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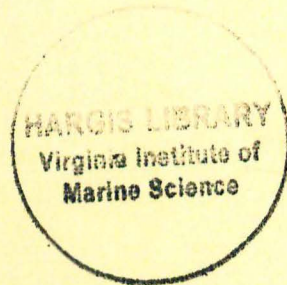
SIXTIETH AND SIXTY-FIRST
ANNUAL REPORTS

of the

*Commission of Fisheries
of Virginia*

for the

Fiscal Years Ending June 30, 1958 and June 30, 1959



COMMONWEALTH OF VIRGINIA
Department of Purchases and Supply
Richmond
1959

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Commission of Fisheries

*MILTON T. HICKMAN, *Commissioner*.....Painter, Va.
CHARLES M. LANKFORD, JR., *Commissioner*.....Franktown, Va.
(Through December 31, 1958)

ASSOCIATE MEMBERS

W. COLLIN CHILTON.....Kilmarnock, Va.
JAMES B. MARTIN.....Gloucester, Va.
CHARLES R. BAGNELL.....Eclipse, Va.
RICHARD B. KELLAM.....Norfolk, Va.

OFFICE

LENA S. COSBY, *Accountant*
ELIZABETH M. CORSON, *Confidential Secretary*
MARY LOU BASS, *Clerk-Stenographer*
MILDRED HUNDLEY, *Clerk-Typist*
PATRICIA H. DICK, *Bookkeeping Machine Operator*
LILLIAN F. KELLAM, *Clerk-Stenographer*
HARRY N. JONES, *Utility Serviceman*

ADMINISTRATION

GEORGE H. BADGER, JR., *Civil Engineer*.....Franktown, Va.
JEFFERSON K. SINCLAIR, *Assistant Engineer*.....Gloucester, Va.
CHARLES J. KERNS, *Assistant Engineer*.....Gloucester, Va.
†J. T. MEYER, *Superintendent of Hatcheries*.....Richmond, Va.
J. WILLIAM RYLAND, *Fisheries Law Enforcement Chief*.....Urbanna, Va.

BEN T. GUNTER, JR., *Attorney*.....Accomac, Va.

GENERAL OFFICES OF COMMISSION—NEWPORT NEWS, VA.

*Appointed Commissioner of Fisheries January 1, 1959.

†Also shown under Inspectors.

OYSTER INSPECTORS AND DISTRICTS

NAME	ADDRESS	DISTRICT	COUNTIES
W. H. Sydnor.....	Lewisetta, Va.....	1 and 2.....	Westmoreland, Northumberland, King George, Prince William, Stafford and Fairfax
K. G. Whaley.....	Mila, Va.....	4.....	Northumberland
E. R. Dameron.....	White Stone, Va.....	5.....	Northumberland and Lancaster
H. C. Doggett.....	Lancaster, Va.....	6.....	Lancaster and Richmond
S. E. Williams.....	Gloucester Pt., Va.....	8.....	Gloucester
L. F. Hogge.....	Wicomico, Va.....	9.....	Gloucester, King and Queen, and King William
George E. Brooks.....	Onemo, Va.....	10.....	Mathews
G. F. Hudgins.....	Cobbs Creek, Va.....	11.....	Mathews and Middlesex
H. B. Miller.....	Topping, Va.....	12 and 14.....	Middlesex and Essex
E. Glenn Phillips.....	Poquoson, Va.....	15 and 16.....	York, James City and New Kent
E. T. Wallace.....	Hampton, Va.....	17.....	Elizabeth City
*W. M. Hogge.....	Newport News, Va.....	18.....	Warwick and James City
*P. T. Martin.....	Rescue, Va.....	19.....	Isle of Wight and Surry
†J. T. Meyer.....	Richmond, Va.....	19-A.....	Chesterfield, Henrico, Prince George, Charles City, King William and New Kent
George A. Corson.....	Eclipse, Va.....	20.....	Nansemond
C. C. Absalom.....	Norfolk, Va.....	21 and 22.....	Norfolk and Princess Anne
J. C. Bell.....	Nassawadox, Va.....	24.....	Accomack and Northampton
Edgar D. Miles.....	Willis Wharf, Va.....	25.....	Northampton
James F. Onley.....	Hallwood, Va.....	26.....	Accomack
W. N. Steelman.....	Chincoteague, Va.....	28.....	Accomack
N. E. Wessells.....	Accomac, Va.....	29.....	Accomack
W. C. Moody.....	Saluda, Va.....	Watchhouse.....	Boat Harbor, Newport News, Va.
F. B. Daniel.....	Saluda, Va.....	Watchhouse.....	Boat Harbor, Newport News, Va.

*Also listed under Police Boat Captains.

†Also listed under Administration.

DEPUTY INSPECTORS AND DISTRICTS

NAME	ADDRESS	DISTRICT	COUNTIES
*Donald P. Markwith..	Colonial Beach, Va..	1 and 2.....	Westmoreland, Northumberland, King George, Prince William, Stafford and Fairfax
L. R. Dixon.....	Eclipse, Va.....	20.....	Nansemond
W. A. Adams.....	Chincoteague, Va.....	28.....	Accomack

*Also listed under Police Boat Captains.

AIRPLANE PILOT AND CREW

George H. Colonna, Jr., Pilot.....Johnsontown, Va.
 Clarence E. Charnock, Co-pilot.....Weirwood, Va.

POLICE BOATS, POLICE BOAT CAPTAINS AND MATES

NAME OF BOAT	CAPTAIN	MATE	ADDRESS
"Chesapeake".....	J. Talmadge Scott.....	Harland S. Conway.....	Onancock, Va.
"Will F. Kellam".....	Carlton P. Matthews.....	C. Odell Ingram.....	Onancock, Va.
"Glamour Girl".....	Duncan R. Minga.....	James T. Watkins.....	Amburg, Va.
"Bonnie".....	A. M. Cross.....	Norman A. Ball.....	Deltaville, Va.
"Ken Di Lai".....	*Percy T. Martin.....	Walter W. Moore.....	Rescue, Va.
"Hon".....	W. H. Crockett.....	B. F. Carpenter.....	Rescue, Va.
"Wasp".....	Robert E. Greene.....	Richard F. Webb.....	Weems, Va.
"Dawn II".....	Donald P. Markwith.....	Jennings B. White.....	Weems, Va.
"Hornet".....	W. Bowdion Wake.....	W. R. Fugh.....	Rescue, Va.
"Mobjack".....	G. T. Benson, Jr.....	John W. West.....	Carrollton, Va.
"James River".....	*Willie M. Hogge.....	Leon P. Price.....	Willis Wharf, Va.
"Sea Bee".....	James H. Sigmon.....	C. R. Wilson.....	Willis Wharf, Va.
"Ranger".....	Oren T. Mears.....		Onancock, Va.
"Nomini".....	C. E. Thomas, Jr.....		Machipongo, Va.
			Colonial Beach, Va.
			Amburg, Va.
			Amburg, Va.
			Deltaville, Va.
			Mathews, Va.
			Newport News, Va.
			Newport News, Va.
			Hampton, Va.
			Amburg, Va.
			Deltaville, Va.
			Deltaville, Va.
			Lewisetta, Va.

*Also listed under Inspectors.

Report of Commission of Fisheries

NEWPORT NEWS, VIRGINIA, October 1, 1959.

To His Excellency, HONORABLE J. LINDSAY ALMOND, JR.,
Governor of Virginia, and
The General Assembly of Virginia.

Pursuant to statute, the Commission of Fisheries submits the following report for the fiscal years ending June 30, 1958 and June 30, 1959.

The report shows the amount of revenue derived from the fish and shellfish industries under supervision of the Commission, all the expenditures of the Commission, historical background and jurisdiction of Commission of Fisheries, and the general condition of the fish and shellfish industries under the supervision of the Commission.

Self-explanatory schedules and reports for the fiscal years named are included herewith, as follows:

1. Receipts from fish and oyster industries.
2. Expenditures for administration, enforcement, and repletion work.
3. List of recorded oyster planting ground.
4. Areas in which repletion work was done.
5. Comparative statements of expenses for the past ten years.

Exhibit A—Reports of J. T. Meyer, Superintendent of Hatcheries.

Exhibit B—Report of Virginia Fisheries Laboratory, Dr. William J. Hargis, Jr., Director.

Historical Background and Jurisdiction of Commission of Fisheries

The historical background of Virginia Fisheries dates back to the arrival of the first settlers at Jamestown in 1607.

The Virginia Company of London held by patent, complete control of fisheries in our waters. In 1661 we had the first issuance of oyster license to native Indians. The House of Burgesses in 1705 passed legislation requiring a license for the taking of fish and oysters. An Act of 1780 decreed that oyster grounds were common to all people. This thought was later written into our Constitution by Section 157. In 1894 the Baylor Survey was made and 210,000 acres of oyster ground were set aside for public use. This is still effective today. Other oyster grounds can be leased to citizens of Virginia, after proper application.

The jurisdiction, authority, and powers of the Commission of Fisheries is set forth in the Code of Virginia by Title 28-1 through 28-258.

The Commission's jurisdiction embraces what is known as Tidewater Virginia, which, by statute, includes thirty-five counties. We work in close relationship with the Commission of Game and Inland Fisheries because conditions are somewhat similar. Our jurisdiction and boundaries are established by mutual agreement, subject to the approval of the General Assembly. It might be said, as for fisheries we control the area where the tide ebbs and flows, and they the fresh water areas.

Enforcement

The Statutory laws and the regulations of the Commission are enforced by the Fisheries District Inspectors, Airplane Pilot and Co-pilot, Boat Captains and Mates, as previously listed.

The patrol boats owned by the Commonwealth and operated by the Commission and the areas they serve are as follows:

"Chesapeake".....	Chesapeake Bay, Tangier and Pocomoke Sounds
"Will F. Kellam".....	Rappahannock River
"Ken di Lai".....	James River
"Glamour Girl".....	James River
"James River".....	James River
"Hon".....	Ocean side of Accomack and Northampton Counties
"Dawn 11".....	Potomac River
"Bonnie".....	Rappahannock River
"Wasp".....	Tangier Sound and Chesapeake Bay
"Mobjack".....	York River and Potomac
"Hornet".....	Piankatank and Rappahannock Rivers
"Ranger".....	Potomac River
"Nomini".....	Potomac River
"Sea Bee".....	Hampton Roads and James River

These boats are stationed in what we consider to be strategic areas, but they are moved from one area to another when necessary.

These State-owned patrol boats vary in length from 23 feet to 56 feet. They are equipped with high speed twin or single motors; living quarters, because during certain seasons they are on patrol day and night, not returning to port for several days.

The Commission has a special radio frequency which has been assigned by the Federal Communications Commission. The foregoing patrol boats, the airplane, Chief Law Enforcement Officer's automobile and the office at Newport News have radio telephones so that constant communication is available to Commission personnel. These radio telephones are very valuable to our patrol boats and plane as a safety factor, and enables them to be promptly dispatched for whatever duty appears necessary.

The Commission has numerous small patrol boats powered with high-powered outboard motors which are used by Fisheries District Inspectors. Some of the Inspectors have boat trailers for attachment to their automobiles, which allows them to transport these boats over land, enabling them to promptly supervise most any area in their District.

Most of the larger inboard patrol boats have these small outboard boats which are much faster and allow the Captain to patrol in waters too shallow for the larger boats.

The Commission leases ten boats from various Inspectors. These boats are necessary for efficient law enforcement because there are not sufficient State-owned boats to properly supervise and patrol all the vast areas of Tidewater Virginia.

The Commission airplane is very valuable for law enforcement, patrolling the vast areas, and transporting personnel. The operation is very economical.

The Inspectors and Captains issue the following licenses and collect the money for same:

Fish

1. 16 types for taking or catching food fish.
2. 4 types for taking fish to be manufactured into oil, fish scrap or manure.

Oysters

1. 7 types to shuck and pack oysters.
2. 4 types to buy oysters for marketing in barrels.
3. 3 types to take and catch oysters.
4. 6 types to take oysters with dredges or scrapes.
5. 3 types for rental of ground.

Crabs, Clams, Scallops

1. 8 types for crabs.
2. 7 types for clams and scallops.
3. 1 type for mussels.

There are numerous other fees and permits issued which are not mentioned above.

The Tax Station adjoining Newport News Boat Harbor has been moved to the former Newport News Ferry Terminal Building, which affords more efficient and comfortable quarters for our personnel. This building enables the Commission to have facilities for storage of equipment and supplies. Appreciation is hereby extended to the City of Newport News for allowing us to use the building at a nominal cost.

Oysters

The demand for Virginia oysters has continued to increase, and we expect the demand to further increase. Virginia oysters are being shipped as far West as California and as far South as Texas. There are some shucking houses which have continued to operate through the summer months.

The supply of oysters from the public rocks continues to decrease because the terrific demand for oysters has encouraged more public oystermen to work longer and harder. The Commission has not been able to purchase sufficient shells to replenish the natural rocks. A large quantity of shells have been sold to neighboring states by Virginia packers, and the price continues to increase.

The production of oysters from privately-owned grounds has been generally satisfactory. However, in some areas, especially the ocean side of the Eastern Shore, losses have been rather heavy. These losses were attributed to unusual low water temperatures, enormous quantities of sea vegetation deposited on beds which smothered the oysters, and the erosion of various beaches on the Atlantic Ocean which caused huge quantities of sand to be deposited on some of the most valuable oyster beds, not only killing all oysters but terminating the production of oysters in all such areas.

The terrific mortality of oysters in New Jersey and Delaware and the Starfish invasion on Long Island in New York has practically eliminated these three states as oyster producing states. Very fortunately, our scientists have found no evidence of this problem in Virginia waters. However, due to the close proximity of these areas to Virginia, every precaution must be maintained and scientific studies must be promptly and constantly conducted.

We continue to give special attention to tremendous natural production of seed oysters in the James River. Over two million bushels of seed oysters were annually harvested. There are 270 lessees of oyster ground in the James River who lease 5,942 acres. There are 24,631 acres of natural oyster rocks in the River. We issued 4,242 tongers licenses in the State and 1,035 of these licenses were issued to tongers in the James River.

We are continually confronted with the problem of oyster drills. Cooperation between private planters and the Virginia Fisheries Laboratory should eventually result in control of this predator.

Crabs

The cooperative crab research program between the United States Fish and Wildlife Service, the Chesapeake Biological Laboratory of Maryland, and the Virginia Fisheries Laboratory is continuing.

Through the efforts of the Atlantic States Marine Fisheries Commission, the United States Fish and Wildlife Service, together with various State laboratories (including Virginia's) will greatly expand their research and scientific studies of the blue crab.

With some exceptions, the supply of crabs in Virginia has been good and the price of crabs, especially the past season, has shown a fair profit to those engaged in the industry.

Our biologists advise us that from the information they now have, no further conservation measures are necessary at this time. However, considerable more scientific studies are necessary to conclude the many questions which are concerning the industry.

Fish

There continues to be a great fluctuation in the quantity of all species of fish from year to year and studies are still being conducted to try to determine the reason.

Fishing in general, especially during the past year, has been very poor. However, the croaker catch in certain areas by commercial fishermen has been in abundance, but in other areas very few.

The striped bass population has been very good, but most of them have been very small. Our biologists predicted this good supply. They have devoted much

time to studies of the striped bass, and this indicates the profitable results of their work.

The catch of gray trout during the past two years was irregular and at a very low level. Most of the trout caught were small.

Small fish escapement from trawl nets, pound nets and haul seines is a coast-wise problem which should have further intensified studies. The basic problem is to learn more about the relationship between natural mortality and fishing mortality. Sport fishermen are encouraged to abide by size regulations. We wish to encourage the commercial fishermen and sport fishermen to mutually discuss and endeavor to solve their differences because they are each seeking the same goal; more fish and larger fish. They should encourage scientific research because the results will inure to the benefit of all people interested in fish.

The Menhaden industry in Virginia is important to the economy of the Commonwealth. The Menhaden catch being second in value of Virginia's seafoods and surpassed only by the oyster industry. The products which this industry processes are becoming much more necessary in our way of life.

The shad hatcheries operated by the Commission have the approval of the shad fishermen. The research studies of shad during the past ten years by the United States Fish and Wildlife Service conclude that hatcheries are not the practical procedure to increase the supply of shad. They suggest that closed seasons during spawning periods produces the most fish.

Hard Clam

The hard clam industry is economically very important in many areas of Virginia.

The demand for the small clam which is served on the half shell generally exceeds the supply but there is very little sale for the larger clams.

This situation has created extensive research in the artificial culture of hard clams and experiments have been extremely successful under laboratory conditions. Millions of juvenile clams have been raised at Milford, Connecticut for use in biological research. The culture technique is being studied as a practical source of seed for commercial farming. Growth and mortality of these clams is under investigation at several places along the Atlantic Coast. One such place is on the Eastern Shore of Virginia where a private planter is today growing clams by artificial culture.

If facilities are made available, our Laboratory will conduct further intensive research. This is a very important project because it could revolutionize the clam industry.

Pollution

Pollution is a continuing and rapidly growing serious problem which requires prompt attention. We earnestly request that special studies and research be conducted in order to preserve and safeguard the seafood industry and also to protect the health and welfare of all citizens.

The State Water Control Board and the Hampton Roads Sanitation Commission have been doing fine work in their efforts to abate this nuisance. However, with the rapid growing population and the growing discharge of industrial waste in our waters these two boards have a herculean task.

Atlantic States Marine Fisheries Commission

This agency has rendered valuable service to member states along the Atlantic Coast. This Commission is a clearing house which affords each State the opportunity to obtain information concerning the developments in marine fishery matters and promotes uniformity of legislation wherever possible.

As stated aforesaid, the research project on the blue crab will be very beneficial to Virginia.

The Commission recommends legislative consideration of our off-shore jurisdictional rights because of possible extension of the present three mile limit.

Virginia Fisheries Laboratory

We feel that the Commonwealth is very fortunate to have secured the services of Dr. William J. Hargis, Jr., who accepted the position as Director of the Virginia Fisheries Laboratory when the very capable Dr. John L. McHugh resigned early in 1959 to accept a position with the United States Fish and Wildlife Service as Director of Biological Research, Bureau of Commercial Fisheries.

We herewith express appreciation to Dr. John L. McHugh for his fine work and his loyal service to the Commonwealth. Dr. McHugh deserves great praise for the promotion and growth of the Virginia Fisheries Laboratory.

Dr. William J. Hargis, Jr. is universally recognized as an authority in Marine Biology. His complete devotion to marine science and his conviction that many of our problems can only be solved through scientific research should make our Laboratory one of the most outstanding.

The laboratory staff is hereby commended for their competence and the real progress in seeking the answers to the many marine biological questions that remain unanswered.

A detailed report of the Laboratory work is incorporated herewith and made a part of this report.

Charles M. Lankford, Jr.

This report to your Excellency and to the General Assembly would be most incomplete without making special reference to the retirement of Charles M. Lankford, Jr., as Commissioner of Fisheries, on December 31, 1958.

During Mr. Lankford's tenure of office, which was more than sixteen years, he promoted Virginia's seafood industry to a position superior to any other State in the Nation. His theory of promoting the leasing of oyster ground to the private individual thereby created private enterprise and individual initiative which developed barren ground into productive oyster producing areas.

The Commonwealth, many individuals, and corporations owe a debt of gratitude to Charles M. Lankford, Jr. for his foresight and devotion to the State and seafood industry.

Legislation

The Commission recommends:

1. Legislation to abate and control pollution in all waters of the Commonwealth.
2. The establishment of an adequate fishery statistics program.

3. Legislation to provide for an annual biological survey of the public rocks.
4. Legislation to protect our off-shore jurisdictional rights.

Additional legislation will be recommended to the General Assembly of 1960 to further strengthen the seafood program of the Commission.

We hereby express our appreciation to Honorable J. Lindsay Almond, Jr. for his interest in the seafood industry.

The cooperation of the Director and Members of the Staff of the Virginia Fisheries Laboratory, the Employees of the Commission, the U. S. Fish and Wildlife Service, and all those engaged in the seafood business, is hereby acknowledged.

Respectfully submitted,

COMMISSION OF FISHERIES OF VIRGINIA

By:

Milton J. Herman
E. R. Baquell
R. B. Keenan
W. Loren Chilton
James Martin

Statistical Tables

TABLE No. 1
 RECEIPTS FROM FISH AND OYSTER INDUSTRY BY DISTRICTS
 For Year Ending June 30, 1958

DISTRICTS	Ground Rents	Oyster Licenses	Tax From Public Rocks	2¢ Bushel Tax	Tax From Leased Grounds	Tax for Carrying Out of State	Crab Licenses	Clam and Scallop Licenses	Fish Licenses	Fees	Miscellaneous	Recording Fees*	Total
1 and 2.....	\$ 6,309 24	\$ 1,250 50	\$ 265 16	\$ 531 20	\$ 860 41	.....	\$ 2,527 00	.....	\$ 2,181 70	\$ 232 00	\$ 271 25	.....	\$ 14,428 46
4.....	2,034 18	583 50	290 67	581 34	513 66	.....	1,331 00	.....	3,437 50	65 00	31 00	.....	8,867 85
5.....	2,765 81	956 50	429 04	858 08	376 85	.....	892 50	.....	2,244 00	76 00	142 00	.....	8,740 78
6.....	5,794 05	3,613 00	3,670 90	7,341 80	2,752 60	.....	1,864 50	.....	1,145 50	368 00	54 00	.....	26,604 35
8.....	8,025 67	349 50	20 71	44 10	1,071 01	.....	533 00	\$ 54 50	591 00	62 00	485 95	\$132 00	11,969 44
9.....	4,385 70	839 50	62 02	172 24	739 68	.....	369 00	31 50	496 00	113 50	268 00	70 50	7,547 64
10.....	9,713 32	447 00	.....	.....	1,017 88	.....	1,182 50	28 50	432 30	57 50	296 30	66 50	13,241 80
11.....	3,261 99	1,533 00	.....	.....	15 64	.....	987 50	.....	233 00	146 00	389 00	134 50	6,700 63
12 and 14.....	4,304 03	2,188 50	1,474 88	3,265 24	853 72	\$289 68	886 50	.....	641 00	200 50	76 30	44 00	14,224 35
15 and 16.....	11,190 71	311 50	.....	.....	22 55	.....	654 50	89 00	933 90	55 00	138 75	64 50	13,510 41
17.....	5,832 62	93 50	.....	.....	1,046 55	.....	799 00	28 50	260 50	22 00	287 30	.....	8,369 97
18.....	2,898 31	1,298 50	.....	169 14	.....	.....	84 00	.....	647 00	273 50	.....	.....	5,370 45
19.....	3,076 41	1,249 00	58 98	.....	310 42	.....	78 00	.....	671 90	207 50	.....	.....	5,652 21
19-A.....	.....	.....	.....	.....	.....	.....	.....	.....	3,805 10	.....	.....	.....	8,805 10
20.....	4,724 96	458 50	393 59	1,057 32	296 70	48	73 50	.....	136 50	115 50	123 00	.....	7,380 05
21 and 22.....	6,707 77	423 00	.....	.....	5,809 93	.....	334 50	5 50	496 50	12 00	23 00	.....	13,812 20
24.....	9,254 91	78 50	.....	.....	285 69	.....	1,006 00	28 00	460 00	38 00	306 50	.....	11,457 60
25.....	7,367 62	885 00	61 32	122 64	3,516 48	122 64	1,142 50	228 00	410 00	185 50	468 85	.....	14,508 55
26.....	5,429 42	378 00	103 90	254 22	991 26	203 80	329 00	10 00	205 00	83 00	197 30	.....	8,184 90
27.....	6,231 48	708 50	.....	620 08	2,539 70	.....	679 50	201 50	299 50	55 00	447 70	.....	11,782 96
28.....	3,725 03	576 00	17 72	1,272 56	874 52	35 44	532 50	39 00	91 00	24 50	194 75	.....	7,383 02
M/V "Chesapeake".....	.....	221 50	16 37	32 74	175 68	.....	1,510 00	2 50	37 50	17 50	.....	.....	2,013 79
M/V "Will F. Kellam".....	.....	17 50	.....	8,652 60	.....	.....	135 50	.....	2 00	232 50	.....	.....	9,040 10
M/V "Sea Bee".....	.....	224 00	.....	7,491 40	.....	.....	167 00	5 50	8 00	230 50	.....	.....	8,126 40
M/V "Nomini".....	.....	591 50	.....	.....	.....	.....	10 50	.....	.....	138 00	.....	.....	740 00
Tax Station.....	.....	280 00	110 53	24,238 04	407 30	12 06	141 50	5 50	50 50	807 00	.....	.....	26,052 43
	\$113,033 23	\$19,555 50	\$ 6,975 79	\$56,704 74	\$24,478 23	\$664 10	\$18,251 00	\$755 50	\$19,916 90	\$ 3,817 50	\$ 4,250 95	\$512 00	\$268,915 44

*Recording fees do not represent revenue. They are paid out immediately to Clerks of Court for the account of the lessee.

TABLE No. 1—CONTINUED
 RECEIPTS FROM FISH AND OYSTER INDUSTRY BY DISTRICTS
 For Year Ending June 30, 1959

DISTRICTS	Ground Rents	Oyster Licenses	Tax From Public Rocks	2¢ Bushel Tax	Tax From Leased Grounds	Tax for Carrying Out of State	Crab Licenses	Clam and Scallop Licenses	Fish Licenses	Fees	Miscellaneous	Recording Fees*	Total
1 and 2.....	\$ 6,371 60	\$ 1,285 50	\$ 201 62	\$ 403 24	\$ 1,160 66	\$ 50	\$ 3,124 50	.....	\$ 2,576 80	\$ 183 50	\$ 176 00	.....	\$ 15,483 92
4.....	2,037 04	727 00	332 03	660 06	952 83	8 00	1,897 00	.....	5,138 50	81 00	66 00	.....	11,899 46
5.....	2,831 74	1,101 50	109 12	289 96	184 15	.....	1,036 00	.....	2,628 50	95 50	267 00	.....	8,543 47
6.....	5,919 58	3,040 50	3,477 92	6,981 38	3,631 98	.....	2,175 00	.....	1,217 70	338 00	348 90	.....	27,130 96
8.....	8,141 40	671 50	12 29	48 94	1,515 85	.....	500 00	\$ 67 00	540 00	85 00	406 50	\$203 00	12,191 48
9.....	4,453 53	691 00	245 33	706 24	854 01	156 84	318 50	8 00	563 00	148 00	17 00	23 00	8,184 45
10.....	9,866 86	474 50	.....	.....	1,415 98	.....	1,341 00	37 00	526 00	59 00	88 25	83 00	13,891 59
11.....	3,373 70	1,445 50	82 02	164 04	149 09	164 04	1,103 00	.....	308 50	151 50	332 25	178 50	7,452 14
12 and 14.....	4,394 91	2,276 50	1,500 46	3,116 66	906 96	464 32	657 50	.....	550 00	224 00	78 50	70 00	14,239 81
15 and 16.....	13,929 32	143 50	.....	.....	76 73	.....	616 00	61 50	337 20	26 50	364 50	109 00	15,664 25
17.....	5,943 07	97 00	.....	.....	1,210 08	.....	1,489 50	74 00	724 00	25 00	295 00	12 00	9,869 65
18.....	2,898 61	1,351 00	.....	553 78	26 56	.....	128 00	20 50	728 60	194 50	35 00	.....	5,936 55
19.....	3,266 69	1,217 00	85 80	86 66	622 92	.....	62 50	.....	831 40	108 00	.....	.....	6,280 97
19-A.....	.....	.....	.....	.....	.....	.....	.....	.....	4,083 50	.....	.....	.....	4,083 50
20.....	4,801 54	633 00	308 57	1,273 46	668 73	.....	73 50	.....	144 70	153 00	126 75	.....	8,183 25
21 and 22.....	6,697 09	218 50	.....	.....	5,489 59	.....	472 50	11 00	399 00	10 00	12 00	.....	13,309 68
24.....	8,663 69	134 00	.....	.....	114 24	.....	1,046 00	25 50	496 00	26 00	110 50	.....	10,615 93
25.....	7,640 21	1,172 50	65 52	131 04	2,621 91	131 04	1,069 00	474 50	299 50	182 50	166 00	.....	13,953 72
26.....	5,880 48	357 00	111 18	224 36	987 25	210 36	530 50	5 50	250 90	111 00	224 80	.....	8,893 33
28.....	5,976 46	595 50	.....	93 88	1,812 56	.....	681 00	371 00	95 00	61 50	153 75	.....	9,840 65
29.....	3,792 07	502 50	7 53	1,094 06	370 18	32 48	667 50	36 00	44 00	23 50	95 10	.....	6,664 92
M/V "Chesapeake".....	298 50	10 49	20 98	.....	130 17	.....	1,942 50	.....	71 50	24 00	.....	.....	2,498 14
M/V "Will F. Kellam".....	14 00	.....	4,854 14	.....	.....	.....	36 50	2 50	.....	136 00	.....	.....	5,043 14
M/V "Sea Bee".....	42 00	3 00	7,506 40	.....	.....	6 00	126 50	.....	18 00	234 50	.....	.....	7,936 40
M/V "Glamour Girl".....	486 50	.....	166 50	.....	33 00	.....	10 50	.....	.....	63 50	.....	.....	760 00
Tax Station.....	462 00	.....	62 88	21,057 95	434 27	125 76	231 50	33 00	50 00	755 00	.....	.....	23,212 36
	\$116,879 59	\$19,438 00	\$ 6,615 76	\$49,433 73	\$25,369 70	\$1,269 34	\$21,336 00	\$1,227 00	\$22,622 30	\$ 3,500 00	\$ 3,363 80	\$678 50	\$271,763 72

*Recording fees do not represent revenue. They are paid out immediately to Clerks of Court for the account of the lessee.

TABLE No. 2

Expenditures for Year Ending June 30, 1958

ADMINISTRATION	
Salaries:	
Office personnel.....	\$ 27,661 34
Members of Commission.....	220 00
Counsel and expert services.....	2,600 00
General repairs.....	595 17
Motor vehicle repairs.....	76 84
Light, heat, power and water.....	673 51
Traveling.....	931 83
Transportation.....	2 50
Communication.....	1,884 42
Printing.....	393 96
Other expenses.....	345 53
Fuel.....	533 78
Office supplies.....	634 88
Medical and laboratory supplies.....	3 18
Laundry, cleaning and disinfecting supplies.....	7 21
Motor vehicle supplies.....	3 78
Other supplies.....	65 68
Office equipment.....	361 63
Other equipment.....	402 50
Rent.....	12 00
Insurance.....	219 86
Total for Administration.....	\$ 37,629 60

INSPECTION AND POLICING	
Salaries.....	\$ 163,977 51
Wages.....	2,132 19
General repairs.....	545 75
Motor vehicle repairs.....	20,720 73
Light, heat, power and water.....	38 50
Traveling.....	31,235 00
Transportation.....	99 30
Communication.....	1,579 66
Printing.....	3,147 73
Other expenses.....	436 67
Laundry.....	252 20
Food supplies.....	1,093 66
Fuel supplies.....	1,143 81
Office supplies.....	41 52
Medical and laboratory supplies.....	3 97
Laundry, cleaning and disinfecting supplies.....	212 62
Refrigerating supplies.....	325 80
Motor vehicle supplies.....	23,357 11
Wearing apparel.....	2,876 62
Other supplies.....	824 00
Building materials.....	98 64
Other materials.....	502 47
Marine materials.....	10,633 54
Office equipment.....	250 00
Household equipment.....	465 83
Motor vehicle equipment.....	3,733 32
Other equipment.....	233 37
Boats and nautical equipment.....	16,485 84
Rent.....	8,345 50
Insurance.....	13,411 06
Total for Inspection and Policing.....	\$ 308,203 92

REPLETION OF OYSTER BEDS	
Salaries.....	\$ 3,191 72
Wages.....	681 00
Motor vehicle repairs.....	90 50
Traveling.....	1,111 04
Printing.....	354 28
Other expenses.....	131,734 87
Motor vehicle supplies.....	182 03
Marine materials.....	39 40
Motor vehicle equipment.....	125 20
Rent.....	470 17 Cr.
Total for Repletion of Oyster Beds.....	\$ 137,039 87

NEW EQUIPMENT (CAPITAL OUTLAY)

Other equipment.....	\$ 277 10
Total for New Equipment.....	\$ 277 10

REPLETION AND RESTORATION OF OYSTER BEDS

Wages.....	\$ 8,272 00
Traveling.....	27 96
Other expenses.....	42,189 64
Total for Repletion and Restoration of Oyster Beds.....	\$ 50,489 60
Grand Total for Expenditures.....	\$ 533,640 00

Expenditures for Year Ending June 30, 1959

ADMINISTRATION

Salaries:	
Office personnel.....	\$ 30,961 78
Members of Commission.....	260 00
Counsel and expert services.....	2,200 00
General repairs.....	1,174 15
Light, heat, power and water.....	601 55
Traveling.....	1,231 28
Transportation.....	5 00
Communication.....	1,637 25
Printing.....	118 19
Other expenses.....	499 84
Fuel supplies.....	359 24
Office supplies.....	228 36
Medical and laboratory supplies.....	95
Laundry, cleaning and disinfecting supplies.....	7 30
Other supplies.....	8 32
Office equipment.....	90 90
Books and periodicals.....	12 00
Rent.....	12 00
Insurance.....	414 04
Office equipment (capital outlay).....	4,063 10
Total for Administration.....	\$ 43,885 25

INSPECTION AND POLICING

Salaries.....	\$ 167,511 84
Wages.....	830 60
General repairs.....	105 00
Motor vehicle repairs.....	20,467 72
Light, heat, power and water.....	26 40
Traveling.....	30,548 28
Transportation.....	72 84
Communication.....	1,856 97
Printing.....	3,321 14
Other expenses.....	1,927 91
Laundry.....	337 76
Food supplies.....	1,076 28
Fuel supplies.....	891 52
Office supplies.....	192 66
Medical and laboratory supplies.....	14 71
Laundry and cleaning supplies.....	183 01
Refrigerating supplies.....	351 33
Motor vehicle supplies.....	20,981 56
Wearing apparel.....	2,125 45
Other supplies.....	474 84
Building material.....	214 42
Other materials.....	474 44
Marine materials.....	10,672 59
Household equipment.....	550 71
Motor vehicle equipment.....	1,818 43
Other equipment.....	21 50
Boats and nautical equipment.....	16,051 37
Rent.....	7,985 00
Insurance.....	15,462 10
Surplus Salvage.....	3,607 01 Cr.
Total for Inspection and Policing.....	\$ 302,941 37

REPLETION OF OYSTER BEDS

Salaries.....	\$ 3,360 00
Wages.....	7,476 00
Motor vehicle repairs.....	18 00
Traveling.....	924 96
Communication.....	90
Printing.....	272 85
Other expenses.....	129,836 09
Fuel supplies.....	1 40
Refrigerating supplies.....	11 90
Motor vehicle supplies.....	657 16
Marine materials.....	69 24
Rent.....	159 74 Cr.
Total for Repletion.....	\$ 142,468 76

NEW EQUIPMENT (CAPITAL OUTLAY)

Household equipment.....	\$ 124 62
Total for New Equipment.....	\$ 124 62
Grand Total for Expenditures.....	\$ 489,420 00

TABLE No. 3

RECORDED OYSTER PLANTING GROUND

Years Ending June 30, 1958 and June 30, 1959

DISTRICTS	1958 Number of Acres	1959 Number of Acres
1.....	2,331.38	2,332.83
2.....	3,969.04	4,040.39
4.....	2,589.58	2,181.16
5.....	3,816.57	3,894.54
6.....	5,694.30	5,973.28
8.....	10,618.01	10,700.59
9.....	4,380.96	4,380.96
10.....	15,989.30	16,020.21
11.....	3,228.92	3,332.07
12.....	681.14	770.39
14.....	3,608.41	3,623.73
15.....	10,069.03	10,053.99
16.....	4,053.11	4,006.07
17.....	5,845.21	5,897.84
18.....	2,786.48	2,786.48
19.....	3,156.01	3,155.21
20.....	4,747.37	4,811.46
21.....	6,305.58	5,046.97
22.....	2,758.40	2,765.00
24.....	9,736.43	8,449.59
25.....	7,512.90	7,669.92
26.....	5,849.69	6,047.08
28.....	6,019.86	6,094.83
29.....	3,722.93	3,781.86
Total Number of Acres.....	129,470.61	127,816.45

TABLE No. 4
STATEMENT OF OYSTERS AND SHELLS PLANTED
During Fiscal Year Ending June 30, 1958

RAPPAHANNOCK RIVER	
113,761 bu. shells planted on Drummond Ground.....	\$ 17,064 15
51,177 bu. shells planted on Towles Point Flats.....	7,675 55
4,000 bu. shells planted on Parrott's Rock.....	600 00
44,151 bu. shells planted at mouth of Urbanna Creek.....	6,622 65
20,962 bu. shells planted at Lower Balds Point.....	3,144 30
14,040 bu. shells planted at Piney Island.....	2,106 00
6,798 bu. shells planted at Morattico Bar.....	1,019 70
49,587 bu. shells planted on Monaskon Bluff.....	6,088 05
20,350 bu. shells planted on Weeks Bar.....	3,052 50
12,500 bu. shells planted on Middle Ground.....	1,875 00
31,200 bu. shells planted on Ware Rock.....	4,680 00
20,717 bu. shells planted in Dumaway Bay.....	3,107 55
15,327 bu. shells planted on Wyatt's Bar.....	2,299 05
32,500 bu. shells planted on Ridge.....	4,875 00
428,070 bushels	Total amount..... \$ 64,210 50

PIANKATANK RIVER	
35,787 bu. shells planted on Capetoon Rock.....	\$ 4,823 37
42,807 bu. shells planted on Middle Rock.....	7,063 15
5,718 bu. shells planted on Horse Rock.....	943 47
12,312 bu. shells planted on Brickhouse Bar.....	2,031 48
10,773 bu. shells planted at Cherry Point.....	1,777 54
107,397 bushels	Total amount..... \$ 16,639 01

EASTERN SHORE	
5,264 bu. shells planted at Swash, Pocomoke Sound.....	\$ 842 24
5,196 bu. shells planted in Hunting Creek, Pocomoke Sound.....	883 32
5,024 bu. shells planted in Guilford Creek.....	854 08
5,024 bu. shells planted in Deep Creek.....	854 08
18,470 bu. shells planted on Kellams Rock, in Pungotengue.....	3,324 60
1,864 bu. shells planted in Muddy Creek, Pungotengue.....	335 52
20,148 bu. shells planted on Flat Rock, in Tangier Sound.....	3,828 12
3,600 bu. shells planted in Northeast Cove, Bradford's Bay.....	612 00
1,200 bu. shells planted in Head Channel Flats, Bradford's Bay.....	204 00
1,200 bu. shells planted in Northeast Cove, Swash Bay.....	204 00
2,550 bu. shells planted on Cockle Creek Rocks, Upshurs Bay.....	612 00
2,550 bu. shells planted on Jeff Tumps Rocks, Upshurs Bay.....	612 00
2,500 bu. shells planted on Middle Gap Rocks, Upshurs Bay.....	600 00
7,950 bu. shells planted in Watts Bay.....	1,290 30
2,530 bu. shells planted in New Virginia Bay.....	430 10
5,180 bu. shells planted in Shelley Bay.....	880 60
5,060 bu. shells planted in Kegotank Bay.....	1,012 00
94,950 bushels	Total amount..... \$ 17,378 96

YEOCOMICO RIVER	
8,372 bu. shells planted on Walker's Bar.....	\$ 1,255 80
2,184 bu. shells planted on Swain's Bar.....	327 60
6,552 bu. shells planted in Palmer's Cove.....	982 80
2,892 bu. shells planted on Indian Bar.....	433 80
20,000 bushels	Total amount..... \$ 3,000 00

REPORT OF THE COMMISSION OF FISHERIES

COAN RIVER

2,145 bu. shells planted in Coan River.....	\$ 321 75
3,922 bu. shells planted on Dobbins Bar.....	588 30
3,772 bu. shells planted on Brasiers Bar.....	565 80
3,952 bu. shells planted on Codd's.....	592 80
12,980 bu. shells planted on Big Bar.....	1,947 00
7,636 bu. shells planted in King's Cote Creek.....	1,145 40
2,181 bu. shells planted at Darlings and Sandy Point.....	327 15
2,012 bu. shells planted on Darlings.....	301 80
2,400 bu. shells planted in Glebe Creek.....	360 00
41,000 bushels	Total amount..... \$ 6,150 00

MOBJACK BAY AREA

26,800 bu. shells planted on public ground in East River.....	\$ 4,020 00
71,448 bu. shells planted in Mobjack Bay.....	9,273 76
15,000 bu. shells planted at Cradle Point, North River.....	2,550 00
3,200 bu. shells planted on Clam Ground between Horn Harbor and Winter Harbor.....	480 00
30,000 bu. shells planted in upper Ware River.....	4,500 00
15,000 bu. shells planted in Severn River.....	2,550 00
161,448 bushels	Total amount..... \$ 23,373 76

LITTLE WICOMICO RIVER

12,350 bu. shells planted in Little River.....	\$ 2,346 50
12,350 bushels	Total amount..... \$ 2,346 50

CORROTOMAN RIVER

16,482 bu. shells planted on Little Middle Ground.....	\$ 2,472 30
13,815 bu. shells planted on Island Bar.....	2,072 25
75,043 bu. shells planted at Corrotoman Point.....	11,256 45
105,340 bushels	Total amount..... \$ 15,801 00

YORK RIVER

7,000 bu. shells planted on Page's Rock.....	\$ 1,050 00
10,000 bu. shells planted on Public Ground No. 30.....	1,500 00
17,000 bushels	Total amount..... \$ 2,550 00
Total amount spent for shells for Eastern Shore and Western Shore..... \$ 151,449 73	

NOTE: Number of shells shown above actually planted during this fiscal year, though some vouchers were paid after the close of fiscal year.

4,476½ gals. of screwborers were caught and destroyed during this period at a cost of..... \$ 8,953 00

During Fiscal Year Ending June 30, 1959

COAN RIVER

10,452 bu. shells planted on Big Bar.....	\$ 1,881 36
972 bu. shells planted on Middle Ground.....	174 96
3,004 bu. shells planted on Harrison's Bar.....	540 72
1,500 bu. shells planted on Spring Bar.....	270 00
3,500 bu. shells planted on Windmill Bar.....	630 00
6,304 bu. shells planted on Public Ground No. 73.....	1,134 72
2,876 bu. shells planted on Smith's Bar.....	517 68
6,400 bu. shells planted at Cotton Patch.....	1,152 00
1,700 bu. shells planted at Honest Point.....	306 00
7,500 bu. shells planted on Public Ground No. 84.....	1,368 00
3,200 bu. shells planted on Public Ground No. 82.....	576 00
1,500 bu. shells planted on Public Ground No. 77.....	270 00
2,700 bu. shells planted on Public Ground No. 78.....	496 00
51,708 bushels	Total amount..... \$ 9,307 44

RAPPAHANNOCK RIVER

6,066 bu. shells planted in Temples Bay.....	\$ 1,091 88
12,000 bu. shells planted at Corrotoman Point.....	2,160 00
1,932 bu. shells planted on Bayport Ridge.....	347 76
13,000 bu. shells planted on Middle Ground.....	2,340 00
81,528 bu. shells planted on Waterview Ridge.....	14,675 04
35,442 bu. shells planted on Monaskon Bluff.....	6,379 56
22,210 bu. shells planted at Rockin Point.....	3,997 80
23,061 bu. shells planted at Piney Island.....	4,150 98
31,961 bu. shells planted on Parrott's Rock.....	5,752 98
21,172 bu. shells planted at mouth of Urbanna Creek.....	3,810 96
33,944 bu. shells planted on Cedar Bar.....	6,109 92
74,476 bu. shells planted on Drummond Ground.....	13,405 68
69,513 bu. shells planted on Ridge.....	12,512 34
15,096 bu. shells planted on Shelton Bar.....	2,717 28
29,232 bu. shells planted on Broad Creek Bar.....	3,694 26
461,633 bushels	
Total amount.....	\$ 83,146 44

YORK RIVER

40,657 bu. shells planted at Green Point.....	\$ 7,318 26
900 bu. shells planted on Hardman's Rock.....	162 00
22,080 bu. shells planted on Page's Rock.....	3,974 40
63,637 bushels	
Total amount.....	\$ 11,454 66

EASTERN SHORE

7,350 bu. shells planted on Old Root (Public Ground No. 20) in Watts Bay.....	\$ 1,249 50
2,400 bu. shells planted on Public Ground No. 15, Simoneaston Bay.....	408 00
3,050 bu. shells planted in Kendall Narrows.....	518 50
3,050 bu. shells planted in Cockle Creek and Tributary.....	518 50
2,050 bu. shells planted on Public Ground No. 29 in Boggs Bay.....	348 50
17,200 bu. shells planted in Upshurs Bay.....	3,440 00
4,300 bu. shells planted in Swash Bay.....	860 00
17,200 bu. shells planted on Hammocks Rock, Floyds Bay.....	3,354 00
2,250 bu. shells planted on Public Ground No. 11, in Big Oyster Bay.....	382 50
5,500 bu. shells planted on Head Channel Rock, Bradford's Bay.....	1,100 00
5,304 bu. shells planted at Swash, in Pocomoke Sound.....	954 72
2,000 bu. shells planted in Guilford Creek, Pocomoke Sound.....	380 00
2,096 bu. shells planted in Deep Creek, Pocomoke Sound.....	398 24
2,000 bu. shells planted in Hunting Creek, Pocomoke Sound.....	380 00
2,000 bu. shells planted in Messongo Creek, Pocomoke Sound.....	380 00
8,800 bu. shells planted on Neck Rock, Pungoteague Creek.....	1,772 00
8,170 bu. shells planted on Flat Rock, Tangier Sound.....	1,634 00
94,780 bushels	
Total amount.....	\$ 18,078 46

PIANKATANK RIVER

1,957 bu. shells planted on Ferry Flats.....	\$ 352 26
1,957 bushels	
Total amount.....	\$ 352 26

JAMES RIVER AREA

29,822 bu. shells planted on Jones' in Nansemond River.....	\$ 6,859 06
29,822 bushels	
Total amount.....	\$ 6,859 06

CORROTOMAN RIVER

8,344 bu. shells planted on Middle Ground.....	\$ 1,501 92
6,036 bu. shells planted at Corrotoman Point.....	1,086 48
14,380 bushels	
Total amount.....	\$ 2,588 40

MOBJACK BAY AREA

30,000 bu. shells planted at mouth of East River.....	\$ 5,400 00
30,000 bushels	
Total amount.....	\$ 5,400 00

REPORT OF THE COMMISSION OF FISHERIES

YEOCOMICO RIVER

6,300 bu. shells planted on Public Ground No. 105.....	\$ 1,134 00
8,750 bu. shells planted on Public Ground No. 100.....	1,575 00
3,500 bu. shells planted on Public Ground No. 103.....	630 00
6,300 bu. shells planted on Public Ground No. 102.....	1,134 00
2,100 bu. shells planted on Public Ground No. 112.....	378 00
<hr/> 26,950 bushels	<hr/> Total amount.....\$ 4,851 00
Total amount spent for Eastern Shore and Western Shore.....	\$ 142,037 72

Note: Number of shells shown above actually planted during this fiscal year, though some vouchers were paid after the close of fiscal year.

2,902 gals. of screwborers were caught and destroyed during this period at a cost of\$ 5,804 00

TABLE No. 5

COMPARATIVE STATEMENT OF EXPENSES BY YEARS
(Expenditures in Repletion Fund Not Included)

July 1, 1949 to June 30, 1959

	Office and Adminis- tration	Field Inspection	Boats and Nautical Equipment	Total Expenses
July 1, 1949 to June 30, 1950.....	\$ 33,024 80	\$146,564 65	\$ 50,835 82	\$230,425 36
July 1, 1950 to June 30, 1951.....	29,648 67	183,675 87	58,466 18	268,790 72
July 1, 1951 to June 30, 1952.....	31,634 52	206,892 75	69,303 92	307,831 19
July 1, 1952 to June 30, 1953.....	32,323 41	230,260 17	37,689 04	300,272 62
July 1, 1953 to June 30, 1954.....	38,176 78	262,730 09	35,138 32	336,045 19
July 1, 1954 to June 30, 1955*.....	37,350 32	258,303 09	40,952 61	336,636 02
July 1, 1955 to June 30, 1956.....	36,185 67	268,417 91	18,455 10	323,058 68
July 1, 1956 to June 30, 1957.....	33,976 50	264,332 60	20,581 89	318,890 99
July 1, 1957 to June 30, 1958.....	37,629 60	291,995 18	16,485 84	346,110 62
July 1, 1958 to June 30, 1959†.....	43,885 25	287,014 62	16,051 37	246,951 24

*Air-conditioning installed in office building during this period.

†Additional bookkeeping machine purchased for office during this period.

EXHIBIT A

*Reports of
Superintendent of Hatcheries*

RICHMOND, VIRGINIA, August 16, 1958.

HONORABLE CHARLES M. LANKFORD, JR., *Commissioner,
Commission of Fisheries of Virginia,
Newport News, Virginia.*

DEAR MR. LANKFORD:

I submit herewith my report covering the shad hatching work on the Mattaponi and Pamunkey rivers for the season 1958, as follows:

The Mattaponi River Hatchery, with Mr. Will Custalow in charge, was in operation from April 21st to May 25th inclusive (35 days), during which time two hundred seventeen (217) spawning roe shad were caught and stripped, from which we received a total of 6,944,000 eggs. Decrease of forty-four (44) spawners caught but an increase of 3,634,500 eggs over the total of 3,309,500 eggs collected during the 1957 season.

The Pamunkey River Hatchery, with Mr. Ivy Bradby in charge, was in operation from April 21st to May 25th inclusive (35 days), during which time two hundred and nine (209) spawning roe shad were caught and stripped, from which we received a total of 6,688,000 eggs. Increase of one hundred twelve (112) spawning roe shad caught and 4,505,500 eggs over the total of 2,182,500 eggs collected during the 1957 season.

From the total of 13,632,000 eggs, we received the usual hatch of from 80 to 85%. All young shad were immediately released in the two above named rivers after hatching.

The number of spawners caught and eggs collected and hatched this season shows an overall increase of eighty-six (86) spawners caught and 5,872,000 eggs over the total of 7,760,000 eggs collected and hatched during the 1957 season, which included the collection of eggs from the Chickahominy River Hatchery during the previous season.

The run of shad in the Mattaponi and Pamunkey rivers was at its best during the latter part of the season and produced a far better percentage of eggs per shad than we have received during the past few years, which accounts for the larger quantity of eggs collected this season.

The Chickahominy River Hatchery did not operate at all this year, as we could not receive sufficient spawners early in the season to justify the operation of same. Practically all of the commercial fishermen, due to the scarcity of shad in the river, simply hung up their nets and quit fishing by Easter and when the shad finally came up the river there were no fishermen to supply the necessary

spawners to operate the hatchery. Both Mr. Orange and myself kept a close check on the river while the fishermen were operating but there were just no spawners available.

You will recall that we had a long spell of rainy and cold weather during the past spring; and due to this fact, the spawners were not available until the very last of the season.

Conditions on the Mattaponi and Pamunkey rivers are somewhat different than they are on the Chickahominy River, as the Indians on the two first named Rivers fish the entire season, regardless of how poor the catch. As above stated the larger portion of the spawners caught on the Mattaponi and Pamunkey rivers were taken the last of the season after the rains stopped and the weather warmed up. Otherwise, I am afraid these two rivers would also have been a flop.

Taking all three rivers into consideration, I must admit the run of shad during the past season was the worst we have had for a number of years.

The commercial dealers here in Richmond advise that they were only able to secure about half the number of shad they generally purchase each season. This is the first time that I can recall that the dealers have been unable to secure as many shad as they needed.

All fishermen on the rivers are still very much interested in the work and I am receiving their full support, and I certainly trust that next season will be a good one for them, as well as ourselves.

I regret very much that we were unable to operate the Chickahominy River Hatchery during the past season, which would have placed the writer in a position to render a much better report and all I can say is that I am living in hopes of forwarding a brighter report next year.

Will be very glad to receive any suggestions from you that will improve the work in any way.

Should there be any further information you may desire, please advise and I will gladly forward same.

Trusting that this report will have your approval and with the very best of regards, I am

Yours most sincerely,

J. T. MEYER,
Superintendent of Hatcheries

RICHMOND, VIRGINIA, July 31, 1959.

HONORABLE MILTON T. HICKMAN, *Commissioner,*
Commission of Fisheries of Virginia,
Newport News, Virginia.

DEAR MR. HICKMAN:

I submit herewith my report covering the shad hatching work on the Mattaponi and Pamunkey rivers for the season 1959, as follows:

The Mattaponi River Hatchery, with Mr. Will Custalow in charge, was in operation from April 20th to May 25th inclusive (35 days), during which time one hundred and ninety eight (198) spawning roe shad were caught and stripped, from which we received a total of 6,336,000 eggs. Decrease of nineteen (19) spawners

caught and 608,000 eggs collected under the total of 6,944,000 eggs collected during the 1958 season.

The Pamunkey River Hatchery, with Mr. Ivy Bradby in charge, was in operation from April 20th to May 25th inclusive (35 days), during which time one hundred and two (102) spawning roe shad were caught and stripped, from which we received a total of 3,264,000 eggs. Decrease of one hundred seven (107) spawners caught and 3,424,000 eggs collected under the total of 6,688,000 eggs collected during the 1958 season.

From the total of 9,600,000 eggs collected, we received the usual hatch of 80% to 85%. All young shad were immediately released in the two above named rivers after hatching.

The number of spawners caught and eggs collected and hatched this season shows an overall decrease of one hundred twenty-six (126) spawners caught and 4,032,000 eggs under the total of 13,632,000 eggs collected and hatched during the 1958 season.

The Chickahominy River Hatchery did not operate at all again this year. We experienced the same difficulty this season as we did during the previous season. That is, we could not receive sufficient number of spawners early in the season to justify the operation of the hatchery. Practically all of the commercial fishermen, due to the big drop in prices and the scarcity of shad in the river, simply hung their nets and quit fishing after Easter and when the spawners finally came up the river late in the season, there were no fishermen to supply the necessary spawners to operate the hatchery.

Conditions on the Mattaponi and Pamunkey rivers are somewhat different than they are on the Chickahominy River, as the Indians on the Mattaponi and Pamunkey rivers, who furnish the bulk of the spawners, fish the entire season, regardless of how poor the catch or the drop in prices. They are there to catch the spawners whether they come early or late in the season and as a rule they come late. The run of shad was larger in the Mattaponi River than the run in the Pamunkey River, which accounts for the larger number of spawners caught in the Mattaponi River during 1959 season.

The run of shad in all three of the rivers this season was much smaller than in previous years and this, along with other conditions, made the season a very poor one.

It appears that it is not possible to get the right conditions at the right time to produce the desired results with the hatching work.

All fishermen on the rivers are still keeping up their interest in the work and I am receiving their full support during the time they are fishing.

I regret very much that we were unable to operate the Chickahominy River Hatchery again this season, which would have placed the writer in a position to render a much better report. Hope we will have better luck next season.

Will be very glad to receive any suggestions from you that you think will improve the work.

Should there be any further information you may desire, please advise and I will gladly forward same.

Trusting that this report will have your approval and with the very best of regards, I am,

Yours most sincerely,

J. T. MEYER,
Superintendent of Hatcheries.

EXHIBIT B

Report of the Virginia Fisheries Laboratory

VIRGINIA FISHERIES LABORATORY

Gloucester Point, Virginia

September 1, 1959

The Honorable Milton T. Hickman, Jr.
Commissioner of Fisheries
Newport News, Virginia

Dear Mr. Hickman:

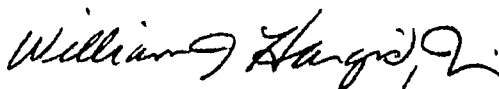
Herewith please find the report of the Virginia Fisheries Laboratory for the biennium 1 July 1957 to 1 July 1959. Since Dr. J. L. McHugh was Director of this Laboratory through most of the time, its successes, and there have been many, are largely his and to him much credit is due.

As you will see from the enclosed report, much progress has been made in our research. As a result the Laboratory has become much more valuable to the commercial and sport fishing industries as attested by the increasing number of requests for advice and aid concerning fishery problems.

With its expansion into the field of marine pollution the Laboratory began to serve the entire people of the Commonwealth. Because the problems entailed are so vital it is essential that progress in this direction be continued.

Your organization has contributed greatly to the successful development of the Laboratory. As a result the Commission and you and your staff deserve my thanks for courtesies of past assistance.

Respectfully submitted,



Director

Virginia Fisheries Laboratory

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*Joined staff in fiscal 1959.

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Except where noted the separate section reports were written by the respective biologists-in-charge.

Mollusk Research Section

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Associate Biologist.....DEXTER S. HAVEN
Laboratory Technician.....CURTIS C. LEIGH

Mortality Studies

Patterns from Ten Years of Study

The summer of 1959 marks the tenth year of studies on mortalities of oysters and their causes. Most of these studies have involved use of suspended trays at the Laboratory pier to eliminate known causes of oyster deaths such as smothering, drills and other predators. Trays on natural bottoms and paint-marked oysters on planted ground have supplemented the pier trays. Death rates from disease and other unknown factors are somewhat higher in trays than on natural bottoms due to contagion of diseases in crowded trays. However, additional losses from smothering, predation, and other bottom-associated factors make total losses on the bottom greater than those in trays.

Deaths in trays, which occur primarily in the warm months of July to October inclusive, are caused mostly by one disease organism—the fungus *Dermocystidium*. From 20 to 30 per cent of the crop nearing market size is lost each summer to this disease. From November to June each year, only about one per cent per month is lost from all causes in trays. On natural beds cold season losses appear to be much greater. Minor peaks of mortality have been observed repeatedly in trays in February-March (end-of-winter kill) and in May and June but the causes are not well understood. End-of-winter kills of approximately 20 per cent were observed on oyster beds in the lower James in 1958 and on deep water beds in Chesapeake Bay proper in 1959.

Fresh Water Kills

Oyster beds in low-salinity waters escape most predation and disease because the causative organisms cannot persist in such waters. The surest way of avoiding losses is to plant oysters in low salinity water. For example, the James River seed area typically has very low death rates except in wet years when fresh water may cause losses as it did in the upper half of James River in the spring of 1958. Oysters are amazingly tolerant of late winter and early spring sieges of low salinity.

South Carolina Seed Oysters in Virginia

The persistent interest of oystermen in South Carolina seed oysters has led us to investigate small lots of these in the past eight years. We conclude that South Carolina seed oysters can be used successfully in high salinity waters of Chesapeake Bay provided severe winters do not occur. Being resistant to *Dermocystidium*, South Carolina oysters have lower death rates in summer than native oysters, but they experience compensatory losses in winter. These losses may be excessive in cold winters, particularly in low-salinity waters. South Carolina oysters are inferior to natives in shape, size, quality, and shucking

characteristics, and we do not recommend their use in the Chesapeake area unless seed production becomes markedly worse in our waters.

Delaware Bay Troubles

Since 1957, Delaware Bay has suffered persistent losses of oysters to the point that the oyster industry is almost destroyed. The causes are not well-defined as yet, but one or more diseases seem to have erupted with disastrous effects. Until the Delaware Bay troubles are clarified, Chesapeake oyster interests must avoid Delaware Bay stock and remain vigilant for possible trouble. To this end, our Laboratory, and the Maryland and U. S. Fish and Wildlife Service laboratories have instituted monitoring programs designed to detect unusual mortalities. The cooperation of oystermen has been obtained in watching oysters in trays and on planted ground.

To help study oyster diseases, a Pathology Research Department comprising a microbiologist and a microtechnician has been established at the Laboratory. This will permit identification and study of minor diseases of oysters which may erupt at intervals. Mortality records have already shown that minor losses occur regularly at the end of winter and in May and June of each year, but the causes are problematical.

Seed Production and Reproduction of Oysters

Annual Surveys of Public Grounds

Since about 1943 regular surveys of public oyster grounds have been made to evaluate annual spatfall and to observe fluctuations in populations of oysters and their pests, predators and competitors. These surveys have been confined primarily to public oyster grounds in the major rivers where shell plantings by the State have been made. With increasing demand for seed oysters this program is being extended to small tributaries and creeks in the hope that some can be used as seed areas by private planters. Weekly and seasonal spat collectors are exposed in many areas of Virginia each year. The creeks emptying into York and Rappahannock rivers and Mobjack Bay were tested for the first time in 1958 and tests are being continued in 1959.

The objective is to determine patterns of timing and intensity of spatfall for each area over a long period of years. Only those areas which produce a minimal set of two or three spat per shell most years can be used as seed areas. Until control measures for oyster drills are more effective, only low-salinity waters can be used for seed production in Chesapeake Bay. On Seaside of Eastern Shore where spatfalls are extremely heavy, special precautions in locating seed beds on relatively high intertidal beds, together with mid-winter transplanting or screening of seed stock, permit use of drill-infested areas for seed oysters.

Use of Shellbags to Increase Catch of Oysters

The success of a Maryland planter in Smiths Creek has led to a renewed interest in shellbags as a means of increasing spatfall in areas of marginal intensity of set. In 1958, Dr. D. B. Quayle, a shellfish biologist from British Columbia, spent several months in Virginia exploring the use of shellbags in commercial

quantities. A total of 4000 shellbags were planted in Mobjack Bay, Gloucester Point, and James River areas. Unfortunately setting failed in all Virginia waters except James River in 1958. But all plantings of shellbags in James River had adequate sets for commercial seed, and it appears that even areas where bottom-planted shells must be left two years to get a satisfactory catch will produce commercial quantities of spat on shellbags in one year. The shellbag method is particularly promising in the James if cultch is planted no earlier than the first or second week of August.

Some twelve years of records for James River show that not more than 10 per cent of the season's catch occurs in July and that the peak of setting usually occurs between mid-August and mid-September. Spatfall is seldom of short duration in James River but spreads out over many weeks. Of all good-setting areas in Chesapeake Bay, only James River has regular late sets of major importance. Shell plantings should be delayed accordingly to coincide with setting peaks in late August or early September.

Prediction of spatfall by sampling oyster larvae in the plankton does not seem feasible yet for Virginia's numerous and varied areas. Successful sets are often dependent upon many broods of larvae of which some broods are effective but many are lost entirely. The long setting season (usually over 90 days in James River—July through September) precludes following the broods in numerous areas with our present staff. Furthermore, even if this could be done it is questionable whether such efforts can be successful in Virginia waters with present knowledge.

Apparently unusually cold ocean waters in 1958 caused the first failure of spatfall on Seaside of Eastern Shore in the memory of oystermen. This failure plus unusually heavy exportations of Seaside oysters to Delaware Bay in the first six or seven years of the 1950's brought fears that the brood stock had been depleted and the setting potential destroyed, but a normal heavy spatfall occurred in 1959.

Growth of Oysters

For several years, individually numbered oysters have been weighed almost weekly by a technique involving submersion in water. Underwater weights of oysters are essentially measures of shell growth. The method appears to measure shell growth with great sensitivity and is being used to investigate seasonal growth, changes in availability of food, sickness of oysters, and individual variations in growth. An early finding was that the presence or absence of "new bill" has little relation to total shell growth. It is expected that the method will provide rapid evaluations of growth potential in various ecological situations with various stocks of oysters.

Condition Studies 1957-1959*

Oysters are valued commercially for their meats, and meat quality or yield often determines the margin of profit for commercial growers. To understand the factors underlying meat production by oysters, "fatness" or "condition" of oysters at different seasons, is being studied under various environmental conditions, and at various localities in Virginia.

*By D. S. H.

The "condition index" of oysters is a satisfactory measure of meat quality and is defined as:

$$\text{Condition Index} = \frac{\text{Dry meat weight in grams} \times 100}{\text{Shell cavity volume in cubic centimeters}}$$

"Condition index" measures the degree to which the shell cavity is filled with meat. Typically, oysters of poor quality have an index of about 4.0 while fat oysters average about 12.0. This "index" also gives a measure of relative yield, for the higher the index the greater will be the yield of meats from a bushel.

Studies show that the disease organism, *Dermocystidium*, which is endemic in the more saline parts of Chesapeake Bay, may adversely influence oyster quality. Experiments also show that oysters free from this parasite fatten more than infected oysters during the late fall and early winter. The data indicate that yearly fluctuations in fatness in various localities may be partly caused by variations in intensity of infection.

Age, too, influences quality of oysters. Young small Rappahannock oysters have been found to be superior in quality (higher condition index) to older larger oysters from the same locality. In addition, the "pea" or oyster crab, frequently present in Virginia oysters, influences yields. Heavily infected oysters may yield about 10 to 15 per cent less meat per bushel than oysters lacking these parasites. This is to be expected since a pea crab will occupy space inside a shell cavity that ordinarily is filled with oyster meat.

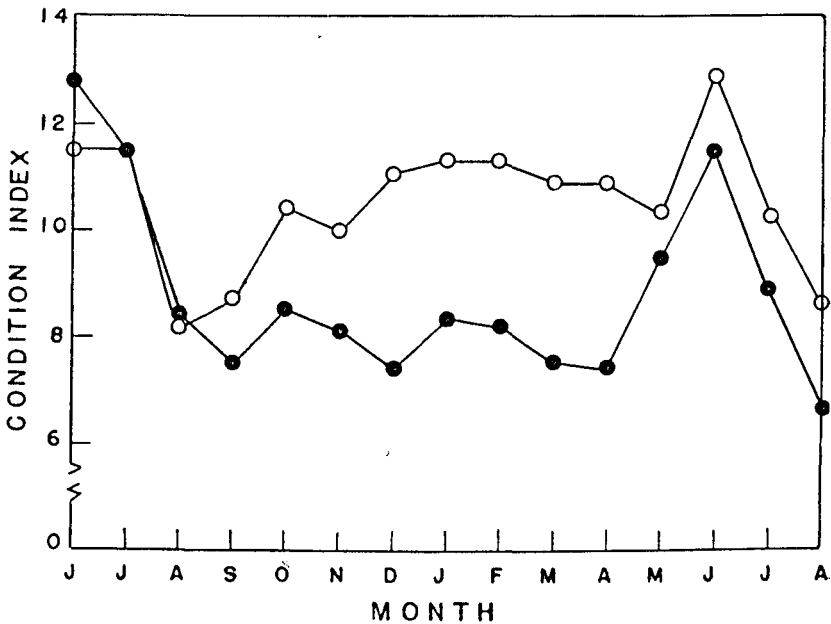


Figure 4. Seasonal Condition Index curve for tray oysters cultured in the lower York River (closed circles) and those cultured in the lower Rappahannock River (open circles). Data represent mean values derived from three separate seasonal studies from 1956 through 1959.

Seasonal condition index studies were conducted on tray-cultured James River seed oysters in the lower York and Rappahannock rivers from 1956 through 1959. The results are shown in Figure 4. Bottom oysters of similar origin were studied concurrently, but were not considered as representative of large areas as tray oysters. Frequently bottom oysters were inferior in quality and size, and differences were associated with local effects caused by the nature of the bottom type or by silting.

Rappahannock tray oysters show a typical seasonal condition index cycle reaching maximum fatness in late spring or early summer around the first of June, and becoming poorer during the spawning season in August and September. Fall fattening begins in late September and by December oysters are nearly as fat as in spring. York River oysters have a different cycle with a single peak of improved condition occurring during May and June. The expected increase in fattening in fall did not occur during this study.

If tray data are typical, then results of the seasonal study should aid commercial growers. These studies suggest that Rappahannock oysters should not be harvested during August or early September because yields and quality will generally be low. If harvesting is delayed until November, December or January, substantial gains in quality and yield may be expected. If oysters cannot be harvested in late fall or winter then early June appears to be the next best period.

In the York River, optimum harvest time lasts only a short period during May and June, and yields during the remainder of the year are usually low in comparison.

Spring harvest of oysters from the York and Rappahannock rivers is desirable because that is the time of peak condition; however, consumer demand may be low at this season. A possible solution is to freeze or process oysters harvested in June for consumption in winter when demand is high.

Work on oyster condition with emphasis on the relation of bottom type to condition is being continued.

*Oyster Drill Investigations**

Biologist in Charge..... DR. W. J. HARGIS, JR.
Assistant Biologist..... JAMES P. WHITCOMB

Extensive studies have been carried out under the U. S. Fish and Wildlife Service, Saltonstall-Kennedy grant since July 1955. We are studying population levels, fecundity, growth rates, mortality rates, gross morphology and biology of the boring snails, screwborers. Previous reports have described the importance of the boring snail populations in eelgrass beds and the possible interchange with adjoining oyster grounds. Our studies are focused on these eelgrass beds but also include preliminary work on oyster grounds.

We have acquired important knowledge about the life history and biology of the rough oyster drill, *Eupleura caudata*. This snail occurs in significant numbers in some parts of Virginia and along the Atlantic coast.

In winter, the rough oyster drill appears to hibernate because very few can be collected on traps and caged animals are dormant. In April and early May, as temperatures rise to over 50°F the animals become active and begin copulating.

*By J. P. W.

Sex ratios obtained from trap catches indicate that equal numbers of males and females move to shells projecting above the bottom during this period. Spawning begins in late May when temperatures rise to 69°F, reaches a peak in June and early July (70°F to 79°F), and ceases about the first of August. During the spawning period, females come onto traps in greater numbers than males. Copulation ends early in July, but it is resumed in fall as water temperatures decline to about 70°, and ceases at about 62°F. The annual cycle of sexual activity ceases at the end of this fall copulation period. Since females isolated after this period are capable of depositing egg cases with living embryos, it seems probable that this fall copulatory period serves to insure that females have spermatozoa when spawning the following spring.

In experimental cages, each mature female deposits an average of 55 egg cases over a period of five to seven weeks which comprises the spawning period. Egg cases in the experimental area are deposited on available hard surfaces of mollusk shells, of which the most important are dead and live hard clams, oysters, and jingles. Most clusters include eight to ten cases, and each case contains an average of 14 embryos. Ninety-three per cent or more of these embryos reach the protoconch or first shelled stage of development within the egg case and probably all protoconchs hatch. In the absence of predation, therefore, a mature female may produce 700 young conchs each summer. At the time of peak spawning in mid-June, the incubation period is from 12 to 20 days. Thus, the greatest emergence of conchs occurs during the first week of July, when oysters begin setting in the York.

Growth of the newly-hatched drills, which emerge at a height of about 0.9 mm, is apparently rapid, for their mean length on October 27, 1956 was 12 mm. Females probably are not mature in their second summer but continue to grow until the third summer when most attain sexual maturity and growth ceases. Males show similar determinate growth.

Trap catches of drills rose to a peak about three weeks before the peak of spawning. As spring temperatures rise the first activity is copulation soon interspersed with feeding which later becomes the dominant activity. It is possible that this heavy feeding period provides energy and food reserves for spawning.

There is good evidence that the success of spawning varies greatly.

These studies have revealed an apparent weakness in the life cycle of the rough oyster drill in that sexual maturity is not reached until after the second summer of life. The snail compensates for this by depositing large numbers of egg cases containing many embryos of which most hatch. Control of this species should not be too difficult for there is a period of almost two years in which to catch or destroy drills before they become mature. If the predators of egg cases can be identified, and their numbers increased on natural bottom, this also offers a possible control measure.

The purpose of this important research is to investigate the biology of both species of oyster drills in an attempt to discover weak spots in their life histories, spots which will be susceptible to application of control measures. In this we have been successful in suggesting several possibilities for control. As mentioned above, several natural predators and diseases affecting egg cases have been detected, but more work remains to be done before it can be determined if they can be employed as effective biological controls.

We have learned that males are chemically attracted to female drills from some distance. It may be possible to utilize this response to advantage.

Crustacea Research Section

Biologist in Charge.....W. A. VAN ENGEL

Assistant Biologist.....FRANK J. WOJCIK

Studies of Blue Crab Abundance

Records of the winter dredge fishery are now available for 30 years, for 1924-25, 1925-26 and continuously since 1931-32. Fishing success in 1957-58 was below the 30-year average, although not as low as 12 other years. Fishing success in 1958-59 was above average, but not as high as eight other years. In the summer soft and peeler crab fishery, catches in 1957 and 1958 were above the 17-year average. Accurate measures of fishing success in the crab pot fishery are available only since July 1956, too short a period to reveal averages or trends. The catches of 1956 and 1958 were substantial and equal, while the 1957 catch was about three quarters that of the other two years.

These figures continue to support our claim that there is no evidence that the blue crab is decreasing in abundance. Fluctuations in catch are to be expected. We recognize that the magnitude of the catch is determined by a number of variable factors, including the effects of weather and the market on the number of units of fishing gear and their efficiency, as well as the true abundance of crabs. Often overlooked is the fact that the blue crab shifts its position throughout the Bay and rivers, and although it may be abundant and potentially catchable it is not always equally available everywhere.

Abundance of Young Crabs

For several years, forecasts of the crab catch have been made six months or more in advance of the fishery. These predictions have been based on estimates of the abundance of young crabs before they are large enough to enter the catchable stock. Several methods of sampling were described in earlier reports, but none of the methods have given a consistently reliable measure of abundance. Variability in the catch of young crabs has been large. Because of this variability, forecasts have been necessarily limited to stating whether the catch will be above or below average or just average. Regardless of their simplicity, these forecasts have been remarkably accurate.

Special studies have been planned to determine the extent and causes of variation in numbers of young crabs on any particular day. Variations may be due to the shifts in position of young crabs between deep and shallow water, up and down river, in response to particular salinity, oxygen, temperature and food requirements. Some of the differences in numbers may be caused by changes in the efficiency of the gear or the mode of sampling.

Otter trawl hauls in the York River have given us some measure of the differences in catches to be expected. In May and August 1958 and May 1959, near Allmondsville, Bell Rock, and Purtan Island, located 15 to 25 miles above the mouth of the river, catches varied with the strength of the bottom water currents (Fig. 5). Fewer crabs were caught when the bottom water was strongly ebbing or flooding, while large numbers were caught at low slack water. However, at Tue Marsh Light at the mouth of the river and at Gloucester Point and Pages

Rock, five and ten miles upriver, catches were consistently small and no pattern of variation was observed. Estimates of abundance based on the largest catches would be five to ten times greater than estimates based on the smaller catches. We hope eventually to find an efficient and accurate measure of abundance of young crabs.

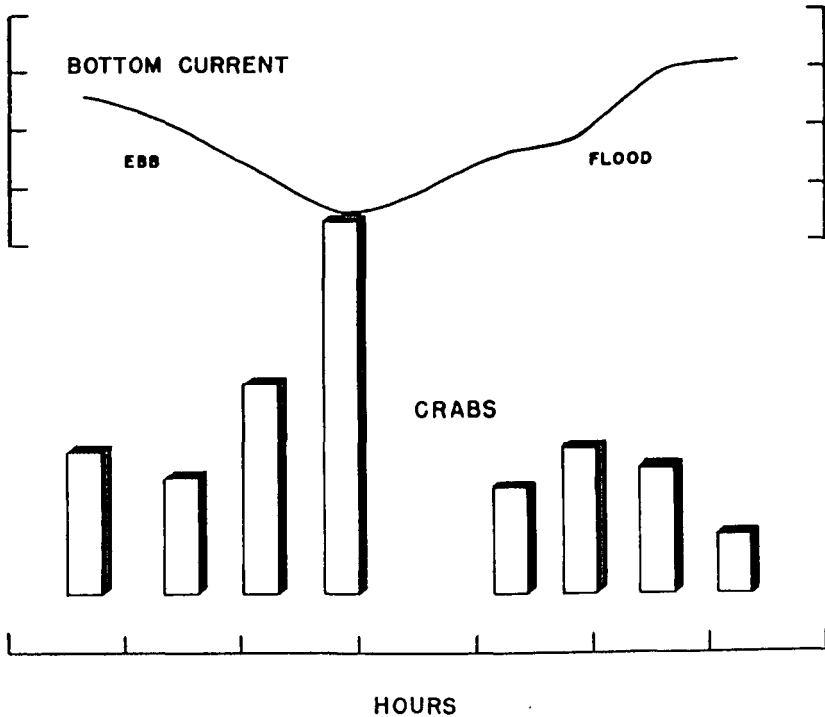


Figure 5. In an otter trawl haul near Purtan Island on the York River in May 1959, fewer crabs were caught when the bottom currents were strongly ebbing or flooding and more crabs caught at low slack water.

Shedding Crabs

The mid-summer rise in the death rate of peeler crabs is a common experience to persons shedding crabs in floats, and results in the loss of thousands of dollars annually. These losses have been attributed to many causes, among them excessive temperatures, suffocation due to lack of oxygen, fouling with suspended sediments or scums, overcrowding, starvation and injuries. Losses can be minimized by careful selection and handling of crabs.

Recently a few crab-shedding tanks have been built on shore or over pilings. Tanks are now in use at West Point on the York River, at Urbanna and Weems on the Rappahannock River, at Wilton Point on the Piankatank River and at Fleeton on the Great Wicomico River. These are wooden troughs, with solid sides and bottoms, five or more feet wide and up to 50 feet long, sometimes divided

into compartments. River water pumped to one end of the tank is drained at the opposite end through a sluice gate or stand-pipe. Aside from the convenience of the tanks to the operator on shore, there is an opportunity to avoid or reduce some losses. Oxygen deficiencies can be eliminated through aeration and scum and wastes easily flushed away.

There is reason to believe that the temperature, salinity and oxygen requirements of peeler and soft crabs can be learned through controlled laboratory studies, which we hope to do in the near future.

Mesh Size in Crab Pots

When the Virginia General Assembly removed the limit on the number of crab pots that each license holder could fish after July 1956, there was speculation that the number of pots in operation would be substantially increased and that the increase would lead to overfishing of the resource. This fear of overfishing had already begun to grow when the pot was introduced in 1935. The crab pot fishery expanded rapidly and by 1945 the pots accounted for over 60 per cent of the hard crab catch. However, since 1945, the percentage contribution of the pot fishery to the catch has remained at the same level. The rapid increase in the number of license holders continued until 1950, while the number of pots actually in operation continued to rise for several more years. By 1954, however, two years before the above-mentioned repeal of the limitation, Virginia fishermen had been using about as many pots as they could handle in one day, and no significant change in the number of pots has occurred since then. Thus, repeal of the pot limit law has had little effect on the numbers of pots in use.

The capture of young crabs in pots appears to be a potential threat to the resource. In certain seasons, over 60 per cent of the crabs in pots are less than five inches in width. Law-conscious potters cull these illegal crabs from their catch. It is not known whether relaxed effort by potters and the removal of many small crabs could lead to a seasonal collapse of the crab populations in some river areas. If the natural death rate among young crabs is high, those that are culled from pots may not live to contribute to the catch at a later date anyhow, but if their natural death rate is low or moderate, the weight gained through growth may add considerably to the catch.

The fear of overfishing young crabs has been expressed by the Virginia crab meat packers, with the recommendation that the Laboratory conduct a study of crab-pot-mesh sizes to determine the proper mesh for maximum escapement of crabs less than five inches in width. In response to their request, a search was begun for a mesh that would hold at least as many legal-sized crabs as now are caught by the pot used by Virginia fishermen, but allow all or most of the juvenile crabs to escape. Seven types of crab pots have been constructed from wire fabrics of different mesh sizes and have been baited and fished in a test area in the York River near the Laboratory. One of the types was made of 18-gauge, $1\frac{1}{2}$ inch hexagon-mesh poultry wire, commonly used by Virginia crab potters. Two-inch mesh poultry wire was used for another type. Two types were made of 1 x 2 inch, rectangular-mesh welded wire, in 14-gauge wire as commonly used by Florida potters, and in 16-gauge wire. The remaining three types were made of 16-gauge welded-wire fabrics specially manufactured to exact specifications, $1\frac{1}{2}$ x 2 inches, $1\frac{1}{2}$ x $2\frac{1}{2}$ inches and $1\frac{3}{8}$ x $2\frac{3}{8}$ inches. Nine pots were made with each type of fabric.

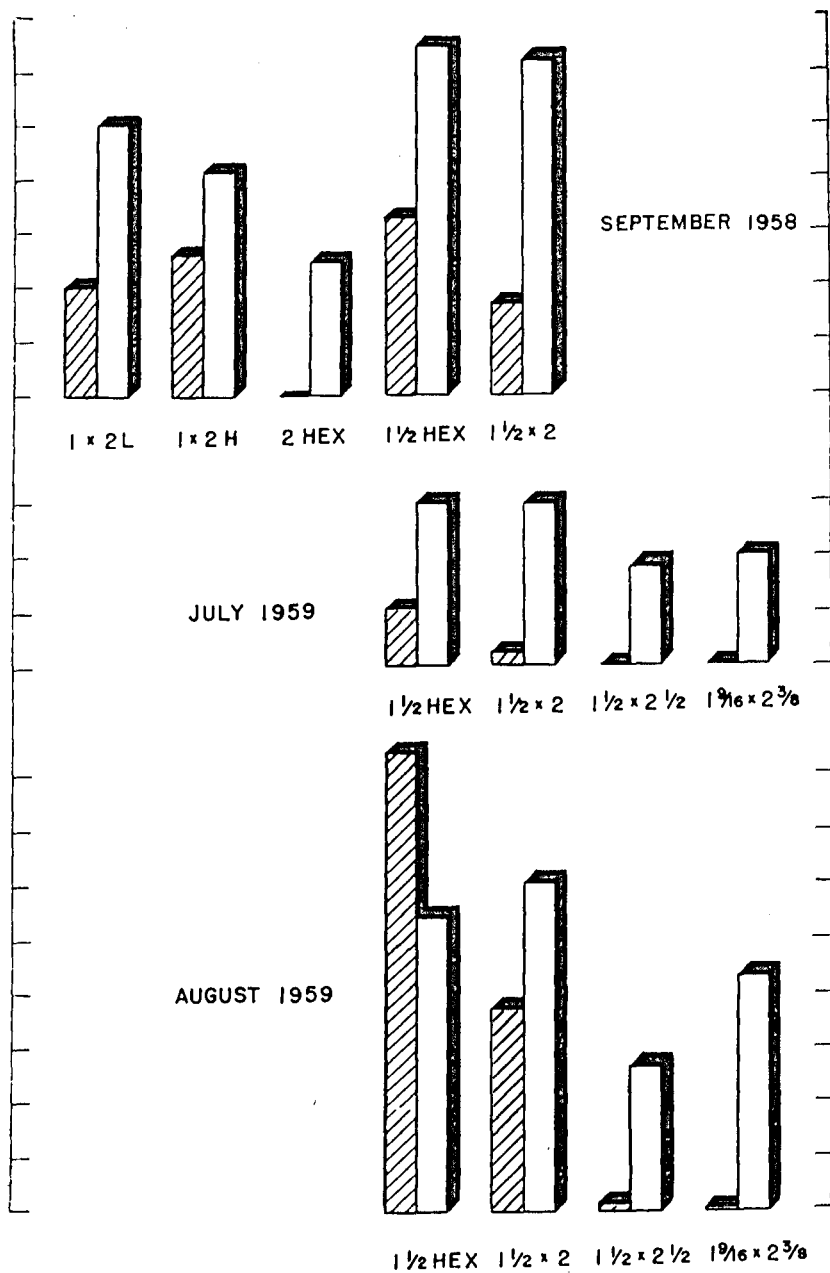


Figure 6. Relative numbers of illegal (shaded bars) and legal-sized (unshaded bars) crabs in seven different types of crab pots. Numerals denote mesh size in inches.

In tests of the first five types mentioned above, run in September 1958, it became evident that three types of fabric are not satisfactory. Fewer legal-sized crabs were caught in the 1- x 2-inch mesh Florida models and the 2-inch mesh pot than in the standard Virginia pot (Fig. 6). However, the specially manufactured 1½- x 2-inch mesh welded-wire pot caught as many legal crabs and only half as many illegal crabs as the Standard.

In July and August 1959, the remaining two types were compared with the Standard and the highly successful welded-wire pot tested the previous year. The performance of the 1½- x 2-inch mesh pot was again similar to the Standard in catching legal crabs and superior in that it held only half as many illegal crabs. The other two types caught too few crabs, indicating that meshes were too large. We believe that a slight increase in the dimensions of the 1½- x 2-inch mesh would improve its culling ability without lowering its catch of large crabs. We have made plans to test at least one modification in 1960.

It must be recognized that no fabric superior to the 1½-inch mesh hexagon netting is commercially available at present. If it is decided that one of the new types of mesh being tested should be mandatory by law, then the Laboratory recommends that the period of replacement be long and gradual. This will allow solution of manufacturing problems and avoid forcing Virginia potters into an economic pinch.

Ichthyology Research Section

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<i>Assistant Biologist</i>	ANTHONY L. PACHECO
<i>Assistant Biologist</i>	C. E. RICHARDS
<i>Laboratory Technician</i>	CARROLL FOSTER

Migratory Fish Research

Croaker

The primary concern of croaker research has been to obtain information that might help explain the extreme fluctuations characterizing this fishery. The extent of these fluctuations are illustrated in Figure 7, which shows croaker landings since 1890 when catch records were first obtained from Virginia fishermen. Landings increased from one million pounds annually to more than 55 million pounds in 1945. Since then catches have declined precipitously until 1952 when only four million pounds were landed. Although landings had tripled by 1957, they are again declining and many believe that 1959 will be one of the worst on record for croakers.

A routine sampling program for both age and length composition of commercial catches has been conducted. In addition, since 1956 some fishermen have cooperated by keeping daily records of both their catches and fishing effort. Periodic airplane surveys have indicated, for pound nets especially, the total amount of fishing from month to month. Information on the relative abundance of young croakers in the nursery areas has been obtained from monthly trawl surveys. These surveys have resulted in useful information concerning the relative strength of reproduction from one year to the next.

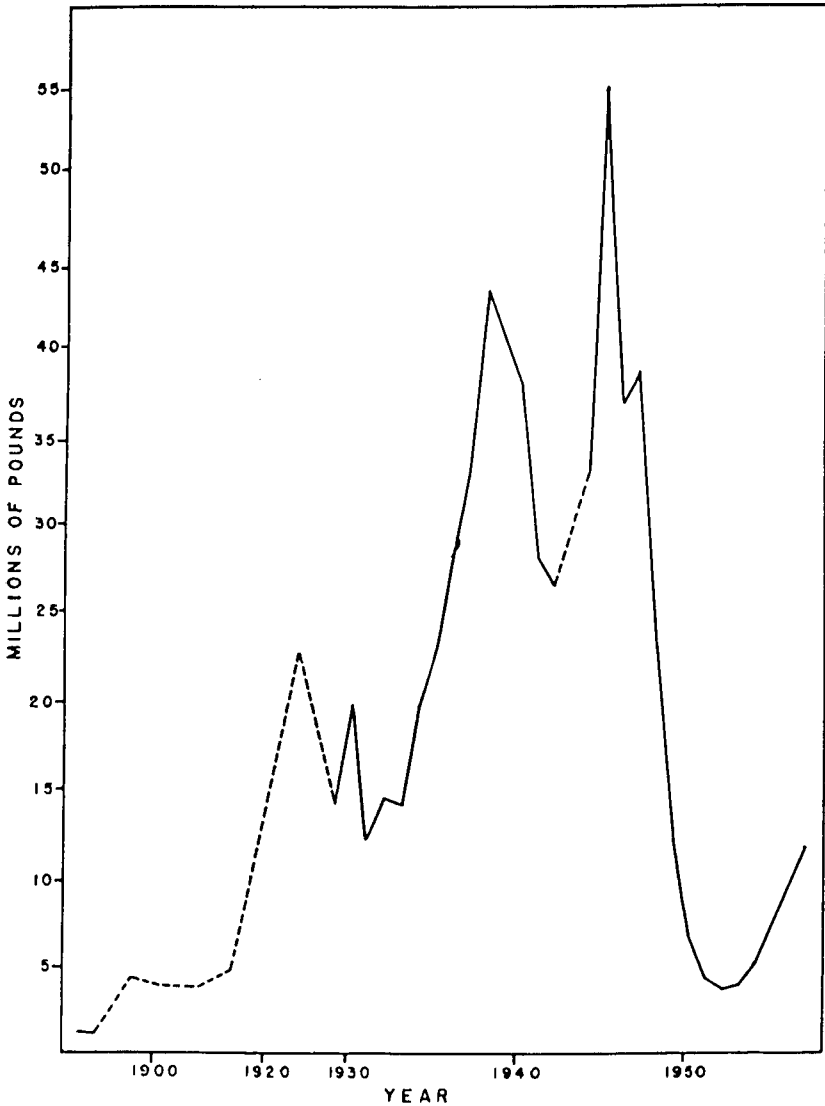


Figure 7. Virginia croaker catches from 1890 to 1957. Broken line indicates years for which consecutive catch records are not available.

The discovery during the extremely cold winter of 1957-1958, that young croakers, which were abundant in nursery areas of the upper York River in late summer and fall, had almost completely disappeared in midwinter was especially significant. In spring of 1958 small fish sampling was extended to include the James and Rappahannock in addition to the York River system. In cooperation with the Chesapeake Biological Laboratory of Maryland, young croaker surveys

were expanded to include the entire Bay. Few young croakers were captured. Young or "pinhead" croakers, generally abundant in fall pound net catches, were rare in catches made in fall of 1958. Based on this evidence, poor catches were predicted for 1959.

Fishing in 1959 has shown the prediction to be essentially correct. Croakers have been scarce and those caught have been mostly large fish spawned prior to the winter of 1957-1958.

Winter surveys on croaker nursery areas in 1958-1959 have indicated, for the second year in succession, that few young croakers survived the winter. Unfortunately, another poor croaker season can be predicted for 1960.

Additional information on croaker migrations and mortalities was obtained from tagging studies. During the 1957 and 1958 fishing seasons 3,894 adult croakers were tagged and released in the James, York and Rappahannock as well as in the Bay. Recaptures of tagged croakers have shown that after June, most croakers remained in the river in which they were tagged. In winter three tagged croakers were recaptured by trawlers fishing off Cape Hatteras. In 1958, fourteen croakers tagged in the York River in 1957 were recaptured, 13 from the York River and one from Hampton Roads.

Preliminary analysis of recapture data has indicated that the annual mortality rate for croakers ranges from 60 to 70 per cent. Only about 10 per cent of the annual mortality was caused by fishing. Apparently fishing plays a minor role in reducing the numbers of croakers.

Gray Sea Trout

Gray sea trout are still at a low level of abundance. Continuing studies have shown a gradual decline in the fishery since 1955. Commercial catches consist primarily of trout that are one and two years old. Young fish surveys have also shown a decrease in the number of young fish since 1956. Annual mortality estimates based on the age structure of fish sampled from commercial pound nets indicate that more than half of the trout die or leave Bay waters each year. Sea trout are so delicate that most tagging has not been successful. In the absence of tagging data, it is not possible to separate fishing mortalities from death or emigration.

The contribution of each year class to the commercial pound net fishery may be estimated from age composition analyses and catch records. Of the 1955 year class about eight million trout were caught in 1956 while less than four million were taken in 1957. About eight million trout of the 1956 year class were captured in 1957. Estimates for 1958 have not been completed. By comparing estimates of the contribution of each year class to the fishery for successive years and comparing these estimates with the results of young fish surveys, it should be possible to predict commercial catches a year ahead.

Spot

Spot are characterized by rapid growth and high mortality rates. Some spot are captured in the commercial fishery before they become one year old, but most are taken at one and two years of age. Annual mortalities of up to 80 per cent have been estimated but the amount of reduction caused by fishing is not known. It seems probable, however, that fishing is responsible for only a small percentage of the annual mortality.

Small fish surveys showed the 1956 spawning to be an extremely successful one and age composition analyses from the commercial pound net catch showed that most spot caught in 1957 and 1958 were from this 1956 spawning. It is anticipated that some very large spot will be captured in 1959. These represent the survivors from the 1956 year class.

Striped Bass

Initial phases of the Chesapeake Bay cooperative striped bass program have not been completed. This joint undertaking of biologists from the U. S. Fish and Wildlife Service, Chesapeake Biological Laboratory of Maryland, and Virginia Fisheries Laboratory has been primarily concerned with obtaining direct information on the origin and movements of the three subpopulations of striped bass found in Chesapeake Bay. In spring of 1957, 1,435 striped bass were tagged in the James, York, and Rappahannock Rivers and in February 1958, 1,004 were tagged in the York.

From the recapture of tagged fish it is evident that most striped bass remained in or near the river in which they were tagged. Ninety-eight per cent of the tagged James River rock were recaptured in the James. Ninety-seven per cent of the fish recaptured from Rappahannock River were caught in the Rappahannock or neighboring Piankatank River and 86 per cent of the fish from York River were recaptured in the York and its tributaries, the Pamunkey and Mattaponi, or in Mobjack Bay just north of the York River mouth. Striped bass that left the vicinity of the Rappahannock moved up Bay to Maryland waters. Eleven striped bass, ten from the York and one from the James were recaptured outside of Chesapeake Bay, one in Maine, three in Rhode Island, two in New York, two in New Jersey, one in Delaware, and one in North Carolina.

Major efforts in the cooperative striped bass study are now being concentrated in the Potomac River, where an intensive program of tagging, catch sampling, and studies on both commercial and sport fisheries is now in progress.

One of the most important recent findings in striped bass research was the discovery, in spring of 1958, that reproduction was more successful than it had been for a number of years. Generally only small numbers of young striped bass are taken by small fish trawls. In the June and July surveys, ten times more young striped bass were caught than had been taken in samples obtained in previous years. Maryland biologists found reproduction in their waters was highly successful in 1958. In 1959 large numbers of small, presumably one-year-old, striped bass are being captured by both commercial and sport fishermen. Striped bass fishing should improve as these small fish grow larger.

Shad

Increased emphasis on croaker, gray sea trout and spot has necessitated restricting research on shad. Catch and effort records have been obtained from some York River fishermen and in spring of 1959 an intensive program was undertaken on the York to obtain measures of total catch, fishing effort and rate, size of run and spawning, escapement with the cooperation of the U. S. Fish and Wildlife Service. The results of this program and information accumulated from past

studies will be of considerable value in attempting to determine the causes of changes in abundance of shad in the York River system.

Menhaden

Basic studies on menhaden, the most valuable fish from Chesapeake Bay, have now been completed. Menhaden mature and spawn for the first time at about one and one-half years of age. Spawning takes place off the mouth of the Bay in late fall and winter. Small menhaden move into the Bay in spring to upriver waters of low salinity and gradually move down river in summer. The larger individuals appear in pound net catches in late summer and fall. With the approach of winter most menhaden leave the Bay, probably moving south. Menhaden reappear in the Bay in spring when they are taken by both pound nets and purse seines. Purse seines, however, account for 98 per cent of the total catch.

Length and scale measurements have shown that ages can be interpreted from scales. Most of the menhaden taken by purse seine are two and three years old, while catches from pound nets consist of fish in their first and second years. Since the fishery is dependent to a large extent on the brood of a single year, a failure in reproduction seriously affects the fishery.

The ability to predict the success of spawning would be of considerable benefit to the industry. This may be done by a special study of scrap fish catches in the pound net fishery. A more direct measure may be obtained by spawning ground surveys. Quantitative sampling of the eggs and larvae should reveal extreme variations success or failure in reproduction and might even suggest hydrographic factors influencing reproduction.

Sport Fishing Survey*

A continuation of the study of salt water sport fishing in Virginia for the 1957-58 seasons indicated further growth in the popularity of salt water angling and significant changes in the availability of important species. Increases in fishing trips by private boats and small rental boats were great. In contrast, the number of party boat (for hire with captains) trips within Chesapeake Bay actually decreased.

Total trip estimates (Table 1) are based on boat counts made from airplanes and counts made daily from the York River Bridge. A 31 per cent decrease in party boat activity and a 30 per cent increase in other boats fishing is indicated for York River. All other areas show greater increases in private and small boat fishing trips. The James River area also showed a significant drop in numbers of party boat trips from 1957 to 1958.

The estimated total sport fishing catch of the important bottom fishes was obtained from log book and interview catch records during 1957 and by log books alone during 1958. Croaker, spot, gray sea trout, and flounder continued to be the most important fish, but changes in relative abundance were obvious (Table 2). During the 1958 season the numbers of spot taken exceeded the croaker catch for the first time since the survey began and the flounder catch moved into third place above gray trout.

*By C. E. R.

Changes in the catch rates (number of fish caught per man hour of fishing) were very interesting (Table 3). For this comparison only private boat catch records were used because of a lack of party boat records for 1958. These records show that for 1958, croaker catch rates held up to their usual level only in the James River area declining in all others. Catch rates for spot remained essentially the same during the 1957-58 seasons except for the Rappahannock and Eastern Shore areas where the 1958 catch rate was approximately double its past levels. Gray trout catch rates show a continuing decline with the 1958 figures approximately half the previous level. Flounder availability jumped from 3 to 20 times higher during 1958, showing an amazing increase. In general spot and flounder fishing was good while croaker and gray trout catches were poor in most areas in 1958.

Catch record collection from the ocean side of the Eastern Shore was also continued during 1957-58 and a report on these data is being written.

Fishing piers in Virginia's tidal waters have increased from only one in 1955 to seven during 1958. All are located in the lower Peninsula and Norfolk-Virginia Beach area. The catches made from piers are also under study.

TABLE 1
ESTIMATED NUMBERS OF SALT WATER FISHING TRIPS DURING 1957 AND
1958 WITHIN THE VIRGINIA PORTION OF CHESAPEAKE BAY
AND TRIBUTARIES

	York Check Area	Total York River	James River	Ocean View	Rappa- hannock River	Eastern Shore	Total
PRIVATE BOATS:							
1957.....	13,340	19,822	31,607	17,403	19,190	5,705	93,727
1958.....	13,129	26,533	98,266	84,089	57,622	19,186	285,696
PARTY BOATS:							
1957.....	1,945	1,945	22,538	6,344	20,450	2,927	54,204
1958.....	1,318	1,318	7,777	8,832	17,003	2,372	37,302

TABLE 2
ESTIMATED TOTAL CATCH IN NUMBERS OF FISH FOR 1957 AND 1958
BY SPORT FISHERMEN IN VIRGINIA
CATCH (NUMBER OF FISH)

YEAR	Spot	Croaker	Gray Trout	Flounder
1957.....	3,385,000	3,812,000	486,000	59,000
1958.....	6,886,000	6,072,000	360,000	983,000

TABLE 3
 A COMPARISON OF THE AVERAGED MONTHLY CATCH RATES FOR 1958
 WITH AVERAGES FOR 1955-1957. PRIVATE BOAT RECORDS ONLY

	York	James	Rappa- hannock	Ocean View	Eastern Shore*
CROAKER:					
1955-57 Average.....	1.81	2.12	1.12	1.66	2.09
1958 Average.....	0.71	2.00	0.12	0.98	0.42
SPOT:					
1955-57 Average.....	0.29	0.45	1.40	1.60	0.55
1958 Average.....	0.32	0.28	3.53	1.37	1.46
GRAY TROUT:					
1955-57 Average.....	0.21	0.05	0.41	0.05	1.06
1958 Average.....	0.03	0.02	0.21	0.03	0.62
FOUNDER:					
1955-57 Average.....	0.03	0.02	0.01	0.03	0.18
1958 Average.....	0.22	0.07	0.07	0.71	0.45

*(1955 data not available).

Pollution Research Section

Biologist in Charge.....DR. MORRIS L. BREHMER

The Pollution Research Section was established January 1959 to undertake studies relating to the effects of natural and foreign contaminants on the plants and animals of our estuarine waters. This unit will cooperate with the other sections of the laboratory in problems concerning commercially important species, aid the State Water Control Board in its research problems and conduct fundamental research concerning the more subtle effects of pollutants.

The initial phase of the research program consists of determining the seasonal nutrient patterns of our estuarine systems and of relating the shell and finfish food production to these nutrient patterns and to seasonal conditions. The value of this basic investigation might well be compared to the establishment of "normal" values for human body temperatures, pulse rate, etc. Obviously, it is impossible to determine abnormal conditions if the normal is unknown.

York River has been chosen for the initial study because of its accessibility and the presence of major industries at the mouth and source. Data obtained will be correlated with oyster "condition" data compiled by the Mollusc Research Section to determine if the aberrant "condition" values found for York River oysters results from a low available food supply or from a physiological response due to contaminants.

The "pink oyster" condition continues to plague oyster packers periodically. The maintenance staff of the Laboratory has constructed a constant temperature culture cabinet so that the microscopic plants frequently suspected of producing the red coloration in packed shellfish products can be grown and investigated. This study will involve the extraction and separation of the pigments found in the microscopic plants and the attempt to induce the coloration under laboratory conditions. If the methods and techniques are successful, we hope to be able to

perfect methods on which predictions of the occurrence of the "pink oyster" condition can be based.

The Pollution Research Section hopes to be able to expand its activities and staff as space permits and place more emphasis on investigations of the subtle effects of industrial and domestic wastes on the flora and fauna. It is apparent to us that coastal Virginia has a much higher industrial potential than is realized at present. Future increased industrialization of the area will present new problems and effects on marine resources. We must be able to study the effects of specific wastes on all stages of the life history of the marine organisms so that future recommendations can be based upon sound scientific research. At the present time most of the research regarding the toxicity levels of industrial and domestic wastes has been carried out in inland regions on freshwater organisms. Since the effects of a contaminant may show tenfold differences in toxicity in fresh waters of varying characteristics, we can hardly speculate as to subtle effects in marine waters.

The Laboratory is receiving more and more inquiries concerning radioactive wastes and their effects on marine life. It is our responsibility to conduct basic research concerning the uptake, concentration, and elimination of radioactive wastes by marine organisms. There are many fishes that spend a part of their life in the open sea before returning to coastal and estuarine waters and, therefore, might come in contact with radioactive wastes during certain periods of their life cycles. In addition, scientists working on other research should have facilities and technical advice on the use of radioactive isotopes in their research. This tool will open up vast research possibilities. We should also expand our radiobiology teaching program so that the students graduating from the Laboratory will be familiar with the useful tool provided by radioactive isotopes for marine research.

Pathology Research Section

Biologist in Charge.....DR. JOHN L. WOOD
Marine Microtechnician.....MRS. DOROTHY K. EMORY

Because this department has only been in operation since July 1959, there is little to report. Progress has been made in setting up facilities for slide-making, and diagnosis has begun. To date several promising staining techniques have been developed for use with the various fungi occurring in oysters.

The Pathology Section also has assisted in diagnosis of pathological conditions in other fishery populations (see immediately below).

Without doubt this research group will materially aid our investigations and improve services to the Commonwealth.

Special Investigations

Fish Kills

Each year several reports are received concerning unusual mortalities of fishes, 1958-59 has been no exception. The usual number of complaints about fish kills have been investigated by our biologists, who have usually been successful in tracing the cause. For example, a report of large numbers of fish being washed up on the shore at Silver Beach in Northampton County was followed up by an immediate airplane survey of the vicinity. The fish were identified as menhaden. A quick check disclosed that a sizable fleet of menhaden boats had been operating in that vicinity for over a week. The likelihood that the "kill" was caused by a lost or dumped catch is extremely strong.

More recently a mortality of catfishes in fyke nets in the vicinity of Hopewell was found to be due to Columnaris disease caused by a bacterial organism which often becomes extremely troublesome when water temperatures are very high as happened several times during the summer of 1959.

Because mortalities are often serious and cause significant reductions in all fishery stocks, crabs, fishes, and oysters, and because all of the causes of such reductions must be understood before the effects of fishing pressure can be properly evaluated, it is necessary that research into natural diseases and mortalities be continued and expanded. An expanded pathology research section will aid greatly in this work and establish Virginia as a leader in this important but neglected field of marine science.

Rappahannock River Condition

For some time the Rappahannock River has been particularly troublesome because of regularly recurring low oxygen levels in summer and numerous complaints about pollution. As a result, the Laboratory, the Water Control Board and Chesapeake Bay Institute have undertaken an extended and detailed series of observations of that river from its mouth to Fredericksburg. Extremely low pH's have been obtained from the upper reaches of the river, indicating that a highly acid contaminant is being introduced upstream. Low oxygens also prevail in the upper portion at times, but reoxygenation is usually well on its way before the water gets too far downstream.

The usual low summer oxygen levels have been observed in the lower portion of the river, but these are probably due to stagnant conditions in the deeper waters. On the whole oxygen levels have been fairly satisfactory all summer at oyster-growing depths in the lower Rappahannock River. Barring some late summer or fall catastrophe, conditions should remain reasonably satisfactory for the remainder of 1959.

This river condition study will be continued through 1960 and actually expanded when Dr. Bruce D. Nelson of Virginia Polytechnic Institute will also begin to study the bottom sediments of the entire river.

Parasites of Fishes

Under contract with the National Institutes of Health, the Laboratory has been conducting a study of certain parasites of fishes of Chesapeake Bay and the Atlantic coast.

Present indications are that it may be possible to use certain parasites of menhaden as living tags to determine where certain segments of the population come from. If this is possible the information thus obtained will be useful in studying movements and migrations of menhaden schools.

Library

Librarian.....MISS EVELYN WELLS

Since the beginning of the Laboratory in 1940, the library has expanded to include over a thousand books and a large collection of pamphlets, reports and reprints. About 150 serial publications are being received regularly by purchase or exchange. The collection is now one of the best in marine biology on the East coast, except for very large institutions.

Credit for assembling this valuable reference library is due Mr. W. A. Van Engel who was acting librarian for twelve years. Much of the work involved was of necessity done on his own time.

By 1958, the library had outgrown the space available. In the rearrangement of the building the stack room was enlarged. A reading room was created in part of the space formerly used for the women's dormitory. This room now houses the map case and globe and provides shelves for the books and reference works. The librarians office, once the men's dormitory, now has room for the reprint collection, the card catalogue, the microfilm reader and the supply of Laboratory publications available for exchange.

The increased size of the library and its greater use by the much larger staff soon demanded the services of a fulltime librarian. Over 800 of the books have now been catalogued by the Library of Congress system and it is expected that the entire library will be catalogued within the next biennium.

In 1958-59 about 200 new books were bought, 130 volumes of serial publications were bound, and several new journals were added to the exchange list. Complete sets of three journals of special interest in marine biology were also purchased. Continued improvement of this important facility is essential to maintenance of satisfactory research and teaching efforts.

Chesapeake Bay Institute

Director.....DR. D. W. PETCHARD

Long needed before it was founded in 1948, the Chesapeake Bay Institute of Johns Hopkins University is of great service to the two states and the federal government which help support it. Scientists of the Institute have made important

advances in adding knowledge about the waters of Chesapeake Bay and its tributaries.

Every year four major hydrographic cruises are conducted by the two vessels *Maury* and *Lydia Louise II*. These cruises are designed to provide long-range seasonal information regarding salinity, temperatures, currents and wind and wave patterns in the Bay and its tributaries. In addition, special short-term cruises are conducted to areas which are causing particular trouble or are of specific interest such as the Rappahannock River, mentioned above.

It is easily understood that detailed knowledge of the physical forces acting in the water is vital to an understanding of the movements and responses of fishery organisms and, therefore, important to the commercial and sport fishing industries.

Detailed hydrographic information is equally important to studies of the effects of industrial and domestic pollutants and large-scale engineering projects. Since requests for information and recommendations from this Laboratory and the Institute, itself, continually increase, it is clear that Chesapeake Bay Institute is extremely important to the Commonwealth.

The large-scale hydrographic surveys mentioned above are beyond the present resources of either Maryland's Chesapeake Biological Laboratory at Solomons or the Virginia Fisheries Laboratory. Thus by their special knowledge and efforts scientists of Chesapeake Bay Institute free their associates in the state laboratories for biological studies which are equally important. The team comprised of the Chesapeake Bay Institute and Virginia Fisheries Laboratory is a very effective research unit.

The services of Chesapeake Bay Institute will be especially needed in the offshore spawning grounds study and the Hampton Roads survey which we hope to be able to carry out in the next three years. These studies are especially important, particularly the latter, in the light of the tremendous development of nuclear shipping which is expected in the next few years.

We urge continued support of the Chesapeake Bay Institute by the Commonwealth of Virginia. The work of this group has contributed in many ways to the entire economy of Virginia and will continue to do so in the future. Its work is more necessary than ever.

Graduate Instruction

Mr. Clyde L. MacKenzie completed his graduate studies in the spring of 1958 and received his M.A. degree from the College of William and Mary. His thesis research concerned the reproduction and growth of *Eupleura caudata*, the rough oyster drill. He is now employed at the U. S. Fish and Wildlife Service, Bureau of Commercial Fisheries Biological Laboratory at Milford, Connecticut, under Dr. Victor Loosanoff.

Mr. John W. McMahan completed his graduate studies in the spring of 1959 and received his M. A. degree in Marine Biology from the College of William and Mary. The subject of his thesis research was the monogenetic trematodes of Chesapeake Bay fishes. Mr. McMahan is currently enrolled as a graduate student at the University of Toronto where he is working toward his doctoral degree.

Two graduate students, Messrs. Richard B. Moore and Reinaldo Morales-Alamo, are currently enrolled. Mr. Moore is studying the microanatomy of oyster drills and Mr. Morales-Alamo is studying parasites of fishes.

One new graduate student, Mr. Peter Eldridge from the University of Massachusetts, enrolled for the fall term. Numerous applications have been received for admission to graduate study. We have followed our policy of rigid screening of such applications and refused more than have been recommended for acceptance. Several applications are still pending.

The experimental High School Teacher Research Training Program in Marine Science financed by the National Science Foundation was so successful that we plan to request its continuance. During the summer of 1959 twelve high school science teachers from Virginia, New Jersey, Ohio, Florida and Texas received training and experience in marine research under this program, which was designed to make their teaching more effective.

Undergraduate Instruction

Also in cooperation with the National Science Foundation the Laboratory conducted an experimental program in the summer of 1959 designed to provide college biology majors with actual experience in biological research. Nine undergraduates from various Virginia colleges and one from a Texas school carried out supervised research projects and attended tri-weekly lectures, thus acquiring valuable training in biology and a detailed preview of biological research as a career.

It is hoped that this very valuable program will also be continued.

Public Education Department

Biologist in Charge.....ROBERT S. BAILEY

The training program for school groups at the Laboratory continues to be popular. Approximately 4,300 students and teachers have come for conservation programs at the Laboratory in the past two years. In addition, approximately 5,000 casual visitors also viewed our facilities. Some 600 of the casual visitors were from out of state or foreign countries. Programs were given for several scout units, and several college groups spent time at the Laboratory collecting, studying, and becoming familiar with marine science.

In response to requests for literature and information from all over the Commonwealth and even out-of-state, an estimated 5,000 pieces of printed material has been sent out. Among the materials sent out were Mr. Bailey's "Let's Be Oyster Farmers" and our "Treasures from the Sea", for which many requests are regularly received.

Many talks have been given to service clubs, fishermen's organizations and other public groups both by the Education Department and other members of the Laboratory staff. Often motion pictures of various phases of the commercial and sport fishing industries and marine research were shown with these programs.

Though the regular series of television programs has been discontinued for want of personnel and funds, several educational TV programs were put on for the Norfolk Public Schools Program—"Classroom of the Air."

Several motion pictures have been made at the Laboratory. Subjects are: Fisheries Research, Menhaden Schooling, Crab Pot Research, Jelly Fish, and Sampling at Sea. Staff members have cooperated with several feature writers of newspapers and magazines in preparing articles on marine research and fisheries. Approximately 50 press releases have been prepared. These were printed by local, state and, in some cases, out-of-state papers and magazines.

In addition to overseeing and carrying out all these activities, Mr. Bailey served as Director for the National Science Foundation Summer Institute programs involving 22 students, both undergraduate and high school teachers.

The Public Education Department continues to be a most useful adjunct to the research activities of the Laboratory. It is axiomatic that in order to be effective we must get our discoveries and ideas across to the public. Only publicity and more formal public education programs will accomplish this. Unfortunately, for some time the facilities of this department, a "one man" operation, have been vastly overloaded. It is hoped that this condition can be remedied in the next biennium.

Facilities

The annex building under construction in 1957 was occupied in May 1958. This combination dormitory-laboratory facility was a much-needed addition but overcrowding still persists because of the rapid increases in scientific personnel and the student body. Needed are a new mortality and pollution research building with an adequate running sea water system to house the physiology, radiobiology, biochemistry and pollution research laboratories and facilities for controlled environment experiments; a permanent field laboratory for the Eastern Shore Branch at Wachapreague; an enlargement to the existing maintenance shop; and, several other small projects to improve existing facilities.

Changing emphasis of the program and increased demands for the services of the Laboratory require that several new buildings and structures be constructed at Gloucester Point and on the Eastern Shore. To accomplish this a capital outlay program of significant proportions is necessary.

Personnel

Dr. John L. McHugh, Director of the Laboratory since 1950, resigned in January of 1959 to become Chief of the Division of Biological Research, U. S. Bureau of Commercial Fisheries and the Laboratory lost the services of an excellent administrator-scientist.

Dr. William J. Hargis, Jr., member of the research staff since 1955 was appointed Acting Director in January and Director in May.

Mr. Anthony L. Pacheco resigned from the scientific staff on July 1, 1959, to accept a more remunerative position with the U. S. Bureau of Commercial Fisheries.

Dr. John L. Wood, formerly of the University of Cincinnati and The Johns Hopkins University, accepted the position as Marine Pathologist authorized by House Bill 107 of the Special Session of the General Assembly. Mr. H. D. Hoese,

formerly with the Texas Fish and Game Commission was employed to fill a position in the oyster research section created under the same authorization. Dr. Bernard L. Patten, a recent graduate of Rutgers University, filled the vacancy created by Dr. Hargis' promotion. Dr. Edwin B. Joseph, formerly of Birmingham Southern College, accepted a new position as head of the Ichthyology Research Section. Dr. Morris L. Brehmer has been employed to fill a position as pollution biologist authorized by the 1958 Session of the General Assembly. Mrs. Dorothy K. Emory accepted the position as Marine Microtechnician working on oyster mortalities.

As usual the staff has been augmented each year by visiting professors and student assistants. Dr. Willis G. Hewatt of Texas Christian University and Dr. Robert W. Ramsey of the Medical College of Virginia have returned each year to teach courses and assist in the research program. In addition, Dr. Sewell H. Hopkins of Texas Agricultural and Mechanical College spent the summer of 1959 at the Laboratory teaching a course and doing research on oyster parasites.

Miss Patricia Conner was promoted from Clerk-Stenographer to Confidential Secretary. Her former position has been filled by Mrs. Audrey Jordan. Miss Barbara Jenkins was employed to fill a position created as the result of occupancy of the annex building. Mrs. Roberta White replaced Mrs. Jeanne Cook as Clerk-Typist to assist Mr. Bailey. Miss Evelyn Wells accepted the post as Librarian authorized by the last General Assembly.

To service the steadily growing staff and physical facilities of the Laboratory we have been fortunate in securing the services of Mr. Hayes Bolden as Electrician Assistant. His skills in plumbing and electrical work are important assets.

Summer assistants, mostly college students, have been employed as funds permitted. This excellent program provides financial assistance to the students, provides the regular staff members with valuable assistance at their busiest time, and furnishes valuable training and experience to these young scientists. Several young assistants have been encouraged to consider marine and fishery science as life-time professions.

Summary and Recommendations

Shellfish

Continuing Delaware Bay mortalities serve to emphasize the importance of studies of the diseases and predators of fishery organisms, thus vindicating our long occupation with *Dermocystidium*, the warm water oyster fungus, and other causes of oyster mortality. As a result of the work of Drs. Andrews and Hewatt and Mr. Haven and their associates this Laboratory has made perhaps the most thorough long-term, continuous record of mortalities of any on the Atlantic coast. Thus, we are in a much better position to detect the possible invasion of Virginia waters by the Delaware trouble than if the work has not been done. The expanded oyster research group, plus the Pathology Section and the staff of the new Eastern Shore facility, is now deeply involved in the search for the causative organism and an extensive monitoring program. The monitoring program is designed to give advanced warning of encroachment of the disease so that oystermen may make preparations to market oysters and take other steps to cushion the blow should the mortality strike.

A disease-resistant stock breeding program, oyster genetics, should be undertaken at once. Development of such oysters will permit rehabilitation of the industry at a much faster rate should the mortality strike. Other problems of shellfish breeding which offer promise of improvement of the industry should also be undertaken. Requests for facilities and personnel to do this work will be included in the next biennial budget request. In addition, it is hoped that the mortality program authorized by the Special Session of the General Assembly will be continued. Because of the recent experiences with the Delaware oyster mortalities and the difficulties of preventing importation of possibly contaminated shells and oysters from Delaware and New Jersey it is possible that the Commission of Fisheries should be empowered to halt such imports and exports should the need arise in the future. The Commissioners of several other states now have such powers. These powers should not be exercised unless there is sound scientific reason to do so.

Continuing studies of oyster setting suggest that putting cultch overboard more than two weeks ahead of time is wasteful procedure. The use of shellbags as collectors has proved to be of value in obtaining sets, particularly if they are planted at the proper time, which normally is about the first two weeks in August. The average peak of setting in the James River is usually from mid-August to mid-September.

Studies indicate that South Carolina seed oysters can be used successfully in high salinity waters of Chesapeake Bay provided severe winters do not occur. But because of their susceptibility to cold, and their inferior shape, size, and shucking characteristics we do not recommend their use in Chesapeake unless local seed production fails.

Condition index studies indicate that *Dermocystidium* and pea crabs affect the quality or yield of oysters, as does age. Present indications are that York River oysters should be harvested in May and June for optimum yield per bushel, because they usually reach the peak of condition at that time. Rappahannock oysters have two peaks, one around the last week in May or early June and another in November and December; therefore, yields will be good at both periods. Of course, if spring market is not favorable there is little advantage in harvesting at that time in either river, but from a biological point of view meat yields will usually be greatest then. In these times of adequate refrigeration and rapid transport there seems to be no reason, except popular prejudice, why oysters should not be marketed and consumed in these early summer months even though they lack "R's." If such marketing is possible, profits will be greater.

Though drill populations on oyster beds in Chesapeake Bay seem small in number as compared to those in nearby eelgrass beds or on the oyster bars of Seaside, there is a strong indication that these predators quickly and regularly ruin otherwise commercially valuable oyster sets. We have evidence that many Bay areas which receive regular but small strikes would be productive were it not for these pests. Thus, if drills could be eliminated much money and effort required to transfer seed oysters into these areas would be saved and the pressure on James River relieved. Therefore, the oyster drill research, which for five years has been supported by the Fish and Wildlife Service out of Saltonstall-Kennedy funds, should be continued even when Federal support is discontinued.

Blue Crabs

Catch records dating back to 1924 show no indication that the blue crab is decreasing in abundance. Actually, catches in 1957 were below the 30-year average, while those of both 1956 and 1958 were above the average. It has been pointed out that fluctuations in catch of fishery organisms are to be expected, particularly in a short-lived animal like the crab which is available to the fishery only a short time. In such an animal there is no back-log of older individuals to provide a buffer if a bad spawning year occurs.

The magnitude of the crab catch is determined by many variables. These include not only abundance of crabs but, weather, market affecting the number of fishermen in operation and the efficiency of the gear. It is often forgotten that, like other migrating species, crabs move in response to various "weather" conditions in the water. Thus, they may actually be plentiful but not available because they have moved away from a particular area. (This is another of the many reasons that an understanding of currents, waves, temperatures, salinities, tides, and pollution is important to the marine biologist.)

There seems little biological reason to alter the sponge crab or dredge fishery regulations at the present time. Closed military areas and the large sanctuary prevent free exploitation of the population and it would be extremely unwise to reduce earnings of fishermen unless an ultimate benefit would result. Because catches of Virginia crabbers often consist of 20 to 30 per cent or more sponge crabs and because crabs produced in several other southern states might permanently fill any vacancy produced in the market by withdrawal of such a large number of Virginia crabs, the result might actually be commercially detrimental.

The young crab program is continuing. Though techniques are not yet fully satisfactory, we have been remarkably successful in predicting the catches of the last several years. This year's low was predicted six months or more in advance of the fishery.

The interest in tank-shedding of crabs for the soft-crab market has increased considerably. As a consequence inquiries concerning accompanying problems have also increased. The Laboratory needs enlarged facilities for studying these problems.

Because large numbers of young blue crabs are captured in crab pots and are either killed or damaged in handling, a self-culling pot would be a sound conservation device. By such a device crabs would be rejected by the pot until large enough to be salable and worthwhile. The crabber would also be saved much hand labor in culling. Tests of five types of mesh showed that pots made of specially-manufactured 1½ by 2 inch mesh welded wire caught as many legal and only half as many illegal crabs as the pot now in general use. Efforts are being made to improve its performance. Unfortunately this special wire is not available commercially. It is likely, however, that wire manufacturers will supply it when demand develops.

Fish

The croaker, the mainstay of Bay food and sport fisheries, has been in extremely short supply this year and are likely to be so again in 1960. This was predicted by our ichthyologists as early as March, 1958. There is no evidence that overfishing of the spawning stock was the cause, however, because very large numbers of young croakers were seen in the Bay in January, 1958. But,

by March they had all disappeared. Thus, this year's shortage was not due to a poor spawning in 1958. Some other phenomenon either killed, the most likely possibility, or carried the young fish away. Probably the prolonged periods of extremely cold water temperatures which occurred in January and February of that year did the damage, but this is not certain. This uncertainty clearly exemplifies the need for more detailed information about the effects of such factors as temperatures and salinity responses of young fish and the effects of temperature, currents and salinity, both without and within the Bay, on the movements of these organisms. For this reason a well-coordinated hydrographic and biological study of the inshore ocean area off Capes Charles and Henry would be tremendously valuable in furnishing more complete and accurate knowledge of the spawning and movements of the croaker and other species like the spot and menhaden which run to the sea to spawn.

For reasons not presently understood gray sea trout catches are extremely small. It is hoped that present young fish studies will shed light on this phenomenon. Spot have been somewhat more plentiful than croakers in 1959. Studies have shown that an annual mortality of up to 80 per cent occurred in Bay spot populations. The proportion of the population decrease actually due to fishing is not known. Studies of natural mortality of this and other fishes are needed in order that we may know what level of fishing pressure is allowable. Obviously, for every species there is an optimum amount of fishing pressure above which future stocks are damaged and below which marketable fish go to waste unnecessarily. One of the aims of fisheries research is to discover these optimums.

As was predicted the population of striped bass has been extremely large this year. Most taken in the fishery have been only pan-sized but, unless a catastrophe occurs, next year's catches should be both large and numerous. Since this condition is apparently Baywide the vociferous cry that overfishing was destroying striped bass populations seemed to have been somewhat overstated.

Menhaden, the most valuable fish in the Bay, have been in short supply in 1959. The causes are not known. Our studies show that normally most of the purse seine catches are of two- and three-year-old fishes. Pound nets take one- and two-year-olds. Because the fishery depends mostly on a single year class, failures in spawning show up drastically and immediately. Projected young fish surveys and spawning ground studies may help clarify some of these unknowns.

The sport fishing survey, underway since 1955, continues to yield noteworthy information. Data collected in the Bay up to 1958 indicate that while party boat fishing has decreased by approximately 30 per cent since 1957, small boat fishing trips are up by about 300 per cent. (There may be a direct relationship between an increase in the numbers of boat owners and the decrease in party boat use. If this is so the amount of money invested in small vessels for sport fishing has also drastically increased.) Thus, it is apparent that the sport fishing industry is rapidly increasing in importance.

It is interesting that despite the large catches of flounder which have been taken the last few years on Seaside and in lower Chesapeake Bay, the flounder fishery is experiencing one of the best years on record. Both sport and commercial catches are large. Perhaps this is a mass migration phenomenon in response to water "climate" changes. Offshore research should do much to clarify the uncertainties involved.

Recent investigations of fish dying in fyke nets in the James near Hopewell were investigated by Laboratory biologists. Specimens brought to the Labo-

ratory for study proved to be suffering from Columnaris disease, a bacterial infection. This appears to be a summer mortality phenomenon occurring regularly as water temperatures reach summer highs. Because at its peak this mortality involves nearly one hundred per cent of the fishes in nets, it seems that fyke fishermen can save time and effort and wear and tear on gear by ceasing to fish when the skin ulcerations characteristic of the disease appear on a large percentage of the netted fishes. The need for continuing study of diseases and predators of fishery organisms is again apparent.

There seems no biological reason for passage of new laws intended to remedy any of the shortages occurring in fish populations this year because there is no sound evidence that restrictions would help increase the populations involved.

Chesapeake Bay Institute

No research investment has been more well-rewarded than that made in the Institute. The Laboratory and the Commonwealth are fortunate to have such valuable technical assistance. Scientists of the Institute are largely responsible for most of the detailed knowledge of the hydrographic features of the Bay available today. Of particular value have been their contributions to the field of scientific instrumentation. Personnel of the Institute have also served as consultants and witnesses in matters involving the physical features of the Bay and its estuaries. Continued support of the Institute is urged.

Personnel and Requests

The Laboratory has been fortunate in being able to establish and fill positions in the fields of marine pollution and marine pathology. The research in mortality and pollution must be continued, even expanded because it is these areas which, in the long view, pose the most serious threats to the commercial and sport fishing industries. When it is recognized that both industries exploit a self-renewing resource, one which requires little capital outlay but which, if capitalized, would be worth at least \$500,000,000, then their economic importance becomes much more significant than the at-landing value of their catches. But pollution damage affects a great many more aspects than just the two fishing industries. Light and heavy industry, other recreational interests, commercial interests and communities are all involved. The value of these interests must total billions. Obviously, contaminated waters are detrimental and costly to all. Facts are needed for wise use of water resources. Facts come only through research.

Because of the tremendous economic importance of these marine problems, the Laboratory proposes to expand its research program into the fields of marine pollution, mortality and physiology. To do so will require the services of about ten additional marine biologists and several supporting people. Adequate laboratory facilities will also have to be provided. For this reason a substantial capital outlay program is being submitted to the General Assembly for its consideration. Included are a mortality and pollution laboratory, a small Eastern Shore laboratory and several other items for the Gloucester Point facility. Because the proposed enlarged research promises to be of benefit to the two fishing industries, to all other Tidewater interests, and to the entire Commonwealth, the support of the Commission is respectfully solicited.