Bd. Conserv., Mar. Res. Lab., Tech. Ser. 56, 27 pp.
- SUTTON, RICHARD E.  
1968. Seafood processing in the Chesapeake Bay area. Univ. Md., Ext. Serv. Rep., 14: 3-9.
- SUTTON, RICHARD E., THOMAS D. CORRIGAN, and ROBERT H. WUHRMAN.  
1968. The commercial fishing and seafood processing of the Chesapeake Bay area. Univ. Md., Agr. Exp. Sta., Contrib. 4077, 80 pp.
- TIEMEIER, OTTO W., and C.W. DEYOE.  
1969. A review of techniques used to hatch and rear channel catfish in Kansas and proposed restrictions on nutritional requirements of fingerlings. Trans. Kan. Acad. Sci. 71:491-503.
- TIEMEIER, O.W., C.W. DEYOE, A.D. DAYTON, and J.R. SHRABLE.  
1969. Rations containing four protein sources compared at two protein levels and two feeding rates with fingerling channel catfish. Progr. Fish-Cult. 31:79-89.

- TIEMEIR, O.W., C.W. DEYOE, and C. SUPPES.  
1967. Production and growth of channel catfish fry (Ictalurus punctatus). Trans. Kan. Acad. Sci. 70:164-170.
- TYLER, RICHARD W., and DONALD E. BEVAN.  
1968. Kodiak Island salmon studies. Univ. Wash., Fish. Res. Inst., Contrib. 280, pp. 9-10.
- VAUGHN, THOMAS L.  
1967. Fecundity of the American shad in the Altamaha River System. Ga. Game Fish Comm., Contrib. 3, 9 pp.
- WEBB, N.B., THOMAS F.F. BUSTA, and R.J. MONROE.  
1967. A study of the quality of North Carolina scallops. N.C. Dep. Conserv. Develop. Spec. Sci. Rep. 12, 63 pp.
- WILLIAMS, AUSTIN B., and EARL E. DEUBLER.  
1968. A 10-year study of macroplankton in North Carolina estuaries. Chesapeake Sci. 9: 27-41.
- WILLIAMS, KENNETH R., VICTOR KOSKI, and ERNEST O. SALO.  
1968. Big Beef Creek studies. Univ. Wash., Fish. Res. Inst., Contrib. 280, pp. 22-23.
- WOFFARD, GEORGE EDWIN.  
1968. Evaluation of freshwater whole fish meal as a protein supplement for growing-finishing swine. Thesis submitted to the Faculty of the Graduate School of the University of Tennessee in partial fulfillment of the requirements for the degree of Master of Science, 36 pp.

## COOPERATORS

<u>State and Others</u>	<u>Agency</u>	<u>Address</u>
Alabama	Department of Conservation	State Admin. Building 64 N. Union Montgomery, Ala. 36104
	Auburn University	Auburn, Ala. 36803
American Samoa	Department of Agriculture	Pago Pago, American Samoa
Alaska	Department of Fish & Game	Subport Building Juneau, Alaska 99801
Arizona	Game & Fish Department	Phoenix, Arizona 85007
Arkansas	Game & Fish Commission	Little Rock, Ark. 72203
California	Department of Fish & Game	Resource Building Ninth & O Streets Sacramento, Calif. 95814
Colorado	Game, Fish, & Parks Dept.	6060 North Broadway Denver, Colo. 80200
Connecticut	Essex Marine Laboratory, Inc.	Essex, Conn. 06428
	State Board of Fisheries & Game	State Office Building Hartford, Conn. 06115
Delaware	Board of Game & Fish Commissioners	Box 457, North Street Dover, Del. 19901
	Commission of Shellfisheries	State House Annex Dover, Del. 19901
Florida	Board of Conservation	107 W. Gaines Street Tallahassee, Fla. 32304
Georgia	State Game & Fish Commission	401 State Capitol Atlanta, Ga. 30334
Guam	Director of Agriculture	Government of Guam Agana, Guam
Hawaii	Division of Fish & Game	Dept. of Land & Natural Resources 400 S. Beretania Street Honolulu, Hawaii 96813
Idaho	Fish & Game Department	600 S. Walnut Street Boise, Idaho 83701
Illinois	Department of Conservation	102 State Office Building Springfield, Ill. 62706
Indiana	Division of Fish & Game	Department of Natural Resources Indianapolis, Ind. 46209
Iowa	State Conservation Commission	300 Fourth Street Des Moines, Iowa 50308
Kansas	Forestry, Fish & Game Commission	Box F Pratt, Kans. 67124

COOPERATORS CONT'D

<u>State and Others</u>	<u>Agency</u>	<u>Address</u>
Kentucky	Department of Fish & Wildlife Resources	Frankfort, Ky. 40601
Louisiana	Wildlife & Fisheries Commission	400 Royal Street New Orleans, La. 70130
Maine	Department of Sea & Shore Fisheries	State House Augusta, Maine 04330
Maryland	Department of Chesapeake Bay Affairs	State Office Building Annapolis, Md. 21404
Massachusetts	Division of Marine Fisheries	Department of Natural Resources 100 Cambridge Street Boston, Mass. 02202
Michigan	Department of Natural Resources	Stevens T. Mason Building Lansing, Mich. 48926
Minnesota	Division of Game & Fish	Department of Conservation St. Paul, Minn. 55101
Mississippi	Marine Conservation Commission	122 E. Jackson Street Biloxi, Miss. 39503
Missouri	Department of Conservation	P.O. Box 180 Jefferson City, Mo. 65102
Montana	Fish & Game Department	Helena, Mont. 59601
Nebraska	Game, Forestation and Parks Commission	State Capitol Building Lincoln, Neb. 68509
Nevada	Fish & Game Commission	Box 10678 Reno, Nev. 89510
New Hampshire	Fish & Game Department	Bridge Street Concord, N. H. 03301
New Jersey	Department of Conservation & Economic Development	27 W. State Street Trenton, N. J. 08625
New Mexico	State Game Commission	State Capitol Building Santa Fe, N. Mex. 87501
New York	State Conservation Department	State Office Building Albany, N. Y. 12226
North Carolina	Division of Commercial & Sport Fisheries	Department of Conservation & Development Raleigh, N. C. 27603
North Dakota	State Game & Fish Department	Port Lincoln Bismark, N. Dak. 58501
Ohio	Division of Wildlife	Department of Natural Resources 1500 Dublin Road Columbus, Ohio 43212

## COOPERATORS CONT'D

<u>State and Others</u>	<u>Agency</u>	<u>Address</u>
Ohio	Division of Geological Survey	Department of Natural Resources 1207 Grandview Avenue Columbus, Ohio 43212
Oklahoma	Department of Wildlife Conservation	State Capitol, 1801 N. Lincoln Oklahoma City, Okla. 73501
Oregon	Fish Commission	307 State Office Building Portland, Oreg. 97201
	Pacific Salmon InterAgency Council	741 State Office Building Portland, Oreg. 97201
Pennsylvania	Fish Commission	Harrisburg, Pa. 17120
Puerto Rico	Department of Agriculture	San Juan, P. R. 00902
Rhode Island	Division of Conservation	Department of Natural Resources 83 Park Street Providence, R. I. 02903
South Carolina	Division of Commercial Fisheries	2024 Maybank Highway Charleston, S. C. 29407
South Dakota	Department of Game, Fish & Parks	State Office Building Pierre, S. Dak. 57501
Tennessee	Game & Fish Commission	Doctors' Building 706 Church Street Nashville, Tenn. 37203
Texas	Parks & Wildlife Department	John H. Reagan Building Austin, Tex. 78701
Utah	Department of Fish & Game	1596 West North Temple Salt Lake City, Utah 84114
Vermont	Fish & Game Department	Montpelier, Vt. 05602
Virgin Islands	Office of the Governor	P.O. Box 599 Charlotte Amalie, St. Thomas Virgin Islands 00801
Virginia	Commission of Fisheries	P.O. Box 756 Newport News, Va. 23607
	Institute of Marine Science	Gloucester Point, Va. 23602
Washington	Department of Fisheries	General Administration Building Olympia, Wash. 98501
	Fisheries Research Institute	University of Washington Seattle, Wash. 98105
West Virginia	Department of Natural Resources	State Office Building 3 Charleston, W. Va. 25305
Wisconsin	Department of Natural Resources	P.O. Box 450 Madison, Wis. 53701
Wyoming	Game & Fish Commission	Box 1589 Cheyenne, Wyo. 82001

**ADMINISTRATIVE ORGANIZATION**  
(BUREAU OF COMMERCIAL FISHERIES)

<u>Region 1</u>		
Idaho	Washington	Donald R. Johnson, Director
Montana	Wyoming	Harvey L. Moore, Federal Aid Supervisor
Oregon		6116 Arcade Building 1319 Second Avenue Seattle, Wash. 98101 Phone: 206-583-7676
<u>Region 2</u>		
Alabama	North Carolina	R.T. Whiteleather, Acting Director
Florida	Puerto Rico	I. B. Byrd, Federal Aid Supervisor
Georgia	South Carolina	Federal Office Building
Louisiana	Texas	144 First Avenue, South
Mississippi	Virgin Islands	St. Petersburg, Fla. 33701 Phone: 813-893-3161
<u>Region 3</u>		
Connecticut	New York	John T. Gharrett, Director
Delaware	Pennsylvania	William R. Beckmann, Federal Aid Supervisor
Maine	Rhode Island	Federal Building
Massachusetts	Vermont	14 Elm Street
Maryland	Virginia	Gloucester, Mass. 01930
New Hampshire	West Virginia	Phone: 617-281-0642
New Jersey		
<u>Region 4</u>		
Arkansas	Missouri	William F. Carbine, Director
Illinois	Nebraska	Leslie E. Whitesel, Federal Aid Supervisor
Indiana	North Dakota	5 Research Drive
Iowa	Ohio	Ann Arbor, Mich. 48103
Kansas	Oklahoma	Phone: 313-663-8541, Ext. 456
Kentucky	South Dakota	
Michigan	Tennessee	
Minnesota	Wisconsin	
<u>Region 5</u>		
Alaska		Harry L. Rietze, Director Frederik V. Thorsteinson, Federal Aid Supervisor P. O. Box 2481 Juneau, Alaska 99801 Phone: 907-586-7236
<u>Region 6</u>		
Arizona	New Mexico	Gerald V. Howard, Director
California	Nevada	Frederick K. Cramer, Federal Aid Supervisor
Colorado	Utah	300 S. Ferry Street, Room 2016 Terminal Island, Calif. 90731 Phone: 213-831-9281, Ext. 575
<u>Hawaii Area</u>		
American Samoa		John C. Marr, Director
Guam		Richard S. Shomura, Federal Aid Supervisor
Hawaii		2570 Dole Street, P.O. Box 3830 Honolulu, Hawaii 96812 Phone: 808-946-2181

MBL WHOI Library - Serials



5 WHSE 00483

As the Nation's principal conservation agency, the Department of the Interior has basic responsibilities for water, fish, wildlife, mineral, land, park, and recreational resources. Indian and Territorial affairs are other major concerns of America's "Department of Natural Resources."

The Department works to assure the wisest choice in managing all our resources so each will make its full contribution to a better United States -- now and in the future.



UNITED STATES  
DEPARTMENT OF THE INTERIOR  
U.S. FISH AND WILDLIFE SERVICE  
BUREAU OF COMMERCIAL FISHERIES  
WASHINGTON, D.C. 20240

OFFICIAL BUSINESS



POSTAGE AND FEES PAID  
U.S. DEPARTMENT OF THE INTERIOR  
THIRD CLASS

Return this sheet to above address, if you do NOT wish to receive this material , or if change of address is needed  (indicate change including ZIP Code).

Librarian S L C  
Marine Biological Lab.,  
Woods Hole, Mass. 02543