

R E P O R T
OF THE
UNITED STATES COMMISSIONER OF FISH AND FISHERIES
FOR THE
FISCAL YEAR ENDED JUNE 30, 1903.

The operations of the Commission of Fish and Fisheries for the fiscal year 1903 are outlined in this report, which is respectfully submitted for the information of the President, the Congress, the Executive Departments, and the public at large. The report embodies a résumé of the work of the Commission, detailed records of the waters stocked with food fishes, and a statement of the appropriations under which the work was conducted, together with an account of the general condition of the fisheries of the country, a historical outline of the Commission's operations from 1871 to 1903, and special reports of the assistants in charge of the different divisions of the Commission.

PROPAGATION AND DISTRIBUTION OF FOOD FISHES.

GENERAL RESULTS.

The work of propagating food fishes and stocking public waters therewith during the fiscal year 1903 was probably more successful than in any previous year in the history of the Commission. More hatcheries were operated than heretofore, all old lines of work were actively pushed, and important new features were taken up. The number of fish distributed was somewhat less than in the previous year, the decrease being due to seasonal conditions which could not be foreseen or obviated; but various valuable fishes, whose cultivation has not recently or has never before been undertaken, received attention, and plans were made for a greatly increased output hereafter.

The necessity for maintaining the fish supply in public and private waters is becoming more urgent each year, and the applications for all kinds of fish now greatly exceed those of a few years ago, taxing to the utmost the resources of the various hatcheries. In order to keep pace with the increased catch by commercial fishermen and anglers, the establishment of additional hatcheries from time to time is demanded, and larger appropriations are required to operate existing hatcheries to their full capacity.

The practical value of the Commission's work of artificial propagation has long since been removed from the realm of doubt, and is appreciated and conceded by all persons qualified to express an intelligent opinion thereon. This is true of the cultivation of marine species no less than of the river, lake, and pond species. Instances of direct economic returns from the operations of the Commission have been noted from time to time in the official reports, and such instances are continually coming to light. In the present report attention is drawn again to certain noteworthy results of fish culture which have already been discussed, and some new cases of successful stocking of waters are mentioned.

STATIONS OPERATED.

The number of stations and substations in operation in 1903 was 46. Substations are those having no permanent personnel, and, in most instances, are without the complete equipment of the major stations; in other respects, however, they are regular hatcheries, and in some cases their work is more extensive than that of the stations to which, for administrative purposes, they are attached. The location of the hatcheries, by states and regions, is shown in the following table:

Sections and States.	Number.	Sections and States.	Number.
New England:		Great Lakes—Continued.	
Maine.....	3	Michigan.....	5
New Hampshire.....	1	Minnesota.....	1
Massachusetts.....	2	North Central:	
Vermont.....	2	Iowa.....	2
Middle Atlantic:		Illinois.....	1
New Jersey.....	1	Missouri.....	1
Maryland.....	2	South Dakota.....	1
District of Columbia.....	2	South Central:	
Virginia.....	1	Tennessee.....	1
West Virginia.....	1	Rocky Mountain:	
South Atlantic:		Montana.....	1
North Carolina.....	2	Colorado.....	1
Georgia.....	1	Pacific:	
Gulf:		California.....	3
Texas.....	1	Oregon.....	2
Great Lakes:		Washington.....	6
New York.....	1	Total.....	46
Ohio.....	1		

The number of stations at which each of the great commercial species distributed by the Commission was cultivated on a large scale in 1903 is shown in the following tabulation:

Species.	Number of stations.
Lobster.....	2
Cod.....	2
Flat-fish.....	2
Shad.....	4
Pike perch.....	2
Yellow perch.....	2
White-fish.....	7
Lake trout.....	5
Salmon.....	11

FISHES CULTIVATED.

The species of fishes cultivated and distributed in 1903 numbered about 50, and included the leading food-fishes of the rivers, lakes, interior waters, and Atlantic coast. The species whose cultivation had not recently been carried on or had not previously been conducted on a large scale are the mackerel, the sea bass, the scup, and the tautog on the Massachusetts coast, the yellow perch on Potomac River and Lake Champlain, the white perch on Susquehanna River, and the striped bass on Roanoke River. Following is a list in systematic order of the fishes handled, a few minor species incidentally distributed from interior stations being omitted.^a

List of fishes propagated and distributed by the Fish Commission in 1903.

Siluridæ, THE CAT-FISHES.

* § *Ictalurus punctatus* (Rafinesque). Spotted Cat; Blue Cat; Channel Cat.

* § *Ameiurus nebulosus* (Le Sueur). Horned Pout; Bullhead; Yellow Cat.

Catostomidæ, THE SUCKERS AND BUFFALO-FISHES.

§ *Ictiobus bubalus* (Rafinesque). Small-mouthed Buffalo-fish.

Cyprinidæ, THE MINNOWS AND CARPS.

†† *Cyprinus carpio* Linnæus. Carp. (Cultivated varieties, German Carp, Leather Carp, Mirror Carp, etc.)

‡ *Carassius auratus* (Linnæus). Gold-fish.

‡ *Tinca tinca* (Linnæus). Tench. (Cultivated variety, Golden Tench.)

‡ *Leuciscus idus* (Linnæus). Ide. (Cultivated variety, Golden Ide.)

Clupeidæ, THE SHADS AND HERRINGS.

* *Alosa sapidissima* (Wilson). Shad.

Salmonidæ, THE SALMONS, TROUTS, WHITE-FISHES, ETC.

* *Coregonus clupeiformis* (Mitchill). White-fish.

* *Argyrosomus arledi* (Le Sueur). Lake Herring; Cisco.

* *Oncorhynchus tshawytscha* (Walbaum). Quinnet Salmon; Chinook Salmon; Tyee Salmon; King Salmon.

* *Oncorhynchus kisutch* (Walbaum). Silver Salmon; Coho.

* *Oncorhynchus nerka* (Walbaum). Blueback Salmon; Red-fish; Sockeye.

* *Oncorhynchus gorbusha* (Walbaum). Hump-back Salmon.

* *Salmo gairdneri* Richardson. Steelhead; Hardhead; Salmon Trout.

* *Salmo irideus* Gibbons. Rainbow Trout.

* *Salmo salar* Linnæus. Atlantic Salmon.

* *Salmo sebago* Girard. Landlocked Salmon.

* *Salmo lewisi* Girard. Yellowstone Lake Trout; Cut-throat Trout; Black-spotted Trout.

* *Salmo pleuriticus* Cope. Colorado River Trout; Black-spotted Trout.

* *Salmo stomias* Cope. Arkansas River Trout; Green-backed Trout.

* *Salmo macdonaldi* Jordan & Evermann. Yellow-finned Trout.

† *Salmo trutta* Linnæus. Sea Trout; Salmon Trout.

† *Salmo trutta levenensis* (Walker). Loch Leven Trout.

* *Cristivomer namaycush* (Walbaum). Lake Trout; Mackinaw Trout; Longe; Togue.

* *Salvelinus fontinalis* (Mitchill). Brook Trout; Speckled Trout.

^aThe fishes artificially propagated are designated, thus *; those simply collected and distributed, thus †; those propagated as food for other fishes, thus ‡; those propagated for ornamental purposes, thus †; and introduced species, thus †.

Salmonidæ, THE SALMONS, TROUTS, WHITE-FISHES, ETC.—Continued.

* *Salvelinus aureolus* Bean. Golden Trout; Sunapee Lake Trout.

* *Salvelinus marstoni* Garman. Canadian Red Trout.

* *Salvelinus fontinalis* × *aureolus*. Hybrid Trout.

Thymallidæ, THE GRAYLINGS.

* *Thymallus montanus* Milner. Montana Grayling.

Esocidæ, THE PIKES.

§ *Esox lucius* Linnæus. Common Pike; Pickerel.

§ *Esox vermiculatus* Le Sueur. Little Pickerel; Grass Pike.

Scombridæ, THE MACKERELS.

* *Scomber scombrus* Linnæus. Common Mackerel.

Centrarchidæ, THE BASSES, SUN-FISHES, AND CRAPPIES.

* § *Pomoxis annularis* Rafinesque. Crappie.

* § *Promoxis sparoides* (Lacepède). Strawberry Bass; Calico Bass.

* § *Ambloplites rupestris* (Rafinesque). Rock Bass; Red-eye; Goggle-eye.

* § *Chaenobrythus gulosus* (Cuvier & Valenciennes). Warmouth; Goggle-eye

§ *Micropterus dolomieu* Lacepède. Small-mouthed Black Bass.

* § *Micropterus salmoides* (Lacepède). Large-mouthed Black Bass.

* § *Lepomis pallidus* (Mitchill). Bluegill; Sun-fish.

Percidæ, THE PERCHES.

* § *Stizostedion vitreum* (Mitchill). Pike Perch; Wall-eyed Pike; Yellow Pike; Blue Pike.

* § *Perca flavescens* (Mitchill). Yellow Perch.

Serranidæ, THE SEA BASSES.

* *Roccus lineatus* (Bloch). Striped Bass; Rock-fish.

* *Morone americana* (Gmelin). White Perch.

* *Centropriates striatus* (Linnæus). Sea Bass.

Sparidæ, THE PORGIES.

* *Stenotomus chrysops* (Linnæus). Scup; Porgy; Scuppaug.

Labridæ, THE LABRIDS.

* *Tautoga onitis* (Linnæus). Tautog; Black-fish.

Gadidæ, THE CODS.

* *Gadus callarius* Linnæus. Cod.

Pleuronectidæ, THE FLOUNDERS.

* *Pseudopleuronectes americanus* (Walbaum). Winter Flounder.

Crustaceans.

* *Homarus americanus* Edwards. American Lobster.

SUMMARY OF DISTRIBUTION.

The fish and fertilized ova distributed in 1903 are shown in the appended table. The aggregate output, somewhat more than one and a quarter billions, exceeded that of any previous year except 1902. While the Commission at its various inland stations makes adequate provision for keeping up the supply of fishes that are sought by anglers, it is noteworthy that more than 98 per cent of the fish handled are those which are caught by commercial fishermen and thus enter directly into the food supply of the country.

Summary of distribution.

Species.	Eggs.	Fry.	Fingerlings, yearlings, and adults.	Total.
Shad	2,555,000	117,862,544		120,417,544
Striped bass.....		8,125,000		8,125,000
Quinnat salmon.....	15,514,177	23,862,956	5,450	39,372,583
Atlantic salmon.....		1,582,409	303,614	1,886,023
Landlocked salmon.....	180,000	203,422	415,321	798,743
Silver salmon.....	680,800	81,812		762,612
Blueback salmon.....		3,731,789		3,731,789
Steelhead trout.....	80,000	800,255	413,041	1,293,296
Loch Leven trout.....		223,330	1,400	224,730
Rainbow trout.....	217,000	726,758	476,999	1,420,757
Black-spotted trout.....	20,000	200,900	2,528,800	2,749,700
Brook trout.....	984,000	6,306,774	806,211	8,098,985
Lake trout.....	8,285,896	29,278,082	25,251	37,689,229
Lake herring.....		1,500,000		1,500,000
Scotch sea trout.....			174	2,674
Golden trout.....	2,500		4,200	21,025
Canadian red trout.....		16,825		585
Hybrid trout.....			1,720	1,720
Grayling.....	445,000	974,114	368	1,419,482
White-fish.....	68,327,000	246,956,040		310,283,040
Pike perch.....	81,500,000	138,439,203	3,915	219,943,118
Cat-fish.....			200,380	200,380
Yellow perch.....	8,000,000	21,467,500	80,450	29,497,950
White perch.....	445,000	30,863,000		31,308,000
Pike.....			15	15
Buffalo-fish.....			200,000	200,000
Black bass.....			528,365	528,365
Crapple.....			398,511	398,511
Strawberry bass.....			3,850	3,850
Rock bass.....			47,844	47,844
Warmouth bass.....			1,400	1,400
Sun-fish.....			432,545	432,545
Cod.....		87,392,000		87,392,000
Flat-fish.....		245,425,000		245,425,000
Tautog.....		5,867,000		5,867,000
Scup.....		280,000		280,000
Mackerel.....		281,000		281,000
Sea bass.....		920,000		920,000
Lobster.....		68,631,000		68,631,000
Total.....	182,238,878	1,036,988,743	6,880,359	1,226,057,476

The following table shows the extent to which the different states and territories were included in the distribution. The figures include the transfers of fish and eggs to state commissions, as well as those fish planted directly by the Commission in state waters:

Distributions and assignments of fish and eggs in the States and Territories.

State or Territory.	Species.	Eggs.	Fry.	Fingerlings, yearlings, and adults.
Alabama.....	Rainbow trout.....			8,400
	Cat-fish.....			12,000
	Black bass.....			33,646
	Crapple.....			200
	Sun-fish.....			200
Arizona.....	Rainbow trout.....			6,700
	Black bass.....			1,200
	Crapple.....			525
	Rock bass.....			300
Arkansas.....	Quinnat salmon.....			400
	Rainbow trout.....		12,000	100
	Black bass.....			7,300
	Rock bass.....			4,850
California.....	Strawberry bass.....			400
	Quinnat salmon.....	11,518,777	1,618,066	100
	Brook trout.....	200,000		

Distributions and assignments of fish and eggs in the States and Territories—Continued.

State or Territory.	Species.	Eggs.	Fry.	Fingerlings, yearlings, and adults.
Colorado	Landlocked salmon.....			4,500
	Steelhead trout.....			29,000
	Rainbow trout.....		26,000	1,900
	Black-spotted trout.....			1,651,900
	Brook trout.....		1,520,200	295,700
	Lake trout.....		5,000	2,400
	Grayling.....		40,000	
	Black bass.....			1,300
	Crappie.....			225
Connecticut.....	Shad.....		2,559,000	
	Landlocked salmon.....	10,000		
	Rainbow trout.....	20,000		
	Brook trout.....			4,300
	Lake trout.....	250,000		
	Pike perch.....		495,000	
	Black bass.....			1,800
	Crappie.....			500
	Lobster.....		8,000,000	
Delaware.....	Shad.....		8,050,000	
	Rainbow trout.....			800
District of Columbia.....	Black bass.....			400
	Shad.....		1,506,579	
Georgia.....	Atlantic salmon.....			100
	Landlocked salmon.....			100
	Rainbow trout.....			112
	Brook trout.....			100
	Scotch sea trout.....			12
	Grayling.....			12
	Pike perch.....		833,330	
	Yellow perch.....	8,000,000		
	Shad.....		1,988,000	
	Rainbow trout.....			10,700
	Cat-fish.....			49,425
Idaho.....	Black bass.....			74,168
	Crappie.....			1,550
	Strawberry bass.....			800
	Rock bass.....			800
	Warmouth bass.....			1,400
	Sun-fish.....			11,400
	Rainbow trout.....			2,500
	Black-spotted trout.....		100,000	26,000
	Brook trout.....			18,000
	Steelhead trout.....			8,000
	Illinois.....	Rainbow trout.....		
Pike perch.....				100
Cat-fish.....				500
Yellow perch.....				6,450
Buffalo-fish.....				15,000
Black bass.....				32,389
Crappie.....				39,925
Rock bass.....				1,620
Sun-fish.....				28,250
Loch Leven trout.....				400
Pike perch.....			11,150,000	
Indiana.....	Black bass.....			18,949
	Crappie.....			2,485
	Rock bass.....			1,454
	Rainbow trout.....			400
Indian Territory.....	Black bass.....			2,565
	Crappie.....			500
	Rock bass.....			1,450
	Quinnat salmon.....		7,000	2,700
Iowa.....	Steelhead trout.....			42,500
	Loch Leven trout.....		4,260	
	Rainbow trout.....		258,850	102,200
	Brook trout.....		100,000	305
	Lake trout.....		9,700	
	Pike perch.....		760,000	8,815
	Cat-fish.....			81,530
	Yellow perch.....			19,000
	Buffalo-fish.....			160,000
	Black bass.....			8,030
	Crappie.....			305,910
	Rock bass.....			1,060
	Sun-fish.....			353,360
	Pike.....			15
Kansas.....	Rainbow trout.....			1,700
	Black bass.....			15,075
	Crappie.....			1,000
	Rock bass.....			4,550

Distributions and assignments of fish and eggs in the States and Territories—Continued.

State or Territory.	Species.	Eggs.	Fry.	Finger- lings, year- lings, and adults.
Kentucky	Rainbow trout			500
	Pike perch		700,000	
	Black bass			8,505
	Crappie			6,640
	Rock bass			1,400
Louisiana	Sun-fish			400
	Black bass			2,000
	Strawberry bass			2,900
	Rock bass			100
	Atlantic salmon		1,582,409	303,414
Maine	Landlocked salmon	70,000	196,122	370,550
	Steelhead trout		5,582	853
	Brook trout	350,000	860,000	115,137
	Lake trout		40,646	
	Scotch sea trout			162
	Grayling		17,114	
	Lobster		32,700,000	
	Shad	1,133,000	30,217,965	
	Rainbow trout	67,000		13,800
	Brook trout			2,400
Maryland	White perch		80,863,000	
	Black bass			93,646
	Crappie			200
	Rock bass			160
	Shad		1,350,000	
	Landlocked salmon	25,000		1,400
	Rainbow trout			2,600
	Brook trout	75,000	24,975	3,024
	Lake trout			100
	Scotch sea trout	2,500		
Massachusetts	Pike perch	10,000,000	997,000	2,000
	Black bass			500
	Crappie			
	Cod		87,392,000	
	Flat-fish		246,425,000	
	Tautog		5,867,000	
	Scup		280,000	
	Mackerel		281,000	
	Sea bass		920,000	
	Lobster		31,431,000	
	Landlocked salmon	20,000		600
	Steelhead trout		24,800	
	Loch Loven trout		80,000	1,000
	Brook trout		901,000	
	Lake trout	1,000,000	19,425,000	
Grayling	200,000			
White-fish		147,650,000		
Pike perch	30,000,000	17,600,000		
Black bass			3,155	
Crappie			750	
Rock bass			300	
Minnesota	Steelhead trout		23,313	
	Rainbow trout		2,000	
	Brook trout		73,500	1,100
	Lake trout		1,580,000	
	Pike perch		3,300,000	
	Cat-fish			450
	Black bass			2,350
	Crappie			400
	Black bass			12,300
	Crappie			2,196
Mississippi	Rock bass			2,350
	Quinnat salmon			2,400
	Rainbow trout	10,000	2,425	22,868
	Steelhead trout			2,900
	Brook trout	30,000		
Missouri	Lake trout		900	
	Grayling	85,000		
	Pike perch	10,000,000	800,000	
	Cat-fish			50,625
	Black bass			4,003
	Crappie			1,150
	Rock bass			11,550
	Steelhead trout			6,000
	Rainbow trout			23,900
	Black-spotted trout		20,000	246,000
Montana	Brook trout	10,000		68,000
	Grayling		887,000	
	White-fish		600,000	
	Rainbow trout	50,000		1,000
	Brook trout	50,000		
Nebraska	Black bass			2,350
	Crappie			900
	Rock bass			100

Distributions and assignments of fish and eggs in the States and Territories—Continued.

State or Territory.	Species.	Eggs.	Fry.	Fingerlings, yearlings, and adults.	
Tennessee	Rainbow trout		122,760	51,242	
	Brook trout			1,500	
	Pike perch		700,000		
	Black bass			6,164	
	Crappie			1,260	
Texas	Rock bass			1,100	
	Shad		2,000,000		
	Rainbow trout			500	
	Cat-fish			50	
	Black bass			101,175	
Utah	Crappie			225	
	Strawberry bass			50	
	Rock bass			5,460	
	Sun-fish			2,485	
	Landlocked salmon	10,000			
Vermont	Steelhead trout	20,000			
	Rainbow trout	25,000			
	Brook trout	50,000		3,000	
	Grayling	100,000			
	Landlocked salmon			18,173	
Virginia	Steelhead trout		19,860	30,000	
	Rainbow trout			2,557	
	Brook trout	1,000	1,025,300	22,611	
	Lake trout	300,000	178,000		
	Canadian red			535	
	Grayling			368	
	White-fish		450,000		
	Pike perch		16,112,203		
	Yellow perch		21,467,500		
	Black bass			1,950	
	Shad		29,000,000		
	Rainbow trout	1,000		107,708	
	Brook trout		171,234	40,616	
	Pike perch		72,531		
	Black bass		1,668,670	60,557	
Crappie			1,820		
Rock bass			2,720		
Washington	Quinnat salmon		8,787,190		
	Silver salmon		81,812		
	Blueback salmon		8,731,789		
	Steelhead trout		440,000	252,015	
	Rainbow trout		7,499	1,900	
	Black-spotted trout			57,000	
	Brook trout			19,314	
	Lake trout		55,483	18,800	
	White-fish		274,040		
	Black bass			200	
	Shad		500,000		
	Rainbow trout		65,000	6,500	
	Brook trout	25,000	145,000	34,490	
	Cat-fish			200	
	Black bass			2,800	
Crappie			600		
Rock bass			400		
Wisconsin	Steelhead trout	20,000	15,000		
	Rainbow trout			9,800	
	Brook trout		159,500	5,000	
	Lake trout	2,000,000	560,000		
	White-fish	25,000,000	1,600,000		
	Pike perch		1,200,000		
	Cat-fish			5,000	
	Yellow perch			5,000	
	Buffalo-fish			25,000	
	Black bass			2,550	
	Crappie			25,000	
	Sun-fish			30,000	
	Wyoming	Steelhead trout	20,000		
		Loch Leven trout		9,500	
		Rainbow trout	30,000	7,500	8,500
Black-spotted trout				13,000	
Brook trout		80,000	104,200	4,500	
Lake trout		200,000			
Grayling		60,000			
Black bass				700	
Crappie				200	
Rock bass				250	

CAR AND MESSENGER SERVICE.

This is an indispensable adjunct of the fish-cultural work, being the medium through which the output of the hatcheries is transferred to the waters to be stocked. The transportation of the immense numbers of fish annually handled by the Commission is made possible only by the use of specially constructed railway cars, of which five were operated in 1903. The work of the cars is supplemented by detached messengers, who accompany consignments of fish in baggage cars. For making small shipments to places off the main lines the detached service is more economical and convenient. In 1903 the transportation cars were hauled 79,378 miles and the detached messengers traveled 260,027 miles. Some of the railroads, appreciating the benefits conferred by the Commission in stocking waters along their routes, haul the cars and carry the messengers free of charge. Following is a statement of the free transportation provided by the railroads in 1903. The thanks of the Commission and of the people along the respective lines are due these companies for the liberal policy pursued in this matter.

Statement of miles of free transportation furnished by certain railroads.

Name of railroad.	Cars.	Messen- gers.	Name of railroad.	Cars.	Messen- gers.
Atchison, Topeka and Santa Fe.....		370	Missouri, Kansas and Texas.....		421
Baltimore and Ohio.....	693		Missouri Pacific.....	1,196	582
Bangor and Aroostook.....	2,298	668	Mobile and Ohio.....	2,166	57
Boston and Maine.....	185	12,686	Montana.....	188	376
Burlington and Missouri River in Nebraska.....	893	5,270	Montpelier and Wells River.....	554	198
Burlington, Cedar Rapids and Northern.....	882	40	Norfolk and Western.....	526	4,752
Central Vermont.....		14	Oregon Short Line.....		982
Chesapeake and Ohio.....	1,156	270	Northern Pacific.....		456
Chicago and North Western.....		1,130	Pere Marquette.....	417	898
Chicago, Burlington and Quincy.....	3,588	1,894	Phillips and Rangeley.....		58
Chicago, Rock Island and Pa- cific.....	446	312	Portland and Rumford Falls.....	188	162
Colorado and North Western.....		62	Rio Grande Southern.....		90
Colorado and Southern.....	3,160		Rio Grande, Pagosa and North- ern.....		62
Colorado and Wyoming.....		50	Rio Grande Western.....		584
Colorado Midland.....	1,469		Rutland.....		1,288
Colorado Springs and Cripple Creek District.....		92	St. Johnsbury and Lake Cham- plain.....	77	1,939
Cooperstown and Charlotte Val- ley.....		64	St. Louis and Northern Arkansas.....		132
Crystal River.....		42	St. Louis and San Francisco.....	2,644	2,629
Delaware, Lackawanna and Western.....		371	St. Louis South-western.....		824
Denver and Rio Grande.....		11,617	San Antonio and Aransas Pass.....		498
Detroit and Mackinac.....	964	252	Sandy River.....		58
El Paso and North Eastern.....		330	Sebasticook and Moosehead.....		16
Fort Worth and Denver City.....		1,728	Somerset.....	82	85
Franklin and Megantic.....		62	Southern Pacific.....		996
Grand Rapids and Indiana.....	609		Spokane Falls and Northern.....		610
Great Northern.....		565	Tacoma Eastern.....		48
Gulf, Colorado and Santa Fe.....	6,293		Tennessee Central.....	198	
Houston and Texas Central.....	1,127		Terminal Railroad Association of St. Louis.....	4	
Illinois Central.....		7	Texas and Pacific.....	1,062	2,283
International and Great North- ern.....	386	8,811	Texas Midland.....		40
Iron Mountain and Greenbrier.....		40	Union Pacific.....		828
Jacksonville and St. Louis.....		36	Yandalla.....	371	
Kansas City Southern.....		471	Virginia-Carolina.....		32
Knoxville and Bristol.....		40	Wabash.....	534	1,610
Maine Central.....	3,803	3,602	Washington County (Me.).....	188	204
Michigan Central.....	288		Wichita Valley.....		102
			Total.....	26,526	85,492

RELATIONS WITH THE STATE FISH COMMISSIONS.

The Commission aims to aid and cooperate with the fishery authorities of the different states in every possible way, and has continued the long-prevailing practice of supplying to state hatcheries eggs and young of various species which, when hatched or reared, are distributed under the direction of the state fish commissions. The states whose hatcheries which were thus stocked by the government in 1903 numbered 16 and the eggs and fish supplied aggregated 170,227,000, as follows:

States and species.	Number of eggs.	States and species.	Number of eggs.
California:		New Hampshire:	
Brook trout	200,000	Brook trout	50,000
Quinnat salmon	10,135,777	Lake trout	500,000
Connecticut:		Landlocked salmon	10,000
Lake trout	250,000	New York:	
Landlocked salmon	10,000	Lake trout	1,830,896
Rainbow trout	20,000	Oregon:	
Shad	a 2,559,000	Quinnat salmon	3,006,400
Maine:		Pennsylvania:	
Brook trout	300,000	Lake trout	1,500,000
Landlocked salmon	30,000	Pike perch	30,000,000
Maryland:		White-fish	38,052,000
Rainbow trout	50,000	Utah:	
Shad	1,028,000	Brook trout	50,000
Massachusetts:		Grayling	100,000
Brook trout	70,000	Landlocked salmon	10,000
Landlocked salmon	20,000	Steelhead trout	20,000
Pike perch	10,000,000	Vermont:	
Shad	a 1,350,000	Lake trout	300,000
Michigan:		Wisconsin:	
Grayling	200,000	Lake trout	2,000,000
Lake trout	1,000,000	White-fish	25,000,000
Landlocked salmon	20,000	Wyoming:	
Pike perch	30,000,000	Brook trout	60,000
Missouri:		Grayling	60,000
Brook trout	30,000	Lake trout	200,000
Grayling	85,000	Total	170,207,073
Pike perch	10,000,000		
Nebraska:			
Brook trout	50,000		
Rainbow trout	50,000		

a Fry.

At the request of the Michigan authorities this Commission has operated, as substations of the Northville hatchery, the stations of the Michigan fish commission at Detroit and Sault Ste. Marie for the propagation of white-fish, lake trout, and pike perch.

RELATIONS WITH FOREIGN COUNTRIES.

The Commission has continued its practice of furnishing, on request, fish and ova to foreign governments or to foreigners prominently identified with fish-cultural work, and in 1903 supplied fertilized eggs to the following countries, in addition to planting 300,000 lake trout in the Canadian waters of Lake Superior:

Countries.	Species.	Number of eggs.
Ireland	Brook trout	25,000
Wales	Landlocked salmon	10,000
	Steelhead trout	20,000
	Lake trout	50,000
Germany	Rainbow trout	10,000
	Black-spotted trout	20,000
	Brook trout	10,000
Switzerland	Lake trout	50,000
Tasmania	Quinnat salmon	494,000
	Total	689,000

NOTE.—Four hundred yearling spotted cat-fish were sent to the Belgian minister of agriculture, Brussels.

NEW STATIONS.

Ground was broken July 22, 1902, for the construction of the station near White Sulphur Springs, W. Va. During the year a hatchery has been built, and sufficient progress made with the pond system to permit fish-cultural operations to begin. The hatchery is a frame building on a brick foundation, is $1\frac{1}{2}$ stories high, 74 feet long, and 32 feet wide, with extensions in front and rear; there are a hatching room, an office, and entrance and stair halls on the first floor, and 5 sleeping and 2 storage rooms in the attic. The hatching room is equipped with 44 troughs 11 feet 8 inches long, $12\frac{1}{2}$ inches wide, and 8 inches deep, arranged in groups of four, the upper pair of each group discharging into the lower, whence the water may be turned into ponds or waste drains as desired. A 6-inch pipe, carried along under the floor at the head of the line of troughs, supplies each pair with water through a standpipe. Water is brought to the hatchery from the spring through an 8-inch Wyckoff wooden pipe line 1,365 feet long. A proper head is maintained at the spring by means of a concrete dam 50 feet long. Below the confluence of the overflow from the spring and several small runs a similar dam 35 feet long has been built, forming a reservoir for the pond supply, from which the water is conducted by means of an open ditch connected with the reservoir by 176 feet of 18-inch terra-cotta pipe. Twelve rearing ponds 50 feet by 8 feet have been completed, besides the greater part of the excavation for one large pond 0.45 acre in extent. A trussed wagon bridge has been built over Wade Creek, and 5 smaller bridges over the open ditch. Several hundred feet of 4, 6, and 8 inch terra-cotta drainpipe have been laid, and suitable roads constructed. The old channel of Wade Creek—a water course flowing through a part of the grounds—has been straightened, and retaining walls, cribwork, and levees have been built along it and for a considerable distance along Spring Branch, the outlet of the spring, to guard against danger from overflows and erosion of the banks.

One portion of the property selected for the lobster hatchery at Boothbay Harbor, Me., containing 7.2 acres, was acquired May 12,

1903, and another portion, containing 1.6 acres, was purchased June 26, 1903. These purchases will permit the beginning of work at an early date. Negotiations for one more small parcel needed are progressing, and all the land requisite will soon be in possession of the government.

The sundry civil bill, approved March 3, 1903, provided for the establishment of a fish-cultural station at or near the town of Mammoth Spring, Ark., and in that month a representative of the Commission visited the locality and made a favorable report on a site near the town. Negotiations for its purchase have begun.

It was found that the cost of maintaining a substation at Charlevoix, Mich., on Lake Michigan, would be less than the expense of making the necessary distribution of eggs and fry in that vicinity, and that if the eggs, after being eyed, were transferred and hatched at Charlevoix, they would produce a larger number of fish for distribution and in better condition than would result from hatching them at Northville and transferring the fry to their destination in the cars. A substation was therefore established at this point, consisting of a frame building, 18 by 36 feet, with 10-foot posts, located on the grounds of the United States Life-Saving Service. It is fully equipped for hatching lake trout and white-fish eggs, and an excellent water supply is furnished free of charge by the village of Charlevoix. The total expense incurred in building and equipping this substation was \$1,260.69, and the cost of hatching and distributing the output was \$524.22. Another season it is believed that the station can be stocked with 25,000,000 to 30,000,000 white-fish eggs and 5,000,000 lake trout eggs, and that these can be hatched and distributed at a cost not exceeding \$600, thus effecting a saving of at least \$1,000 annually over the old method.

The purchase of the property selected for the station at Tupelo, Miss., was consummated in August, 1902, when a topographical survey was made and the proposed improvements laid out. Construction work was begun February 21, 1903, and at the close of the year 11 artesian wells 400 feet deep had been bored and 2 large ponds of over 3 acres in area were nearing completion. The wells furnish a little over 80 gallons of water per minute, of a temperature of 63° F.

An acre of land adjoining the property at the Put-in Bay, Ohio, station was purchased in May, 1903, of the Independent Ice Company at a cost of \$500, for the purpose of erecting a superintendent's residence thereon.

For the purpose of increasing and protecting the water supply at the Duluth, Minn., station, two lots which adjoin the property were purchased of the Lake Side Land Company on June 20, at a cost of \$1,000.

Bills for numerous new hatcheries in various parts of the country have been introduced in Congress and referred to the Commission for recommendation. On most of these a favorable recommendation has been made. A feature of some of the bills, which is regarded as undesirable and which has been uniformly objected to, is the provision that a proposed hatchery shall be established at some particular point in a given state. To limit the Commission in this way may preclude the possibility of building a successful hatchery because of unsuitable topographical conditions and water supply, and is almost certain to involve a larger outlay for site and privileges than would otherwise be required.

ECONOMIC ASPECTS OF NATIONAL FISH CULTURE AND ACCLIMATIZATION.^a

The question is often asked, "Does government fish-culture pay?" or, "Are the economic results of national fish-culture commensurate with the cost?" The people who entertain doubts on this point are mostly those who have not taken the time or had the opportunity to familiarize themselves with what has been attempted and what has been accomplished by the national and state fish commissions.

Much evidence can be adduced to show that the fish-cultural operations of the general government are of direct financial benefit to the country at large. The results, in the case of some species, have been so striking and so widespread that it would be almost as supererogatory to refer to them as to discuss the utility of agriculture; in the case of other species there can be no doubt of the value of the work, although it may be only occasionally possible to distinguish the effects of human intervention on the fish supply from those due to natural causes. Some of the important results of the Commission's efforts, which have previously been cited in the reports, may appropriately be again referred to, if only to draw attention to the continuance of the results.

The leading river fish of the eastern seaboard is the shad. No other anadromous species has been more extensively cultivated and none is now so dependent on artificial measures for its perpetuation. Inasmuch as the principal fisheries are in interstate or coastal waters and the movements of the fish from the high seas to our rivers and back to the high seas place it beyond the claim to ownership which might be urged by the various states were the shad a permanent resident within their jurisdiction, it has seemed especially desirable and necessary that this species should be fostered by the general government for the benefit of the entire country. The shad was one of the first species whose artificial propagation was taken up by the Fish Commission, and its cultivation is to-day a leading factor in fishery work. Almost every large shad stream has been the site of hatching operations, and during

^a Extract from a lecture by Hugh M. Smith, deputy commissioner, entitled "How the Government maintains the fish supply," delivered before the Geographical Society of Baltimore, January, 1903.

the ten years ending in 1903 the number of artificially hatched shad returned to public waters by the government was over one and a half billion. An important point is that these eggs are taken from fish that have been caught for market, and hence would be totally lost if the Commission did not collect them from the fishermen.

The great multiplication of all kinds of fishing appliances on the coast, in the bays, in the estuaries, and along the courses of the rivers results in the capture of a very large part of the run each season before the shad reach the spawning grounds, and hence the natural increase is seriously curtailed, and, in some streams, almost entirely prevented. The steady increase in the shad catch in the face of conditions more unfavorable than confront any other fish of our eastern rivers is conclusive evidence of the beneficial effects of artificial propagation. In 1880, prior to which year shad cultivation had been on a comparatively small basis, the total yield of this species from Maine to Florida was 18,000,000 pounds; during the four succeeding years the supply in many of the streams decreased to such an extent that the abandonment of the fishery, as a commercial enterprise, was imminent. From 1885, when the largely-increased plants of fry began to produce results, until the present time, the trend of the fishery has been steadily upward in every stream. Against a product of 18,000,000 pounds, worth \$995,000, in 1880, is to be placed an annual catch of over 50,000,000 pounds, valued at \$1,700,000, at the present time. As a result of the increased abundance of shad, the cost of this toothsome food has been materially reduced, but even at the price actually received the value of the increase in the annual catch at this time is upward of a million dollars, or more than three times the amount expended by the government in the propagation of shad in twenty years.

Evidence is not lacking to show that the long-continued and increasingly extensive fish-cultural operations on the Great Lakes have prevented the depletion of those waters in the face of the most exhausting lake fisheries in the world. The luscious white-fish, the splendid lake trout, the excellent pike perch, or wall-eyed pike, are hatched in such numbers as to assure their preservation without further curtailing the fisheries.

The magnitude of the salmon fisheries of the Pacific States has required very extensive artificial measures to keep up the supply. Hatcheries have been established on tributaries of the Sacramento and Columbia, in the Puget Sound region, and on some of the short coast rivers; here are taken the eggs of the royal chinook, of the scarcely less royal blue-back, and of other species, and here each year millions of young salmon are started on their way to salt water. Having grown and waxed fat on the rich pasturage of the ocean, these fish return to the rivers to spawn in from two to four years. Some seasons as many

as 75,000,000 salmon eggs have been collected, a quantity representing nearly 21,000 quarts, or 650 bushels.

A remarkable fact in the history of the Pacific salmons—of which there are five species—is that without exception all fish which enter any stream on the entire coast, from the Golden Gate to the Arctic Ocean, die after once spawning, none surviving to return to the sea. This wise provision of nature to prevent the overstocking of streams has been made foolish by the appearance of man on the scene; he not only catches the salmon in the coast waters and the lower courses of the rivers with gill nets, seines, and pound nets, in the upper waters with the same appliances supplemented by the fish wheels, and on the spawning grounds with all sorts of contrivances, but in certain sections even carries his foolhardy greed to the extent of barricading the streams so that no fish can reach the waters where their eggs must be deposited.

Natural reproduction, thus so seriously curtailed, is not sufficient to keep up the supply in many of the streams where fishing is most active, for many of the eggs escape fertilization, many more are eaten by the swarms of predaceous fishes that haunt the spawning beds, and many are lost in various other ways during the long hatching period; while the helpless fry and alevin fall a ready prey to the same fishes in the upper waters and the young salmon have to run the long gauntlet of the rivers only to meet new foes in the estuaries, on the coast, and in the open sea.

It is, therefore, no wonder that artificial propagation on a large scale is imperatively demanded in the western salmon streams, and is actively urged and highly commended by fishermen, canners, business men, and the public at large. The beneficial influence of the work of the government, supplemented by that of the three coast states, has been unmistakable in some sections and can not be doubted in general; but it has not often been possible to distinguish definitely the increase due to natural from that due to artificial propagation; recently, however, some striking evidence of the benefits arising from the hatchery operations has come from the experimental marking of young salmon before liberation. Thus, a lot of 5,000 fingerlings incubated at the Clackamas (Oregon) station in 1896 were released after being marked in such a way that they could be recognized if again caught. In 1898 375 of these marked fish, averaging 27 pounds, were caught in the Columbia and 5 in the Sacramento, and in the two following seasons probably 70 more were taken, the aggregate weight of the salmon known to have been recaptured being not less than 10,000 pounds.

The outcome of this experiment is of extraordinary significance. It means that for every thousand fingerling salmon hatched and liberated by the Fish Commission on the Columbia, 2,000 pounds of adult fish were caught for market two, three, and four years later. Let us

reduce this to a financial basis and see what a striking exhibit is made: The total expense to the government of hatching and planting salmon is under \$1 per thousand fish of the size in question; the value of the resulting salmon caught by the fisherman is, at a very reasonable estimate, 5 cents per pound, or \$100 for the 2,000 pounds actually taken. It is not claimed or expected that such extraordinary results are regularly attained, but, if the average outcome is only one-tenth as large as shown by these figures, then the salmon work of the Commission is yielding an actual money return of 1,000 per cent per annum.

Man's possible influence on the fishes of the open sea is problematical, but there is no doubt of the effects of human intervention on the abundance of fishes and other animals which regularly frequent the bays and coastal waters, more especially the bottom-living species like the cod, the flounders, and the lobster, which are hatched in large numbers at the marine establishments of the Commission. The utility of fish culture as applied to the cod is scouted by some people in the United States and abroad; singularly enough, however, some of these same people are willing to admit the injury done by overfishing or indiscriminate fishing.

In taking up the culture of the cod many years ago, and in continuing it to the present time, the Fish Commission has proceeded on the principle that the effects of man's improvidence may be counteracted by the application of man's ingenuity and power in aiding nature. The ultimate success of cod culture on the Atlantic coast was therefore confidently expected, and the expectations have been more than realized. Practical results of an unmistakable character were first manifested in 1889, since which time a very lucrative shore cod fishery has been kept up on grounds that were entirely depleted or that had never contained cod in noteworthy numbers in the memory of the oldest inhabitants. There is much unsolicited testimony on this point from many people who have profited from the past twelve or fifteen years' operations at Gloucester and Woods Hole stations. The benefits have not been confined to the immediate vicinity of the hatcheries, but have extended westward and southward along the Middle Atlantic coast and eastward along the whole coast of Maine.

A very important line of practical work conducted by the Commission is the transplanting of aquatic food animals into waters to which they were not indigenous. This work is addressed not only to lake, pond, and stream fishes like the basses and trouts, but also to the sea-going species like the salmon, shad, and striped bass. Examples of the results of such efforts have been published in the annual reports from year to year, and some further data will appear elsewhere in the current report; but attention is particularly drawn to two of the most successful instances of acclimatization of native fishes. About thirty years ago the shad and the striped bass of the Atlantic coast were

introduced on the Pacific coast; the slender colonies became established, flourished, extended themselves widely, and multiplied to such an extent that these two species now rank among the leading food fishes of the Pacific States, and in certain localities exist perhaps in greater abundance than in any waters on the Atlantic coast. The economic results of what was at first only an experiment may be thus stated:

Total cost of planting shad and striped bass on Pacific coast, under	\$5, 000
Average annual catch of these fish at present time	2, 500, 000
Yearly market value of the catch	\$100, 000
Aggregate catch to end of 1902	18, 900, 000
Total value of the catch to end of 1902	\$670, 000

BIOLOGICAL INVESTIGATIONS.

The work of that branch of the Commission charged with the inquiry respecting food-fishes and the fishing grounds has for its immediate object the application of the principles of biological science to the practical problems which arise in connection with the commercial fisheries and fish culture. The operations of this division, as outlined in the special report appended hereto, cover a wide range and are addressed to some of the most valuable economic products of the water and to some of the most vital matters affecting the fishing industry and the cultivation of fish.

The oyster has deservedly received a great amount of attention. Further progress has been made in interesting experiments having for their object the fattening of oysters by increasing their natural food. Oyster culture in Japan is the subject of a timely special report issued during the year, for which there has been a large demand in view of the proposed cultivation of Japanese oysters in the Pacific States. The lobster, the blue crab, the diamond-back terrapin, the Atlantic and Pacific salmons, the carp, the catfishes, the tile-fish, and the commercial sponges of Florida have been objects of special investigation. In the case of the last named, the sponge grounds lying off the east coast of Florida have been surveyed and plotted, and very important experiments in the growing of sponges from cuttings have been conducted.

At the direction of the President, a special commission was formed for the purpose of making an investigation of the salmon industry of Alaska, the main objects being to determine the actual fishery conditions in different parts of the territory and to make such recommendations as seem necessary to regulate the fishery and preserve the supply of salmon. The extraordinarily large increase in the salmon catch in recent years has led to the belief that there would be serious depletion of the salmon streams unless more effective restrictions were imposed. Dr. David S. Jordan was selected as head of the commission, and plans were made for a very thorough canvass of the entire subject.

The investigation of the aquatic resources of the Hawaiian Islands, which had been in progress during the previous fiscal year, was continued and concluded; and in conjunction therewith an examination of the fish fauna of the Samoan Islands was undertaken.

The marine biological laboratories at Woods Hole, Mass., and Beaufort, N. C., have been resorted to by many investigators, and much important research work has been carried on.

In view of the important rank attained by the Japanese in fishery matters, it was deemed advisable to conduct an inquiry which would acquaint the Commission with the general condition and methods of the fisheries of Japan and afford information in regard to a number of branches in which Americans are practically interested and in which the Japanese are preeminent. Dr. H. M. Smith was assigned to this inquiry, which was in progress at the close of the year. Among the subjects specially considered were the utilization of seaweeds, the culture of terrapin, the artificial production of pearls, and the habits, food value, etc., of the dwarf salmon with a view to its introduction into the United States.

STATISTICS AND METHODS OF THE FISHERIES.

The importance of showing from time to time, by accurate statistics, the extent and trend of the fisheries need not be emphasized. The small sums devoted to this work in the Commission are well expended and should be increased in order to permit a more frequent canvass of the entire country than is now possible. During the year detailed statistics of the entire fishing industry of the Middle Atlantic, South Atlantic, and Gulf States were gathered; and a number of statistical inquiries addressed to special states or territories were also taken up, including Colorado, Alaska, and Porto Rico. The collection of statistical information showing the receipts of fish at the ports of Boston and Gloucester has continued, and the monthly bulletins based thereon furnish much useful information to the trade. Special branches which have been canvassed are the mackerel fishery of New England, the salmon fishery of Penobscot Bay and River, and the salmon industry of Alaska in connection with the work of the Alaska salmon commission elsewhere alluded to.

OPERATIONS OF VESSELS.

Steamer Albatross.—This vessel returned to San Francisco from the Hawaiian Islands on August 30 having been absent 173 days, of which 122 were spent in work at sea, and 36 at work in port, the remainder being Sundays and holidays. Four hundred dredging and collecting stations were established, a record which has never been exceeded by the *Albatross*. The investigations at the islands were carried on among the channels and on surrounding banks, and

included the tracing of the size and shape of the insular shelf out to the 1,000-fathom curve; and the survey was extended westward along the chain of reefs and islets which reach out from the main group in the direction of Japan. The vessel went as far westward as Laysan Island, where collections of fishes and other aquatic animals were made, and opportunity was afforded for observation and study of the vast rookeries of albatrosses and other sea birds which breed upon this small island. On the return from Laysan visits were made to several other islets, including French Island, Frigate Shoal, Necker Island, and Bird Island, and valuable collections were secured.

The results of the dredging and other operations were exceedingly prolific, and have added largely to the knowledge of the aquatic fauna of the Hawaiian Islands. As opportunity offered, hydrographic notes, with charts and sailing directions, were made by the ship's officers and transmitted to the United States Coast and Geodetic Survey. A full report of the expedition and of what was accomplished thereby is now in course of preparation.

The amount of hard cruising the ship had been called on to perform made it necessary to give her a thorough overhauling as to both hull and machinery, the latter, especially, requiring considerable repairs and alterations, and a new electric plant and searchlights being needed. Congress provided for this purpose a special appropriation, approved March 5, and the work was undertaken at once and completed June 11.

By direction of the President, a special commission, with Dr. David Starr Jordan as executive head, was appointed by the Commissioner to make investigations concerning the condition and needs of the Alaska salmon fisheries, and as these investigations necessitated visits to the numerous remote salmon streams and canneries and salteries in Alaska, the *Albatross* was detailed for the use of the commission. The ship sailed on June 11 from San Francisco for Seattle, whence, after having been joined by the various members of the party, she proceeded northward June 18. The next few days were devoted to dredging at various places in Georgia Strait and Queen Charlotte Sound.

February 12, 1903, Commander Chauncey Thomas, U. S. Navy, who had been in command of the *Albatross* somewhat over a year, during which he displayed great efficiency, was detached by order of the Secretary of the Navy, and was succeeded by Lieut. Franklin Swift, U. S. Navy, retired, formerly in command of the steamer *Fish Hawk*.

Steamer Fish Hawk.—During the months of July, August, and September the *Fish Hawk* was detailed for biological work in connection with the laboratory at Beaufort, N. C. Five lines of soundings and dredgings were made at right angles to the trend of the coast out to the inner margin of the Gulf Stream, to develop the character of the fauna of the region and to determine the possibility of establish-

ing deep-water fisheries in that locality. Though interruptions were experienced from severe winds, considerable progress was made. The region covered consists of a hard sandy bottom with little animal life, and on the edge of the Gulf Stream a scarcity of life was observable. About 20 miles south-southwest of Beaufort, however, an important fishing ground was located and surveyed; fishing trials showed an abundance of sea bass and other desirable food fishes.

At the close of the season at the Beaufort laboratory, after undergoing necessary repairs at Savannah, the vessel sailed from that port November 22 for Key West, Fla., to continue her previous work on the sponge grounds of Florida. The scope of this is outlined in the last report, and this year the investigation embraced the keys from Boco Grande Channel to Cape Florida, and the "New Ground" extending north of the keys to Cape Sable. Work was begun December 4, lines of soundings and dredging being run over the region to be developed, with stations every 3 miles out to the 5-fathom curve. All classes of sponges are found on the New Ground, and good fares are taken when the fishermen can find the water sufficiently clear to work. The ground to the southeast of Cape Sable is considered good, but there are considerable expanses of barren sandy bottom. The investigations were continued along the known sponge grounds among the keys and channels eastward to Cape Florida. These were completed March 12, when lines of soundings and dredgings were begun off shore in the vicinity of Fowey Rocks and Cape Florida to determine the character of the fauna of that region and on the edge of the Gulf Stream. These investigations were not completed when it became necessary for the vessel to proceed north to take up the usual shad hatching on the Delaware River. She sailed from Miami April 6, arriving at Gloucester City, N. J., April 16. The shad work continued till June 19.

In order to remedy defects incident to the wear and tear of long service, considerable repairs to the machinery were found advisable, including the installation of new pumps; and certain parts of the decks and beams needed to be replaced. This work is now in progress and will add to the efficiency of the vessel and the economy of operating her.

The *Fish Hawk* has continued under the command of Boatswain J. A. Smith, U. S. Navy, retired, whose long and faithful service on the vessel has been invaluable to the Commission.

Schooner Grampus.—The *Grampus* is an important adjunct of the marine fish-cultural operations in New England, and under the efficient command of Mr. E. E. Hahn has rendered most valuable service under conditions involving much discomfort and exposure. During the early part of the fiscal year this vessel was engaged in collecting egg-bearing lobsters on the Maine coast to supply the hatchery at Glou-

cester, Mass. At the conclusion of the lobster work she proceeded to Woods Hole and was there employed for a while during the summer in connection with the biological laboratory. In the fall of 1902 the vessel made the usual trips to Nantucket Shoals to obtain brood cod-fish for the Woods Hole station, and later the crew proceeded to Maine for the purpose of gathering cod eggs for the Gloucester hatchery. In the spring the *Grampus* resumed the collecting of brood lobsters on the coast of Maine and was thus engaged at the close of the year.

MISCELLANEOUS.

CHANGES IN PERSONNEL.

The position of deputy commissioner, created at the last session of Congress, was filled by the appointment of Dr. Hugh M. Smith, to take effect July 1, 1903. Doctor Smith held the position of assistant in charge of scientific inquiry from January, 1897, until June 30, 1903, and prior to that service was assistant in charge of statistics and methods of the fisheries for a period of four years.

The Commission regrets the loss of the services of Mr. Charles H. Townsend, assistant in charge of statistics and methods of the fisheries, who on November 11, 1902, resigned to become director of the New York Aquarium. Mr. Townsend entered the Commission as scientific assistant in 1883, and for many years prior to his appointment as chief of division was naturalist on the *Albatross*. In addition to his other duties, Mr. Townsend was prominently identified with the fur-seal investigations in the North Pacific Ocean and Bering Sea, under the direction of the Treasury Department.

Dr. Barton W. Evermann, principal scientific assistant, was, on November 13, 1902, appointed to the position made vacant by Mr. Townsend's withdrawal from the service, and was subsequently appointed assistant in charge of scientific inquiry, to take effect July 1, 1903.

The position of scientific assistant, vacated by Doctor Evermann, was filled by the promotion, on November 17, 1902, of Dr. H. F. Moore, naturalist on the *Albatross*, who, on November 19, 1902, was succeeded as naturalist by Mr. Cloudsley Rutter, scientific assistant.

The position of assistant in charge of statistics and methods of the fisheries was filled by the appointment of Mr. A. B. Alexander, fishery expert on the *Albatross*, to take effect July 1, 1903.

The propagation and distribution of food-fishes have continued under the supervision of Mr. John W. Titcomb. Mr. J. Frank Ellis, who for many years has been superintendent of the car and messenger service, has remained in immediate charge of that branch.

PUBLICATIONS.

During the year there have been added to the library 164 bound volumes and 466 unbound volumes and pamphlets. The bound report for 1901 and the bound bulletins for 1900 and 1901 have been issued, besides the following extracts in pamphlet form from the report and bulletin for 1902:

- Description of a new species of shad (*Alosa ohioensis*), with notes on other food fishes of the Ohio River, by Barton Warren Evermann. Report for 1901, pp. 273-288. 1902.
- The reproductive period in the lobster, by Francis H. Herrick. Bulletin for 1901, pp. 161-166. 1902.
- Notes on five food fishes of Lake Buhí, Luzon, Philippine Islands, by Hugh M. Smith. Bulletin for 1901, pp. 167-171, plate 22. 1902.
- Marine protozoa from Woods Hole, by Gary N. Calkins. Bulletin for 1901, pp. 413-468. 1902.
- Notes on a species of barnacle (*Dichelaspis*) parasitic on the gills of edible crabs, by Robert E. Coker. Bulletin for 1901, pp. 399-412. 1902.
- The fishes and fisheries of the Hawaiian Islands. A preliminary report, by David Starr Jordan and Barton Warren Evermann. Commercial fisheries of the Hawaiian Islands, by John N. Cobb. Report for 1901, pp. 353-499, plates 21-27. 1902.
- Notes on the fisheries of the Pacific coast in 1899, by William A. Wilcox. Report for 1901, pp. 501-574, plates 28, 29. 1902.
- Statistics of the fisheries of the Great Lakes. Report for 1901, pp. 575-657. 1902.
- Statistics of the fisheries of the Mississippi River and tributaries. Report for 1901, pp. 659-740. 1902.
- The Pan-American Exposition. Report of the representative of the U. S. Fish Commission, by W. de C. Ravenel. Report for 1901, pp. 289-351, plates 6-20. 1902.
- Notes on the boats, apparatus, and fishing methods employed by the natives of the South Sea Islands, and the results of fishing trials by the *Albatross*, by A. B. Alexander. Report for 1901, pp. 741-829, plates 30-37. 1902.
- The salmon and salmon fisheries of Alaska. Report of the Alaskan salmon investigations of the United States Fish Commission steamer *Albatross* in 1900 and 1901, by Jefferson F. Moser. Bulletin for 1901, pp. 173-398 and 399-401, plates I-XLIV, plate A, and charts A, B. 1902.
- Observations on the herring fisheries of England, Scotland, and Holland, by Hugh M. Smith. Bulletin for 1902, pp. 1-16, plates 1 and 2. 1903.
- Japanese oyster culture, by Bashford Dean. Bulletin for 1902, pp. 17-37, plates 3-7. 1903.
- The habits and culture of the black bass, by Dwight Lydell. Bulletin for 1902, pp. 39-44, plate 8. 1903.
- Hearing and allied senses in fishes, by G. H. Parker. Bulletin for 1902, pp. 45-64, plate 9. 1903.
- Natural history of the quinnat salmon. A report on investigations in the Sacramento River, 1896-1901, by Cloudsley Rutter. Bulletin for 1902, pp. 65-141, plates 10-18. 1903.
- Notes on fishes from streams and lakes of northeastern California not tributary to the Sacramento Basin, by Cloudsley Rutter. Bulletin for 1902, pp. 145-148. 1903.
- Breeding habits of the yellow cat-fish, by Hugh M. Smith and L. G. Harron. Bulletin for 1902, pp. 151-154. 1903.
- The destruction of trout fry by hydra, by A. E. Beardsley. Bulletin for 1902, pp. 157-160. 1903.
- Descriptions of new genera and species of fishes from the Hawaiian Islands, by David Starr Jordan and Barton Warren Evermann. Bulletin for 1902, pp. 161-208. 1903.
- Report of the Commissioner for the year ending June 30, 1902, including the reports of divisions of fish-culture, scientific inquiry, and fisheries. Report for 1902, pp. 1-160, plates 1-5. 1903.

There were distributed during the year 3,087 bound and 18,250 pamphlet publications of the Commission. The demand for publications

is increasing yearly, and it has been necessary to have reprinted certain of the more popular and useful pamphlets.

The Museum of Comparative Zoology, Cambridge, Mass., has published, under the general title, "Reports on the scientific results of the expedition to the tropical Pacific, in charge of Alexander Agassiz, by the U. S. Fish Commission steamer *Albatross*, from August, 1899, to March, 1900, Commander Jefferson F. Moser, commanding:"

The coral reefs of the tropical Pacific. By Alexander Agassiz. (Vol. XXVIII. February, 1903.)
Sharks' teeth and cetacean bones from the red clay of the tropical Pacific. By O. R. Eastman. (Vol. XXVI, No. 4. June, 1903.)

THE AMERICAN FISHERIES SOCIETY.

This society includes in its membership most of the persons engaged in practical fish culture in the United States and, in addition, many of those interested in biological, economic, and administrative work in connection with the fisheries. The yearly meetings, held in different parts of the country, are well attended and greatly promote the interests of fish culture and the fisheries. The annual meeting for 1902-3 was held at Put-in Bay, Ohio, August 5 to 7, 1902, Gen. E. E. Bryant, of the Wisconsin Fish Commission, presiding. Among the papers presented and discussed were the following:

The habits and culture of the black bass. By Dwight Lydell, of the Michigan Fish Commission.
Discouragements in bass culture. By H. D. Dean, of the United States Fish Commission.
Some remarks on the rainbow trout, the time for planting, etc. By George A. Seagle, of the United States Fish Commission.
Fish culture on the farm. By J. J. Stranahan, of the United States Fish Commission.
Artificial feeding of trout; its effect on growth and egg production. By W. T. Thompson, of the United States Fish Commission.
The brook-trout disease and cement ponds. By M. C. Marsh, of the United States Fish Commission.
A successful year in the artificial propagation of the white-fish. By Frank N. Clark, of the United States Fish Commission.
The role of the larger aquatic plants in the biology of fresh water. By Raymond H. Pond, of the University of Michigan.
Food and game fishes of the Rocky Mountain region. By James A. Henshall, of the United States Fish Commission.

For the ensuing term George M. Bowers, United States Fish Commissioner, was elected president, and the place selected for the next meeting was the United States Fish Commission station at Woods Hole, Mass.

M'DONALD PATENTS.

By an act of Congress approved February 14, 1902, the Secretary of the Treasury was directed to purchase from the owners of the McDonald hatching jar all their rights in and the patents on this apparatus for the United States, and the same act provided for the purchase from the estate of the late Commissioner McDonald, for the use of the government, the rights and patents pertaining to all fish-cultural apparatus and appliances invented by him.

APPROPRIATIONS.

The appropriations for the Commission for the fiscal year 1903 were as follows:

Salaries.....	\$241, 140
Miscellaneous expenses:	
Administration.....	12, 500
Propagation of food fishes.....	175, 000
Inquiry respecting food fishes.....	22, 500
Statistical inquiry.....	7, 500
Maintenance of vessels.....	38, 000
For repairs to buildings in Washington.....	3, 000
For surfboat for steamer <i>Albatross</i>	500
For steam boiler at Woods Hole, Mass.....	2, 000
For purchase of site for station at Tupelo, Miss.....	2, 000
For purchase of additional land, for improvements, and for completion of stations at—	
Erwin, Tenn.....	5, 000
San Marcos, Tex.....	2, 500
Green Lake, Me.....	4, 000
Gloucester, Mass.....	2, 500
Duluth, Minn.....	2, 000
Beaufort, N. C. (biological laboratory).....	12, 500

A report of the expenditures under these appropriations will be made to Congress, in accordance with law.

GENERAL CONDITION OF THE FISHERIES.

The commercial fisheries of the United States, excluding insular possessions, are now more valuable than those of any other country. Some of the leading branches are peculiar to this country, and contribute largely to the importance of its fishing industry, while in others, which are common to many lands, the United States is pre-eminent or has prominent rank.

The condition of the fishing industry during the year 1903 was on the whole prosperous. While the great commercial fisheries are subject to seasonal fluctuations, there has been no indication of a permanent downward tendency except in a few cases, in some of which improvement may be effected by artificial propagation.

From data collected by the Commission, it appears that the number of persons directly engaged in the fishing industry at this time is about 213,000, of whom 155,000 are fishermen and 58,000 are shoresmen and employees of fishing and fish-curing establishments. The aggregate capital invested is about \$76,850,000, of which \$13,450,000 represent vessels, \$4,530,000 boats, \$8,220,000 apparatus of capture, and the remainder shore and accessory property and cash capital. The 6,340 registered vessels employed in fishing have a net tonnage of 172,400. The value of the catch at first hands is \$49,882,000, of which the ocean and coast fisheries represent \$44,964,000 and the Great Lakes and other interior fisheries \$4,918,000.

The ocean fisheries of New England, which have always been the most important of their class, have been in a satisfactory condition.

At the two great fishing ports of Gloucester and Boston the quantity of fish landed by American fishing vessels in 1902 was about 168,000,000 pounds, valued at \$4,380,000, an increase of 17,000,000 pounds and \$130,000 as compared with 1901. The mackerel catch has never since reached the proportions attained in the years preceding 1887, although it is now greatly in excess of the product during the first half of the present period of unprecedented scarcity. The tendency of late has been upward, and it is believed that in a comparatively few years the mackerel will have again become abundant on our shores.

The condition of the lobster fishery has been practically unchanged for several years, although it can not be doubted that the tendency is downward. The catch fluctuates somewhat from year to year, and certain localities may show a decided increase; but if the general output in a state is greater in one year than another, the cause may usually be found in the fact that the fishery was prosecuted for a longer time, or that more men and more apparatus were employed. It seems very improbable that there will be any general improvement in the fishery until new methods of conducting it are adopted and shall have continued for a number of years. Uniform protective laws are greatly needed, and without them the work of the Commission in lobster cultivation will have but little effect at this stage of the decline.

The oyster fishery is engaged in by more persons than any other branch and contributes nearly one-third of the annual value of the United States fisheries. A very satisfactory feature of this industry during recent years has been the increased interest manifested in oyster culture, more especially in the Middle Atlantic region, where the most beneficent results may be expected to follow the adoption of proper laws for the promotion of oyster planting.

The Pacific salmon industry in 1902 reached larger proportions than ever before, and became the leading branch of the United States fisheries, if the value of the product as prepared for market is considered. The pack of canned salmon was more than 3,500,000 cases of 48 one-pound cans, and in addition upward of 42,000,000 pounds of fresh, smoked, and salted salmon were marketed. The pack of canned salmon in Alaska was over 2,500,000 cases, an increase of half a million cases over 1901. In the Puget Sound region the supply of fish was much smaller than in the previous year, but the season was considered successful owing to the good prices received. The fall run of salmon in Columbia River was remarkably large, and for a period of three weeks the canneries were unable to handle the catch. At some of the seine fisheries 20 tons of chinook salmon were sometimes taken in one day, and the gill-net fishermen had no difficulty in loading their boats in a night. From a careful computation made by the Commission, it appears that in 1902 the wonderful Pacific salmon fisheries yielded about 280,000,000 pounds of round fish whose first value, as placed on the markets, was \$18,000,000.

A RETROSPECT.

With the current report, the existence of the Commission as an independent establishment of the government ceases, for on July 1, 1903, the Commission became a part of the new Department of Commerce and Labor, under the terms of the act of Congress approved February 14, 1903. While it can not be doubted that the changed status will prove most beneficial to the Commission, it is felt that its entire record as an independent institution has been so extremely creditable that the best wish that can be entertained for it is that under the new conditions it may continue to receive the liberal support which has heretofore been accorded, and that its operations and influence may increase in the same ratio that has characterized recent years.

The joint resolution of February 9, 1871, by which Congress established the Commission, provided only for an inquiry into the decrease of food fishes, with a view of adopting any remedial measures that seemed necessary, and appropriated \$5,000 therefor. During the next ten years the sums devoted to the operations of the Commission remained comparatively small, but through the energy and ability of the Commissioner, Prof. Spencer F. Baird, with the assistance of several of the executive departments, the work steadily increased and its scope was extended. The early inquiries conducted by the Commission showed that artificial propagation was the most effective form of aid which the federal government could render the commercial fisheries, and artificial propagation quickly became and has remained the keynote of the Commission's efforts. So efficiently did the Commission labor in devising fish-cultural methods and in applying them to the practical work of maintaining and increasing the supply of food fishes that at the International Fisheries Exhibition held in Berlin in 1880 the grand prize was awarded to Professor Baird as "the first fish culturist in the world," and at the International Fisheries Exhibition held in London in 1883 Professor Huxley said that he "did not think that any nation at the present time had comprehended the question of dealing with fish in so thorough, excellent, and scientific a spirit as the United States."

Owing to the liberal policy of Congress in recognizing the importance of the fishery work and in providing for its development, the growth of the Commission in the past twenty-five years has been phenomenally rapid, not only in fish culture, but in biological investigation addressed primarily to fish culture and the fisheries, in the study of the methods and relations of the fisheries, and in the gathering and presentation of statistical information covering all phases of the fishing industry. The Commission at an early date became one of the most popular of the government bureaus, and its popularity has increased yearly as its work has become more thoroughly understood and as the practical results of its operations have multiplied.

It may not be inappropriate, in concluding this report, to show the magnitude of the Commission's work in artificial propagation and to indicate the growth of this work from the year 1871 to the present time. The following table shows the number of eggs, fry, yearlings, and adults of each of the more important species distributed by the Commission during the thirty-three years of its existence, the time being divided into three periods of eleven years each. The aggregate output is seen to have been over 12 billions, more than three-fourths of which represent the operations of the past eleven years. The seven species which have received the most attention—namely, the shad, the quinnat salmon, the white-fish, the pike perch, the cod, the winter flounder, and the lobster—are of great economic value, and their aggregate output has been more than 90 per cent of the total.

Table showing the number of adult fish, yearlings, fry, and eggs distributed by the United States Fish Commission, 1871-1903.

Species.	1871-1881.	1882-1892.	1892-1903.	Total.
Shad	200,946,350	767,697,000	1,632,984,284	2,501,627,634
Alewives	9,833,000	6,850,000		16,683,000
Striped bass	400,000	885,587	3,575,000	4,360,587
Sea bass		3,654,000	2,302,000	5,956,000
White perch	180,000	2,573	81,808,000	81,490,573
Quinnat salmon	33,172,734	29,152,195	318,105,847	375,430,776
Blueback salmon			21,620,242	21,620,242
Silver salmon			3,682,144	3,682,144
Atlantic salmon	12,524,387	11,652,864	12,731,850	36,809,101
Landlocked salmon	6,414,961	6,284,275	4,850,089	16,556,274
Steelhead trout			6,704,101	6,704,101
Loch Leven trout		677,083	938,624	1,615,707
Rainbow trout	116,830	2,888,224	8,922,794	11,927,848
Black-spotted trout		19,000	8,411,270	8,430,270
Brook trout	100,700	1,926,328	30,487,424	32,514,452
Brown trout		004,481	638,491	1,442,572
Scotch sea trout			158,829	158,829
Golden trout		64,473	165,918	220,391
Lake trout	40,606	14,638,967	170,878,420	185,567,993
White-fish	77,072,409	928,215,000	2,330,365,335	3,335,642,744
Lake herring			126,447,000	126,447,000
Grayling			13,931,630	13,931,630
Smelt		13,850,000		13,850,000
Pike perch		332,046,700	1,565,604,761	1,897,651,461
Yellow perch		830,328	30,431,684	31,262,022
Black bass		122,666	1,840,040	1,962,706
Carpnies, sun-fishes, etc		154,178	2,874,466	3,033,644
Carp and suckers		1,788,350	780,082	2,568,432
Cod	25,000	178,216,500	1,451,158,500	1,629,399,500
Tomcod		5,400,000		5,400,000
Pollock		39,458,500	6,289,000	44,747,500
Haddock		5,799,000	19,500	5,818,500
Scup		431,000	280,000	711,000
Sheepshead		7,300,000		7,300,000
Tautog		862,000	24,066,000	24,428,000
Squeteague		227,000		227,000
Cat-fish			337,673	337,673
Mackerel		688,000	3,809,000	4,497,000
Spanish mackerel	270,000	1,026,000		1,296,000
Flat-fish		13,932,019	717,271,000	731,203,019
Miscellaneous fishes		64,875	91,124	156,000
Lobster		15,836,647	863,547,065	879,382,712
Total	341,096,977	2,391,389,410	9,291,005,146	12,023,491,533
Annual average	31,008,816	217,399,037	844,636,831	

GEORGE M. BOWERS,
Commissioner.