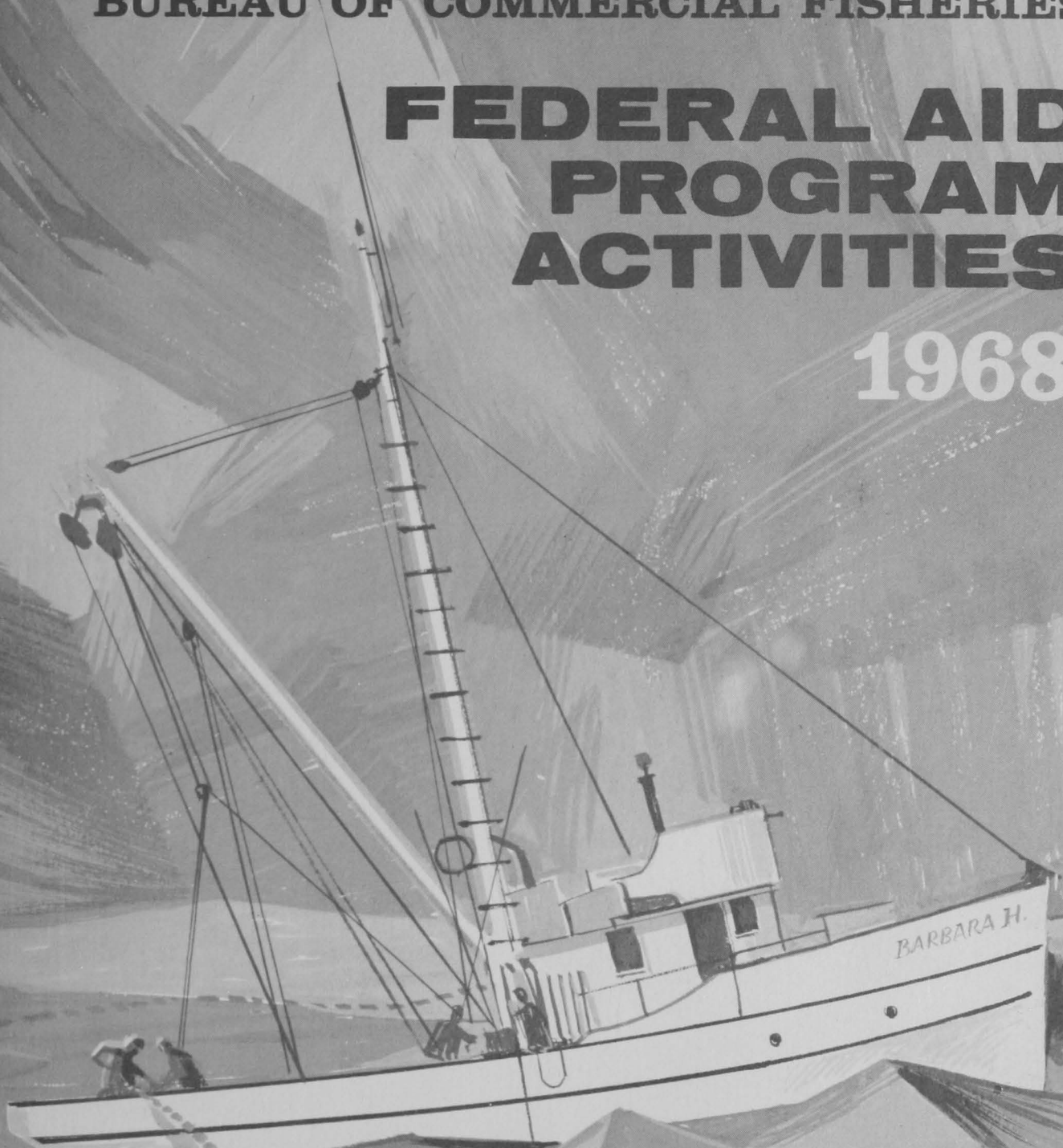


BUREAU OF COMMERCIAL FISHERIES

**FEDERAL AID
PROGRAM
ACTIVITIES**

1968



UNITED STATES DEPARTMENT OF THE INTERIOR

FISH AND WILDLIFE SERVICE

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U.S. FISH AND WILDLIFE SERVICE

BUREAU OF COMMERCIAL FISHERIES

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FEDERAL AID PROGRAM

Prepared by

Branch of Federal Aid

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BUREAU OF COMMERCIAL FISHERIES
FEDERAL AID PROGRAM

Prepared by Branch of Federal Aid Staff

INTRODUCTION

This publication contains information on project activities through May 15 of fiscal year 1968 within the Bureau of Commercial Fisheries grant-in-aid program authorized by the Commercial Fisheries Research and Development Act of 1964, the Anadromous Fish Act of 1965, and the Jellyfish Act of 1966.

Information presented is intended to provide project personnel, State program coordinators and administrators, Federal personnel, and others concerned with research, development, conservation, and management of commercial fisheries resources with a convenient reference to the Federal Aid program of the Bureau of Commercial Fisheries.

This publication is intended to facilitate planning, coordination, and integration of State, Federal, and other activities concerned with the commercial fishery resources of the Nation. This is the first of a series of annual publications on project activities of the Federal Aid program of the Bureau of Commercial Fisheries.

The projects are listed on pages 3 through 32. Included are Public Law under which the project is funded, year work started, duration of proposed work, total cost of both Federal and State shares, and page references for project narrative.

Project narratives are given on pages 33 through 111. Included are project identification number, principal investigator, and current annual total cost. Requests for any additional information about a project or reprint of any publication should be made to the State agency or cooperator. The State agencies and cooperators, including addresses, are listed on pages 116 through 119.

THE 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 fishery 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.
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 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.

PROJECT TITLES BY STATE, DURATION, AND COST

<u>Public Law</u>	<u>Project Title</u>	<u>Date Initiated (Year)</u>	<u>Estimated Duration (Years)</u>	<u>Estimated Total Cost (Dollars)</u>	<u>Reference (Page)</u>
<u>ALABAMA</u>					
88-309	Cooperative Gulf of Mexico estuarine inventory-Alabama	1966	3	130,000	81
	Oyster raft production	"	3	55,000	69
	Oyster rearing pond construction	"	2	8,000	94
	Construction of public oyster landing facilities	"	Completed	13,000	95
	Shell planting for oyster cultch	"	Completed	18,100	69
	Gulf of Mexico estuarine film	1967	1	7,900	110
89-304	Research on striped bass in Alabama rivers	1967	3	70,000	46
<u>ALASKA</u>					
88-309	Coordination and planning	1966	4	140,400	84
	Expansion of current and development of additional commercial fisheries catch, production, and gear statistics	"	4	43,800	106

<u>Public Law</u>	<u>Project Title</u>	<u>Date Initiated</u> (Year)	<u>Estimated Duration</u> (Years)	<u>Estimated Total Cost</u> (Dollars)	<u>Reference</u> (Page)
	<u>ALASKA CONT'D.</u>				
88-309	Pink salmon forecast research	1966	4	\$225,400	33
	Kvichak River smolt study	"	4	102,200	33
	Cook Inlet sockeye salmon investigations	"	4	205,000	33
	Investigation of factors limiting the production of introduced sockeye in lakes	"	4	93,400	33
	Monitoring the effects of land use on salmon production	"	4	73,300	34
	Investigation of ecological factors limiting production of the Alaskan pandalid shrimp	"	4	103,000	75
	Dungeness crab research in Southeastern Alaska	"	4	84,800	65
	Reproduction of king crabs (<u>Paralithodes camtschatica</u>) in the Kodiak Island area	"	4	138,100	65
	King salmon headquarters-architectural plans	"	Completed	15,000	96
	Commercial feasibility of Alaskan scallop fishery	1968	2	80,000	77
	Southeastern and Kodiak Island, Alaska, stream catalogs	"	1	4,000	52
89-304	Identification of red salmon stocks taken in the Cape Kumlik-Aniakchak Bay fishery (Chignik area)	1967	2	40,000	35

<u>Public Law</u>	<u>Project Title</u>	<u>Date Initiated (Year)</u>	<u>Estimated Duration (Years)</u>	<u>Estimated Total Cost (Dollars)</u>	<u>Reference (Page)</u>
	<u>ALASKA CONT'D.</u>				
89-304	Sockeye salmon migration behavior and biological statistics collection, Southeastern Alaska	1967	4	\$220,000	34
	Restoration and rehabilitation of earthquake damaged pink and chum salmon spawning areas in Prince William Sound	"	4	250,000	34
	Bristol Bay intermediate high seas inshore test fishing program	"	4	280,000	34
	Offshore salmon abundance index	"	4	270,000	34
	Yukon and Kuskokwim anadromous fish investigations	"	4	290,000	35
	Kodiak Island sockeye salmon investigations	"	4	389,000	35
	Copper River sockeye salmon investigations	"	4	220,000	35
	Planning and coordination	"	4	178,400	84
	Computer simulation model of the Dixon Entrance salmon stocks	1968	2	36,000	36
	Pink salmon forecast research	"	3	120,000	36
	Escapement enumeration investigations	"	3	127,400	36
	Forecast of Kodiak Island pink salmon runs from abundance of juveniles in estuaries	"	1	47,400	36
	Optimum escapement studies of Chignik sockeye salmon	"	1	33,700	36

<u>Public Law</u>	<u>Project Title</u>	<u>Date Initiated (Year)</u>	<u>Estimated Duration (Years)</u>	<u>Estimated Total Cost (Dollars)</u>	<u>Reference (Page)</u>
<u>ARIZONA</u>					
88-309	Investigation of commercial fishery potentials in reservoirs	1966	3	\$ 27,147	58
<u>ARKANSAS</u>					
88-309	Commercial fishery industry survey	1966	4	73,270	106
<u>CALIFORNIA</u>					
88-309	Fisheries resources sea survey	1966	3	329,000	50
	Shellfish laboratory operations	"	3	32,300	77
	Coordination and planning	"	3	66,300	84
	Port sampling at Crescent City	"	4	24,000	106
	Food habits study of organisms of the California current system	"	4	150,000	50
	California shellfish and bottomfish data analysis	"	4	156,000	77
89-304	Mad River hatchery construction	1967	4	3,000,000	86
	Caspar Creek egg station construction	"	2	40,000	86
	Scott Valley fish screen construction	"	Completed	70,000	88
	Eel and Mad River anadromous fish water requirements	"	1	147,000	37

<u>Public Law</u>	<u>Project Title</u>	<u>Date Initiated (Year)</u>	<u>Estimated Duration (Years)</u>	<u>Estimated Total Cost (Dollars)</u>	<u>Reference (Page)</u>
<u>CALIFORNIA CONT'D.</u>					
89-304	Delta migration study	1967	1	72,000	37
<u>CONNECTICUT</u>					
88-309	Coordination and planning	1966	3	11,400	84
	Investigations on the lobster	"	4	60,000	67
	Investigation of the life histories and potential fishery of river herrings	"	Completed	42,100	45
89-304	A study of the rate and pattern of shad migration in the Connecticut River utilizing sonic tracking apparatus	1967	2	30,000	42
	Investigation of the life histories and potential fishery of river herrings in Connecticut	1968	2	33,000	44
<u>COLORADO</u>					
88-309	Raising bait fishes in the Rocky Mountain States	1966	4	78,000	58
<u>DELAWARE</u>					
88-309	Rehabilitation of the natural seed oyster beds in Delaware	1965	Completed	40,000	69
	Pilot studies of the spawning and rearing of MSX resistant oysters	1966	4	114,000	69

<u>Public Law</u>	<u>Project Title</u>	<u>Date Initiated (Year)</u>	<u>Estimated Duration (Years)</u>	<u>Estimated Total Cost (Dollars)</u>	<u>Reference (Page)</u>
<u>DELAWARE CONT'D.</u>					
88-309	A resurvey of the condition and extent of the natural seed oyster beds in Delaware	1967	Completed	\$ 12,000	69
89-304	Feasibility of the restoration of shad runs in the tributaries of the Delaware estuary	"	Completed	\$ 15,000	42
	Shad passageway construction on the Brandywine River	1968	3	480,000	88
<u>FLORIDA</u>					
88-309	Marketing	1965	4	877,332	108
	Gulf of Mexico estuarine film	1967	1	7,900	110
	Construction of artificial oyster reefs	"	4	150,000	70
	A study of the effects of a commercial hydraulic clam dredge on benthic communities in estuarine areas	"	4	140,000	81
89-304	Investigations on the American shad in the St. Johns River	1968	3	90,000	42
<u>GEORGIA</u>					
88-309	Feasibility study of methods for improving oyster production in Georgia	1965	4	120,900	70

<u>Public Law</u>	<u>Project Title</u>	<u>Date Initiated (Year)</u>	<u>Estimated Duration (Years)</u>	<u>Estimated Total Cost (Dollars)</u>	<u>Reference (Page)</u>
<u>GEORGIA CONT'D.</u>					
88-309	Preliminary survey of existing and potential marine resources on the Georgia coast	1966	1	\$ 3,600	50
	Research vessel construction	"	2	50,860	90
	Seasonal abundance and biological stability of the commercial shrimp of Georgia	"	3	98,900	75
	Survey of a potential hard clam fishery	"	2	43,400	63
	Economic survey of the marine commercial fishing industry of Georgia	"	2	25,000	105
89-304	Shad fishery of the Altamaha River	1967	2	30,000	43
<u>HAWAII</u>					
88-309	Development of a prawn fishery	1966	2	77,085	75
	Investigation for the development of a commercial oyster industry	"	2	39,575	70
	Central Pacific Tuna Conference	"	Completed	4,000	84
	Management investigation of the akule or jack mackerel (<u>Trachurus crumenophthalmus</u>)	"	3	39,282	52
	Management investigation of two species of spiny lobsters, <u>Panulirus japonicus</u> (<u>De Siebold</u>) and <u>P. Penicillatus</u> (<u>Oliver</u>)	"	3	45,027	67

<u>Public Law</u>	<u>Project Title</u>	<u>Date Initiated</u> (Year)	<u>Estimated Duration</u> (Years)	<u>Estimated Total Cost</u> (Dollars)	<u>Reference</u> (Page)
<u>LOUISIANA CONT'D.</u>					
88-309	Shell planting for oyster cultch	1967	Completed	\$105,000	71
	Construction of saltwater culture ponds	1968	1	135,000	94
89-304	Ecological factors affecting anadromous fishes of Lake Pontchartrain and its tributaries	1967	3	125,000	46
<u>MAINE</u>					
88-309	Study of the economic and operational feasibility of mechanization of the Maine sardine processing canning operations	1965	Completed	95,000	101
	Investigation of physical aspects of raw herring	1965	Completed	12,000	101
	Northern shrimp - biological and technological research	1966	3	140,928	75
	Maine marine fisheries extension service	"	3	100,464	110
	Lobster research program	"	3	275,664	67
	The development of commercial fisheries estuarine resources	"	2	88,390	50
	Biological, environmental and technological research on marine worms	"	3	140,000	101

<u>Public Law</u>	<u>Project Title</u>	<u>Date Initiated</u> (Year)	<u>Estimated Duration</u> (Years)	<u>Estimated Total Cost</u> (Dollars)	<u>Reference</u> (Page)
<u>MAINE CONT'D.</u>					
88-309	Promotion and market development	1966	3	\$168,900	108
	Coordination and planning	1967	2	52,000	84
	Laboratory and tank room construction for P.L. 88-309 projects	"	1	4,000	92
89-304	Increased development of the commercial anadromous fishery resources	1967	2	48,000	44
	Stream improvement and fishway construction	1968	1	50,000	88
<u>MARYLAND</u>					
88-309	Determination of the distribution and abundance of the winter flounder, <u>Pseudopleuronectes americanus</u>	1966	Completed	27,200	48
	Study of the effects of thermal pollution on <u>Crassostrea virginica Gmelin</u> in the Patuxent River estuary	"	Completed	16,224	74
	Studies of the physical and chemical properties of the estuarine environment associated with fish kills	"	Completed	21,000	82
	Tagging of juvenile striped bass, <u>Roccus saxatilis (Walbaum)</u> , in Chesapeake Bay estuaries	"	2	50,400	46

<u>Public Law</u>	<u>Project Title</u>	<u>Date Initiated (Year)</u>	<u>Estimated Duration (Years)</u>	<u>Estimated Total Cost (Dollars)</u>	<u>Reference (Page)</u>
	<u>MARYLAND CONT'D.</u>				
88-309	Studies of the physical processes of movement and dispersion of oyster larvae	1966	Completed	\$ 18,000	74
	Suspended sediments in the upper Chesapeake Bay	"	2	48,000	80
	An economic study of the fisheries and seafood processing industries with emphasis on the Chesapeake Bay area	"	2	41,008	105
	Development of a disease-resistant oyster brood stock	1967	Completed	19,500	71
	Biologic and environmental control of Eurasian milfoil (<u>Myriophyllum spicatum</u> L.) in Chesapeake Bay	"	2	20,913	80
	Coordination and planning	"	2	36,000	85
	Market development for Chesapeake Bay seafoods	"	2	500,000	108
	Maryland marine fisheries extension service	"	2	40,100	110
	Development of disease-resistant oysters (<u>C. virginica</u>) under field conditions in lower Chesapeake Bay	"	2	76,546	71

<u>Public Law</u>	<u>Project Title</u>	<u>Date Initiated (Year)</u>	<u>Estimated Duration (Years)</u>	<u>Estimated Total Cost (Dollars)</u>	<u>Reference (Page)</u>
	<u>MARYLAND CONT'D.</u>				
89-304	Ecological study of Susquehanna River and tributaries below Conowingo Dam and their contributions to the anadromous fish populations of upper Chesapeake Bay, and development of methods to eliminate massive mortalities below Conowingo Dam	1967	3	\$263,000	50
	Stream improvement program for anadromous fish management	"	3	129,300	59
89-720	A study of the biology of sea nettles to develop potential methods for control of their abundance	1968	3	300,000	79
	<u>MASSACHUSETTS</u>				
88-309	Collection, compilation, evaluation and dissemination of commercial fisheries statistics	1966	2	64,988	106
	Identification of winter flounder subpopulations	"	2	40,000	48
	Cat Cove dike repair	"	Completed	35,000	96
	Coordination and planning	"	3	136,384	85
	Consumer education and market development	"	2	54,000	108

<u>Public Law</u>	<u>Project Title</u>	<u>Date Initiated (Year)</u>	<u>Estimated Duration (Years)</u>	<u>Estimated Total Cost (Dollars)</u>	<u>Reference (Page)</u>
<u>MASSACHUSETTS CONT'D.</u>					
88-309	Cat Cove pier repair and pool rehabilitation	1966	2	\$ 54,000	96
	Shellfish extension	"	3	39,000	110
	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	117,000	101
	Study of the feasibility and application of Danish seining to the Massachusetts fishing industry	"	2	45,000	98
89-304	Anadromous fish investigations	1967	4	48,000	44
88-309	Marine research vessel acquisition	1968	1	40,000	90
<u>MICHIGAN</u>					
89-304	Appraisal of stocks of anadromous fishes in the Michigan waters of the Great Lakes	1967	Completed	20,000	59
	Parasites, diseases, and disease control of Great Lakes anadromous and commercial fish	1968	1	60,000	59
88-309	Surveillance of lake trout restoration in Michigan waters of Lake Michigan	1966	4	134,800	53

<u>Public Law</u>	<u>Project Title</u>	<u>Date Initiated (Year)</u>	<u>Estimated Duration (Years)</u>	<u>Estimated Total Cost (Dollars)</u>	<u>Reference (Page)</u>
<u>MINNESOTA</u>					
88-309	Minnesota commercial fisheries improvement-Western Lake Superior	1965	3	\$ 32,447	54
	Development of under-ice horizontal sonar scanning equipment and technique for locating fish schools	1966	2	10,000	98
89-304	Anadromous fish habitat development (commercial fisheries phase)	1967	1	16,000	60
88-309	Lake Superior commercial fisheries assessment studies	1968	3	30,000	59
	Minnesota commercial fisheries improvement-Lake of the Woods	1968	3	105,978	60
<u>MISSISSIPPI</u>					
88-309	Cooperative Gulf of Mexico estuarine inventory and study, Mississippi	1966	2	295,300	51
	A study of coliform bacteria and <u>Escherichia coli</u> on polluted and unpolluted oyster bottoms of Mississippi and a study of depuration by rebedding	"	3	97,284	71
	A seasonal study of nektonic and benthic faunas of the shallow gulf off Mississippi out to the fifty fathom curve	"	3	94,299	80
	Gulf of Mexico estuarine film	1967	1	7,900	110

<u>Public Law</u>	<u>Project Title</u>	<u>Date Initiated (Year)</u>	<u>Estimated Duration (Years)</u>	<u>Estimated Total Cost (Dollars)</u>	<u>Reference (Page)</u>
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MISSISSIPPI CONT'D.

88-309	A study of bacterial spoilage patterns in iced <u>Penaeus</u> shrimp	1967	2	\$ 38,600	102
89-720	Population studies of Mississippi Sound and inshore Gulf coelenterates with special emphasis on noxious planktonic forms	1967	2	49,180	79
89-304	A study of the striped bass, <u>Roccus saxatilis</u> , in Mississippi waters	1967	4	210,000	46

MISSOURI

88-309	Research and management of commercial fisheries	1966	2	46,650	106
	Palatability of Missouri fish	1967	1	7,500	102

MONTANA

88-309	Fort Peck Reservoir fishery investigations	1966	3	60,000	60
	Construction of fishery research vessel for Fort Peck Reservoir fishery investigations	"	Completed	20,000	90
	Processing and marketing Montana commercial fisheries products	1967	1	20,400	109

<u>Public Law</u>	<u>Project Title</u>	<u>Date Initiated (Year)</u>	<u>Estimated Duration (Years)</u>	<u>Estimated Total Cost (Dollars)</u>	<u>Reference (Page)</u>
<u>NEBRASKA</u>					
88-309	Establishment of the seasonal distribution and availability of commercial fish species in the waters of Nebraska	1967	2	\$ 75,300	60
	Design and construction of facilities relative to trapping and handling of commercial fishes	1966	Completed	54,000	96
<u>NEW HAMPSHIRE</u>					
88-309	Soft-shell clam population study in Hampton-Seabrook Harbor, New Hampshire	1966	3	12,000	63
	An investigation of the possibility of seed oyster production in Great Bay, New Hampshire	"	3	74,767	71
89-304	Commercial fisheries development	1968	3	230,000	45
<u>NEW JERSEY</u>					
88-309	Shell planting program Maurice River Cove (Delaware Bay) and Mullica River (Atlantic Coast)	1965	3	538,000	72
	Evaluation of the menhaden and shad fishery in Delaware Bay and adjacent waters	1966	Completed	38,000	51
	Disease resistant oyster program - Delaware Bay	1967	1	50,000	72

<u>Public Law</u>	<u>Project Title</u>	<u>Date Initiated (Year)</u>	<u>Estimated Duration (Years)</u>	<u>Estimated Total Cost (Dollars)</u>	<u>Reference (Page)</u>
<u>NEW JERSEY CONT'D.</u>					
89-304	Population and migration study of major anadromous fish	1967	2	\$ 59,500	43
<u>NEW MEXICO</u>					
88-309	Investigations on commercial fishery potential of rough fish species	1968	3	33,000	62
<u>NEW YORK</u>					
88-309	Pilot plant depuration of hard clams	1965	Completed	39,000	64
	Management planning for New York fresh-water commercial fisheries	1966	3	72,000	60
	Construction of a marine research and development laboratory	"	3	360,000	92
	Pond culture of oyster seed in a controlled natural environment	1967	3	99,400	72
	Studies of problems involved when hard clams in commercial quantities are subjected to the depuration process	"	2	66,000	63
<u>NORTH CAROLINA</u>					
88-309	Oyster studies	1965	3	68,000	72
	A study of the quality of North Carolina scallops	"	3	37,500	102
	Studies on macroplanktonic crustaceans and ichthyoplankton of the Pamlico Sound	"	Completed	24,400	81

<u>Public Law</u>	<u>Project Title</u>	<u>Date Initiated (Year)</u>	<u>Estimated Duration (Years)</u>	<u>Estimated Total Cost (Dollars)</u>	<u>Reference (Page)</u>
<u>NORTH CAROLINA CONT'D.</u>					
88-309	Shrimp studies	1966	3	\$ 86,000	75
	Equipping exploratory fishing vessel	1967	1	25,000	91
89-304	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	46
	Factors affecting survival of immature striped bass	1968	3	41,212	47
	Offshore anadromous fish exploratory fishing program	"	3	150,000	47
<u>NORTH DAKOTA</u>					
88-309	Garrison Reservoir commercial fishery investigations	1966	4	26,400	61
	Commercial fish markets for North Dakota fisheries	"	2	10,000	109
	A survey of commercial fisheries on the mainstem reservoirs of the upper Missouri River system	"	Completed	4,500	61
	A study of the commercial fishery potential of Lake Ashtabula	1967	3	29,000	61

<u>Public Law</u>	<u>Project Title</u>	<u>Date Initiated (Year)</u>	<u>Estimated Duration (Years)</u>	<u>Estimated Total Cost (Dollars)</u>	<u>Reference (Page)</u>
		<u>OHIO</u>			
88-309	Lake Erie commercial fisheries research	1966	4	\$199,000	56
	Value of whole fish meal in breeding gestation ration for swine	1967	3	75,000	102
	Mussel fisheries investigations	"	3	80,000	68
89-304	A study of the physical characteristics of the major reef areas in the western basin of Lake Erie	1967	3	56,000	83
		<u>OKLAHOMA</u>			
88-309	Commercial fisheries investigations	1967	2	104,400	61
	Commercial fisheries statistics	"	2	50,000	107
		<u>OREGON</u>			
88-309	Processed hake in feed for mink	1965	3	18,153	103
	Study on the distribution and abundance of pink shrimp, <u>Pandalus jordani</u> , in the Pacific Ocean off Oregon	"	3	96,158	76
	Investigation of the abundance and recruitment of bottomfish off Oregon, with emphasis on Dover sole	"	3	75,000	48

<u>Public Law</u>	<u>Project Title</u>	<u>Date Initiated (Year)</u>	<u>Estimated Duration (Years)</u>	<u>Estimated Total Cost (Dollars)</u>	<u>Reference (Page)</u>
<u>OREGON CONT'D.</u>					
88-309	Controlled rearing of dungeness crab larvae and the influence of environmental conditions on their survival	1965	3	\$ 35,964	65
	Coordination and planning	"	3	17,091	85
	Development of the shad industry	1966	3	39,271	102
	Utilization of hake, dogfish, and by-products of the fillet industry for protein supplements	"	3	82,167	103
	Laboratory hatching and rearing of Pacific Coast clams and oysters	1967	1	18,543	63
	Preparation of marine protein concentrate from hake	"	2	60,000	103
	Boat charter	"	2	75,000	52
89-304	Rearing ponds - North Nehalem River salmon hatchery	1967	4	260,000	86
	Planning and coordination	"	4	26,000	85
	Construction and operation of the Elk River salmon hatchery	"	3	564,500	86
	Development and improvement of hatchery techniques for Pacific salmon and steelhead trout	"	4	589,000	37

<u>Public Law</u>	<u>Project Title</u>	<u>Date Initiated</u> (Year)	<u>Estimated Duration</u> (Years)	<u>Estimated Total Cost</u> (Dollars)	<u>Reference</u> (Page)
<u>OREGON CONT'D.</u>					
89-304	Management of the troll salmon fishery with emphasis on the collection of data on shore and at sea for regulation formula	1967	3	\$ 85,000	37
	Evaluate, coordinate, and plan Pacific salmon research and management activities on a coastwide basis	"	4	236,000	85
	Increased production of anadromous salmonids in Oregon coastal streams and lakes	"	Completed	36,000	38
	Production and distribution of anadromous salmonids from the Alsea River salmon hatchery	"	2	66,805	97
	Effects of logging on salmon populations in coastal streams	1968	3	57,200	38
	Remove culvert and construct bridge to provide anadromous fish passage on Clear Creek, tributary to the Kilchis River	"	Completed	10,000	96
	Research and management on wild and hatchery-produced salmon in Oregon south coastal streams	"	3	204,000	38
	Hatch, rear and release salmonids at the North Nehalem River salmon hatchery	"	3	100,000	97
	Shad and striped bass management study	"	2	33,000	43

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<u>PENNSYLVANIA</u>					
88-309	A study to establish a program to increase the production of high value commercial fishes in Lake Erie	1967	3	\$198,996	61
89-304	Feasibility study of the restoration of shad runs in tributaries of the Delaware estuary	1967	2	30,000	43
<u>RHODE ISLAND</u>					
88-309	Investigation of the deep sea red crab (<u>Geryon quinquedens</u>)	1966	3	21,000	65
	Investigation of the basic life history of the red crab	"	3	55,100	66
	Operational testing of two pelagic trawls on two small draggers	"	Completed	20,000	99
	Mollusk environmental modification and control studies	"	3	60,000	77
89-304	Construction of fish ladders	1967	4	430,000	88
88-309	Wickford marine laboratory dock repairs	1968	1	2,500	93
<u>SOUTH CAROLINA</u>					
88-309	Charting of subtidal oyster beds and experimental transplanting of seed oysters thereto from polluted seed oyster beds	1965	3	52,583	72

<u>Public Law</u>	<u>Project Title</u>	<u>Date Initiated (Year)</u>	<u>Estimated Duration (Years)</u>	<u>Estimated Total Cost (Dollars)</u>	<u>Reference (Page)</u>
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SOUTH CAROLINA CONT'D.

88-309	To manage and practice aquaculture in shrimp farm ponds and in large tanks under controlled conditions	1966	3	\$ 30,615	76
	To add a refrigerating unit to existing system for temperature control of saltwater culture tanks	"	Completed	2,387	92
89-304	Survey of sturgeon fishery of South Carolina	1967	Completed	10,000	49

SOUTH DAKOTA

88-309	Commercial fishery industry survey	1966	2	33,845	107
	Missouri reservoir fisheries product development and evaluation	"	2	20,600	103
	Effects of intensive bullhead removal in selected lakes in eastern South Dakota	1967	3	29,750	56
	Commercial fishing gear research and development for lakes and reservoirs in South Dakota	1968	2	20,000	100

TENNESSEE

88-309	Development of improved fishing methods for use in southeastern and south central reservoirs	1965	3	39,984	99
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<u>Public Law</u>	<u>Project Title</u>	<u>Date Initiated (Year)</u>	<u>Estimated Duration (Years)</u>	<u>Estimated Total Cost (Dollars)</u>	<u>Reference Page</u>
<u>TENNESSEE CONT'D.</u>					
88-309	Evaluation of whole fish meal as a protein supplement for swine	1967	1	\$ 5,000	104
<u>TEXAS</u>					
88-309	An evaluation of the effects of estuarine engineering projects	1966	3	40,320	81
	Construction of a Gulf research vessel	"	Completed	122,300	90
	Coastal fisheries experiment station	"	3	514,000	92
	Northern Gulf of Mexico marine fisheries investigation	1967	3	200,000	51
	Gulf of Mexico estuarine film	"	2	7,900	111
	Commercial fishery landings statistical program	"	3	46,800	107
	Study of migratory patterns of fish and shellfish through a natural pass	"	3	70,000	77
	Seafood marketing	"	3	195,000	109
	Experimental pond research planning	1968	1	6,400	85
<u>UTAH</u>					
88-309	Investigations of the intensity of natural selection upon different phenotypes (blood types) of rainbow trout in commercial trout rearing ponds and reservoirs	1967	2	17,430	55

<u>Public Law</u>	<u>Project Title</u>	<u>Date Initiated (Year)</u>	<u>Estimated Duration (Years)</u>	<u>Estimated Total Cost (Dollars)</u>	<u>Reference (Page)</u>
<u>VERMONT</u>					
88-309	Investigation of the commercial fisheries potential of Lake Champlain	1967	2	\$ 75,000	62
<u>VIRGINIA</u>					
88-309	Investigation of potential for expansion of the industrial fishery of the mid-Atlantic bight	1965	3	149,556	51
	Production of disease-resistant oysters	"	3	150,000	73
	Investigation of oyster larvae and spat and certain important environmental factors in an horizontally stratified estuary	"	Completed	140,800	73
	Characterization of coastal and estuarine fish nursery grounds as natural communities	"	Completed	90,100	82
	Propagation of disease resistant oysters	1967	1	190,000	73
	Consumer education and market development	"	1	16,000	109
	A study of the soft clam resources of Virginia	"	2	63,562	63
89-304	Biology and utilization of anadromous alosids	1967	4	418,000	44
89-720	An ecological study of the jellyfish (<u>Chrysaora quinquecirrha</u>) in lower Chesapeake Bay	1968	3	85,266	79

<u>Public Law</u>	<u>Project Title</u>	<u>Date Initiated</u> (Year)	<u>Estimated Duration</u> (Years)	<u>Estimated Total Cost</u> (Dollars)	<u>Reference</u> (Page)
<u>WASHINGTON</u>					
88-309	Coordination and planning	1965	3	\$ 36,000	85
	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	38
	Construction of small fishways	"	2	28,000	89
	Monitor condition of certain groundfish stocks, Washington trawl grounds	"	3	260,000	48
	Inspection of oyster seed, new Asiatic sources	"	Completed	6,000	73
	Early marine life history, chum and pink salmon	"	Completed	16,000	40
	Field recovery, coded wire tag	"	2	36,600	38
	Willapa oyster studies	"	2	56,000	73
	Hatchery coho salmon--contribution to the fishery	"	3	42,000	39
	Evaluation of dry feed for hatchery salmon	"	3	135,000	39
	Analysis and publication of coded wire tag research data	"	3	44,000	39

<u>Public Law</u>	<u>Project Title</u>	<u>Date Initiated</u> (Year)	<u>Estimated Duration</u> (Years)	<u>Estimated Total Cost</u> (Dollars)	<u>Reference</u> (Page)
<u>WASHINGTON CONT'D.</u>					
88-309	Mid-water trawl fisheries management investigations	1967	2	\$ 35,500	99
	Larval and estuarial studies, pink and chum salmon populations	"	2	65,000	39
	Determination of the nutritive value of North Pacific fish meals for poultry	"	3	54,000	104
	Subtidal hardshell clam fisheries development	"	3	53,000	64
	Oyster drill (<u>Ocenebra japonica</u>) control	"	2	25,000	74
89-304	Salmon rearing operations	1967	Completed	392,000	97
	Planning and coordination	"	4	22,000	85
	Construction of Soleduck salmon hatchery	"	3	1,666,000	86
	Stream improvement planning	1968	1	20,000	39
	Samish salmon hatchery supplemental water supply and rearing pond system	"	1	98,000	87
	Port Susan-Port Gardner pink salmon studies-stock separation and identification	"	1	18,500	40
	Measuring of spawning success of chum salmon utilizing natural and controlled spawning areas in Big Beef Creek, Washington	"	1	91,948	40

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<u>WASHINGTON CONT'D.</u>					
89-304	Gill net dropout study	1968	3	\$ 70,000	40
	Nooksack hatchery coho yearling pond construction	"	1	28,000	87
	Simpson hatchery rearing pond construction	"	1	92,000	87
	Issaquah hatchery coho yearling pond construction	"	1	22,000	87

WEST VIRGINIA

88-309	Investigations of the commercial potential of fishery resources in West Virginia	1966	3	46,500	62
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WISCONSIN

88-309	Assessment of lake trout restoration in the Wisconsin waters of Lake Michigan	1965	3	81,999	53
89-304	Walleye population study in respect to a possible commercial fishery	1967	2	27,000	57
	A comparative study of thyroidal, interrenal, and gonadal activity in the alewife	1968	1	6,000	44
	An investigation of the reproductive cycle of the alewife in Lake Michigan	"	3	55,930	45

<u>Public Law</u>	<u>Project Title</u>	<u>Date Initiated (Year)</u>	<u>Estimated Duration (Years)</u>	<u>Estimated Total Cost (Dollars)</u>	<u>Reference (Page)</u>
<u>AMERICAN SAMOA</u>					
88-309	A determination of the feasibility of developing offshore commercial fishing in American Samoa	1966	3	\$104,942	98
<u>GUAM</u>					
88-309	A study to determine the feasibility of developing a deep-sea commercial fishing industry on Guam	1966	3	\$104,000	98
<u>PUERTO RICO</u>					
88-309	Coordination and planning	1966	3	109,000	85
	Design and construction of an improved fishing boat	"	2	7,600	90
	Gear research and testing of improved commercial fishing boats	"	3	205,000	99
	Construction of commercial fisheries laboratory	"	2	100,000	92
	Construction of fishing port facilities	1967	2	150,000	95
	Fisheries statistical program	"	2	200,000	107
<u>VIRGIN ISLANDS</u>					
88-309	Study of the fisheries potential of the Virgin Islands	1966	3	82,000	99

RESEARCH

MARINE FISH

Pacific salmon:

Alaska 5-4-R. Michael McHugh \$76,300

Pink salmon forecast research - This project provides for the expansion and refinement of pink salmon forecast and optimum escapement research into the Kodiak, Cook Inlet, and Southeast Alaska areas using preemergent fry abundance as an index to adult returns and through preliminary experiments using tow nets in certain estuaries. Each season, about 25 streams are sampled in the Kodiak area, 12 in the Cook Inlet area, and about 100 in the southeastern Alaska work. The major Alaskan pink salmon fisheries are in these areas.

Alaska 5-5-R. Steven Pennoyer 28,000

Kvichak River smolt study - This project is concerned with smolt enumeration on one of the most important sockeye salmon producing systems of Bristol Bay, the Kvichak River. A great deal of work has been done in the past on counting of downstream migrants as an index to predict returning run size and estimate the annual escapement levels needed to sustain maximum yield in other areas. This extensive past work is being evaluated to determine its applicability to the Kvichak system.

Alaska 5-6-R. Allen Davis 47,000

Cook Inlet sockeye salmon investigations - Sonar equipment to overcome difficulties in enumerating salmon runs into glacially turbid river systems was developed under this project. (This phase of the work was transferred to P.L. 89-304, see Alaska AFC-16.) Research is continuing on annual outmigration of smolt, age, and condition in the Kenai and Kasilof Rivers in an attempt to understand carrying capacity of various river systems, plus spawning ground sampling and age and sex composition of catch and escapement in major spawning river systems in the Cook Inlet area for management information.

Alaska 5-7-R. Martin Eaton 27,400

Investigation of factors limiting the production of introduced sockeye salmon in lakes - Much lake area is available in British Columbia and Alaska that appears suitable as rearing area for sockeyes, but the species does not occur in these systems because of obstructions in the outlet streams. Many such obstructions could be laddered and a run of sockeye introduced. Much remains to be learned, however, about the factors that limit production of introduced sockeye runs. This research is designed to evaluate such factors in Frazer Lake where this species has been introduced.

Monitoring the effects of land use on salmon production - This project is responsive to intensive research on the impact of logging on salmon streams, primarily pink salmon. It is a joint monitoring effort by the U.S. Forest Service and the Alaska Fisheries Research Institute. This type of monitoring has been underway for several years and will become an even more critical requirement as this and other land uses are expanded.

Alaska AFC-2.

Charles Engelking

50,000

Sockeye salmon migration behavior and biological statistics collection, Southeastern Alaska - During the 1967 season, 260 sockeye salmon were tagged and released in Sumner and Clarence Straits to determine migration routes and racial composition of the catch. In conjunction with the tagging program, weekly biological sampling of the gill net fishery and at seven weirs on the major spawning systems has been undertaken. The study will upgrade the knowledge of the sockeye salmon stocks in southeastern Alaska necessary not only for the proper management of the resource but for the international problem of separating Alaskan and Canadian fish in the boundary area.

Alaska AFC-3.

Robert Roys

102,800

Restoration and rehabilitation of earthquake-damaged pink and chum salmon streams in Prince William Sound, Alaska - The objectives of this project are the restoration of pink and chum salmon and the rehabilitation of spawning areas in 181 streams in Prince William Sound where production has been seriously curtailed by tectonic disturbances of the March 1964 earthquake. Restorative work was completed on 15 streams during fiscal years 1967 and 1968, and 15 streams are programmed for rehabilitation during 1969. Production increases were evidenced in some systems and were directly attributable to the improvement work.

Alaska AFC-4.

James Mauney

150,000

Offshore salmon abundance index - Offshore fishing with gill nets and long line gear is being conducted in a band approximately 50 miles wide from the coast of southeastern Alaska, between Yakutat Bay and Dixon Entrance, to provide short-term annual forecasts of the magnitude of the chum, pink, and sockeye salmon runs as they near the inshore fisheries and spawning areas. The study would provide the industry and the State with lead time for adjusting plant operations, disposition of the fishing fleet, and regulation of the runs.

Alaska AFC-6.

Kenneth Middleton

64,000

Bristol Bay intermediate high seas inshore test fishing program - This project is designed to provide estimates of the magnitude,

timing, and age composition of the Bristol Bay adult sockeye salmon runs six to eight days prior to the time the fish reach the inshore commercial fishery. During the Spring 1967 runs, test fishing with gill nets was done along a transect from Port Moller to Cape Newenham. In addition to recording the catches, approximately 450 scales were collected for determining age composition. Also, 25 fish were tagged to evaluate the feasibility of marking gill-net-caught fish. Data are being analyzed.

Alaska AFC-7. Ronald Regnart 100,000

Yukon and Kuskokwim Rivers anadromous fish investigations - Little is known of the large salmon runs which are utilized for commercial and subsistence purposes north of Bristol Bay. During May and June 1967, about 4,000 king and chum salmon were sampled for age, sex, length, and weight information; 3,700 captured and subsequently tagged and released for abundance index, timing, and spawning distribution; and 50 samples taken for fecundity information. Data collected are presently being analyzed.

Alaska AFC-8. Martin Eaton 120,600

Kodiak Island sockeye salmon investigations - The sockeye salmon resource in the Kodiak Island area has been characterized by a long-term general decline. The purpose of this long-range investigation is to provide the necessary information needed to restore this valuable resource to former levels of abundance. Offshore seining and tagging program of the Kodiak sockeye was initiated in June 1967. Biological data were obtained on the fish captured and released.

Alaska AFC-9. Jack Lechner 18,000

Identification of red salmon stocks in the Cape Kumlik-Aniakchak Bay fishery (Chignik area) - A red salmon cape fishery has developed at Cape Kumlik on the south side of the Alaska Peninsula since 1960 and has increased from 13,000 fish in 1960 to 109,000 in 1964, and presently depends only on run size. The study will determine the origin of these red salmon stocks by tagging program and biological sampling on recovered tagged fish and fish taken in the fisheries, so that an established management basis may be determined for this Cape fishery.

Alaska AFC-10. Robert Roys 70,000

Copper River sockeye salmon investigations - This project is undertaken to determine the qualitative and quantitative Copper River red salmon escapement during the upstream migration by tag and recovery programs and by extensive surveys of the spawning grounds. During the 1967 season, most of the objectives were organizational to get the study underway; however, aerial and ground surveys were made of spawning grounds, over 2,000 spaghetti and 1,275 Peterson disc tags were applied, and biological data were collected from fish caught at the tagging sites.

Alaska AFC-12.

Richard Tyler

\$ 69,200

Forecast of Kodiak Island pink salmon runs from abundance of juveniles in estuaries - This project provides for research by the Fisheries Research Institute of the University of Washington to develop indices of juvenile pink salmon abundance. Tests of sampling with tow nets and the feasibility of marking pink and chum salmon fingerlings during tow-netting operations using sprayed fluorescent pigments are investigated. The work will be accomplished in four bays of Kodiak Island: Ugak, Alitak, Uganik, and Uyak Bays.

Alaska AFC-13.

Duane Phinney

33,700

Optimum escapement studies of Chignik sockeye salmon - Preliminary studies in the Chignik Lake system have suggested that sockeye salmon production is limited by the carrying capacity of nursery areas. This project is undertaken to investigate the extent and quality of the spawning areas to learn how they might limit production and to learn the most efficient distribution of the escapement for maximum production. The field work will be conducted by the University of Washington from their field station at the outlet of Chignik Lake.

Alaska AFC-14.

Daniel Hennick

40,000

Pink salmon forecast research - This project proposed to sample 12 to 15 streams in the Chignik area of the Alaska Peninsula to obtain an index of the yearly fry production from which the returning runs may be forecast a year in advance. By extension of this work into the Chignik and Peninsula areas, forecasts will be made for all major pink salmon-producing areas of the State.

Alaska AFC-15.

Robert Frances

12,000

Computer simulation model of the Dixon Entrance salmon stocks - Tagging experiments have demonstrated a mixture of Canadian and southeastern Alaska salmon stocks in the Dixon Entrance area. This project proposed to construct a computer simulation model of these salmon stocks. The use of this technique in the evaluation of a potential resource is new. The work will be conducted at the University of Washington and is the subject of a Ph.D. thesis.

Alaska AFC-16.

Allen Davis

53,400

Escapement enumeration investigations - This project will evaluate and improve salmon escapement enumeration by an electric fish counter and compare visual tower and aerial counts with the electric counter for efficiency and accuracy under differential water conditions. The research will be conducted on clear water streams in Bristol Bay drainage and the turbid Kenai and Kasilof Rivers in Cook Inlet.

California AFC-7.

John Hayes

\$147,000

Eel and Mad River anadromous fish water requirements - The anadromous fishery resources of north coastal streams of California are threatened by future export water developments. This study will provide information on the water requirements for spawning salmon and steelhead trout, rearing of juveniles, and downstream migrants. The research is on the king and coho salmon in the Eel River system in Humboldt and Mendocino Counties.

California AFC-8.

Richard Hallock

72,000

Delta migration study - This project provides for behavior study by electronic tracking apparatus of king salmon through the Sacramento-San Joaquin Delta in relation to flow reversal and other physical conditions produced by water transport. The king salmon run of the San Joaquin River has dropped drastically in recent years and losses to the commercial fishing industry have been substantial.

Oregon AFC-18.

Wallace Hublou

200,000

Development and improvement of hatchery techniques for Pacific salmon and steelhead trout - This project is undertaken to develop better methods for Pacific salmon disease prevention, detection, and control, and to improve nutritional qualities and physical characteristics of a pilot pellet formula and test the diet under hatchery conditions. Most of the research is being done at the Fish Commission Laboratory at Clackamas and at Oregon State University field stations. Construction of laboratory for nutritional work and purchase of equipment have been completed.

Oregon AFC-19.

Robert Loeffel

30,000

Management of the troll salmon fishery with emphasis on the collection of data on shore and at sea for regulation formulation - Under this project, catch statistics on the troll chinook and coho fisheries are collected and analyzed so that they are available for immediate catch appraisal. In addition, the study includes an evaluation of barbless hooks as a management tool in the troll fishery and the use of the radionuclide Zn⁶⁵ as an identification mark of Oregon-Washington coho salmon when mixed with coho from other areas. The troll salmon management program will be conducted from the Astoria Laboratory of the Fish Commission's research division.

Oregon AFC-20.

Leon Verhoeven

78,600

Evaluate, coordinate, and plan Pacific salmon research and management activities on a coastwide basis - The aim of this project is to assist the Pacific Salmon Inter-Agency Council in their efforts to evaluate current and future plans, needs, programs, and results of Pacific coast fishery activities as they relate to management of these stocks and to update the Salmon Compendium.

Oregon AFC-21.

Ernest R. Jeffries

Completed

Increased production of anadromous salmonids in Oregon coastal streams and lakes - Essentially this project is a complete inventory of the streams along the coast of Oregon to find suitable water supplies that can be used for salmon hatchery and enclosure rearing. Potential streams and coastal lakes for rearing salmon are investigated. Additional production facilities are needed to keep pace with increasing demands for salmon.

Oregon AFC-23.

James D. Hall

18,000

Effects of logging on salmon populations in coastal streams - This is a segment of Oregon's Alsea watershed study to determine the effects of Douglas-fir-logging practices on the physical and biotic resources in small coastal streams. Seven years of data on spawning coho salmon populations, juvenile survival, and yield of smolts in Drift Creek in Lincoln County are interpreted for publication.

Oregon AFC-26.

Alan McGie

19,000

Research and management on wild and hatchery-produced salmon in Oregon south coastal streams - This project will obtain life history information on fall chinook salmon in the Elk and Sixes Rivers that will be useful in hatchery operations, predicting and controlling effects of environmental alterations, evaluating the effects of hatchery-produced fish on natural stocks and regulating the fishery. Information obtained will be valuable to the operation of the Elk River salmon hatchery which is currently under construction.

Washington 1-18-R.

Harry Senn

2,000

Investigation of effects of Grays Harbor waters on coho emigration - Considerable questions prevail whether or not differential survival factors exist for seaward migrating salmon in Grays Harbor within specific areas. Marked yearling coho salmon are released into the Chehalis River system upstream of its confluence with Grays Harbor and into the Humptulips River system which enters near the confluence of the harbor and the Pacific Ocean to determine if the marked fish contribute to the marine fishery at a differential rate.

Washington 1-30-R.

Earle Jewell

11,600

Field recovery coded wire tag - This study is attempting to improve magnetic detectors for recovery of coho salmon marked by coded wire tag and to develop tools and techniques to improve tag extraction. Field recovery tests are continued over a broad range of conditions in Puget Sound where tagged fish are expected to be recovered.

Washington 1-32-R. Earl Jewell \$ 14,000

Hatchery coho salmon--contribution to the fishery - This project expands Washington's marking and recovery program of Puget Sound and Columbia River coho salmon in a coordinated program with the Bureau of Commercial Fisheries and the State of Oregon, to evaluate the contribution of hatchery-produced fish to the fishery.

Washington 1-33-D. Richard Noble 40,000

Evaluation of dry feed for hatchery salmon - Increased large-scale salmon hatchery programs make it imperative that satisfactory dry feeds suitable for mechanical feeding be developed. An evaluation of raw materials, including non-food fish and kelp, as well as by-products from milling and other food production operations, for formulation of dry fish feeds is underway at the College of Fisheries of the University of Washington.

Washington 1-37-R. Peter Bergman 16,900

Analysis and publication of coded wire tag research data - This project is an attempt to bring the coded wire tag into regular salmon research use at the highest level of confidence. Tagged coho in storage from earlier works are examined and measured where differential tag loss may be studied in relation to fish size. New fish are tagged and studied under improved handling techniques and equipment adjustment to achieve more positive tag retention under actual use. All unreported coded wire tag research is analyzed and published.

Washington 1-40-R. Ray Johnson 22,000

Larval and estuarial studies pink and chum salmon populations - This project is concerned with predicting the success of natural spawning and survival of pink and chum salmon in the Puget Sound area. These species do not lend themselves to hatchery rearing as do chinook and coho salmon; therefore, methods by which the survival of pink and chum salmon can be predicted, extending to their eventual entry into the fisheries, need to be developed for effective management of the resources.

Washington AFC-8. Robert Kramer 20,000

Stream improvement planning - Washington coastal streams in which runs of salmon have barriers to full utilization of spawning areas are investigated to pinpoint the size and extent of these barriers and to evaluate practical means of making corrections. Priorities are assigned to streams for improvement based not only on needs but on a cost-benefit analysis.

Washington AFC-12.

Earl Jewell

\$ 18,500

Port Susan - Port Gardner pink salmon studies - stock separation and identification - Pink salmon occur in the Port Susan and Port Gardner commercial fishing areas on odd number calendar years, and often one or more of the runs are substantially smaller than the other. To protect the smaller runs and still continue harvesting the other at an adequate rate, a tag and recovery program is underway to determine where and when a separation of the various races takes place. The stocks of pink salmon in the areas are from the Snohomish, Stillaguamish, and Skagit Rivers.

Washington AFC-13.

Ernest Salo

91,948

Measurement of spawning success of chum salmon utilizing natural and controlled spawning areas in Big Beef Creek, Washington - This work is carried out by the University of Washington's Fisheries Research Institute station at Big Beef Creek near Seabeck in Kitsap County. It is an evaluation of the production of chum salmon fry from an artificial spawning channel versus that from a natural spawning area. The aim is to develop artificial spawning and rearing areas for multiple anadromous species.

Washington AFC-14.

Earl Jewell

33,500

Gill net dropout study - To assess the commercial fishing mortality rate on salmon stocks, the magnitudes of fish escaping or dropping out of gill nets and possible subsequent mortality must be known. This study will assess the rate of gill net dropout and survival of chinook salmon in Budd Inlet, the southernmost portion of Puget Sound, and develop a gill net which will reduce such loss and possibly increase the harvest of male salmon which are generally in excess of spawning needs.

Washington 1-29-R.

Ray C. Johnson

Completed

Early marine life history, chum and pink salmon - Visual observations, beach seine hauls, and traps were used to determine abundance and distribution of pink and chum salmon fry in Puget Sound tributaries for the prediction of adult run size. Analysis of variance tests indicated that abundance of chum fry in 1966 was significantly less than in either 1964 or 1965, and that numbers of pink fry in 1966 were less than those of 1964. This would suggest that adult run size in 1967 for pink salmon and in 1969 for chum salmon will be poor. Use of a fluorescent pigment which adheres to the scales when applied from a small sandblast gun for mass marking of the fry proved infeasible.

Steelhead trout:

Idaho 1-1-D.

Terry Holubetz

\$ 7,824

Experimental rearing of steelhead trout at Hayden Creek ponds, Idaho - Smolts from eggs of the spring mid-Snake River steelhead trout runs were reared in one year at stocking densities of 60,000 and 120,000 per acre at the Hayden Creek ponds. Studies are continued to determine maximum stocking density of the ponds under varied conditions. Additional research is underway to investigate chinook salmon production at the same facility on a crop rotation basis.

American shad:

Connecticut AFC-1.

William Leggett

\$ 20,000

A study of the rate and pattern of shad migration in the Connecticut River utilizing sonic tracking apparatus - American shad are captured with gill nets in lower Connecticut River, marked with sonic tags and tracked by individuals with both stationary and portable monitors during their upstream movement. The purpose is to investigate their upstream migratory behavior to include movement through an area of heated outfall of an atomic power plant. The study is carried out by the Connecticut State Board of Fisheries and Game and the Essex Marine Laboratory.

Delaware AFCS-1.^{1/}

Charles Lesser

Completed

Feasibility of the restoration of the shad runs in the tributaries of the Delaware estuary - Successful hatching of fertilized American shad eggs from the Susquehanna River indicated that the Brandywine River was suitable for the restoration of shad runs. Restoration would be possible through an extensive egg-transplanting program in the upper Brandywine and the laddering of low-head dams in the lower Brandywine. This river originates in Pennsylvania and enters the Delaware River at Wilmington, Delaware.

Delaware AFSC-3.^{1/}

Charles Lesser

120,000

Shad passageway construction on the Brandywine River, Delaware - The feasibility study (Delaware AFCS-1) indicated that restoration of the runs of American shad in the Delaware River was possible, provided passage facilities were provided at low-head dams in the lower river. This project provides for the construction of fish passageways at eleven dams between the confluence of the Brandywine with the Delaware River at Wilmington, Delaware, to the Pennsylvania line, a distance of about 25 miles. This is a joint study with the Pennsylvania Fish Commission. (See Pennsylvania AFCS-1)

Florida AFC-2

Martin Moe, Jr.

30,000

Investigation of the American shad in the St. Johns River - The shad run into the St. Johns River, Florida, is one of the most important along the Atlantic seaboard. The annual commercial catch is about 750,000 pounds. Proposed water developments, such as the upper river flood control dams and the Sanford-Cape Kennedy Canal, however, are threatening the existence of this valuable resource. Studies are made of the abundance, migratory behavior, spawning activities, and survival of the young shad to evaluate the possible effects of these proposed water developments on the runs.

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

Georgia AFC-1.

Walter Godwin

\$ 19,980

Shad fishery of the Altamaha River, Georgia - The estimated weight of the shad population entering the Altamaha River was 468,362 pounds (141,928 fish) and the exploitation rate was 48.7 percent. Most of the fish were 4 and 5 years old and none had previously spawned. Factors affecting shad production in the river are under investigation. This is the most productive shad stream in the State.

New Jersey AFCS-1.^{1/}

Ronald White, Jr.

29,500

Population and migration of major anadromous fish - American shad are tagged and released in the upper Delaware Bay and mouth of Delaware River to determine the fish's migratory behavior and identity of the stocks in the Bay fishery. Also, information is obtained on the effect of the pollution block in the Camden-Philadelphia area of the Delaware River on the upstream and downstream migrants. This project is a part of a large comprehensive Delaware River fishery program.

Oregon AFC-10.

T. Edwin Cummings

16,400

Shad and striped bass management study - This project expands an existing Oregon Fish Commission study to obtain information on life history and abundance of shad and striped bass in the Suislaw, Umpqua, Smith, Coos, and Coquille Rivers, with emphasis on the shad resource. Catch records, catch per effort data, and scales for age analyses are collected. Natural and fishing mortalities are investigated also.

Pennsylvania AFCS-1.^{1/}

David Daniels

15,000

Feasibility study of the restoration of shad runs in the tributaries of the Delaware River estuary - This is a joint study with the Delaware Board of Fish and Game to restore runs of shad in the Brandywine River, a tributary of the Delaware River. (See Delaware AFSC-3) Adult shad are taken below the dam at Wilmington, Delaware, and released in Pennsylvania waters of the Brandywine. In addition, fertilized shad eggs from the Susquehanna River are distributed in the same general area to supplement natural reproduction.

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

Alewife and blueback herring:

Massachusetts AFC-1. Clinton Watson \$ 16,000

Anadromous fish investigations - Survey of coastal streams to evaluate the effectiveness of existing fishways for upstream passage of river herrings and to determine the need for new and improved passage facilities has been completed in Bristol and Barnstable Counties. Those in Dukes, Nantucket, Plymouth, and Norfolk Counties are being investigated. The desirability of establishing American shad and smelt in coastal streams is considered, also.

Virginia AFC-1. Jackson Davis 160,000

Biology and utilization of anadromous alosids - The annual average landings of alewife and blueback herring in Virginia are about 24 million pounds. Apparently, the stocks are not being over-exploited. Industry is interested in increasing the landings. The biology and utilization of these species are investigated to determine how many additional pounds the stocks can yield without endangering the fisheries.

Maine AFC-2. Frederick Baird, Jr. 50,000

Increased development of the commercial anadromous fishery resources of Maine - This project is undertaken to survey the potential commercial anadromous fishery areas, with emphasis on those streams supporting or capable of supporting alewife and blueback herring. The inventory includes a documentation of barriers to fish movement, fish passage needs, and establishment of a priority program of stream improvement.

Connecticut AFC-3. William Lund, Jr. 14,000

Investigation of the life histories and potential fishery of river herrings in Connecticut - This study is undertaken to evaluate the river herrings (alewife and blueback herring) as a commercial resource in the Connecticut River and to obtain basic biological knowledge needed to regulate such a fishery. Spawning and nursery areas have been identified and information collected on age, size, and sex composition of the stocks entering the river. A tagging program is underway to observe migratory behavior and to estimate size of populations entering the river.

Wisconsin AFC-4. Marcia Boyles 6,000

A comparative study of thyroidal, interrenal, and gonadal activity in the alewife - This project, conducted at Grand Valley State College, Allendale, Michigan, provides for research on the relationship between the endocrine activity of the alewife and selected environmental factors. The work is a part of an overall program to determine the course of the annual alewife mortality in the Great Lakes.

Wisconsin AFC-5.

Carroll R. Norden

\$ 18,122

An investigation of the reproductive cycle of the alewife in Lake Michigan - The development and maturation of the gonads in the alewife and the factors which influence the reproductive cycle are investigated. This work can fill an important gap in our knowledge of the biology of this species and may contribute information on the cause of the annual mass mortality of the alewife in the Great Lakes. The research is conducted at the University of Wisconsin, Milwaukee.

Connecticut 3-45-R.

William A. Lund, Jr.

Completed

Investigation of the life histories and potential fishery of river herrings in Connecticut - This project, initially funded under P.L. 88-309, has been transferred to P.L. 89-304. Narrative of the research is given under Connecticut AFC-3.

New Hampshire AFC-1.

William Ayer

30,000

Commercial fisheries development - Detailed surveys are conducted on Hampton and Piscataqua Rivers and their tributaries to determine the suitability and magnitude of increase in the size of anadromous fish runs, particularly for alewife. Engineering surveys are conducted also of fish passage needs at existing dams. The watersheds of concern are located in Rockingham and Strafford Counties.

Striped bass:

Maryland 3-27-R.

Ted S.Y. Koo

\$ 16,550

Tagging of juvenile striped bass, *Roccus saxatilis* (Walbaum) in Chesapeake Bay estuaries - Tank tests on juvenile striped bass, using Carlin tag, single dart tag, double dart tag, and a straight wire, indicated that the Carlin tag was superior. Field tagging is conducted in Chesapeake Bay and Patuxent River where about 3,000 young striped bass have been released with Carlin tag to study migratory behavior, homing instinct,

Alabama AFC-1.

E.W. Shell

30,000

Research on striped bass in Alabama rivers - This research is being conducted at Auburn University to develop economical method for rearing large numbers of striped bass to a length of 4 to 6 inches for stocking in estuarine areas of the Mobile Delta. The aim is to determine the feasibility of establishing runs by stocking hatchery-produced fish.

Louisiana AFCS-1.^{1/}

James T. Davis

50,000

Ecological factors affecting anadromous fishes of Lake Pontchartrain and its tributaries - Measurement of water quality and survey of fish populations are being made in Lakes Pontchartrain, Maurepas, and Borgne and tributaries to determine the feasibility of establishing striped bass runs by the introduction of hatchery-produced fingerlings.

Mississippi AFCS-1.^{1/}

Gordon Gunter

50,000

A study of striped bass, *Roccus saxatilis*, in Mississippi waters - The striped bass is found in all major river systems along the Mississippi Gulf coast from the Pascagoula River west to the Tangipahoa River. The Pascagoula River population supports a limited fishery and it is the only river that consistently yields fish from year to year. Experimental stocking of 4-to-6-inch striped bass is undertaken in the Pascagoula and Pearl Rivers to determine whether production in these waters can be increased by practical means.

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 - This project expands an on-going study of the biology and population dynamics of the Roanoke River and Albemarle Sound striped bass stocks and includes stocks in Pamlico-Tar River and Pamlico Sound.

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

North Carolina AFC-4.

R.E. Stevens

\$ 20,606

Factors affecting survival of immature striped bass - Deficiencies exist in our knowledge of the requirements of fry and fingerling striped bass in rearing ponds and in natural waters. Fry are obtained from North Carolina hatcheries and transported to the laboratory at North Carolina State University to study the tolerances of immature striped bass to potential limiting factors of the environment. The food habits of fry and fingerlings reared in hatchery ponds will also be investigated.

North Carolina AFC-5.

James S. Sterling

59,394

Offshore anadromous fish exploratory fishing program - This project is a segment of an offshore large-scale inventory of the commercial fish stocks with the new State research vessel Dan Moore. The distribution and migratory behavior of anadromous fish along the North Carolina coast, with emphasis on the "jumbo" striped bass off the Outer Banks, are investigated.

Groundfish:

Maryland 3-21-R.

Ted S.Y. Koo

Completed

Determination of the distribution and abundance of the winter flounder, Pseudopleuronectes americanus - Adult winter flounder were found throughout the Bay and in the mouth of all tributaries, except at lower Marlboro and Trueman Point on the Patuxent River. They were caught from November through May in deep or channel hauls. It is believed they spawn in deep waters from mid-February to mid-March at water temperatures from 0.0° to 5.6° C. Those caught by trawl ranged from 100 mm. to 390 mm. in total length.

Massachusetts 3-38-R.

Philip G. Coates

20,000

Identification of winter flounder subpopulations - Past tagging studies conducted in 1960, 1961, and 1965 are evaluated and experimental otter trawl data are analyzed to define the limits of the winter flounder populations and to determine the effect of present regulations on the fishery. This study is coordinated with work at the Bureau of Commercial Fisheries' Biological Laboratory at Woods Hole, Massachusetts.

Oregon 1-4-R.

Robert L. Demory

32,187

Investigation of the abundance and recruitment of bottomfish off Oregon, with emphasis on Dover sole - This project is undertaken to evaluate existing data on fluctuations in abundance and year-class strength of the true major flatfish species, Dover, English and petrale soles and Pacific Ocean perch and to develop techniques for determination of spawning success, year-class strength, and abundance. The work is handled through the Astoria Laboratory of the Oregon Fish Commission.

Washington 1-22-R.

Gene Di Donato

90,000

Monitor condition of certain groundfish stocks, Washington trawl grounds - The English sole, Pacific cod, and petrale sole are the species of concern. Five to ten thousand fish of each species will be tagged and biological data collected in an effort to increase knowledge on stock identity and migratory behavior. The knowledge will be useful in the international negotiations of eastern Pacific fishery problems. An attempt also will be made to evaluate the effect of fishing on these species.

Sturgeon:

South Carolina AFC-1.

John G. Leland, II

\$ 10,000

Survey of sturgeon fishery of South Carolina - Though seasonal, the sturgeon fishery during the 1890's was one of the most important in the State. At present, however, the sturgeon is in a critical situation in South Carolina and may disappear from the State's waters unless given protection. The major factors associated with the decline are the catch of small sturgeon by shad fishermen, pollution, and elimination of spawning habitat by water developments. This study recommends that measures be sought immediately to correct existing negative situations where possible.

General:

California 6-3-R. John L. Baxter \$145,126

Fisheries resources sea survey - This project is undertaken to determine the total pelagic and bathypelagic fishery resources in the coastal waters of California and Baja California, Mexico, and to determine their abundance, degree of utilization, and potential use. The fishery resources of primary concern are the sardine, anchovy, Pacific mackerel, and jack mackerel.

California 6-7-R. Phil M. Roedel 41,843

Food habits study of organisms of the California current system - Stomachs of economically important and potentially important organisms as hake, bonito, rockfish, albacore, yellowtail, squid, and others are collected and the contained food items are identified, their number determined per stomach, and sizes determined. The objective is to determine the food habits and requirements of the significant fishes and cephalopods inhabiting the California current system adjacent to the California coast.

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

Preliminary survey of existing and potential marine resources on the Georgia coast - The diversity of Georgia's existing and potential marine fishery resources were examined, research need determined, and appropriate projects developed. The State's commercial fisheries are in great need of an effective research program, particularly on the shrimp, oyster, crab, and hard clam.

Maine 3-15-R. Frank P. Ricker 24,607

The development of commercial fisheries estuarine resources - The objective of this project is to develop commercial fisheries for underutilized and underexploited marine plants and animals of the Maine estuaries and inshore waters. Of the thousands of marine and estuarine plant and animal species found along the coast of Maine, less than 50 are used commercially. It is desirable to find out which of these resources are available, in what quantity, and where they are located.

Maryland AFCS-1.^{1/} Ralph A. Bitely 135,540

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 - This project provides for study on abundance of shad, alewife, blueback herring, and striped bass and rate of exploitation by the fisheries in the Susquehanna

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River below Conowingo Dam, and on the feasibility of eliminating massive fish mortalities below the dam associated with changes in operation of power turbines on the dam. The practicability of spawning habitat will be investigated, also.

Mississippi 2-25-R.

J.Y. Christmas

156,200

Cooperative Gulf of Mexico estuarine inventory and study, Mississippi - This study of the estuarine areas of Mississippi is a part of a Gulf of Mexico estuarine inventory in cooperation with other Gulf States and the Bureau of Commercial Fisheries. Populations of exploited crustaceans and fishes are examined with special reference to the effect of brood success on commercial availability. The objective is to establish environment-oriented criteria for successful management and maintenance of commercial species in northern Gulf estuaries and prediction of fluctuations in availability to the fisheries.

New Jersey 3-2-R.

Ronald L. White

Completed

Evaluation of the menhaden and shad fishery in Delaware Bay and adjacent waters - This project is concerned with two commercial fishery resources in Delaware Bay: 1) menhaden fishery to observe if food fish are taken along with menhaden and whether oyster bottoms are damaged by nets, and 2) shad fishery to determine the effectiveness and desirability of the "lift period" regulation now in force. Also, the presence of sharks are observed to determine if they are attracted by the menhaden fishing activities.

Texas 2-47-R.

Henry W. Compton, Jr.

62,181

Northwestern Gulf of Mexico marine fisheries investigations - The major objective of this project is to determine the ecological characteristics of commercially important and potentially commercial fish and crustaceans in the northwestern Gulf of Mexico. The abundance and size distribution of shrimp in shallow waters of the Continental Shelf during the time of egress are monitored as basis for regulating the commercial fishery, and the abundance and seasonal distribution of brown and royal red shrimp and industrial fish in depths beyond 60 fathoms off the Texas coast are determined. The life history and ecology of the red snapper and related reef fishes are studied also.

Virginia 3-5-D.

Jackson Davis

120,968

Investigation of potential for expansion of the industrial fishery of the mid-Atlantic Bight - This project is undertaken to describe the spatial and seasonal distribution of fishes of shelf waters between Cape May, New Jersey, and Cape Hatteras, North Carolina, and to ascertain which species, if any, occur in sufficient numbers to support an industrial fishery. There is a need to broaden the

base of the industrial fishery, and probably the greatest potential for developing additional fisheries is in the mid-Atlantic area. This study is conducted by the Virginia Institute of Marine Science, Gloucester Point.

Oregon 1-46-R. James Meehan 36,000

Boat charter - This project provides for charter of a commercial fishing vessel (trawler), 55 feet or larger, on an annual basis for research on bottomfish, shrimp, crabs, tuna, and other marine species. If albacore appear in sufficient numbers, several thousand will be tagged to observe migration. Shrimp, bottomfish, and crab research are confined to the Oregon coast between Astoria and Newport. Tuna work covers the entire Oregon coast and may extend to Cape Mendocino, California.

Alaska 5-14-D. James W. Parker 4,000

Southeastern and Kodiak Island, Alaska, stream catalogs - Salmon escapement catalogs for southeastern Alaska Regulatory Districts 10 through 15 are published for 1965 and 1966 survey data. Escapement counts for 1965, 1966, and 1967 are added to the Kodiak catalog.

Hawaii H-10-R. Garth I. Murphy 10,000

Handling baitfish in Hawaii - Capture and handling methods and oxygen and water requirements for the Hawaiian anchovy, Stolephorus purpureus are investigated, with particular reference to the baitfish need of the Hawaiian tuna fleet. Feeding regime for the species is developed, also. The work is by the Hawaii Institute of Marine Biology of the University of Hawaii, Honolulu.

Hawaii H-4-D. Henry M. Sakuda 16,326

Management investigation of the akule or jack mackerel (Trachurus crumenophthalmus) - A tagging program is underway in the southern akule fishing grounds of Oahu to obtain information on growth and migratory behavior of the akule or jack mackerel. A total of 2,987 tagged young akule have been released at Kewalo Basin and Keehi Lagoon, of which 100 have been recaptured. Tagging will continue until 5,000 fish have been tagged and released. Analyses of the tag returns are continued.

FRESH-WATER FISH

Lake trout:

Michigan 4-2-R.

Walter R. Crowe

\$ 32,946

Surveillance of lake trout restoration in Michigan waters of Lake Michigan - This project is undertaken to assess and describe conditions of lake trout stocks in Michigan waters of the Lake Michigan. Major investigations are confined to the northerly areas of the Lake where hatchery-produced lake trout are being released and where sea lamprey efforts were initiated. This study is an essential adjunct to the Bureau of Commercial Fisheries sea lamprey control and lake trout rehabilitation program in Lake Michigan.

Wisconsin 4-7-R.

Russell Daly

32,069

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. The work is closely coordinated with that of other State agencies and the Bureau of Commercial Fisheries.

Lake herring:

Minnesota 4-8-R.

Charles R. Burrows

\$ 12,600

Minnesota commercial fisheries improvement - western Lake Superior -
The lake herring population in Lake Superior has shown relatively serious decline and alarming symptoms of deterioration in the past few years. Commercial production in Minnesota declined from a normal catch of about five million pounds annually to less than one million pounds in 1964. This project is undertaken by the University of Minnesota's Fisheries Department to obtain life history information on species associated with the lake herring with respect to food habits, distribution, and predation. This information is then related to lake herring abundance. The study site is western Lake Superior and the work is coordinated with that of Bureau of Commercial Fisheries on the lake.

Rainbow trout:

Utah 6-10-R.

Clair B. Stalnaker

\$ 11,395

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 to provide fingerlings to commercial trout farmers. Progeny tests are set up, also, which will provide information on the genetic control of the blood types found. The major objective is to eliminate undesirable genotypes from the breeding population

Channel catfish and bullhead:

Illinois 4-32-R.

William M. Lewis

\$ 17,500

Feeding-out catfish in cages - It is evident that commercial production of channel catfish as human food is feasible. The present technique of production involves stocking fingerlings fish in shallow, drainable ponds and feeding the fish until they reach marketable size. This project is underway at the University of Southern Illinois to determine the feasibility of stocking yearling channel catfish in cages in infertile lakes such as stripmine lakes and producing marketable size fish through daily feeding.

Kansas 4-1-R.

Roy E. Schoonover

28,000

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

Kentucky 4-27-R.

Hunter M. Handcock

14,000

Catfish fishery investigations - The studies are conducted on Kentucky Lake from Kentucky Dam to the Tennessee State line by the Murray State University Biological Station at Murray, Kentucky. Various size hoop nets are fished under different conditions to determine efficiency and selectivity on catch of channel and blue catfish. Also, the growth and abundance of these fish are investigated.

Ohio 4-6-R.

Jerry V. Manz

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

South Dakota 4-29-R.

Charles Backlund

4,700

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 the effects of the removal upon the fish population structure and to determine what percentage of the younger bullhead must be removed to produce a vigorous population.

Walleye:

Wisconsin AFC-2.

Russell Daly

\$ 7,500

Walleye population study in respect to a possible commercial fishery -
Walleye are tagged and released in Lake Superior between the towns of Port Wing and Superior Harbor, Wisconsin, to determine population size and migratory behavior of discrete walleye stocks. Age and growth are determined through scale samples. This information is needed to determine whether populations are sufficiently large to support a commercial fishery without damage to the resource.

General:

Arizona 6-1-R.

W. L. Minckley

\$ 8,000

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 for a sustained commercial yield. Production and marketing possibilities for the products are surveyed.

Colorado 6-2-D.

Robert E. Vincent

7,400

Raising bait fishes in the Rocky Mountain States - The fathead minnow, Pimephales promelas, which is native to Colorado, is being considered for commercial production and sale as bait minnow. Growth and mortality of this species as related to population density in experimental production ponds are investigated. Preliminary indications are that the fathead minnow will be a desirable bait fish in the Rocky Mountain area.

Illinois 4-33-R.

William M. Lewis

17,500

Investigation of problems associated with the confinement of warm-water fishes in holding tanks - Basic to the further development of warmwater fish farming, there is a great need for information on handling and confining fish for live sales. The objectives of this study are to determine to what extent oxygen levels affect the occurrence of epizootics of pathogens in holding tanks and the effects of temperature manipulation on control of epizootics. The work is done by the Fisheries Research Laboratory of Southern Illinois University, Carbondale.

Illinois 4-36-R.

George W. Bennett

9,200

Physiological and behavioral relationships among species of fishes - This investigation of physiological and behavioral relationships among channel catfish, golden shiner, and tilapia as they affect growth and condition is by Sam A. Parr Fisheries Research Center in Marion County, Illinois. Populations of these fish are isolated as individual species, as well as combined in separate combinations, to determine the effects on growth rate and condition of direct antagonistic behavior and of metabolic or hormonal action within and between these species.

Indiana 4-16-R.

Darryl Christensen

10,400

Inland waters commercial fisheries studies - Studies are in progress on the Wabash and White Rivers to evaluate the efficiency, extent, and harvest by commercial fisheries. Tests will be made of the harvest

potential of D-nets and hoop nets. The numbers of commercial fishermen and their harvest will be assessed. In addition, the interrelationship of commercial fishes and commercial mussels will be investigated.

Iowa 4-11-R.

Harry M. Harrison

28,290

Industrial and commercial food fish investigations - The commercial fisheries of the Mississippi and Missouri Rivers bordering Iowa and the inland waters of the State are evaluated. Programs for proper utilization of industrial and commercial food fish stocks are developed. The fish species involved include carp and buffalo as food for human consumption, and gizzard shad and sucker for possible use as pet food or for protein additive in livestock feed.

Maryland AFC-3

Ralph A. Bitely

179,230

Stream improvement program for anadromous fish management - This project includes a wide range of activities 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

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. A part of the research is biological studies of commercial species in Lake Michigan and sampling the physical and chemical properties of the lake waters.

Michigan AFC-7.

L. N. Allison

60,000

Parasites, diseases, and disease control of Great Lakes anadromous and commercial fish - 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, Michigan. It is a study of red worm of yellow perch and of bacteria associated with seasonal mortality of the alewife.

Minnesota 4-38-R.

Charles Burrows

12,500

Lake Superior commercial fisheries assessment studies - The primary objective 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 objective, 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 investigated, also.

Minnesota 4-39-R.

Charles Burrows

9,384

Minnesota commercial fisheries improvement - Factors determining fish production in the American waters of Lake of the Woods are investigated. Current work includes sampling catches of commercial gill nets and trap nets to determine condition of individual species, size groups harvested, and relative weight of various species in the catch. The commercial yield has been composed primarily of tullibee, yellow pike, sauger, and burbot. A large mink industry and food fish market are dependent on the yield for existence.

Minnesota AFC-2.

Richard Hassinger

Completed

Anadromous fish habitat development - A survey was made of spawning habitat and stream improvement needs for Great Lakes fish that enter streams tributary to the North Shore of Lake Superior.

Montana 1-19-D.

James L. Cooper

23,333

Fort Peck Reservoir fishery investigation - Fort Peck Reservoir is the oldest and probably the least understood of all Missouri River mainstem impoundments. For many years commercial fishermen have fished this reservoir; however, little is known of their operation. This project provides for complete inventory of the fish populations in the reservoir and an investigation of methods for selective fishing within the means of local fishermen. Commercial species harvested include carp, buffalo, goldeye, catfish, burbot, suckers, and yellow perch.

Nebraska 4-4-R.

Robert E. Thomas

28,000

Establishment of the seasonal distribution and availability of commercial fish species in the waters of Nebraska - An electrical barrier and trap are used to collect fish on the North Platte River approximately two miles upstream from McConaughy Reservoir. Numbers, weight, time of capture, age composition, and sexual maturity are recorded for all species captured.

New York 3-9-D.

Fred Tingley

24,000

Management planning for New York freshwater commercial fisheries - The purpose of this project is to develop plans for better utilization of the State's freshwater fish resource, including expansion of fisheries for underutilized species. The fish of concern are whitefishes, lake herring, American eel, American smelt, carp, American shad, striped bass, and bait minnows. Project areas are Lake Ontario, St. Lawrence River, Lake Erie, and interior waters.

A survey of commercial fisheries on the mainstem reservoirs of the Upper Missouri River System - Fort Peck Reservoir of Montana, Garrison Reservoir of North Dakota, and Oahe and Fort Randall Reservoirs of South Dakota were investigated to determine possible expansion of the commercial fisheries operations. Data were collected on the number and type of fishing operations, species composition of the catch, and distribution and abundance of stocks of fish. The work was by the University of North Dakota, Grand Forks.

North Dakota 4-15-R.

John Owen

8,000

Garrison Reservoir commercial fisheries investigations - At present, Garrison Reservoir supports a sizeable unutilized population of goldeye which is in demand on the Canadian markets. However, the life history of this species is largely unknown. This project is concerned with obtaining specific life history data on the goldeye, as well as bullheads and yellow perch and the behavior of these species to physical factors such as turbidity which are unique to reservoir conditions.

North Dakota 4-30-R.

John Owen

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 in Lake Ashtabula. Bullheads are now fished commercially, and project results show that rate of growth and replacement are excellent. Yellow perch are not exploited as yet but plans are underway to begin harvesting. This study will determine population density and rate of growth before and after harvesting.

Oklahoma 4-24-R.

Robert Summerfelt

16,192

Commercial fisheries investigations - The relationship between sediment type and the distribution and abundance of invertebrates and fishes is being studied at Lake Carl Blackwell. Sediment surveys are conducted 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 analyzed.

Pennsylvania 3-67-R.

Keen Buss

77,000

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

Investigation of commercial fisheries potential of Lake Champlain -
Basic information is being obtained on the number and activities of live bait supplies along the lake to determine the economic value of the bait industry and the 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 exploited commercially.

West Virginia 3-58-R.

Roger Schoumacher

15,500

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 which affects the taste are also being studied.

New Mexico 6-11-R.

Douglas B. Jester

11,000

Investigations on commercial fishery potential of rough fish species -
Four species of fish, including buffalo, river carpsucker, carp, and gizzard shad, are studied in Elephant Butte-Caballo Reservoir complex in the Rio Grande River in southeastern New Mexico to determine the practicability of development of a commercial fishery. Estimates of abundance and basic biological and life history information are determined. Methods of harvest are investigated, also.

Clams:

Georgia 2-44-R. Walter Godwin \$ 20,780

Survey of a potential hard clam fishery - The State is conducting a survey along the Georgia coast to determine the feasibility of establishing a hard clam fishery. Biological and ecological data are collected at sampling stations over approximately 50 miles of coastline. Several types of harvesting techniques are also being tested.

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 utilization of the soft-shell clam is being investigated through population studies, growth studies, and studies of seeding, growth, and mortality. Approximately 85 percent of the clam flats in Hampton-Seabrook Harbor have been surveyed. Research studies are underway to determine growth and mortality.

New York 3-68-D. Quentin R. Bennett 66,000

Studies of problems involved when hard clams (*Mercenaria mercenaria*) in commercial quantities are subjected to the depuration process - The economic feasibility of the depuration process on hard clams from moderately polluted areas on Long Island Sound is continuing. Submerged wellpoint seawater is being tested to determine if the clams function in a normal manner. Commercial quantities of clams are used to obtain detailed records of all associated costs. Chemical, physical, and biological controls of the process are constantly recorded.

Oregon 1-27-R. Paul Reed 18,543

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 emphasis of this study. A nontoxic plastic pipe used as cultch for setting oysters is successful. Growth is being observed from spat grown in the laboratory and placed in Netarts and Yaquina Bays.

Virginia 3-77-R. Dexter Haven 26,400

A study of the soft 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 to determine distribution and abundance by means of a hydraulic soft clam rig, the rate at which the dredged areas will repopulate, and the effect of dredging on the substrate.

Washington 1-42-D.

Ronald Westley

\$ 32,000

Subtidal hardshell clam fisheries development - To encourage the private development of commercial subtidal clam fisheries, diver surveys are continuing to investigate the presence of clams in Puget Sound and the Straits of Juan de Fuca. Commercial quantities have been found in some of the 41 acres surveyed. In cooperation with industry and the Bureau, development of an efficient harvesting method is now underway.

New York 3-11-D.

Gerald Strobel and
James Redman

Completed

Pilot plant depuration of hard clams - A pilot plant was set up to determine the feasibility of purification of hard clams from moderately polluted waters of Long Island Sound. Standard techniques were used for chemical and bacteriological work. An evaluation of various factors such as salinity, turbidity, temperature, flow rate, recirculation, and dissolved oxygen was made relative to the effect of the depuration process for the hard clam.

Crabs:

Alaska 5-10-R.

Carl W. Lehman

\$ 27,000

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, the effect log rafting areas have on crab populations is observed through the use of SCUBA gear. Knowledge of dungeness crab biology and life history is increasingly needed for management as the fishery expands.

Alaska 5-11-R.

John C. McMullen

51,200

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. The lack of adequate information on king crab reproduction has become very important because of the conservation policy of harvesting only the large males.

Hawaii H-6-R.

Henry M. Sakuda

9,582

Management and development investigation of the kona crab (*Ranina serrata*) - The objectives of this project are to develop and manage the kona crab fishery by investigating its biology and determining the extent and abundance of crabs on the fishing grounds. Exploratory fishing and gear development for more effective methods of harvesting the resource are investigated. Although the range of this crab extends from Hawaii to New Zealand, the Waimea Bay, Oahu, and kona crab fishing grounds of Hawaii constitute the primary sampling area.

Oregon 1-5-R.

Paul H. Reed

15,752

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

Rhode Island 3-43-R.

Andreas Holmsen

7,000

Investigation of the deep sea red crab (*Geryon quinquedens*) - The deep-sea red crab has a delicate flavor and is about twice the weight of the blue crab. No market has, however, been

developed for the red crab, which, when caught, is discarded by the fishermen. The aims of this project are to determine the input requirements and the cost involved in handling the crab, both on a trawler and in a processing plant, and to determine the commodity and marketing characteristics of the crab.

Rhode Island 3-46-R.

George W. Gray, Jr.

5,300

Investigation of the basic life history of the red crab - The objective of this study is to determine growth, age at sexual maturity, spawning and moulting seasons, migratory behavior, and natural mortality of the red crab. Current work is concerned with determination of satisfactory means for marking the crab and reliable sampling technique, and the growth of adult (larger) male crab by use of length frequency data.

Lobster:

Connecticut 3-44-R.

William Lund, Jr.

\$ 22,700

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 the bottom type preferred by lobsters and their movement and behavior. Plankton tows are also made weekly during the spring and summer months to define the hatching period and presence of late-stage larvae.

Hawaii H-5-R.

Henry Sakuda

496

Management investigation of two species of spiny lobsters, Panulirus japonicus and P. penicillatus - During the period 1948 to 1964, the commercial landings of spiny lobsters declined from approximately 42,300 pounds to 8,800 pounds. This study is designed to evaluate the catch statistics of the net and trap fishery and to analyze previously collected sampling and tagging data relative to migration, molting frequency, growth, and reproduction.

Maine 3-14-R.

James Thomas

65,000

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 ten different locations along the inshore area to determine changes in length, weight, sex ratio, and maturity. Hydrographic data are collected at Cousins Island Cove to evaluate ecological changes due to heated sea water from a power-plant.

Mussels:

Illinois 4-13-R. William C. Starrett \$ 12,100

Clam industry in Illinois - The Department of Conservation is making a study of the mussel industry to formulate a sound basis of managing this resource. The work involves an inventory of the clam fisheries on the Illinois, Mississippi, and Wabash Rivers. The demand for clam shells by Japanese for use in pearl culture is good and the market price is high. As a result, many people throughout the State are mussel fishing.

Indiana 4-10-R. Louis A. Krumholz 15,600

Mussel research study - The Wabash and White Rivers are sampled at 50 one-mile stations with crowfoot bar to inventory the mussel resource. Biological and life history information, such as reproductive success, age, and growth, is obtained for evaluation of management regulations. Recent increases in activity in the mussel industry, instigated by the Japanese cultured pearl operations, have produced an accelerating demand for freshwater mussel shells.

Kentucky 4-19-R. John C. Williams 20,000

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. Current work is on the Ohio River from the point where the River enters the State at river mile 313 to Cairo, Illinois, river mile 981. The work is done by Murray State University Biological Station at Murray, Kentucky.

Ohio 4-28-R. Henry Van der Schalie 26,000

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 of the annual harvest by collectors is made, also. 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.

Oysters:

Alabama 2-18-R. Edwin May \$ 13,750

Oyster raft production - This study is designed to develop additional methods of oyster production on a more intensive scale which would be accepted by the industry. The design of a low-cost raft and development of inexpensive cultch material are the primary objectives. Research is also conducted on spat growth related to changing environmental conditions as selected rafts are moved from one area to another.

Alabama 2-30-D. George Allen Completed

Shell planting for oyster cultch - An area in Mobile Bay on Point Clear Reef was selected and delineated for planting of oyster cultch to maintain a continued source of seed oysters. A total of 37,309 barrels of shells was planted in the area. Samples of shells from the area planted revealed a light to moderate spat set. It is expected that a substantial supply of seed will be available from this planting.

Delaware 3-9-D. Ted Ritchie Completed

Rehabilitation of the natural seed oyster beds in Delaware - This project was initiated to develop and enlarge several small natural seed oyster beds in Delaware Bay on which seed oysters with a high degree of MSX resistivity are presently setting. Three areas were planted with a total of 219,184 bushels of shell. A successful spatfall was recorded at each area.

Delaware 3-49-R. Kent Price 28,500

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. Spawning was induced by increasing the water temperature from 15.0°C. to 29.0°C. and, when necessary, by adding a sperm-egg suspension. Further work is underway to rear newly hatched oysters in the laboratory and in the field.

Delaware 3-55-R. Ted Ritchie 12,000

A resurvey of the condition and extent of the natural seed oyster beds in Delaware - This study is designed to survey and evaluate the existing seed oyster beds in Delaware Bay. The location and extent of hard bottom areas are also surveyed as potential grounds to create new natural seed oyster beds. Biological studies of each bed are underway which will provide data on bottom type, abundance of predators and fouling organisms, and abundance and size of oysters present.

Florida 2-52-D.

Robert Ingle

\$ 40,000

Construction of artificial oyster reefs - Natural oyster reefs are being established from Tampa Bay north to Choctawhatchee Bay. This will create permanent areas for oyster attachment and growth, consequently, commercial production. Approximately 357,400 bushels of oyster shells have been planted creating 60 acres of new reefs.

Georgia 2-10-R.

Thomas Linton

40,300

Feasibility study of methods for improving oyster production in Georgia - An inventory of the oyster resources, an evaluation of management techniques, and ecological studies are the major objective of this study. An inventory of the intertidal resources is completed. Pilot studies are underway on pond and raft culture to evaluate cultivation methods which appear applicable in Georgia and other South Atlantic States.

Hawaii H-2-R.

Henry Sakuda

8,732

Investigation for the development of a commercial oyster industry - The investigation relating to the development of commercially adaptable oyster culture techniques is continuing. Seed oysters are collected from West Loch, Pearl Harbor, Oahu, and transplanted into Hilo Bay on the island of Hawaii, Kaneohe 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. Introduction of oysters into suitable waters of the State for eventual establishment in the wild is continuing.

Louisiana 2-23-D.

John Loy, Sr.

79,400

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 approximately one-half mile intervals.

Louisiana 2-24-D.

Max Summers

Completed

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 to maintain a continued source of seed oysters. Approximately 18,000 cubic yards of clean clam shells were planted in Bay Boudreaux and Black Bay. Gross examination of eight samples taken in each area showed a 50 percent catch of spat on the Bay Boudreaux planting and 75 percent on the Black Bay planting.

Louisiana 2-54-D.

Max Summers

Completed

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. Approximately 33,300 cubic yards of clam shell were planted. Gross examination of six samples taken in each area indicated a 23 percent spat catch on the Half Moon shells and 17 percent on the Black Bay plant.

Maryland 3-20-R.

Victor Sprague

Completed

Development of a disease-resistant oyster brood stock - Various strains of oysters were tested for relative resistance to diseases. Laboratory and field studies are conducted to determine the means by which the MSX organism is transmitted to the oyster and to develop a resistant brood stock in the laboratory and in pond culture experiments.

Maryland 3-75-R.

Fred Sieling

50,446

Development of disease-resistant oysters (C. virginica) under field conditions in lower Chesapeake Bay - The feasibility of raising oysters resistant to MSX in Chesapeake Bay is considered. Oysters on natural bars in the Manokin Rivers 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 monitored throughout the study area and selected samples are examined at the BCF Biological Laboratory in Oxford. Spat from disease-resistant brood stock are used to repopulate areas where heavy mortalities have occurred.

Mississippi 2-28-R.

David Cook

41,300

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.

George Moore

25,200

An investigation of the possibility of seed oyster production in Great Bay, New Hampshire - Determination of the extent and potential of developing seed oyster production on a commercial basis is the concern of this study. 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 Biological Laboratory in Milford, Connecticut have shown excellent growth. The environment is also being monitored.

New Jersey 3-1-D. Christopher Riley 117,500

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. These beds have been major oyster-producing areas for many years.

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, utilization 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 28,400

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. Intensity of spawning, setting, and survival data are also obtained from spat set on hard bottom areas and rafts.

North Carolina 2-6-R. Howard Marshall 21,800

Oyster studies - This study is designed to conduct 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 cultch materials and time of placement as a factor in the success of oyster spat are studied. Spat intensity, water temperature, salinity, and tidal cycle data 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 chart the subtidal areas of the State to locate suitable oyster growing areas. Approximately 188 miles of waterways have been surveyed. Oysters from the Wando and Santee Rivers

subjected to several types of pollution have been moved to unpolluted areas for natural depuration. Growth of the transplanted oysters is good. Samples are taken routinely to monitor growth, condition, and survival.

Virginia 3-6-R.

Jay Andrews

60,325

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 is being accomplished under this project by testing stocks of oysters for disease resistance, breeding potentially disease-resistant oysters, determining disease agents, and continuing selection and concentration of potentially disease-resistant stocks. Research activities are carried out in waters adjacent to the Virginia Institute of Marine Science, Gloucester Point.

Virginia 3-7-R.

William Hargis, Jr.

Completed

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 related to physical factors as salinity, density gradients, current direction and velocity, light, temperature and oxygen were examined. A model of the James River system was used to determine the rate of movement and dispersion. These findings were also correlated with field collections.

Virginia 3-62-D.

Charles Bagnell

130,000

Propagation of disease resistant oysters - The purpose of this project is to provide cultch material for spat setting in their natural habitat where MSX is known to be present. Work is carried out in the waters of the Piankatank and Rappahannock Rivers and Mobjack Bay. Approximately 1,002,714 bushels of cultch material were planted. A good set was observed. Since the brood stock was not affected by the MSX disease, it is expected that the resultant larvae are also disease resistant.

Washington 1-24-D.

Cedric Lindsay

Completed

Inspection of oyster seed - new Asiatic sources - Because of the continuing decline of oyster seed imports 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 was found in Korea acceptable under the standards required by the State. The sources investigated in Taiwan were not acceptable.

Washington 1-31-R.

Clyde Sayce

28,000

Willapa oyster studies - Pacific oyster growth and fatness studies

are conducted at the Shellfish Laboratory, Nahcotta, Washington. Supplemental feeding utilizing materials such as powdered milk and egg products, and fish protein concentrate is used to determine its effect upon the fatness and pumping rate of the Pacific oyster. Hydrographic factors that have a direct effect upon the retention of oyster larvae to setting size are being defined to provide improved production of commercial spatfall to the industry.

Washington 1-43-R.

Ronald Westley

11,300

Oyster drill (*Ocenebra japonica*) control - The behavior patterns of Japanese oyster drills and development of means for control of the drill are the main objectives of this study at the Point Whitney Shell Laboratory, Brinnon, Washington. Investigations in the laboratory and in the field indicate that the male drills are attracted to a waterborne substance released by the female. Further work is underway to define this substance. The testing of chemicals to control the drill is continuing.

Maryland 3-23-R.

William Roosenburg

Completed

Study of the effects of thermal pollution on (*Crassostrea virginica*) in the Patuxent estuary - A study of oyster growth, mortality, gonad development, and condition was conducted in the upper Patuxent estuary. Stations were located from 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

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 use of this analysis in the design of a field study. The area chosen for the field study was the Manokin River estuary. Results of this study were used in the planting of brood stock under another project.

Shrimp:

Alaska 5-9-R.

Jerry A. McCrary

\$ 40,500

Investigation of ecological factors limiting production of the Alaskan pandalid shrimp - Data have been collected in southeastern Alaska for determination of age and growth, length-weight relation, sex changes, ovigerous period of the pink and the side-striped shrimps; similar, but not as extensive, data have been collected on the humpy and spot shrimps. At present, work is in progress to continue life history studies of these shrimp species in the Kodiak area.

Georgia 2-43-R.

Charles M. Frisbie

35,965

Seasonal abundance and biological stability of the commercial shrimp of Georgia - Biological studies are in progress to provide information with which to better manage the shrimp population along the Georgia coast. Sampling stations are located offshore in sounds, rivers, and in marshes throughout the shrimp's habitat. Adults, postlarval, and larval shrimp are collected with trawl, seine, and plankton net throughout the year. Determinations are made on relative and seasonal shrimp abundance, growth rate, sex ratio, spawning success, and limiting environmental factors.

Hawaii H-1-D.

Takuji Fujimura

32,196

Development of a prawn fishery - Laboratory findings indicate that the prawn, Macrobrachium rosenbergi, can be held successfully for an indefinite period under tank conditions, the species will reproduce in captivity, and the young survive its larval stages 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 the establishment of a commercial prawn-raising industry. The research is at the Keehi Fishery Station of Hawaii's Division of Fish and Game, Honolulu.

Maine 3-12-R.

Spencer Apollonio

35,232

Northern shrimp - biological and technical research - Studies are underway on waters adjacent to the Maine coast to determine the relative abundance of the northern shrimp species, 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

29,536

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 in North Carolina. A combined total of 26,989 shrimps were 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 Bogue Sound estuaries, including Newport River.

Oregon 1-3-R.

Gary Milburn

21,658

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

12,500

To manage and practice aquaculture in shrimp farm ponds and in large tanks under controlled conditions - Experiments at South Carolina's Bears Bluff Laboratory, Wadamalaw Island, beginning in 1947, have shown that it is possible to culture shrimp from postlarval stages to mature adults in shallow ponds constructed in saltwater marsh. Under this project, shrimp culture is continued in 3,000-gallon tanks where environmental conditions can be controlled. Attempts are made to hatch brown shrimp eggs which may be from captured shrimp and carry this through to postlarval development. Experiments will also be conducted with other local species of commercially valuable shrimp and possibly imported shrimp of other species.

General:

California 6-4-R.

H. G. Orcutt

\$ 16,580

Shellfish laboratory operations - This project provides for research on development of mass culture methods of clams, oysters, abalone, shrimp, and crab in order to open research avenues and increase both the food potential and recreational value of the ocean. In view of the decline of the San Francisco Bay crab fishery, crab larvae are being tested to determine their short-term tolerances to selected pesticides and long-term tolerance to DDT and endrin. A bioassay of water from the Bay is conducted and the effluent of two acid barges is also tested for toxicity to crab larvae.

Rhode Island 3-57-R.

Saul B. Saila

20,000

Mollusk environmental modification and control studies - Studies are in progress to design and execute appropriate field plot designs to determine effects of mineral nutrients and substrate composition on the growth of hard and soft clams and oysters. Predator control fence, chemical predator control, and various culture techniques on survival are investigated. The research is in Point Judith Pond, Narragansett, and is conducted by the University of Rhode Island, Kingston.

Texas 2-55-R.

B.D. King

52,000

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 and movement of larval and postlarval shellfish and fish from the Gulf of Mexico into the coastal bays and estuaries. Surface and bottom shrimp and crab traps are spaced at intervals across the pass to study species composition, modes, and abundances of juvenile, subadult, and adult shrimp and blue crab that move through the pass into the Gulf. Factors which influence movements are investigated also.

California 6-8-D.

H.G. Orcutt

56,846

California shellfish and bottomfish data analysis - The objective of this project is 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.

Alaska 5-13-D.

Gary Finger

40,000

Commercial feasibility of Alaskan scallop fishery - This project has three phases: 1) 40 days of exploratory scallop fishing by a

New England fishing vessel in Alaska's south central coastal area to determine the economic feasibility of development of a fishery; 2) to obtain biological information on scallops whenever possible on growth rate, age, and sexual maturity, and 3) to gather information on processing and distribution costs, as well as consumer acceptance.

JELLYFISH

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 - Maryland is continuing its studies to obtain a thorough knowledge of the life history of the sea nettle, determine its relationship to various environmental factors, determine the effect of this and related species on other Bay animals, and to develop, test, and evaluate physical, chemical, and biological methods of control. Most research is conducted at the Chesapeake Bay Biological Laboratory, Solomons, Maryland.

Mississippi JF-2-1-R.

Philip Phillips

24,534

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

Virginia JF 3-2-R.

Dexter Haven

38,493

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. Possible predators and other causes of mortality associated with the jellyfish will be investigated at the Virginia Institute of Marine Science, Gloucester Point.

ENVIRONMENT

Marine:

Maryland 3-30-R.

Gerald Schubel

\$ 35,910

Suspended sediments in the Upper Chesapeake Bay - Suspended materials are collected 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 on a monthly basis. The properties of the suspended materials are used to determine the relative importance of the several sources. Field work is by the Chesapeake Bay Institute, Annapolis, Maryland.

Maryland 3-56-R.

Charles H. Southwick

9,680

Biologic and environmental control of Eurasian milfoil (*Myriophyllum spicatum* L.) in Chesapeake Bay - Excessive milfoil growth is an environmental problem in Chesapeake Bay affecting 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, Saltpetre Creek, West River, and Rhode River. The purpose is to find a means of biologic control.

Mississippi 2-24-R.

C. E. Dawson

45,900

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 fifty fathoms. Together with the current work in the bays and sounds, this will cover the marine-estuarine littoral and shore fishes and crustaceans of economical importance on the Mississippi coast.

Estuarine:

Alabama 2-34-R. Johnie H. Crance \$ 63,000

Cooperative Gulf of Mexico estuarine inventory (Alabama) - This study of the estuarine areas 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 ten-fathom isobath and consists of four phases: area description, hydrology, sedimentology, and biology.

Florida 2-53-R. Edwin A. Joyce, Jr. 45,000

A study of the effects of a commercial hydraulic clam dredge on benthic communities in estuarine areas - The study areas for the project are Tampa Bay, Apalachicola Bay, Ten Thousand Islands, and Indian River. The effects of hydraulic dredging are evaluated for a variety of bottom types, including clay, silt, and shell. In addition, the project is concerned with the effects by hydraulic dredging on finfishes, crustaceans, and other invertebrates important in the fisheries food chain in estuarine areas.

Louisiana 2-22-R. J. D. Broom 324,145

Ecology of Louisiana's estuarine waters - This project is undertaken to 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 the ecological factors influencing this fauna and to determine possible means of preserving the estuarine areas.

North Carolina 2-9-R. Austin B. Williams 12,400

Studies on macroplanktonic crustaceans and ichthyoplankton of the Pamlico Sound complex - An immediate concern of North Carolina's Department of Conservation and Development is the growing industrial impact on shellfish and marine finfish resources, especially in Pamlico Sound and its tributaries. This research is directed toward gathering basic information on these waters. The objectives are threefold: 1) to secure data on recruitment of larval forms into the area, 2) to obtain an index to community composition before possible alteration from phosphate mining and other engineering projects, and 3) to analyze relationship of relative abundance and movement of larval forms to changes in the environment.

Texas 2-12-R. Roy B. Johnson, Jr. 19,460

An evaluation of the effects of estuarine engineering projects -

Each year the Texas Parks and Wildlife Department receives numerous requests for permits for construction in or alteration of the coastal bay areas. Many of the bays contain valuable nursery areas for commercial species of fish, shrimp, crabs, and oysters. This research is obtaining physical and biological data on the effect various engineering projects have on the ecology of the bay areas with emphasis on Galveston Bay. Procedures are recommended to minimize the adverse effects of water development on the fishery resources.

Virginia 3-19-R.

Edwin B. Joseph

Completed

Characterization of coastal and estuarine fish nursery ground as natural communities - The features of low-salinity nursery areas of the York-Pamunky estuary suitable for the larval and juvenile stages of many important coastal fishes are described. The distribution and abundance of such species as white perch, striped bass, Atlantic croaker, Atlantic menhaden, spot, and others were determined. Hydrography data including salinity, temperature, dissolved oxygen, turbidity, and current velocity were collected.

Maryland 3-26-R.

D. W. Pritchard

Completed

Studies of the physical and chemical properties of the estuarine environment associated with fish kills - A monitoring program provided several hundred temperature, salinity, dissolved oxygen, and pH observations of the waters of the upper Chesapeake Bay. Fish kill surveys and observations of blue crab movement were made during the monitoring program. The fish species of major concern was menhaden. The work was by The Johns Hopkins University, Baltimore, Maryland.

Freshwater:

Ohio AFCS-1, 1/

Charles E. Herdendorf

\$ 52,000

A study of the physical characteristics of the major reef areas in the western basin of Lake Erie - The objective of this study is to determine the physical characteristics of the reefs and surrounding area of the western basin of Lake Erie from Locust Point north to west Sister Island, then southeast to Catawba Island and south to Port Clinton and to Locust Point along the Ohio shoreline. The area is mapped topographically and bathymetrically by sediment and bedrock type. Subsurface and core samples are used to determine a chronology of ecological and geological events for this portion of the lake. To evaluate factors which may contribute to the success or failure of the fishery resources, it is essential that the physical characteristics be used.

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

PLANNING AND COORDINATION

Alaska 5-1-S. Gary Finger \$ 36,300

Coordination - To provide coordination and planning of Public Law 88-309 projects in Alaska.

Alaska AFC-11. Gary Finger 69,200

Coordination - To provide coordination and planning of Public Law 89-304 projects in Alaska.

California 6-5-S. Stanley S. Kobel 29,600

Coordination - To provide coordination and planning of Public Law 88-309 projects in California.

Connecticut 3-33-S. Richard L. Homes 3,300

Coordination - To provide coordination and planning of Public Law 88-309 projects in Connecticut.

Hawaii H-3-R. Michio Takata 4,000

Central Pacific Tuna Conference - The potential for increased yield of the three principal species of tuna presently harvested from the Central Pacific area is as follows: skipjack from present yield of 70,000 metric tons to an additional 100,000 to 200,000 metric tons; yellowfin from 100,000 to an additional 30,000 to 50,000 metric tons; and bigeye, little, if any, increase possible. To obtain greater yields, the answers to the following questions must be sought concurrently: 1) how can the fish be caught, 2) where are the fish abundant, 3) what are the relationships of the fish in the different areas, and 4) what is the magnitude and potential of the resources.

Hawaii H-9-R. Michio Takata 5,000

Publication of Central Pacific Tuna Conference proceedings and background papers - Proceedings of the Governor's Conference on Central Pacific Fishery Resources, as well as background papers utilized during deliberations of the conference, were published in a single volume of 266 pages.

Louisiana 2-20-S. T. B. Ford 7,414

Coordination - To provide coordination and planning of Public Law 88-309 projects in Louisiana.

Maine 3-70-S. Richard P. Choate 24,000

Coordination of research and development - To provide coordination and planning of Public Law 88-309 projects in Maine.

Maryland 3-65-S. George Murphy \$ 24,000

Coordination - To provide coordination and planning of Public Law 88-309 projects in Maryland.

Massachusetts 3-40-S. W. Leigh Bridges 27,000

Coordination of research and development - To provide for coordination and planning of Public Law 88-309 projects in Massachusetts.

Oregon 1-8-S. Austin R. McGill

Coordination - To provide coordination and planning of Public Law 88-309 projects in Oregon.

Oregon AFC-20. Leon A. Verhoeven 78,660

Evaluate, coordinate, and plan Pacific salmon research and management activities on a coastwide basis - Provide funds for the continuation of the Pacific Salmon Inter-Agency Council's efforts to evaluate current and future plans, needs, programs, and results of Pacific Coast fishery activities as they relate to anadromous stocks, coordinate research and its application to management of these stocks among Pacific Coast fishery agencies, and update the Salmon Compendium.

Oregon AFC-12. Austin R. McGill 7,000

Coordination of P.L. 89-304 - To provide coordination and planning of Public Law 89-304 projects in Oregon.

Washington 1-17-S. Marshall Thayer 12,000

Coordination of projects under P.L. 88-309 - To provide coordination and planning of Public Law 88-309 projects in Washington.

Washington AFC-4. Marshall Thayer 8,000

Coordination of anadromous fish projects - To provide coordination and planning of Public Law 89-304 projects in Washington.

Puerto Rico 2-37-S. Rolf Juhl 37,000

Coordination - To provide coordination and planning of Public Law 88-309 projects in Puerto Rico.

Texas 2-66-R. William R. Moore 6,400

Experimental pond research planning - To plan a research program for the saltwater pond experiment station currently under construction at the Seabrook Laboratory as Public Law 88-309 activity.

CONSTRUCTION

Hatcheries and hatchery facilities:

California AFSC-1.-^{1/} Robert Macklin \$1,120,000

Mad River hatchery construction - To begin construction of a large salmon and steelhead trout hatchery to help restore and maintain such fish runs in California coastal rivers. When fully operative, the hatchery would have potential annual production of one million yearling coho salmon and five million yearling king salmon. The proposed hatchery site is on the Mad River near the city of Arcata in Humboldt County.

California AFC-3. C.S. Kabel 40,000

Caspar Creek egg station construction - This project provides for construction of an egg-taking station on Caspar Creek near Fort Bragg in Mendocino County. The station would provide an additional source for coho salmon eggs for the Mad River hatchery.

Oregon AFC-11. Ernest R. Jeffries 40,000

Rearing ponds, North Nehalem River salmon hatchery - Six additional rearing ponds were constructed at the State-owned North Nehalem River salmon hatchery in Clatsop County, Oregon. The 14 original ponds have an annual capacity of one million yearling coho salmon and one million 90-to-120-day reared fall chinook salmon. It is anticipated that the additional rearing ponds will increase the hatchery capabilities substantially. In addition, a three-bedroom residence to house a permanent employee is under construction.

Oregon AFC-17. Jim Van Domelen 452,000

Construction and operation of the Elk River salmon hatchery - To meet the increasing demands for salmon in Oregon's southern coastal areas, a complete fish hatchery is under construction on the Elk River in Curry County, Oregon. When fully operative, the hatchery will be capable of rearing about two million coho and fall chinook salmon a year for release in southern coastal drainages such as the Elk, Pistol, Chetco, and Winchuck Rivers. Construction is scheduled for completion in October 1968.

Washington AFC-5. Marshall Thayer 431,684

Construction of Soleduck salmon hatchery - Plans and specifications have been developed for a large salmon hatchery to be located on the Soleduck River in Clallam County, Washington. Construction will get underway during the current fiscal year and is scheduled for completion about July 1969. When fully operative, the hatchery will be capable of producing about 115,500 pounds of young salmon

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

for release. This production is calculated to yield about 58,000 salmon (435,000 pounds) to the fisheries.

Washington AFC-9. Marshall Thayer 98,000

Samish salmon hatchery supplemental water supply and rearing pond system - The Samish hatchery, located on a tributary of Samish River, near Burlington, Washington, has been in continuous operation since 1899. At present, it is capable of rearing one-half million coho salmon until late fall or early spring (nearly one year of age), and 1.4 million fingerling chum or fall chinook salmon. This project provides for pumping and transporting of supplemental hatchery well water supplies, a denitrification tower, and construction of a large yearling rearing pond. The added facilities will enable the continuance of rearing the older year class fish until the optimum time of release, which occurs in midspring of their second year on the station.

Washington AFC-15. Marshall Thayer 28,000

Nooksack hatchery coho yearling pond construction - This project entails construction of a large yearling coho salmon rearing pond at the Nooksack State Salmon Hatchery which is located 20 miles northeast of Bellingham in Whatcom County, Washington. This pond will increase the hatchery capacity and efficiency by providing space for the extended rearing of coho salmon commencing with the time when conventional ponds must be vacated to make room for the oncoming brood years of both coho and chinook salmon.

Washington AFC-16. Marshall Thayer 92,000

Simpson hatchery rearing pond construction - The Simpson Hatchery, located at the confluence of the Middle East Fork of the Satsop River and Bingham Creek, about 25 miles west of the town of Shelton in Grays Harbor County, has been in operation since 1950. A new one-acre pond being constructed under this project will provide space for extended rearing of yearling coho salmon from February to May. This extended rearing practice will increase hatchery efficiency and total salmon survival.

Washington AFC-17. Marshall Thayer 22,000

Issaquah hatchery yearling coho rearing pond construction - The Issaquah State Salmon Hatchery is located within the town of Issaquah and 15 miles east of Seattle in King County, Washington. To increase the effective capacity of the hatchery, a one-fourth-acre pond is under construction where yearling coho salmon can be held until the optimum time of release to yield the highest survival rate.

Fish facilities:

California AFC-6. C. S. Kabel Completed

Scott Valley fish screen construction - A fish screen and trapping facility was constructed at the Scott Valley Irrigation District's water diversion from the Scott River near Fort Jones in Siskiyou County, California, to prevent the loss of downstream migrant salmonids. It was placed in operation in the spring of 1967. Good water conditions allowed a direct bypass of fish during the greatest part of the first season of operation; however, about 25,000 to 30,000 juvenile coho and king salmon and steelhead trout were trapped and transported to live water below the diversion.

Delaware AFSC-3.^{1/} Charles A. Lesser 120,000

Shad passageway construction on the Brandywine River - A feasibility study during the spring of 1967 (See Delaware AFCS-1) indicated that the Brandywine River is suitable for the restoration of American shad runs, provided workable fish passage facilities are installed at existing barriers. This project provides for the construction of fishways on 11 low-head dams on the section of river in Delaware which would make available about 35 river miles of historical spawning and nursery area.

Maine AFC-6. Fred Baird 50,000

Stream improvement and fishway construction - The major objectives of this project are the construction of fishways and/or the removal or bypassing of hazards to the upstream migration of anadromous species, especially the alewife. Fish passage facilities or other improvements have been engineered for several coastal streams. Construction is scheduled to get underway within specific watersheds in spring of 1968. In addition, where new fisheries are to be developed, stocking will be undertaken.

Rhode Island AFSC-1.^{1/} John Cronan 60,000

Construction of fish ladders - Fishways are under construction on the two low-head dams in Hunt River, Kent County; six low-head dams on the Saugatucket River in Washington County; three low-head dams on the Annaquatucket River in Washington County; and one dam on the Nonquit Pond of Narragansett Bay in Newport County. These installations would provide passage for alewife at Nonquit Pond, alewife and American shad in the Annaquatucket River, and alewife, American shad and sea-run trout in Hunt and Saugatucket Rivers.

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

Construction of small fishways - This project provides for construction of small semiformal fishways and removal and clearance of log jams in the stream channel on Hutchins Creek to make available spawning and rearing areas to fall chinook and coho salmon. Hutchins Creek is a tributary of Nooksack River and is located in Whatcom County, Washington.

Completed James H. Powell

Construction of fishery research vessel for Port Park Research Station - The subject research vessel was delivered August 1967. This 37-ft vessel is used for conducting research on the commercial fishery, such as the goby, in Port Park Research Station, northern Whatcom County.

Completed John

Design and construction of an improved fishing boat - About 1,300 fish have been, at present, engaged in the commercial fishery of Port Park. The boats are of simple construction from 41-ft long to 45-ft long. Fishing is almost all done by hand, resulting in low production per boat. This project provides for design and construction of a new, improved boat about 50 ft in length for use in the commercial fishery.

Completed Henry H. Gorman, Jr.

Construction of a fish research vessel - This 32-ft steel hull fishing trawler, Marine Fish, was delivered in the spring of 1967. It is currently used in monitoring spring and industrial fish resources of the lower coast.

Completed Frank

Fishing research vessel modification - A marine research vessel, approximately 40 feet in length, is being constructed for research on the more important commercial fish in Massachusetts coastal waters. The vessel will be equipped with radio communication, electronic sounding gear, navigation gear, and various types of equipment necessary to conduct the research. The major portion of work will be to collect biological information on lobster and other fisheries.

Research vessel:

Georgia 2-35-C. Charles M. Frisbie \$ 48,000

Research vessel construction - The State of Georgia planned to design and construct a research vessel for conducting research on the commercial fish species along the coast. Plans and specifications were developed; however, attempts to have a vessel constructed with available funds were unsuccessful. The project now is for the purchase of a modified trawler for use as a research vessel.

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

Construction of fishery research vessel for Fort Peck Reservoir fishery investigation - The subject research vessel was delivered August 1966. This 35-ft. vessel is used for conducting research on fish of commercial potential, such as the goldeye, in Fort Peck Reservoir in northeastern Montana.

Puerto Rico 2-38-C. Rolf Juhl 7,600

Design and construction of an improved fishing boat - About 1,300 fish boats are, at present, engaged in the commercial fisheries of Puerto Rico. The boats are of simple construction from 14-ft. row boats to 40-ft. sloops. Fishing is almost all done by hand, resulting in low production per boat. This project provides for design and construction of a new, improved boat about 20 ft. in length for upgrading the commercial fishery.

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

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

Massachusetts 3-76-C. Frank Grice 40,000

Marine research vessel acquisition - A marine research vessel, approximately 40 feet in length, is being constructed for research on the more important commercial fish in Massachusetts coastal waters. The vessel will be equipped with radio communication, electronic sounding gear, navigation gear, and various types of equipment necessary to conduct the research. The major portion of work will be to collect biological information on lobster and winter flounder.

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

Laboratory:

Maine 3-72-C. Phillip L. Goggins \$ 4,000

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

New York 3-10-C. David H. Wallace 360,000

Construction of a marine research and development laboratory -
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 saltwater system and other essential utilities. The construction site is located in the village of Old Field, adjacent to Flax Pond, which is a saltwater estuary off Long Island Sound. The State University of New York is building a university at Stony Brook, New York, which is about five miles from this site.

South Carolina 2-36-C. G. Robert Lunz Completed

To add a refrigerating unit to existing system for temperature control of saltwater culture tanks - Refrigerating units to control temperature were installed in six large volume experimental saltwater tanks used for research in pond cultivation of shrimp and supplementary feeding of oysters.

Texas 2-14-C. Terrance R. Leary 385,500

Coastal fisheries experiment station - This station is approved for construction on north shore of Matagorda Bay near Well Point in Calhoun County. It consists of an experimental station and 21 ponds, ranging in size from four acres to one-fourth acre, with total acreage of about 23 acres, and related structures to provide controlled habitat for marine research and demonstration.

Puerto Rico 2-40-C. Rolf Juhl 100,000

Construction of commercial fisheries laboratory - 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, Puerto Rico, relatively close to the Puerto Rico College of Agriculture and Mechanic Arts, the Inter-American University, and the Institute of Marine Biology.

Wickford Marine Laboratory dock repairs - To assure adequate and safe facilities for marine fisheries research, sections of the dock which supports laboratory tanks and sundry equipment are under repair. The laboratory is located in North Kingston, Rhode Island.

Fish culture ponds:

Alabama 2-31-C.

Johnie H. Crance

\$ 8,000

Oyster rearing pond construction - The objective of this project is to construct a one-fourth-acre pond for the study of commercial raising of oysters in saltwater ponds. This project is located adjacent to the Alabama Marine Resources Laboratory at Dauphin Island.

Idaho 1-9-C.

James F. Keating

11,750

Construction of Hayden Creek rearing pond - The site of the rearing ponds is an abandoned trout hatchery approximately three miles upstream from the mouth of Hayden Creek, a tributary of the Lemhi River. There are to be two one-acre ponds and related facilities for experimental rearing of chinook salmon and steelhead trout.

Louisiana 2-63-C.

J. D. Broom

135,000

Construction of saltwater culture ponds - Plans are to construct 16 one-quarter-acre saltwater ponds on Grand Terre Island, Jefferson Parish, Louisiana, near the Louisiana Wildlife and Fisheries Commission's marine laboratory. Research will be on pond culture of the commercially important brown and white shrimps, as well as work on oysters and selected species of fish.

Landing facilities:

Alabama 2-29-C.

Johnie H. Crance

Completed

Construction of public oyster landing facilities - Three public oyster landings were constructed on Heron Bay in Baldwin County. The landings enable oystermen to unload their catch in a protected area and close to the oyster processing shops. Before construction, the oystermen had to travel eight miles or more over exposed waters to unload their catch.

Puerto Rico 2-41-C.

Rolf Juhl

150,000

Construction of fishing port facilities - Lack of storage, fish handling, and docking facilities are a major problem in the development of the fishing industry of Puerto Rico. This project provides for construction of essential fishing port facilities at Barrero at Rincón, Puerto Nuevo at Vega Baja, Cerro Gordo at Vega Alta, Culebra Island, Punta Santiago at Humacao, Hucares at Naguabo, and various other fishing centers to facilitate and stimulate the fishing activity.

Others:

Alaska 5-12-C. G.L. Ziemer Completed

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.

Massachusetts 3-39-C. A. Russell Ceurvels Completed

Cat Cove dike repair - The dike on Cat Cove impoundment consisting of about eight acres of coastal water was repaired and a water level control system installed so that the pool can be utilized for shellfish culture studies. It is located on Salem Harbor in Salem, Massachusetts, the proposed site for a marine laboratory.

Massachusetts 3-52-C. A. Russell Ceurvels 54,000

Cat Cove pier repair and pool rehabilitation - This project is for rehabilitation of Cat Cove pool and reconstruction of an adequate pier for shellfish culture studies. The pool is about eight acres and is located on Salem Harbor in Salem, Massachusetts, the proposed site for a marine laboratory.

Nebraska 4-17-D. Robert E. Thomas Completed

Design and construction of facilities relative to trapping and handling of commercial fishes - An electrical fish weir and trap were installed across the North Platte River near Lewellen, Nebraska, to observe the movement and availability of commercial fishes. Included is the construction of research facilities were live-holding facilities and storage building.

Oregon AFC-25. Austin Magill Completed

Remove culvert and construct bridge to provide anadromous fish passage on Clear Creek, tributary to the Kilchis River - The project provided for removal of a culvert and replacement with a precast concrete slab and wood pile bridge across Clear Creek for upstream passage of chum, chinook, and coho salmon. The culvert was a partial barrier to fish movement. Clear Creek enters the Kilchis River about five miles north of the town of Tillamook in Tillamook County, Oregon.

EXPLORATORY FISHING AND GEAR DEVELOPMENT

American Samoa H-8-D. James R. Holloway, Sr. \$ 83,500

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; conduct exploratory fishing to determine the availability and abundance of marine animals of potential commercial value; and study the economic potential in the Island and elsewhere for the fishery products.

Guam H-7-D. Isaac I. Ikehara 39,600

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. Objectives of this study are to investigate the feasibility of adopting the Hawaiian-type sampans for suitable fishing vessel for use offshore around Guam, determine the relative potential importance of the various fish groups to the Island's fishery development, and 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 45,000

Study of the feasibility and application of Danish seining to the Massachusetts fishing industry - Controlled comparative fishing demonstrations are conducted by Danish seining and otter trawling to determine the feasibility of Danish seining as a method of improving the harvest of commercially valuable fish. Trials are conducted at various depths from shoal water (8-20 fathoms) to deep water (30-100 fathoms) and include ground fishing, mixed fishing, as well as a combination of methods. The project areas are New Bedford and coastal waters off Massachusetts.

Minnesota 4-22-D. Charles R. Burrows 4,100

Development of under-ice horizontal sonar scanning equipment and technique for locating fish schools - The experimental work with sonar equipment is located on inland lakes of southwestern and south central Minnesota and on the St. Croix River. The purpose of this study is to develop gear and methods for locating schools of fish under the ice by means of echo-ranging equipment, and if effective, to promote the use of this technique among commercial fishermen to increase harvest of fish by under-ice seining in inland lakes.

Puerto Rico 2-39-R.

Rolf Juhl

\$104,600

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 conducting experimental pot fishing and longline bottom fishing. The project also provides for test trolling and gill net fishing.

Rhode Island 3-53-R.

Richard W. Burton

Completed

Operational testing of two pelagic trawls on two small draggers - Two fishing boats tested different types of midwater trawling gear off Point Judith, Rhode Island, for the benefit of New England commercial fishermen. The common method of fishing off the New England coast is by otter trawl near the bottom of the ocean for groundfish. But certain commercially valuable species such as herring, butterfish, and scup rise to midwater depths during the daytime. The midwater trawl is designed to catch these fish. This study made recommendations for the nets, doors, and transducer systems tested.

Tennessee 4-5-R.

Harry L. Hargis

12,650

Development of improved fishing methods for use in southeastern and south central reservoirs - Studies are underway in the Chickamauga and Watts Bar Reservoirs of the Tennessee River to determine, through biological and developmental research, more efficient and effective methods for catching underharvested commercial species of fish such as carp, buffalofish and sucker. Haul seine and trap net are the gears being tested.

Virgin Islands 2-33-R.

Arthur E. Dammann

54,667

Study of the fisheries potential of the Virgin Islands - Very little basic ecology, oceanography, and environmental analysis 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 as received from them by the consumer is nearly always substandard. Under this project, methods of harvesting and handling which have practical value of improving the fishery are investigated. Also, the extent to which long-range commercial 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 midwater trawl for harvesting hake and other species in commercial quantities in Puget Sound.

South Dakota 4-37-D.

Donald Monroe

11,000

Commercial fishing gear research and development for lakes and reservoirs in South Dakota - In order to find and develop efficient methods of harvesting rough fish for commercial purposes from South Dakota's waters, principally the large reservoirs, the development of special gears is undertaken. Experimental floating trap nets are fished, along with gill nets and frame nets normally used by fishermen on a comparison basis of gear capabilities. The species of concern are buffalo, carp, carpsucker, and bluesucker. Current experiments are on the Oahe and Garrison Reservoirs.

TECHNOLOGY

Maine 3-16-R.

Edwin P. Creaser

\$ 40,000

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 are also investigated. Marine worm landings in Maine are valued at \$1.25 million, and industry is concerned for the future of this resource.

Maine 3-17-R.

Robert L. Dow

Completed

Study of the economic and operational feasibility of mechanization of the Maine sardine processing and canning operations - The objective of this project was to develop more efficient and lower cost methods of processing and canning Maine sardines to enable the industry to meet foreign competition in its domestic market, to expand exports, and to compensate for a dwindling labor pool of cannery workers. A prototype machine that orients, cuts, eviscerates, and stacks herring of $4\frac{1}{2}$ to $5\frac{1}{2}$ inches has been developed under subcontract by Dynatech Cooperation, Cambridge, Massachusetts.

Maine 3-18-R.

Robert Dow

Completed

Investigation of physical aspects of raw herring - Means to determine the quality of the resultant canned product as sardines by examination of the raw herring when taken from the nets and landed at the dock were investigated. 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. Different lots of herring from the same area and taken at the same time often result in both good and poor quality sardines, even though handling and canning procedures could not be the quality-determining factors.

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 conducting a bacteriological and sanitary survey of handling facilities and practices affecting quality of fish offshore and onshore. 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 newsletters.

Mississippi 2-61-R.

David W. Cook

\$ 19,300

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 contributing to the spoilage of Penaeus shrimp stored in crushed ice. Comparisons are made between 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. The work is conducted at Gulf Coast Research Laboratory, Ocean Springs, Mississippi.

Missouri 4-34-D.

Ruth E. Baldwin

6,200

Palatability of Missouri fish - Cubed cooked fish fillets are tested by trained panel to determine the acceptability of different species of fish, relation of aroma of water to pollution source and acceptability of fish, and the feasibility of various measures for improving quality of fish. Experimental fish are collected from the Mississippi River at points above and below St. Louis during winter and summer. The study is by the Home Economics of the University of Missouri, Columbia.

North Carolina 2-8-R.

Neil B. Webb

12,500

A study of the quality of North Carolina scallops - The North Carolina scallop industry has shown considerable growth in recent years but has suffered financially in competition with New England and Canadian scallops. Based on scientific data, recommendations are to be made for the handling of scallops from the time harvested through the various handling and processing stages, to the final packaging, in order to ensure a top quality product. The three species of scallops of commercial importance to North Carolina (Pecten gibbus, P. irradians, and P. grandis) are considered.

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 complimentary groundfish. An acceptable smoked pepperoni

product, using shad and striped bass, has been developed. The shelf-life of this 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 18,000

Utilization of hake, dogfish, and byproducts of the fillet industry for protein supplements - The State of Oregon has an immense quantity of hake and dogfish, both sources of animal protein and, in addition, fillet scrap from the bottom fishery which amounts to over 60 percent of trawl fish landed. Oregon State University, Corvallis, and their Seafood Laboratory at Astoria, are experimenting with these fish and byproducts to develop a stable protein product and determine possible uses of such products. An eight-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 6,153

Processed hake in feed for mink - This study has indicated that Pacific hake can serve as the source of protein in mink ration and will support growth almost equivalent to that of a practical-type mink diet. Processing methods to improve the physical characteristics of the product to conform with conventional mink-feeding procedures, and to improve the protein quality of the meal are investigated. Experiments are conducted at the Experimental Fur Farm of Oregon State University, Corvallis.

Oregon 1-34-R. James E. Langler 20,000

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

South Dakota 4-21-D. Kenneth Schneider 12,000

Missouri reservoir fisheries product development and evaluation -

Exploratory research is in progress to determine chemical and physical factors affecting carp utilization for food and feed purposes. Experimental fish from reservoirs in the Missouri River system are processed at the research facilities of South Dakota State University, Brookings.

Tennessee 4-31-D.

M. R. Johnston

\$ 5,000

Evaluation of whole fish meal as a protein supplement for swine - Research is in progress at the University of Tennessee Agricultural Experiment Station, Knoxville, to determine 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. Multiple nonselective species of rough fish taken by commercial fishing methods in Kentucky Reservoir are processed into whole fish meal for feeding experiments. The quality and fat composition of pork tissue from the feeding trials are evaluated.

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 the worth of fish meals from species of fish peculiar to North Pacific waters, such as hake, anchovy, and dogfish, in the formulation of feeds for chickens, turkeys, and other egg-laying birds. Also, the relative nutritive worth of such fish meals with established fish meals such as herring meal is considered.

ECONOMICS

Georgia 2-46-R.

D. J. Purcell

\$ 25,000

Economic survey of the marine commercial fishing industry of Georgia - To more effectively develop a broad research and management program for Georgia's commercial fisheries, an economic survey is underway. The economic importance of the seafood industry and the value added to seafood products landed at various stages of the market channel from the fisherman to the consumer are determined. In addition, the effect of physical and socio-economic factors on the consumption of seafoods and the demand for seafood to future time periods are investigated. The major commercial fisheries of Georgia are shrimp, blue crab, oyster, and shad. The work is at the Department of Agricultural Economics, Georgia Experiment Station, Experiment.

Maryland 3-42-D.

Richard E. Suttor

13,400

An economic study of the fisheries and seafood processing industries with emphasis on the Chesapeake Bay - The Chesapeake Bay fisheries, one of the nine major fisheries in the United States, landed a catch valued at \$30 million in 1963. There has been little research, however, on the economic aspects of the fisheries; therefore, this study is undertaken to: 1) analyze the demand for seafood by region in the United State, 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.

STATISTICS

Alaska 5-3-D.

Barbara Hill

\$ 13,600

Expansion of current and development of additional commercial fisheries catch, production and gear statistics - Presently, the State of Alaska's fishing statistics do not reflect the harvest, abundance, trends, and values, which are needed for management and research on industrial fisheries in the various areas. 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

23,270

Commercial fishery industry survey - The objective of this study is to develop a statistical reporting system for all the commercial fisheries of the State of Arkansas. Some statistics on fishing on the different river systems have been collected by the Bureau of Commercial Fisheries but have not included the fish-farming industry, which is much greater in value. Fish farmers and commercial fishermen are interviewed to establish the base for refined surveys.

California 6-6-D.

H. G. Orcutt

24,400

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, which are prerequisite to effective management of these resources. Catches are sampled in Crescent City, California, and Brookings and Port Orford, Oregon, areas.

Massachusetts 3-37-D.

Allen E. Peterson, Jr.

21,000

Collection, compilation, evaluation and dissemination of commercial fisheries statistics - Presently, there are inadequacies in the reporting of commercial fisheries statistics in the Commonwealth of Massachusetts. 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 trawl dragners. Statistics are compiled, evaluated, and disseminated in monthly bulletins in cooperation with the Bureau of Commercial Fisheries.

Missouri 4-3-R.

John W. Robinson

20,500

Research and management of commercial fisheries - This project is carried out on the Mississippi and Missouri Rivers in Missouri to

improve the accuracy of statistics on commercial fish landings. In addition, the commercial catches are sampled throughout the season for species taken, and size composition of the catch recorded. Age and growth determinations are made on the important species.

Oklahoma 4-25-D.

Gary Mensinger

24,200

Commercial fishery statistics - Current economics of the commercial fisheries is constantly needed in the promotion and management of the fishery resources. 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

94,000

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, number of fishermen, and data on fish marketing from the fishermen to the consumer.

South Dakota 4-18-D.

Donald Monroe

19,635

Commercial fishery industry survey - The Bureau of Commercial Fisheries has been collecting statistics on the Missouri River system but has not included the other inland fishery operations in South Dakota. No information is available from licensed hatchery operators, bait dealers, hoop net and set line licensees, and frog dealers. 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.

Texas 2-49-R.

Claude L. Hamilton, Jr.

17,400

Commercial fishery landings statistical program - The level of commercial fisheries production can best be determined by maintaining statistical records of the various products as they are handled by dealers. 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.

A major effort is being made to correct this inadequacy through a program of consumer education that is patterned after the highly successful promotion of the sea scallops landed in New Bedford, Massachusetts.

Montana 1-45-D. Glenn R. Barth 20,400

Processing and marketing Montana commercial fisheries products -
Preliminary results of Montana Fish and Game research indicate a substantial supply of goldeye, carp, buffalo, and lesser abundance of sucker, sheephead, catfish, and bullhead for commercial markets. The markets for selected classes of commercial fish are identified and the competitive position of Montana in serving these markets with local commercial fishery products is investigated.

North Dakota 4-20-D. David C. Nelson 5,000

Commercial fish markets for North Dakota fisheries -
The supply of fish for commercial markets is about 14 million pounds annually from North Dakota. The species of fish include mainly buffalo, carp, and goldeye. This project is undertaken to identify the market demand, alternate uses, and potential demand and market for North Dakota fisheries.

Texas 2-62-D. Terrance Leary 65,000

Seafood marketing - A basic problem facing the Gulf fisheries is that of expanding old markets and creating new markets for Gulf seafoods. To promote greater sale of these 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 will be accomplished mainly through the development and distribution of educational materials such as video tapes and films, recipe leaflets, and prop materials, and cookery demonstrations and exhibits.

Virginia 3-69-D. Fred W. Rawlinson 16,000

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

EXTENSION SERVICES

Alabama 2-58-D. Johnie Crance \$ 7,900

Gulf of Mexico estuarine film - Alabama is cooperating with other Gulf States, the Gulf States Marine Fisheries Commission, and the Bureau of Commercial Fisheries in preparation and distribution of a 28-minute color, sound motion picture film showing the values and problems in estuarine fisheries.

Florida 2-50-D. Harmon Shields 7,900

Gulf of Mexico estuarine film - See Alabama 2-58-D.

Louisiana 2-57-D. Theodore Ford 7,900

Gulf of Mexico estuarine film - See Alabama 2-58-D.

Mississippi 2-59-D. William J. Demoran 7,900

Gulf of Mexico estuarine film - See Alabama 2-58-D.

Maine 3-13-D. Donald M. Harriman 254,464

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 scientifically accepted 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 22,125

Maryland marine fisheries extension service - The objective of this project is to disseminate to the persons who harvest and process fishery resources throughout tidewater Maryland and to 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 11,720

Shellfish extension - To improve the shellfish resources along the Massachusetts coast, technical assistance and advice are provided to town and regional shellfish management programs. Management practices such as raft culture of oysters, collection and redistribution of spat, reseeding operations, predator control, and other activities designed to increase harvests are encouraged.

Gulf of Mexico estuarine film - See Alabama 2-58-D.

Completed Ernest Borgnine, 2-58-D. Connecticut 2-58-D.

Disaster relief - Connecticut Water Agency - The preparation of 15 spawning beds in selected locations of Long Island Sound was completed. Each bed was obtained, provided with predator control material, and planted with 400 bushels of brood stock. A highly successful test - completed from the first spawning, will provide seed oysters and brood stock for several years. p. 11, 2-58-D, 2-58-D, 2-58-D.

Completed Max Summers Louisiana 2-58-D.

Rehabilitation and restoration of oyster seed ground - To rehabilitate the oyster seed ground damaged by Hurricane Betsy, the planting of 60,000 bushels of oyster seed was completed in selected areas in Bay Bourneaux and Black Bay. Handled seed was taken in both areas showed a gain of 95 percent in Black Bay and 65 percent in Bay Bourneaux. p. 11, 2-58-D, 2-58-D.

Texas 2-58-D. Robert Holstetter 30,000

Oyster rehabilitation in San Antonio Bay - To increase oyster spat setting as a means of repopulating public reefs damaged by hurricanes, approximately 15,000 bushels of oyster brood stock are being stocked from Mission Bay and transported on depleted reef sites in San Antonio Bay. p. 11, 2-58-D, 2-58-D.

Michigan, Illinois, Wisconsin, and Minnesota - Completed

Spoked flap - Under this section of the Act, approximately 2 million pounds of frozen oysters were removed from trade channels and additional funds were provided to institute microbiological research and monitoring procedures. p. 11, 2-58-D, 2-58-D.

The following resource disaster projects, initially funded under Section 210 of the Department of the Interior Research and Development Act, P.L. 88-302, are now authorized under Section 210 of the Act:

Delaware 2-58-D. Pilot studies of the spawning and rearing of HBY (see page 11 for project description)

Maryland 2-58-D. Development of disease-resistant oyster brood stock (see page 11 for project description)

Virginia 2-58-D. Rehabilitation of oyster seed ground (see page 11 for project description)

RESOURCE DISASTER PROJECTS

Public Law 88-309, Section 4(b)

Connecticut 3-51-D. Ernest Bontya Completed

Disaster relief - Connecticut oyster fishery - The preparation of 15 spawning beds in selected locations of Long Island Sound was completed. Each bed was cleaned, protected with predator control material, and planted with 400 bushels of brood stock. A highly successful set, obtained from the first spawning, will provide seed oysters and brood stock for several years.

Louisiana 2-27-D. Max Summers Completed

Rehabilitation and restoration of oyster seed ground - To rehabilitate the oyster seed grounds damaged by Hurricane Betsy, the planting of 630,000 bushels of clam and/or reef shell was accomplished 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.

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, approximately 15,000 bushels of oyster brood stock are being dredged from Galveston Bay and transplanted on depleted reef sites in San Antonio Bay.

Michigan, Illinois, Wisconsin, and Minnesota Completed

Smoked fish - Under this section of the Act, approximately 2 million pounds of frozen chubs were removed from trade channels and additional funds were provided to institute microbiological research and monitoring procedures.

The following resource disaster projects, initially funded under Section 4(b) of the Commercial Fisheries Research and Development Act, P.L. 88-309, are now supported under Section 4(a) of the Act:

Delaware 3-49-R. Pilot studies of the spawning and rearing of MSX resistant oysters (See page 69 for project description)

Maryland 3-20-R. Development of a disease-resistant oyster brood stock (See page 71 for project description)

Virginia 3-6-R. Production of disease-resistant oysters (See page 73 for project description)

PUBLICATIONS

BENDIX CORPORATION.

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1966. Field test report, sonar system for salmon counting. Electrodynamics Division, 11600 Sherman Way, North Hollywood, Calif., Rep. 92-329-1, 6 p.
1967. Field test report of array sonar salmon counter. Electrodynamics Division, 11600 Sherman Way, North Hollywood, Calif., Rep. 92-353, 11 p.

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

DAVIS, ALLEN S.

1967. Forecast research on 1967 Cook Inlet area pink salmon fisheries. Alaska Dep. Fish. Game, Leaflet 98, 13 p.
1968. Forecast research on 1968 Cook Inlet area pink salmon fisheries. Alaska Dep. Fish. Game, Leaflet 117, 13 p.
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DEPARTMENT OF CHESAPEAKE BAY AFFAIRS

1968. Commercial fisheries news. Fish. Exten. Serv., 1(1-3): 4 p. ea.

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1967. Frazer Lake sockeye investigations, 1966. Alaska Dep. Fish. Game, Leaflet 99, 48 p.
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FRISBIE, CHARLES M.

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- MAINE DEPARTMENT OF SEA AND SHORE FISHERIES.
1967. Fabulous feasts with Maine seafood. State House, Augusta, No. 7744, 32 p.
- MANOR, THOMAS A. (Ed.)
1966. Proceedings of the Governors Conference on Central Pacific fishery resources. State of Hawaii, 266 p.
- MASSACHUSETTS SEAFOOD COUNCIL
1967. Seafood 'n seaports...a cook's tour of Massachusetts. Mass. Div. Mar. Fish, 32 p.

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1967. A study of the quality of North Carolina scallops. N. C. Dept. Conserv. Dev. Raleigh, Spec. Sci. Rep. 12, 63 p.

COOPERATORS

<u>State and Others</u>	<u>Agency</u>	<u>Address</u>
Alabama	Department of Conservation	State Admin. Building 64 N. Union Montgomery, Alabama 36104
	Auburn University	Auburn, Alabama 36830
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, Arkansas 72203
California	Department of Fish & Game	1416 Ninth Street Sacramento, California 95814
Colorado	Game, Fish, & Parks Dept.	6060 North Broadway Denver, Colorado 80200
Connecticut	Essex Marine Laboratory, Inc.	Essex, Connecticut 06428
	State Board of Fisheries & Game	State Office Building Hartford, Connecticut 06106
Delaware	Board of Game & Fish Commissioners	State House Annex Dover, Delaware 19901
	Commission of Shellfisheries	State House Annex Dover, Delaware 19901
Florida	Board of Conservation	107 W. Gaines Street Tallahassee, Florida 32304
Georgia	State Game & Fish Commission	401 State Capitol Atlanta, Georgia 30303
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

COOPERATORS CONT'D.

<u>State and Others</u>	<u>Agency</u>	<u>Address</u>
Illinois	Department of Conservation	State Office Building Springfield, Illinois 62706
Indiana	Division of Fish & Game	Department of Conservation Indianapolis, Indiana 46209
Iowa	State Conservation Commission	Valley Bank Building 4th & Walnut Streets Des Moines, Iowa 50308
Kansas	Forestry, Fish & Game Commission	Box F Pratt, Kansas 67124
Kentucky	Department of Fish & Game Resources	Frankfort, Kentucky 40601
Louisiana	Wildlife & Fisheries Commission	400 Royal Street New Orleans, Louisiana 70130
Maine	Department of Sea & Shore Fisheries	State Office Building Augusta, Maine 04330
Maryland	Department of Chesapeake Bay Affairs	State Office Building Annapolis, Maryland 21404
Massachusetts	Department of Natural Resources	100 Cambridge Street Boston, Massachusetts 02202
Michigan	Department of Conservation	Lansing, Michigan 48926
Minnesota	Division of Game & Fish	Department of Conservation St. Paul, Minnesota 55101
Mississippi	Marine Conservation Commission	122 E. Jackson Street Biloxi, Mississippi 39530
Missouri	Department of Conservation	P.O. Box 180 Jefferson City, Missouri 65102
Montana	Fish & Game Department	Helena, Montana 59601
Nebraska	Game, Forestation and Parks Commission	State Capitol Building Lincoln, Nebraska 68509
New Hampshire	Fish & Game Department	Bridge Street Concord, New Hampshire 03301
New Jersey	Department of Conservation & Economic Development	27 W. State Street Trenton, New Jersey 08625

COOPERATORS CONT'D.

<u>State and Others</u>	<u>Agency</u>	<u>Address</u>
New Mexico	State Game Commission	State Capitol Building Santa Fe, New Mexico 87501
New York	Department of Conservation	State Office Building Albany, New York 12226
North Carolina	Division of Commercial & Sport Fisheries	Department of Conservation & Development Raleigh, North Carolina 27603
North Dakota	State Game & Fish Department	Port Lincoln Bismarck, North Dakota 58501
Ohio	Division of Wildlife	Department of Natural Resources 1500 Dublin Road Columbus, Ohio 43212
	Division of Geological Survey	Department of Natural Resources 1207 Grandview Avenue Columbus, Ohio 43212
Oklahoma	Wildlife Conservation Department	State Capitol Oklahoma City, Oklahoma 73105
Oregon	Fish Commission	Portland, Oregon 97201
	Pacific Salmon Inter-agency Council	741 State Office Building Portland, Oregon 97201
Pennsylvania	Fish Commission	Harrisburg, Pennsylvania 17120
Puerto Rico	Department of Agriculture	San Juan, Puerto Rico 00902
Rhode Island	Division of Conservation	Department of Natural Resources 83 Park Street Providence, Rhode Island 02902
South Carolina	Division of Commercial Fisheries	2024 Maybank Highway Charleston, South Carolina 29405
South Dakota	Department of Game, Fish & Parks	State Office Building Pierre, South Dakota 57501
Tennessee	Game & Fish Commission	Doctors' Building 706 Church Street Nashville, Tennessee 37203

COOPERATORS CONT'D.

<u>State and Others</u>	<u>Agency</u>	<u>Address</u>
Texas	Parks & Wildlife Department	John H. Reagan Building Austin, Texas 78701
Utah	Department of Fish & Game	1596 West North Temple Salt Lake City, Utah 84114
Vermont	Fish & Game Department	Montpelier, Vermont 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, Virginia 23607
	Institute of Marine Science	Gloucester Point, Virginia 23062
Washington	Department of Fisheries	General Administration Building Olympia, Washington 98501
	Fisheries Research Institute	University of Washington Seattle, Washington 98105
West Virginia	Department of Natural Resources	State Capitol Charleston, West Virginia 25305
Wisconsin	Conservation Department	Madison, Wisconsin 53701

ADMINISTRATIVE ORGANIZATION

Region 1

Idaho	Washington	Donald R. Johnson, Director
Montana	Wyoming	6116 Arcade Building
Oregon		1319 Second Avenue
		Seattle, Washington 98101

Region 2

Alabama	North Carolina	Seton H. Thompson, Director
Florida	Puerto Rico	Federal Office Building
Georgia	South Carolina	144 First Avenue, South
Louisiana	Texas	St. Petersburg, Florida 33701
Mississippi	Virgin Islands	

Region 3

Connecticut	New York	John T. Gharrett, Director
Delaware	Pennsylvania	Federal Building
Maine	Rhode Island	14 Elm Street
Massachusetts	Vermont	Gloucester, Massachusetts 01930
Maryland	Virginia	
New Hampshire	West Virginia	
New Jersey		

Region 4

Arkansas	Missouri	William F. Carbine, Director
Illinois	Nebraska	5 Research Drive
Indiana	North Dakota	Ann Arbor, Michigan 48103
Iowa	Ohio	
Kansas	Oklahoma	
Kentucky	South Dakota	
Michigan	Tennessee	
Minnesota	Wisconsin	

Region 5

Alaska		Harry L. Rietze, Director
		P. O. Box 2481
		Juneau, Alaska 99801

Region 6

Arizona	New Mexico	Gerald V. Howard, Director
California	Nevada	101 Seaside Avenue
Colorado	Utah	Terminal Island, California 90731

Hawaii Area

American Samoa	Hawaii	John C. Marr, Director
Guam		2570 Dole Street, P.O. Box 383
		Honolulu, Hawaii 96812

DISTRIBUTION OF FUNDS

Fiscal Year 1968

<u>State</u>	<u>P.L. 88-309</u>	<u>P.L. 89-304</u>	<u>P.L. 89-720</u>	<u>Total</u>
Alabama	\$ 44,400	\$ 15,000	\$	\$ 59,400
Alaska	246,000	435,300		681,300
Arizona	20,500			20,500
Arkansas	20,500			20,500
California	246,000	325,000		571,000
Colorado	20,500			20,500
Connecticut	20,500	17,000		37,500
Delaware	21,700	15,000		36,700
Florida	246,000	15,000		261,000
Georgia	92,600	9,990		102,590
Hawaii	33,500			33,500
Idaho	20,500			20,500
Illinois	22,800			22,800
Indiana	20,500			20,500
Iowa	20,500			20,500
Kansas	20,500			20,500
Kentucky	20,500			20,500
Louisiana	246,000	15,000		261,000
Maine	192,600	25,000		217,600
Maryland	171,600	75,000	50,000	296,600
Massachusetts	246,000	11,000		257,000
Michigan	20,500	30,000		50,500
Minnesota	20,500			20,500
Mississippi	117,100	15,000	11,817	143,917
Missouri	20,500			20,500
Montana	20,500			20,500
Nebraska	20,500			20,500
Nevada	20,500			20,500
New Hampshire	20,500	15,000		35,500
New Jersey	150,000	9,834		159,834
New Mexico	20,500			20,500
New York	177,600	20,000	11,000	208,600
North Carolina	58,700	50,000		108,700
North Dakota	20,500			20,500
Ohio	54,800	26,000		80,800
Oklahoma	20,500			20,500
Oregon	127,500	423,810		551,310
Pennsylvania	46,000	7,500		53,500
Rhode Island	25,700	20,000		45,700
South Carolina	22,100			22,100
South Dakota	20,500			20,500
Tennessee	20,500			20,500
Texas	246,000			246,000
Utah	20,500			20,500

DISTRIBUTION OF FUNDS CONT'D.

<u>State</u>	<u>P.L. 88-309</u>	<u>P.L. 89-304</u>	<u>P.L. 89-720</u>	<u>Total</u>
Vermont	\$ 20,500	\$	\$	\$ 20,500
Virginia	181,600	80,000	19,246	280,846
Washington	204,700	476,816		681,516
West Virginia	20,500			20,500
Wisconsin	20,500	17,750		38,250
Wyoming	20,500			20,500
American Samoa	59,000			59,000
Guam	20,500			20,500
Puerto Rico	246,000			246,000
Virgin Islands	20,500			20,500
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TOTAL	\$4,100,000	\$2,150,000	\$ 92,063	\$6,342,063

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