1968

ILLINOIS DEPARTMENT OF CONSERVATION

DIVISION OF FISHERIES

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ILLINOIS FRESH-WATER MUSSEL SHELL INDUSTRY

SPECIAL FISHERIES REPORT
NUMBER 24

MARCH 1968

ILLINOIS DEPARTMENT OF CONSERVATION
Division of Fisheries

ILLINOIS FRESH-WATER MUSSEL SHELL INDUSTRY

by
A. C. Lopinot
Chief Fishery Biologist

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ACKNOWLEDGEMENTS

The following exporters have been supplying the Department of Conservation with total tons of shells purchased from Illinois buyers along with average prices paid during the year:

Automatic Button Export Company
Muscatine, Iowa

Tennessee Shell Company, Incorporated
Camden, Tennessee

George Borden Shell Company
Savannah, Tennessee

M. D. Cohen & Son, Incorporated
Terre Haute, Indiana

During 1967, fishery biologists were assigned to periodically measure and weigh shells purchased by Illinois buyers. The assignments were as follows:

Raymond Fisher - Wabash River
Bob Dunn - Illinois River
Kenneth Russell - Mississippi River

The data collected by the biologists was tabulated by Mrs. Edith Campbell. Mrs. Campbell also typed the manuscript for publication.

The Bureau of Commercial Fisheries supplied data on mussel shell harvest from various states in the Mississippi River Drainage.

CONTENTS

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INTRODUCTION

In recent years, renewed interest in the commercial harvest of fresh-water mussel shells occurred in Illinois when the increased demand for cultured pearls in Japan occurred. The Illinois commercial harvest of shells for the Japanese cultured pearl industry began in 1963 when the license sales started increasing. The sale of licenses increased from 69 in 1961 to 1,279 in 1966.

The peak harvest of shells in Illinois, during the past three years, occurred in 1966 when 7,115,300 pounds were sold for $604,308.00. The highest price paid for shells that year was $500 per ton on the Wabash River.

Due to the increased interest and harvest of mussels and to help protect the resource, the laws regulating the take had to be changed to conform with the modern day requirements and use of shells. These new laws went into effect during the 1967 season.

INVESTIGATIONS

During 1966, the Division of Fisheries contacted Illinois buyers of mussel shells to obtain information on tonnage being harvested, species caught, price paid per ton, equipment used, and problems concerned with the industry. The major exporters were also contacted and information obtained on the use of the shells, total amount purchased from the various streams in Illinois, and price paid by the buyers for the different varities. The exporters agreed to supply the Illinois Department of Conservation with annual harvest figures for the various streams fished. This has been found to be more accurate than contacting individual buyers along the rivers. Based on the investigations during 1966, recommendations were made for changes in the harvest regulations; these went into effect in 1967.

During 1967, fishery biologists contacted the Illinois mussel shell buyers once a month to weigh and measure the different species stored in their bins. These measurements and weights provided information on the size of shells being harvested and the total number of mussels of an individual species required to produce a ton of cooked out shells. Complete information could not be obtained from the

Mississippi River due to the fact that shelling was discontinued early in the season.

The Bureau of Commercial Fisheries was contacted to determine the harvest of shells from other states in the Mississippi River Valley and how Illinois ranked with other states in the total pounds of shells sold. During the peak year for Illinois (1966), the States of Alabama, Arkansas, Indiana, and Tennessee ranked ahead of Illinois.

There is a discrepancy in the figures provided by the Bureau of Commercial Fisheries and those obtained by Illinois from the exporters. This probably results from the fact that the Bureau contacts individual buyers along the rivers while Illinois obtains the total sales of these buyers from the exporters who purchase their shells.

Details on the use of the shells in pearl culture is contained in the reprint included with this report. The export prices for certain species of shells have been reported to exceed $1,500 a ton and have been as high as $2,500 a ton.

ILLINOIS MUSSEL FISHING REGULATIONS

Prior to the 1967 mussel fishing season, the Illinois laws concerning mussel fishing were as follows:

METHODS OF TAKING - SIZE LIMITS AND OPEN SEASONS -

Sec. 28.06. No person shall take mussels, except from April 15th to November 1st, both inclusive, by means of rakes, forks, or crowfoot bars. However in State Fish Preserves established as provided by this Act, no person shall take mussels except with written authorization from the Department.

Sec. 28.07. No person shall take any rough shell mussels less than 1 3/4 inches, or smooth shell mussels less than 3 inches in size in their greatest dimensions; provided, that not more than 5% of such mussels possessed may be undersize.

FEES FOR RESIDENT LICENSES -

Sec. 37 (f). For taking mussels by any means whatsoever, $2.00.

FEES FOR NON-RESIDENT LICENSES -

Sec. 39 (e). For taking mussels by any means whatsoever, $4.00.

MUSSEL DEALER LICENSES -

Sec. 46. It shall be unlawful for any person to receive, collect or buy, or to offer so to do, or to act as an agent or broker in receipt, collection or purchase of mussels, within the State of Illinois, without first having secured a permit from the Department so to do.

The fee for such permit for residents of the State of Illinois shall be five dollars ($5.00) a year; and for non-residents of the State of Illinois, twenty-five dollars ($25.00) a year. Such permits shall expire on the 31st day of January of each year.

The above laws and fees were established many years ago when mussel shells were used in the manufacture of pearl buttons. Investigations in 1966 showed that a change in the laws was needed; the exporters were grading the shells to two and one-half inches in height and larger. One exporter stated that 20 percent of the shells he received from Illinois were less than this size and could not be used. This resulted in a wasted resource.

Changes in the law for taking fresh-water mussels went into effect with the beginning of the 1967 season and the changes in fees will be in effect with the 1968 season. The current laws read as follows:

METHODS OF TAKING - SIZE LIMITS AND OPEN SEASONS -

Sec. 28.06. No person shall take mussels, except from sunrise to sunset during the period of April 15th to September 30th, and then only by means of crowfoot bars, or hand picking, except that in the Illinois River and Mississippi River, including adjoining backwater lakes, mussels may be taken during the season provided by the additional means of hand rakes, hand forks, or hand dredges. In State Fish Preserves established as provided by this Act, no person shall take mussels except with written authorization from the Department.

Sec. 28.07. No person shall take mussels less than 2 1/2 inches on the shortest line from the center of the hinge side and at a right angle across the shell to the outer edge.

FEES FOR RESIDENT LICENSES -

Sec. 37 (f). For taking mussels, $5.00. A report of each year's activity will be required of each holder of mussel license as directed by the Department.

FEES FOR NON-RESIDENT LICENSES -

Sec. 39 (e). For taking mussels, $10.00. A report of each year's activity will be required of each holder of mussel license as directed by the Department.

MUSSEL DEALER LICENSE -

Sec. 46. It is unlawful for any person to receive, collect or buy, or to offer so to do, or to act as an agent or broker in receipt, collection or purchase of mussels, within the State of Illinois, without first having secured a permit from the Department so to do.

The fee for such permit for residents of the State of Illinois shall be $25.00 a year; and for non-residents of the State of Illinois, $100.00 a year. Such permits shall expire on the 31st day of January of each year. A report of each year's activity will be required as directed by the Department.

STATE OF ILLINOIS

DEPARTMENT OF CONSERVATION

Administrative Order - 1967*

ARTICLE XXXI - REGULATIONS PERTAINING TO THE TAKING OF MUSSELS FROM WATERS IN THE STATE OF ILLINOIS ISSUED IN ACCORDANCE WITH THE PROVISIONS OF SECTION 3.01 OF THE FISH CODE OF ILLINOIS

IT IS UNLAWFUL:

1. For any person to take mussels except from sunrise to sunset during the period of April 15th to September 30th, and then only by means of crowfoot bars or hand picking, except that in the Illinois River and Mississippi River, including adjoining backwater lakes, mussels may be taken during the season provided by the additional means of hand rakes and hand forks. In State Fish Preserves established as provided in the Fish Code, no person shall take mussels except with written authorization from the Department;

2. For any person to take rough shell mussels of a size less than 2 1/2 inches on the shortest line from the center of the hinge side and at a right angle across the shell to the outer edge.

The foregoing regulations are established in accordance with the Fish Code of Illinois and persons violating these provisions are subject to the penalties provided by Section 36 of that Code.

The laws supplementing this Administrative Order are to be found in Chapter 56 of the Illinois Revised Statutes.

The effective date of this Administrative Order shall be April 1, 1967.

*Administrative Order issued prior to the passing of the new mussel fishing regulations in July 1967.

SALE OF ILLINOIS MUSSEL FISHING LICENSES

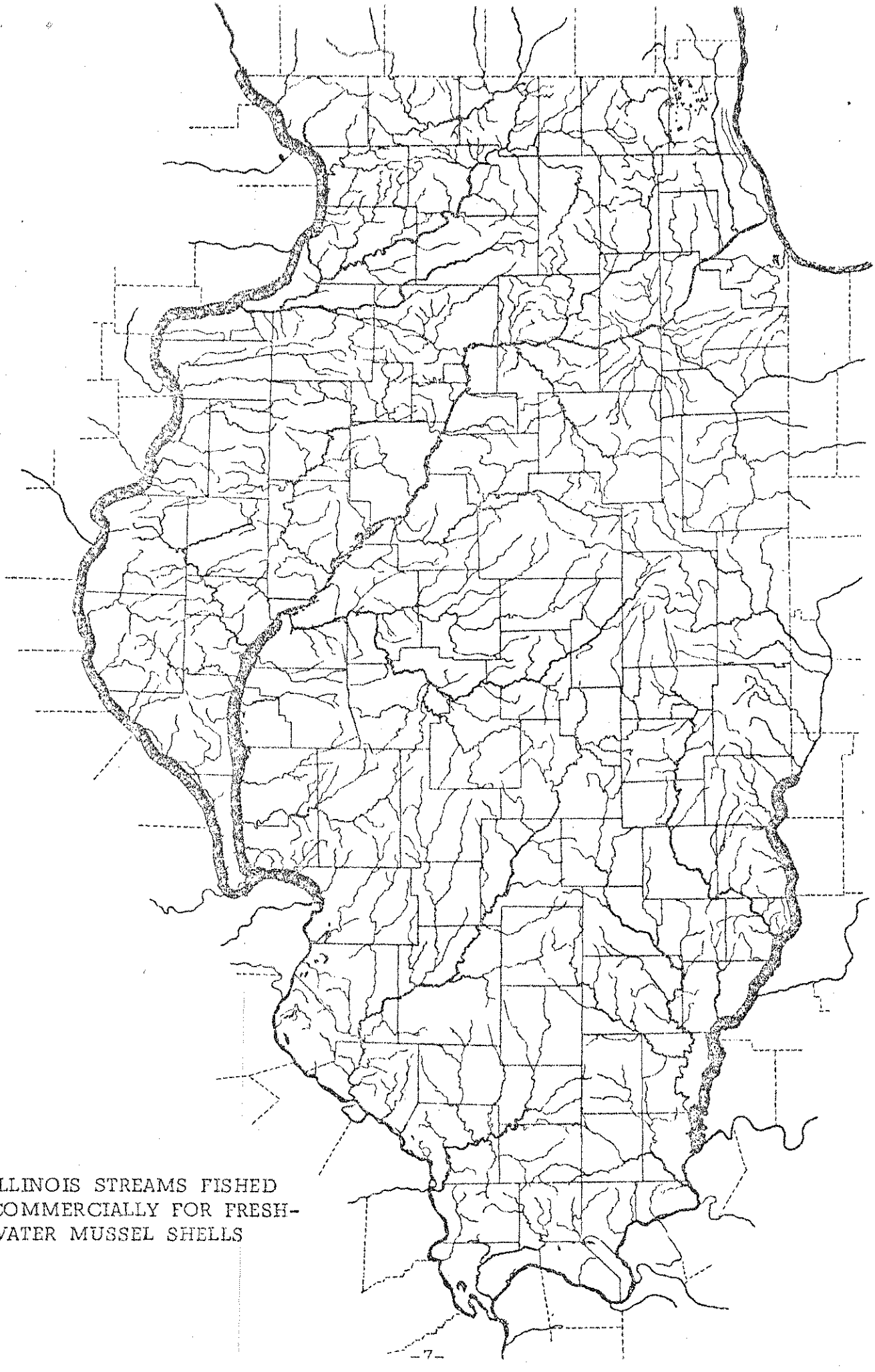
(Resident and Non-resident)

YEAR	TOTAL NUMBER SOLD
1932	1,023
1933	1,419
1934	4,688
1935	597
1936*	-----
1937*	-----
1938*	-----
1939	113
1940	343
1941	333
1942	655
1943	209
1944**	195
1945	221
1946	691
1947	402
1948	209
1949	114
1950	90
1951	68
1952	95
1953	131
1954	165
1955	72
1956	87
1957	67
1958	45
1959	68
1960	151
1961	69
1962	97
1963	355
1964	187
1965	505
1966	1,279
1967***	587

*Records not available

**Prior to this year separate licenses were required for bars and rakes.

***Incomplete returns



ILLINOIS STREAMS FISHED COMMERCIALLY FOR FRESH-WATER MUSSEL SHELLS

PRINCIPLE SPECIES OF SHELLS HARVESTED BY RIVER 1965 - 1967*

River	YEAR 1965 Species	1965 Percent of Total Catch	1965 Av. Price Paid Per Ton	1966 Species	1966 Percent of Total Catch	1966 Av. Price Paid Per Ton	1967 Species	1967 Percent of Total Catch	1967 Av. Price Paid Per Ton
Illinois	Three Ridge	70	---	Three Ridge	80	86.00	Three Ridge	72	100.00
	Washboard	25	---	Washboard	15	86.00	Washboard	24	100.00
	Misc.	5	---	Misc.	5	86.00	Misc.	4	100.00
Mississippi	Washboard	75	---	Washboard	80	97.50	Washboard	75	90.00
	Three Ridge	20	---	Three Ridge	15	97.50	Three Ridge	20	90.00
	Misc.	5	---	Misc.	5	97.50	Misc.	5	90.00
Wabash	Maple-leaf Mix	50	---	Maple-leaf Mix	50	320.00	Maple-leaf Mix	53	250.00
	Three Ridge	35	---	Three Ridge	35	320.00	Three Ridge	26	250.00
	Washboard	6	---	Washboard	6	90.00	Washboard	8	90.00
	Buckhorn	4	---	Buckhorn	4	90.00	Buckhorn	5	90.00
	Misc.	5	---	Misc.	5	90.00	Misc.	8	90.00

*Data furnished by exporters

MAJOR SPECIES OF SHELLS HARVESTED BY RIVER IN 1967*

Species	Illinois River	Mississippi River	Wabash River
	(Percent of Total Catch)		
Three Ridge	72%	20%	26%
Washboard	24%	75%	8%
Pimple Back	1%	---	---
Rock Pocketbook	1%	---	---
Maple Leaf	1%	---	---
Miscellaneous species	1%	5%	---
Buckhorn	---	---	5%
Mucket	---	---	8%
Mixed shells	---	---	53%

Above Shells Composed Of:

Maple Leaf - 56%
Pimpleback - 14%
Hickory Nut - 8%
Niggerhead - 7%
Monkey Face - 9%
Pigtoe - 1%
Miscellaneous - 5%

*Data obtained by Illinois fishery biologists.

ILLINOIS MUSSEL SHELL PRODUCTION BY RIVER 1965 - 1967*

YEAR	1965			1966			1967		
RIVER	Pounds	Tons	Total Value $	Pounds	Tons	Total Value $	Pounds	Tons	Total Value $
Illinois	2,318,000	1,159	75,335	2,236,800	1,118.40	109,461	776,960	388.48	38,848
Mississippi	362,000	181	11,765	2,489,200	1,244.60	130,806	148,800	74.30	66,870
Wabash	1,838,000	919	240,000	2,389,300	1,194.65	364,041	634,420	317.21	84,695
Total	4,518,000	2,259	327,100	7,115,300	3,557.65	604,308	1,560,180	779.99	170,413

*Data furnished by exporters.

HEIGHT AND WEIGHT OF PRINCIPLE FRESH-WATER MUSSEL SHELLS HARVESTED IN 1967

ILLINOIS RIVER

Species	Total Number Measured	Height In Inches* Range	Height In Inches* Average	Total Number Weighed (Lbs.)	Average Weight Per Shell (Lbs.)
Three Ridge	716	1.5-3.8	2.54	25	0.23
Niggerhead	3	2.7-2.9	2.77	--	----
Pig Toe	34	1.8-2.7	2.15	4	0.16
Washboard	672	1.7-5.0	3.64	25	0.48
Rabbit's Foot	1	2.4	2.40	--	----
Warty Back	35	1.3-2.6	2.15	--	----
Pimple Back	172	1.2-2.9	2.04	--	----
Maple Leaf	270	1.5-2.7	2.22	7	0.15
White Heel Splitter	5	3.2-3.9	3.56	--	----
Pink Heel Splitter	4	3.0-3.9	3.38	--	----
Mucket	1	2.8	2.80	--	----
Yellow Sand Shell	6	1.4-2.6	1.83	--	----
Rock Pocketbook	100	1.4-2.9	2.22	--	----
Three-horned Warty Back	5	1.3-1.6	1.40	--	----
Paper Shell	2	2.7-2.8	2.75	--	----
		MISSISSIPPI RIVER			
Three Ridge	50	2.0-3.9	2.66	--	----
Pig Toe	50	1.8-2.3	2.01	--	----
Washboard	50	2.6-4.1	3.30	--	----
Pimple Back	50	1.8-2.4	2.10	--	----
Maple Leaf	30	1.9-2.5	2.16	--	----

*Height of shell in inches measured on the right half of the shell at right angles to the middle of the hinge across the shell to the ventral margin with the measuring ruler laying across the interior portion. The right half was also weighed to obtain a weight average.

HEIGHT AND WEIGHT OF PRINCIPLE FRESH-WATER MUSSEL SHELLS HARVESTED IN 1967

WABASH RIVER

Species	Total Number Measured	Height In Inches*		Total Number Weighed (Lbs.)	Average Weight Per Shell (Lbs.)
		Range	Average		
Three Ridge	925	2.3-4.9	3.18	250	0.32
Elephant's Ear	66	2.2-3.6	2.97	9	0.34
Niggerhead	555	2.0-3.9	2.92	260	0.27
Pig Toe	344	1.8-3.5	2.51	131	0.21
Washboard	896	3.5-5.8	4.61	175	0.80
Bullhead	36	2.1-2.9	2.49	29	0.21
Rabbit's Foot	3	1.3-1.7	1.47	---	----
Monkey Face	706	2.0-3.0	2.43	214	0.19
Warty Back	119	1.8-2.7	2.24	62	0.13
Pimple Back	730	1.7-3.0	2.37	190	0.15
Maple Leaf	872	2.0-3.9	2.86	250	0.21
Buckhorn	816	1.9-3.5	2.78	227	0.24
White Heel Splitter	50	3.2-5.0	4.15	12	0.29
Fluted Shell	5	2.5-3.2	2.80	---	----
Squaw Foot	1	3.5	3.50	---	----
Mucket	502	2.0-3.9	3.15	191	0.39
Yellow Sand Shell	279	1.7-3.5	2.52	105	0.26
Pocketbook	102	2.8-4.1	3.37	66	0.34
Black Sand Shell	4	1.8-2.6	2.33	3	0.25
Three-horned Warty Back	38	1.6-2.3	1.99	3	0.10
Hickory Nut	605	1.8-2.7	2.34	182	0.18
Pink Pig Toe	5	2.5-2.9	2.64	2	0.19
Butterfly	57	2.0-3.4	2.64	22	0.26

*Height of shell in inches measured on the right half of the shell at right angles to the middle of the hinge across the shell to the ventral margin with the measuring ruler laying across the interior portion. The right half was also weighed to obtain a weight average.

PERCENT OF SHELLS MEASURED IN 1967 LESS THAN 2.5 INCHES

Species	Total Number Measured	Total Number Less Than 2.5 Inches	Percent Less Than 2.5 Inches
	ILLINOIS RIVER		
Three Ridge	716	294	41.00
Niggerhead	3	---	-----
Pig Toe	34	30	88.00
Washboard	672	6	0.90
Rabbit's Foot	1	1	100.00
Warty Back	35	28	80.00
Pimple Back	172	170	99.00
Maple Leaf	270	240	89.00
White Heel Splitter	5	---	-----
Pink Heel Splitter	4	4	100.00
Mucket	1	---	-----
Yellow Sand Shell	6	5	83.00
Rock Pocketbook	100	81	81.00
Three-horned Warty Back	5	5	100.00
Paper Shell	2	---	-----
TOTAL	2,026	864	42.65
	MISSISSIPPI RIVER		
Three Ridge	50	10	20.00
Pig Toe	50	50	100.00
Washboard	50	1	2.00
Pimple Back	50	50	100.00
Maple Leaf	30	29	97.00
TOTAL	230	140	61.00

PERCENT OF SHELLS MEASURED IN 1967 LESS THAN 2.5 INCHES

Species	Total Number Measured	Total Number Less Than 2.5 Inches	Percent Less Than 2.5 Inches
	WABASH RIVER		
Three Ridge	925	3	0.30
Elephant's Ear	66	2	3.00
Niggerhead	555	10	1.80
Pig Toe	344	190	55.00
Washboard	896	-----	------
Bullhead	36	12	33.00
Rabbit's Foot	3	3	100.00
Monkey Face	706	367	52.00
Warty Back	119	104	87.00
Pimple Back	730	415	57.00
Maple Leaf	872	19	2.18
Buckhorn	816	32	3.90
White Heel Splitter	50	-----	------
Fluted Shell	5	-----	------
Squaw Foot	1	-----	------
Mucket	502	3	0.60
Yellow Sand Shell	279	77	27.60
Pocketbook	102	-----	------
Black Sand Shell	4	2	50.00
Three-horned Warty Back	38	38	100.00
Hickory Nut	605	457	76.00
Pink Pig Toe	5	-----	------
Butterfly	57	12	21.00
TOTAL	7,716	1,746	22.60

APPROXIMATE NUMBER OF FRESH-WATER MUSSELS NEEDED TO MAKE ONE TON (2,000 POUNDS) OF COOKED OUT SHELLS

Species	RIVERS			
	ILLINOIS		WABASH	
	Average Weight Per Mussel Without Meat (2 Shells) (Lbs.)	Approximate Number Of Mussels Per 2,000 Pounds	Average Weight Per Mussel Without Meat (2 Shells) (Lbs.)	Approximate Number Of Mussels Per 2,000 Pounds
Washboard	0.96	2,083	1.60	1,250
Three Ridge	0.46	4,348	0.64	3,125
Maple Leaf	0.30	6,667	0.42	4,762
Pig Toe	0.32	6,250	0.42	4,762
Monkey Face	----	-----	0.38	5,263
Pimple Back	----	-----	0.30	6,667
Hickory Nut	----	-----	0.36	5,556
Niggerhead	----	-----	0.54	3,704
Yellow Sand Shell	----	-----	0.52	3,846
Buckhorn	----	-----	0.48	4,167
Mucket	----	-----	0.78	2,564
Pocketbook	----	-----	0.68	2,941
Warty Back	----	-----	0.26	8,692
Bullhead	----	-----	0.42	4,762
Butterfly	----	-----	0.52	3,704

MISSISSIPPI RIVER VALLEY MUSSEL SHELL PRODUCTION BY STATE 1956 - 1966*
(THOUSANDS OF POUNDS)

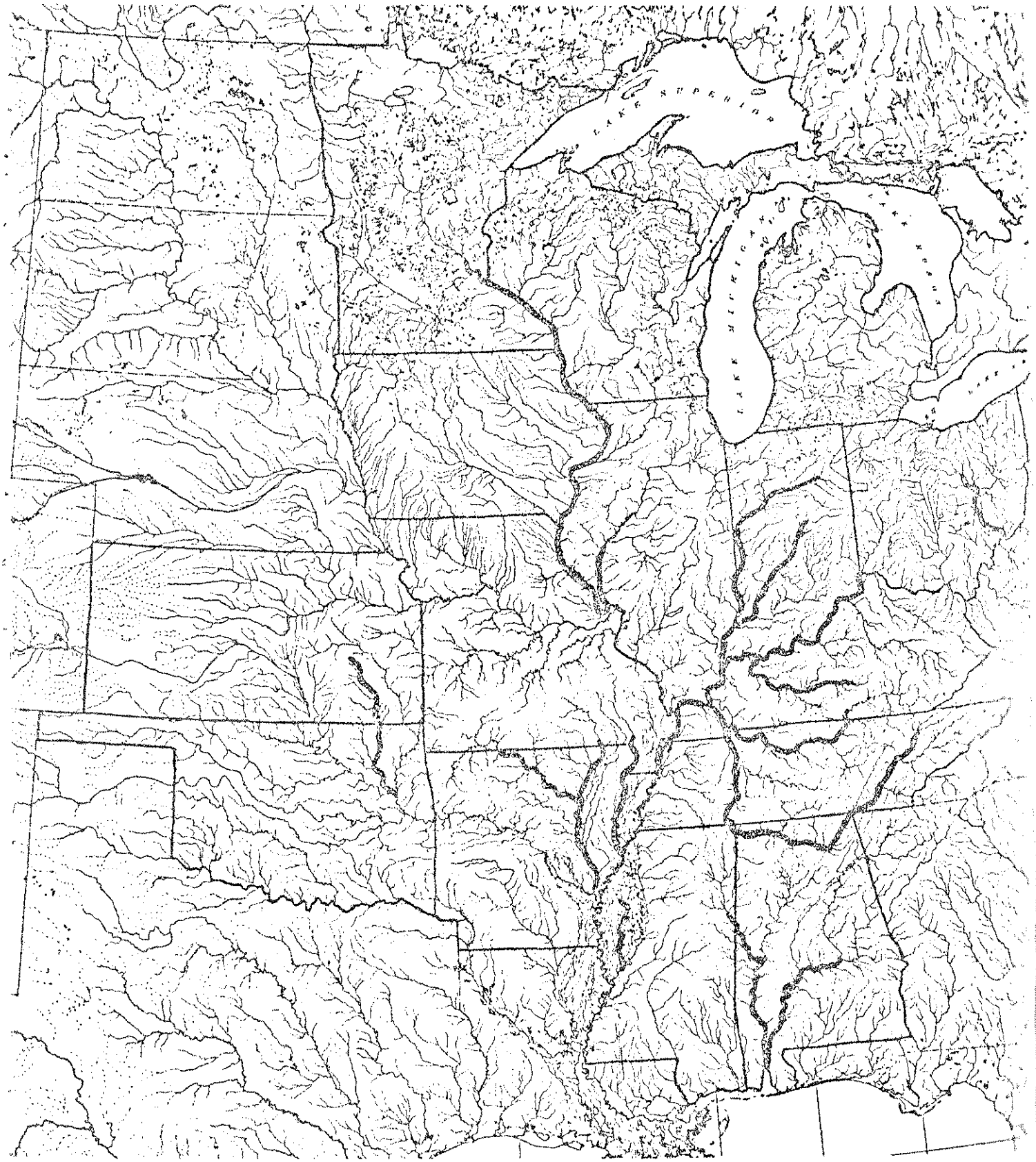
State	YEAR										
	1956	1957	1958	1959	1960	1961	1962	1963	1964	1965	1966
Alabama	9,410	7,150	4,760	8,314	13,456	9,336	5,728	3,031	822	491	12,370
Arkansas	3,104	1,940	648	66	595	595**	399	481	76	5,301	11,000
Illinois	44	9	22	100	400	100	400	1,812	1,358	1,750	4,165
Indiana	1,018	400	16	8	900	900**	600	1,600	1,800	2,884	8,311
Kansas	------	------	------	------	------	------	------	------	-----	------	32
Kentucky	4,158	3,868	1,500	734	1,356	1,356**	778	1,860	265	1,004	1,150
Minnesota	------	------	------	------	------	------	------	------	-----	------	187
Mississippi	------	------	------	------	------	------	------	------	-----	------	300
Missouri	------	------	------	------	------	------	------	------	-----	108	106
Ohio	------	------	------	------	------	------	------	------	-----	------	177
Oklahoma	------	------	------	------	------	------	------	------	-----	------	1,506
Tennessee	4,274	5,648	4,416	2,764	6,948	4,232	3,076	6,959	3,352	4,357	5,102
Wisconsin	------	------	------	------	------	------	------	------	174	1,000	2,005
TOTAL	22,008	19,015	11,362	11,986	23,655	16,519	10,981	15,743	7,847	16,895	46,411

*Data furnished by Bureau of Commercial Fisheries, Ann Arbor, Michigan 1967.
**Survey not made - data used is for 1960.

1966 MUSSEL SHELL PRODUCTION BY MAJOR STREAM AND STATE*

State	Stream	Pounds Harvested
Alabama	Tennessee River	230,400
	Alabama River	11,990,000
	Tombigbee River	100,000
Arkansas	White River**	8,600,000
	St. Francis River	2,400,000
Illinois	Illinois River	1,448,800
	Mississippi River	1,627,200
	Wabash River	1,089,300
Indiana	Wabash River***	8,310,700
Kansas	Verdigris River	32,000
Kentucky	Green River	382,100
	Ohio River	542,200
	Tennessee River	225,500
Minnesota	Mississippi River	186,800
Mississippi	Sunflower River	300,000
Missouri	Mississippi River	106,000
Ohio	Muskingum River	177,300
Oklahoma	Verdigris River	1,506,000
Tennessee	Cumberland River	90,000
	Tennessee River (West)	4,718,000
	Tennessee River (East)	293,400
Wisconsin	Mississippi River	2,005,000
TOTAL		46,360,700

*Data furnished by Bureau of Commercial Fisheries, Camden, Tennessee.
**Includes Black River
***Includes White River



MAJOR STREAMS PRODUCING MUSSEL SHELLS IN 1966

RESOURCE MANAGEMENT

During 1967, the harvest of shells dropped off drastically. This was due to the fact that the Japanese were requiring larger size shells (2 3/4 to 3 inches) and the fishermen found it more difficult to obtain shells; indicating that they might have over-harvested the streams in 1966.

In order to protect the mussel resource so it will maintain a fishery, the following recommendations might be considered:

1. The annual harvest of shells from a given river should not be more than 50 percent of the standing crop (commercial species and size). In order to determine this harvest, the standing crop of commercial shells would have to be known in advance of the harvest. At present, this would not be practical as there is no known way of accurately determining the standing crop of shells.

2. Sections of a given river could be closed to fishing for a period of not less than three years. In this way a new section could be fished every third or fourth year. The harvest would be prolonged, the smaller shells would have a chance to grow to commercial size, and the mature shells could carry on reproduction.

3. Strict regulations on type of gear used would help protect the resource. Restricting harvest to only the use of the crowfoot bar as compared to the power and hand dredge would prevent the tearing up of mussel beds. Scuba diving and hand picking is a more thorough harvesting method and might be harmful to the resource over a period of time.

4. The demand for the shells in the cultured pearl industry might regulate the take of shells without further restrictive measures. During 1966-1967, the sales of cultured pearls were reported to have decreased 20 percent from what they were the previous year. Thus, in 1967, the requirement for larger size shells and certain species was more evident.

5. A closed season does not protect the mussels during their reproductive period as there are species spawning each month of the year. However, the season for taking the shells could be used in controlling the harvest. A short season could restrict the total tonnage harvested in a given year.

COMMON AND SCIENTIFIC NAMES OF FRESH-WATER MUSSELS*

Common Name	Scientific Name
Three-Ridge	Amblema costata
Purple Warty-Back	Cyclonaias tuberculata
Elephant's Ear	Elliptio crassidens
Niggerhead	Fusconaia ebenus
Wabash Pig-Toe	Fusconaia flava
Pig-Toe	Fusconaia undata
Washboard	Megalonaias gigantea
Bullhead	Plethobasus cyphyus
Rabbit's Foot	Quadrula cylindrica
Monkey-Face	Quadrula metanevra
Warty-Back	Quadrula nodulata
Pimple-Back	Quadrula pustulosa
Maple-Leaf	Quadrula quadrula
Buckhorn	Tritogonia verrucosa
Floater	Anodonta grandis
Heel-Splitter	Anodonta suborbiculata
Rock Pocketbook	Arcidens confragosus
White Heel-Splitter	Lasmigona complanata
Fluted Shell	Lasmigona costata
Squaw Foot	Strophitus rugosus
Mucket	Actinonaias carinata
Yellow Sand-Shell	Lampsilis anodontoides
Pocketbook	Lampsilis ventricosa
Pocketbook	Lampsilis ovata
Black Sand-Shell	Ligumia recta
Three-Horned Warty-Back	Obliquaria reflexa
Hickory-Nut	Obovaria olivaria
Butterfly	Plagiola lineolata
Pink Heel-Splitter	Proptera alata

*Taken from "The Fresh-Water Mussels of Illinois" by Paul W. Parmalee, Illinois State Museum. 1967

APPENDIX

Illinois Department of Conservation
Division of Fisheries
Springfield, Illinois 62706

FRESHWATER MUSSEL PURCHASE REPORT

For the Year_____

Name of River (or Lake):_____

Instructions: For each river or lake list separately the name, town and state of each buyer along the river, the total tons of shells that were purchased from him during the year, the average price paid per ton during the year, the maximum and minimum price range paid during the year, and the principal kinds (by common name) purchased on a percentage basis. (Example: Three-Ridge 70%, Washboard 20%, Maple-Leaf Mix 5%).

Name and Address Of Buyer	Total Tons Purchased	Price Per Ton ($)			Percent of Principal Kinds of Shells Purchased
		Average	Maximum	Minimum	

EXPORTER:_____ DATE:_____

ADDRESS:_____

FRESH-WATER MUSSEL
SHELL MEASUREMENTS
(Height In Inches)

Water_____

Name_____

Town_____

Date_____

	SPECIES							
1.								
2.								
3.								
4.								
5.								
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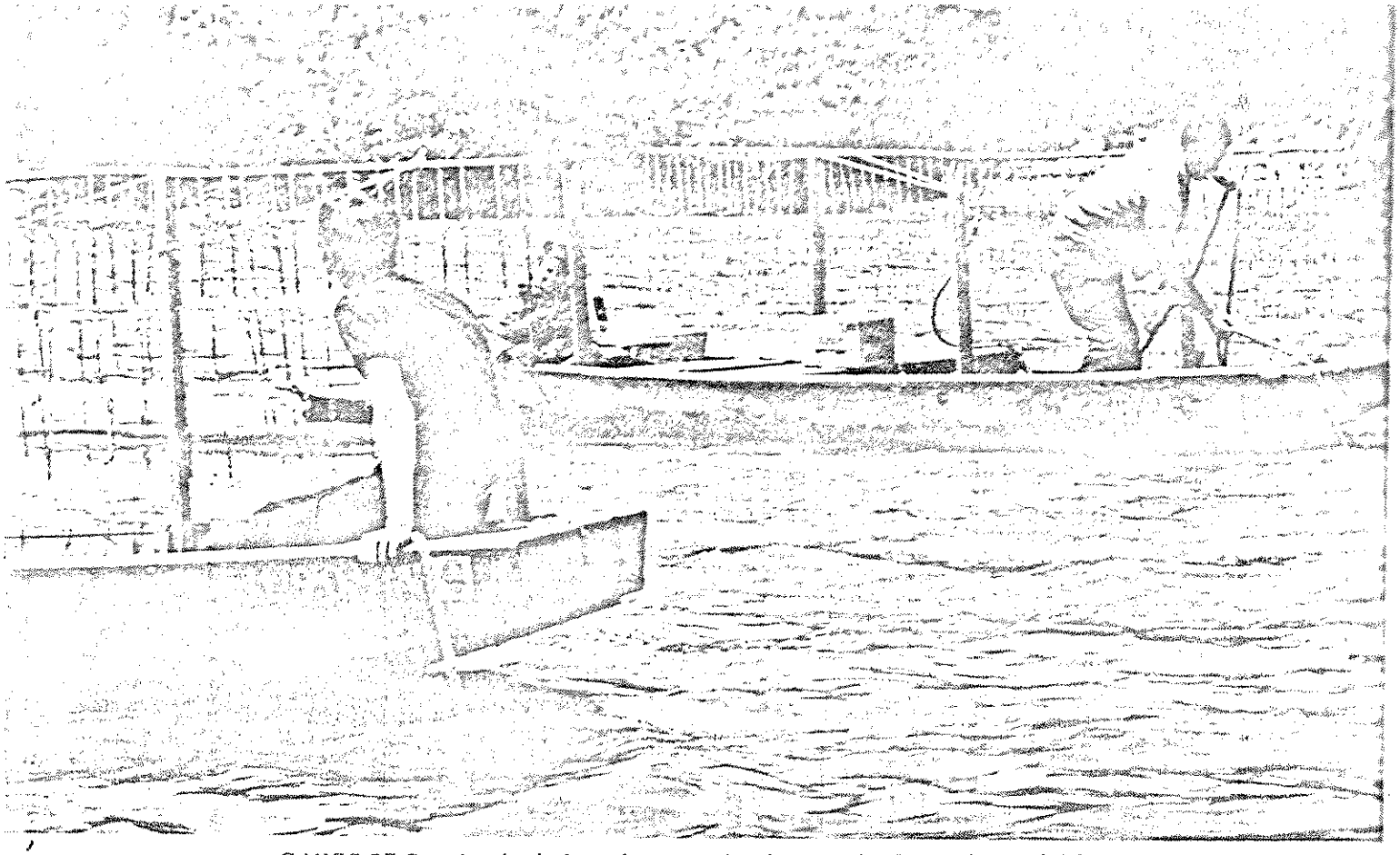
Biologist_____



GANGS OF Crowfoot hooks hang from crowfoot bars on riverboats of mussel fishermen along the Wabash River near Mt. Carmel. Mussel shell, once the raw material of the pearl button, is making comeback in Illinois.

The Illinois Mussel

He May Be Ugly and Uncultured, But Don't Undersell This Pearl In The Rough

By Al C. Lopinot
Chief Fishery Biologist
Illinois Department of Conservation

AT THE turn of the century when mussel shells were raw material for pearl buttons, fishing for freshwater mussels in Illinois was a big business. After World War II the pearl button was replaced by plastic, and mussel fishing declined.

Once again, however, fleets of boats dredge the river bottoms for mussel shells because Japan is using the shells for producing cultured pearls. This is the story of mussel fishing and its relation to cultured pearls.

The Freshwater Mussel

Freshwater mussels or clams live in the bottom muds or in sand and gravel bars of most streams and lakes. The mussel's soft body is enclosed in a hard hinged shell which opens to let the animal eat, breathe, and reproduce and which shuts for protection. The mussel moves by expanding and contracting a fleshy foot that is extended through the lower part of the shell and is attached to the bottom material of the stream. Two siphons are extended from the top portion of the shell; one takes in water, the

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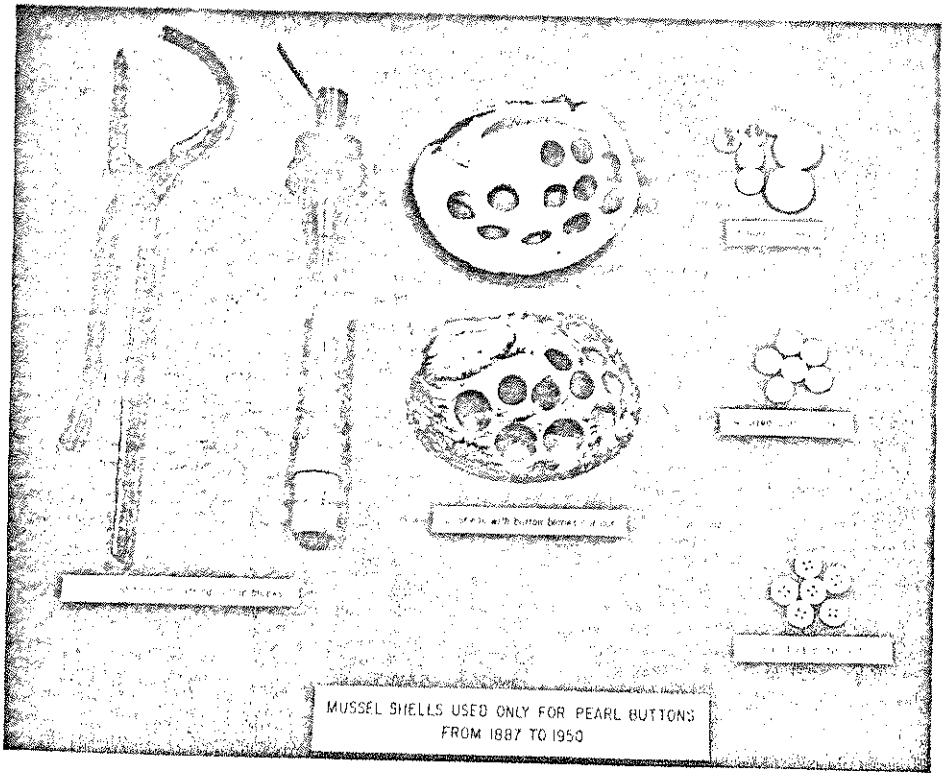
other expells water and waste products. The incoming water passes over the gills and mouth to supply oxygen and food.

The "mantle", a tissue covering the body of the mussel, produces a substance called *nacre* or "mother-of-pearl" which makes up the hard shell. The shells grow larger and thicker each year — the rate of growth depends upon the food supply and species of mussel.

During the breeding season the male mussel discharges sperm into the water through its excurrent siphon, and the female produces eggs which become attached to her gills. Water containing the sperm enters the female through her incurrent siphon and passes over the gills. The fertilized eggs develop on the gills for a period of time and are then shed into the water as minute larvæ called glochidia. The glochidia usually attach themselves to the gill of certain species of fish, and there they live for several weeks as parasites. After the glochidia develop, they break loose and fall to the bottom of the stream as tiny mussels to live, feed, and grow to maturity.

There are over fifty major species of freshwater mussels living in our Illinois waters. About a dozen of the thicker shelled ones are of commercial value.

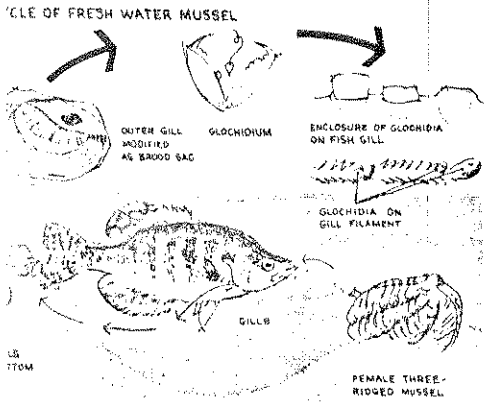


PEARL BUTTON industry once stimulated mussel fishing along the Mississippi and Illinois Rivers, but introduction of plastic buttons brought fishing to a standstill after World War II.

Pearl Buttons

IN THE early 1900's thousands of mussel boats plied the Illinois rivers in search of mussel shells and freshwater pearls. The shells were used in the manufacture of pearl buttons, and the waste portion of the shell was used for poultry grit. Button manufacturing from freshwater mussel shells originated in Europe in 1840. In 1892 the first pearl button factory was established in the United States, at Muscatine, Iowa, by J. F. Boepple, a German immigrant. Muscatine became known as the pearl button capitol of the world. Most of the shells caught by Illinois fishermen were sold in Muscatine. In the manufacture of buttons the button blanks were first cut from the shell with a cylindrical saw. The blanks were ground to desired thickness, placed in automatic machines for the facing and drilling of holes, then polished in tumblers. Next they were graded and sorted according to size and design. Some were dyed while others were left with their natural pearl color.

LIFE CYCLE of freshwater mussel includes short stage as parasite on fish gill.



During the peak years Illinois mussel fishermen produced from one to four thousand tons of shells annually for pearl button manufacture; they received an average of about fifteen dollars per ton. After plastics were introduced, the demand for shells decreased. Mussel fishing came to almost a standstill after World War II. In the early days freshwater pearls were a frequent prize for the mussel fisherman, and some sold for over two thousand dollars.

Mussel Fishing

Mussel fishing has changed very little since the turn of the century. The most popular method continues to be the use of the crowfoot bar. Mr. and Mrs. Elmer Dill of Mt. Carmel are experts in this method of fishing. Elmer makes his own wooden flatbottom boats, designed to carry and pull bars over the mussel beds. The crowfoot bar, or brail, consists of either an iron pipe or a 2 x 4 piece of lumber about fourteen to sixteen feet in length. Gangs of crowfoot hooks are attached to the bar about four inches apart along its entire length. The crowfoot is a special handmade hook with four prongs bound together by a wire spiral or by a twist. Three or four of these hooks are attached to the bar in a gang by wire, chain, or twine. Some fishermen prefer six or more hooks in a cluster attached to the end of a small length of chain. Two crowfoot bars are worked on each boat, and a bridle rope for towing is attached near both ends and in the center of the bar. Two upright notched standards on each side

of the boat hold the bars when they are not in the water.

The fisherman uses a "mule" as an underwater sail to pull his boat and bar over the mussel bed. This mule consists of a frame with heavy canvas or a large plywood board nailed to it. Guide ropes are fastened to the mule in order to control its pulling power in the water.

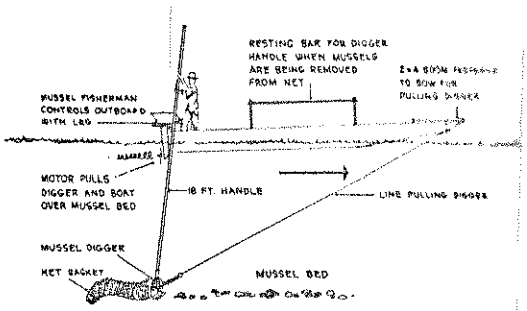
The crowfoot bar is placed in the water from the bow of the boat with the bridle rope attached to a special holding device on the bow. The mule is dropped into the water from the stern. When the current strikes the broad surface of the mule, the boat and crowfoot bar are pulled over the bed. Mussels lie in the sand or mud facing upstream with their shells partially open. As soon as a hook touches the body of one of them, the mussel closes its shell on the hook. After combing the mussel bed, the bar is raised and placed on the standards, and the shells are removed. The desirable shells are thrown into the bottom of the boat, and the undesirable ones are put back into the water. The fisherman then raises the mule and heads upstream to begin another drift over the bed.

Elmer Dill's fishing day begins at dawn when he cruises the Wabash to a mussel bed which he had found previously. Other fishermen may be on the same bed, but usually a bed is several hundred yards or several miles long, big enough to accommodate more than one boat. As the mule pulls the boat downstream, Elmer repairs the crowfoot hooks that have been damaged on a previous run. He fishes the bed all day and may harvest from a few pounds to perhaps a ton of shells. At the end of the day he returns to shore, sacks up the shells, and takes them home.

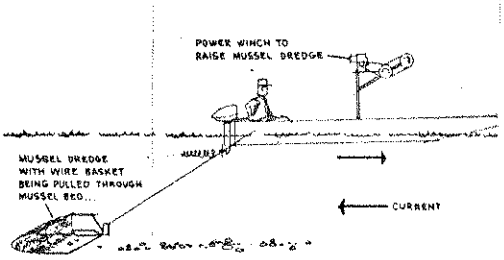
The next morning, while Elmer drifts over the mussel beds, Mrs. Dill "cooks out" the shells. Water is poured into a large metal vat, the shells are dumped into it, and it is covered with burlap. A fire is kindled under the vat, and the water boils and steams open the shells. After about twenty minutes the shells are cooked enough for removal of the mussel meat.

The cooked shells are placed on a sorting table, and Mrs. Dill and her family remove the mussel meat and sort the shells by species. They search the meats for valuable pearls, pearl baroques, pearl slugs, rose bud pearls, turtle back pearls, pearl spikes, and button pearls. The mussel meat is stored in containers, left to ferment, and later is sold as catfish bait to commercial fishermen.

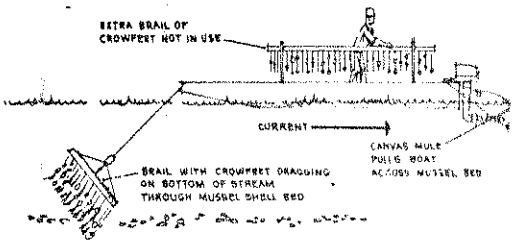
Because the Dills are also buyers, they will cook out shells for other fishermen or buy cleaned shells. The price varies



SIDE VIEW OF HAND-OPERATED MUSSEL DIGGER (RAKE OR DREDGE) IN OPERATION



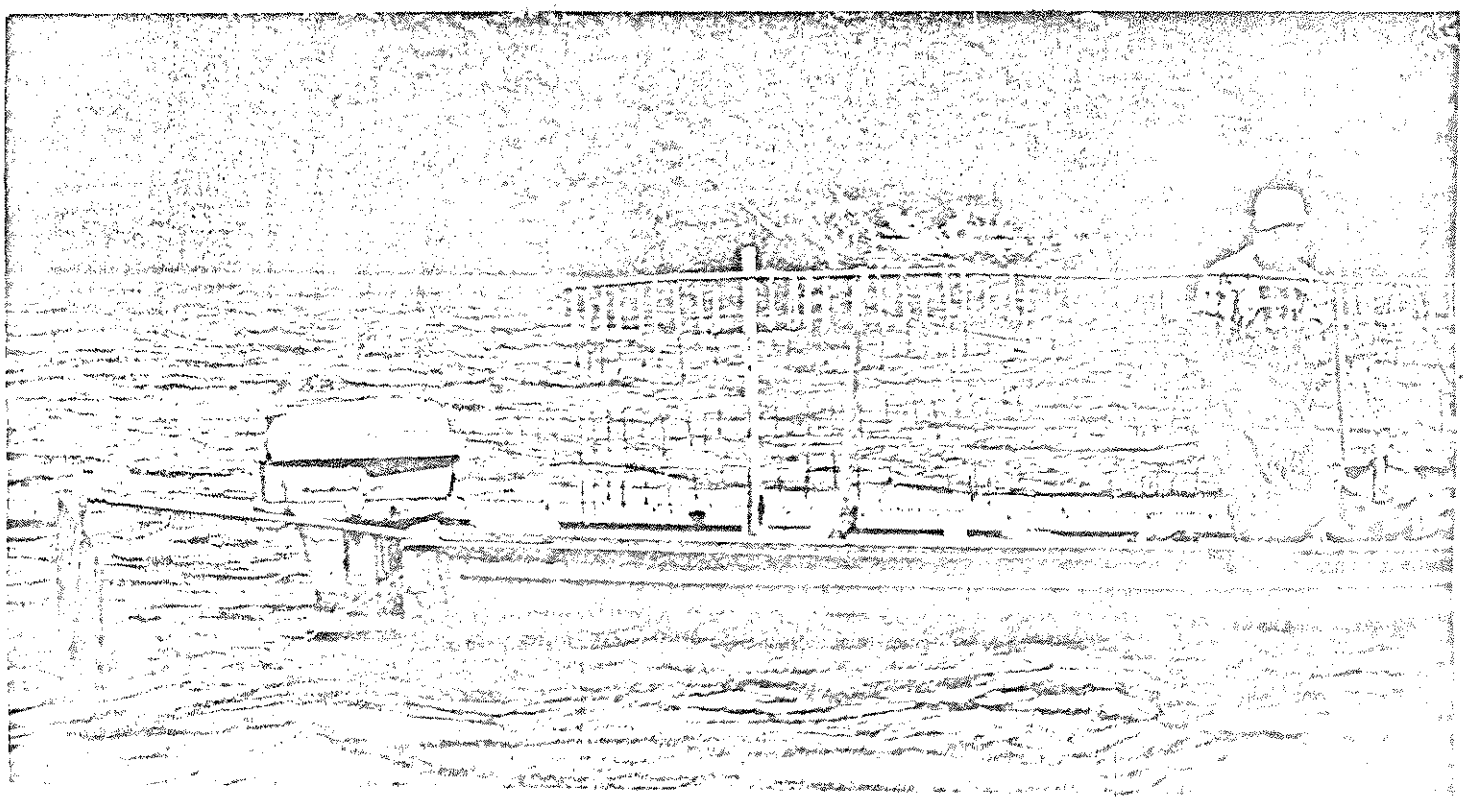
SIDE VIEW OF POWER OPERATED MUSSEL DREDGE IN OPERATION



SIDE VIEW OF MUSSEL FISHING BOAT IN OPERATION USING CROWFOOT BARS

Methods of Mussel Fishing

MUSSEL FISHERMAN repairs crowfeet hooks and straightens lines while fishing along the Wabash. Note "mule", attached to stern of boat, which acts as underwater sail.



depending upon the kind, size, and thickness of the shell. The maple leaf-mix-variety, which include the monkey face, warty and pimple back, pig toe, maple leaf, and niggerhead shells brought as much as five hundred dollars per ton paid in 1966. The washboard and buckhorn shells brought a lower price with a maximum of about one hundred dollars per ton paid in 1966. The three-ridge shell brought about three hundred dollars per ton. These are the principal shells of commercial value at the present time.

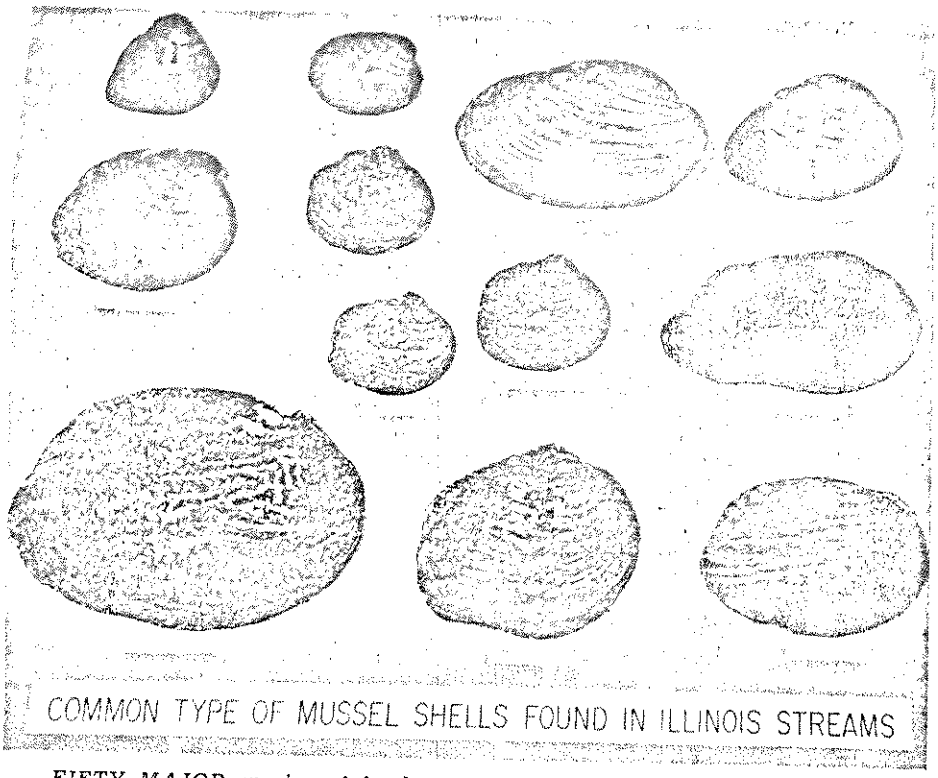
Elmer Dill has his shells sorted into bins. When he has accumulated a large supply, he contacts an exporter who picks them up and transports them to his place of business. The exporter then grades the shells for size and kinds, sacks them in two hundred pound bags, and trucks them to New Orleans where they are placed aboard Japanese ships for shipment to Japan.

In midsummer, when the water levels on the Wabash are too low for the use of the crowfoot bar, fishermen wade the shallows and hand-pick the mussels. Diving suits are often used to hand-pick the deep water areas.

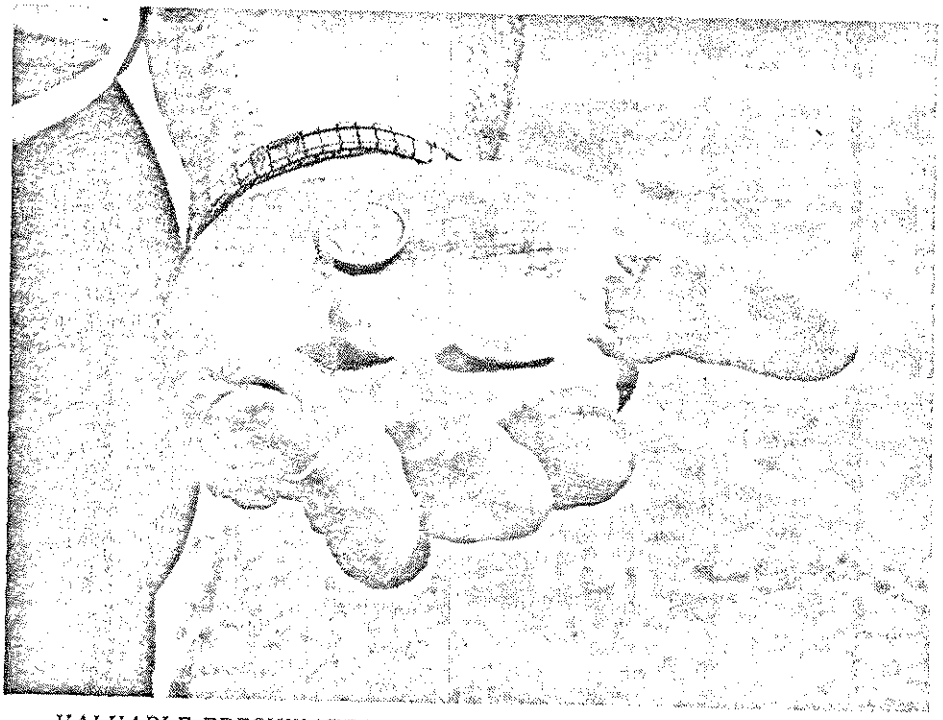
Shellers on the Mississippi and Illinois rivers use larger boats and longer and heavier crowfoot bars than the Wabash fishermen. Sometimes two bars are dragged over the mussel beds by an outboard motor rather than by a mule. Because the water is usually deep, power winches are often used to pull the bars to the surface, and some fishermen put wheels on their bars to keep them off the bottom while fishing.

These big river fishermen employ a hand dredge (digger or rake) which was first used on Peoria Lake in 1911. This is a flat, triangular steel hoop on a sixteen to twenty foot wooden handle. The bottom edge of the frame has pointed steel teeth. A long two-inch mesh net bag trails from the rear of the hoop. The dredge is set on the bottom of the stream directly behind the stern. As the boat moves upstream over the mussel bed, the fisherman maintains steady pressure on the dredge so that it will stay on the bottom and scoop up everything in its path. A rope attached to the bow of the boat by a boom pulls the dredge with the boat. The lone fisherman may attach the outboard motor handle to his leg while operating the dredge so that he can control the boat's direction. When a run has been made over a mussel bed, the boat is turned to help bring the dredge to the surface with its catch.

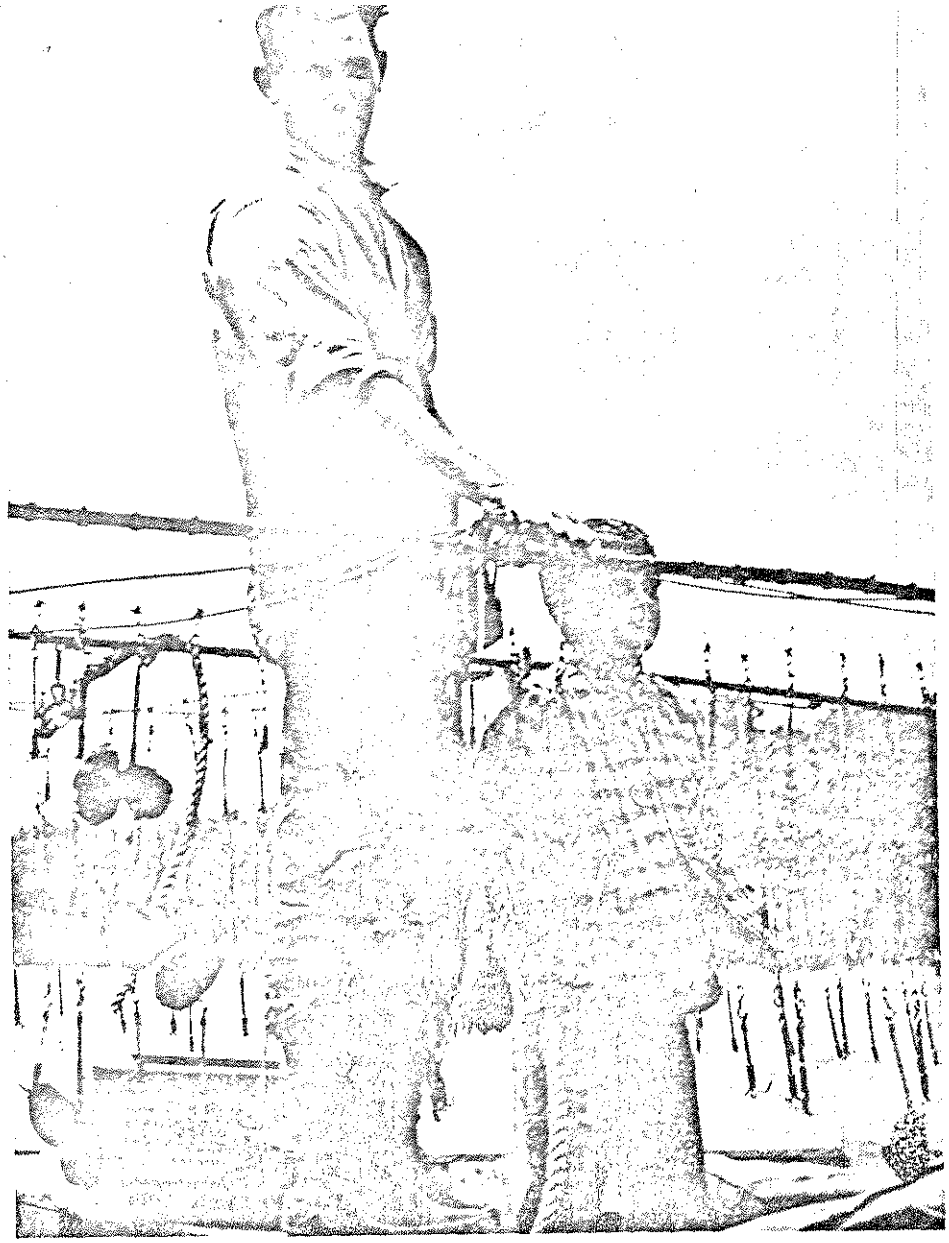
A larger version of the dredge with a steel frame and wire netting is dragged over the bed by an outboard motor and is pulled to the surface by a power winch. Some fishermen have tried power driven dredges with conveyor belts and suction devices to harvest shells. Usually these types of rigs are too expensive to warrant their use.



FIFTY MAJOR species of freshwater mussels live in Illinois waters but only about a dozen are of commercial value.

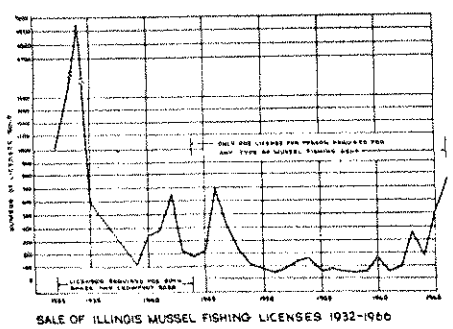


VALUABLE FRESHWATER pearls taken from a mussel shell. Note comparison with dime.



ELMER DILL and son, with catch of mussels from the Wabash River. Dill, of Mt. Carmel, begins day at dawn and fishes all day and may harvest from a few pounds to a ton of shells.

Most Illinois and Mississippi River fishermen do not process their own shells, but sell them alive to a buyer who uses mechanically driven meat sorters in which the cooked shells are placed in a perforated revolving drum to separate the meat from the shells. As the shells tumble in the drum, the meats fall through the holes, and the shells spill onto a conveyor belt.



SALE OF ILLINOIS MUSSEL FISHING LICENSES 1932-1966

In 1965 three rivers — the Wabash, Illinois, and Mississippi — produced 2,259 tons of shells. The Wabash produced the most valuable shells with 919 tons valued at $240,000; the Illinois, 1,159 tons valued at $75,335; the Mississippi, 181 tons valued at $11,765.

Mussel fishing has been revived in Illinois during the last four years. After World War II the big harvest for the cultured pearl industry was in the Tennessee Valley river system but, due to over-fishing, the industry moved north.

The Adventure of the Cultured Pearl

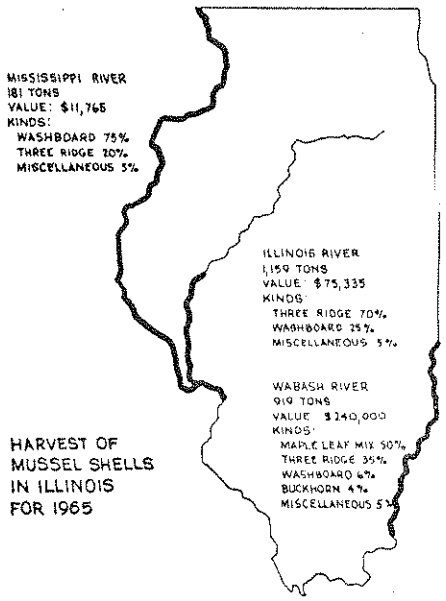
Kokichi Mikimoto of Japan developed and obtained a patent on artificial pearl culture in 1912. He experimented with many types of material to produce cultured pearls but found that the freshwater mussel shell produced the best kernel (nucleus) for high quality culture pearls. These were best because the *nacre* (mother-of-pearl) from the oyster adhered to this nucleus better than any other material. Since his discovery Japan has been the leading country in producing cultured pearls.

When Illinois mussel shells arrive in Japan, they are sent to factories where the thickest portion of the shell is cut into strips; these strips, into cubes. The cubes are converted to round pellets by using grinding stones and a sand slurry. The pellets are polished with jewelers rouge in special rotating polishing plates and tumblers. The finished pellets are examined for imperfections, and the perfect pellets are then sold to pearl farmers. The size of the pellet will determine the size of the pearl produced. A ton of shells will produce forty to sixty pounds of pellets that can be used in the pearl industry. Most of the persons working in the pellet factories are women.

Pearl Farming

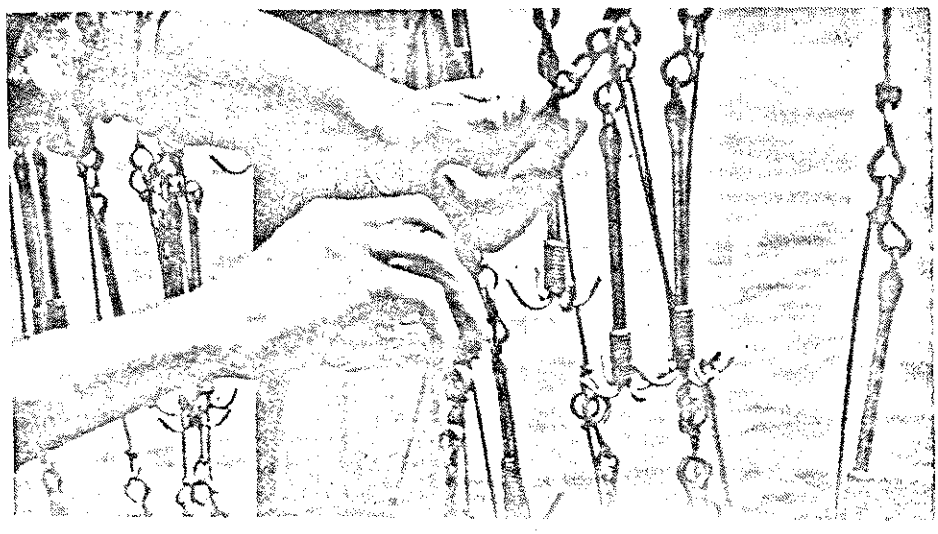
There are about five thousand pearl farmers located in southern Japan where the Japanese pearl oyster is found.

The pearl farmer obtains his oysters by sending girl divers to collect three-year-old oysters, or he may use special



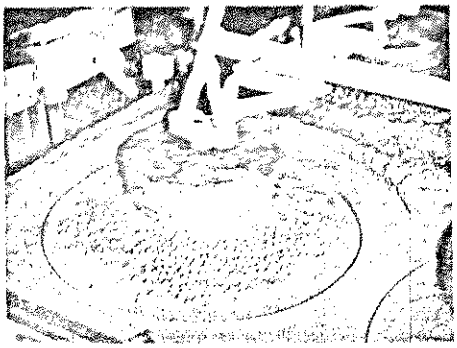
HARVEST OF MUSSEL SHELLS IN ILLINOIS FOR 1965

IN MIDSUMMER when Wabash level is lower, fishermen wade the shallows and some in diving suits hand-pick the deeper pools.

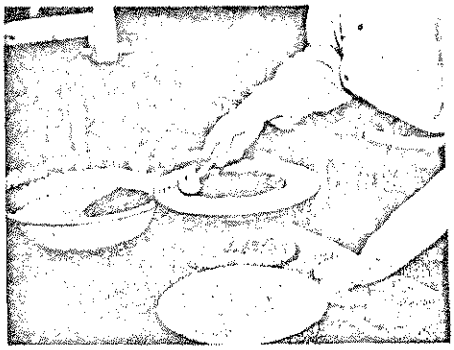


MUSSELS CLAMP on crowfoot hooks and are removed by hand.

SHELL STRIPS are cut in cubes.



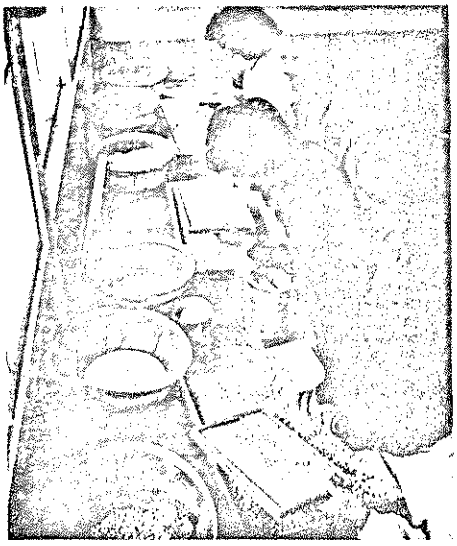
CUBES are ground into pellets.



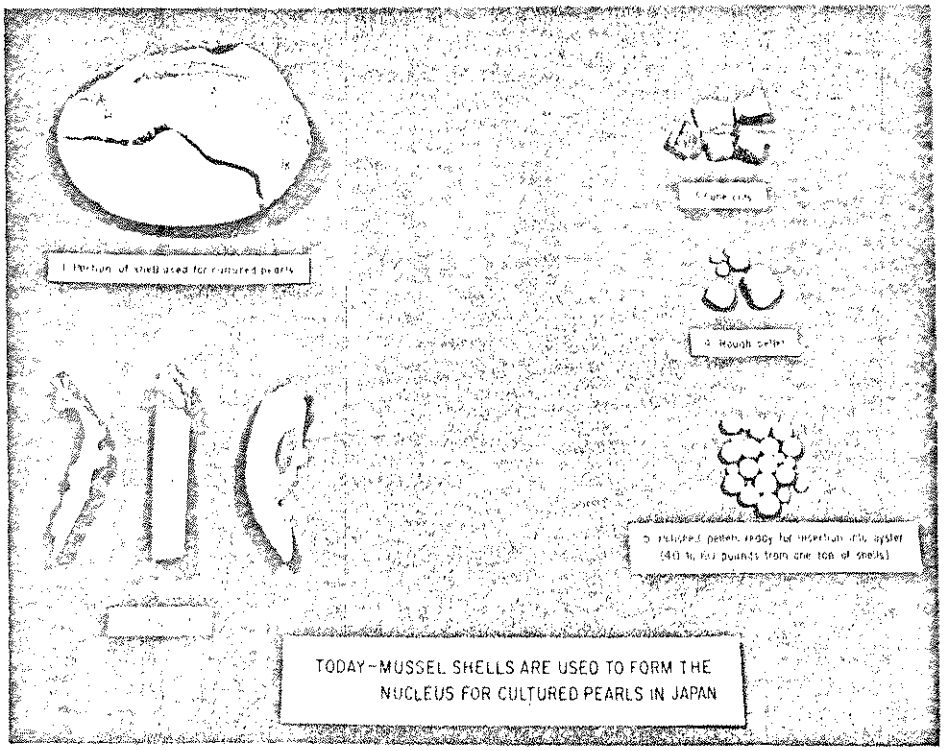
PELLETS are finely polished..

from mussel shell to nucleus for cultured pearls

FRESHWATER MUSSELS from the Wabash River are shipped to Japan where thickest portion of shell is cut into strips, then cubes. After cubes have been ground into round pellets they are polished and ready for insertion into oyster as kernel, or nucleus, of cultured pearl. One-third of the cultured pearls produced in Japan have their origin from Wabash mussel shells.



INSPECTING for imperfect pellets.



FIVE STEPS in preparation of cultured pearl nuclei from mussel shells.

cages or straw ropes suspended from rafts to capture the "spat" (larval oysters). The spat are placed in rearing cages until they are one year old, and then the oysters are placed in shallow water over rough bottoms to grow for two more years. During the third year the oysters are collected by divers.

Girls dive to the bottom, collect a small hand net full of oysters, bring them to the surface, and empty their nets into tubs. When the tubs are full, they are emptied into boat tenders.

The "mother oysters", which are used for pearl culture, are wedged open and kept in containers filled with sea water. Each one is then placed in a special holding device while the nucleus is being inserted. Trained girls make an incision in the foot portion of the oyster and place the nucleus in the incision with a piece of living mantle tissue from another oyster. Depending upon the size of the oyster, more than one nucleus may be inserted into a single

oysters. The living mantle tissue first forms a sac around the nucleus and then continues to lay coatings of nacre around the nucleus.

About fifty oysters with their inserted nuclei are placed into a wire cage which is hung from large bamboo rafts floating in the bays of southern Japan. Periodically the baskets are removed to inspect the oysters and to remove barnacles and possible parasites. The mother oyster remains in the cage from one to five years before the cultured pearl is harvested; three years is about the average length of time required to produce a cultured pearl. About 0.3 millimeter of nacre is deposited each year on the nucleus.

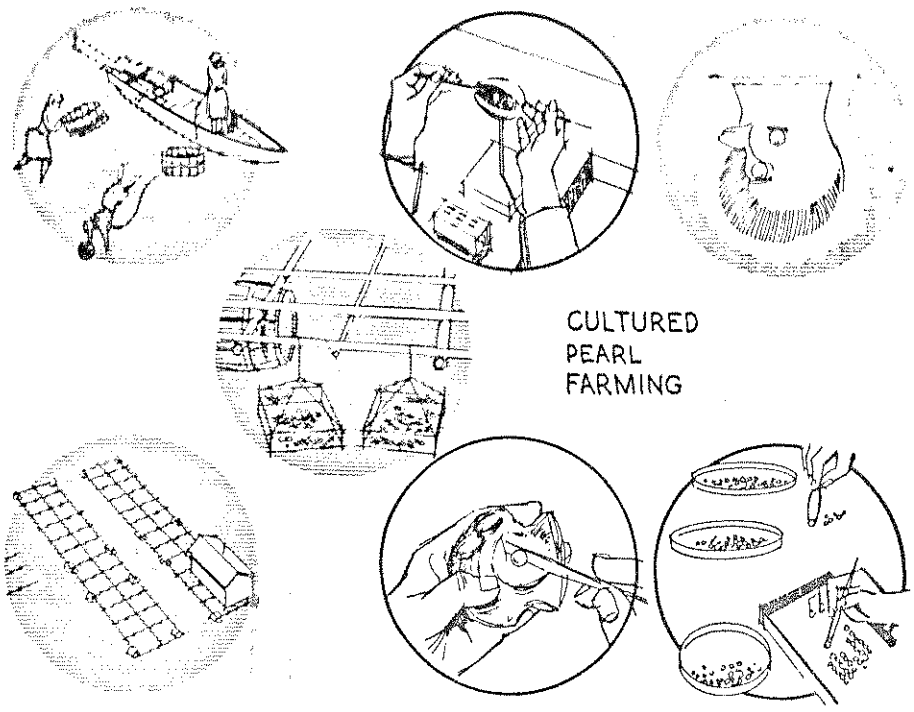
At the proper time, usually from October to January, the oysters are removed from the cages and the cultured pearls removed. The size of the pearl produced depends upon the size of the introduced nucleus, the duration of the growth period, and the vitality and age of the oyster.

The pearls are graded and sorted according to size, color, and lustre. At a winter auction buyers from all over the world bid on the pearls, which are exported to various countries throughout the world. In 1965 fifty-five million dollars worth of cultured pearls were exported from Japan, the United States being the chief buyer, followed by Switzerland and West Germany. This was 37% of the total value of all Japanese marine products exported.

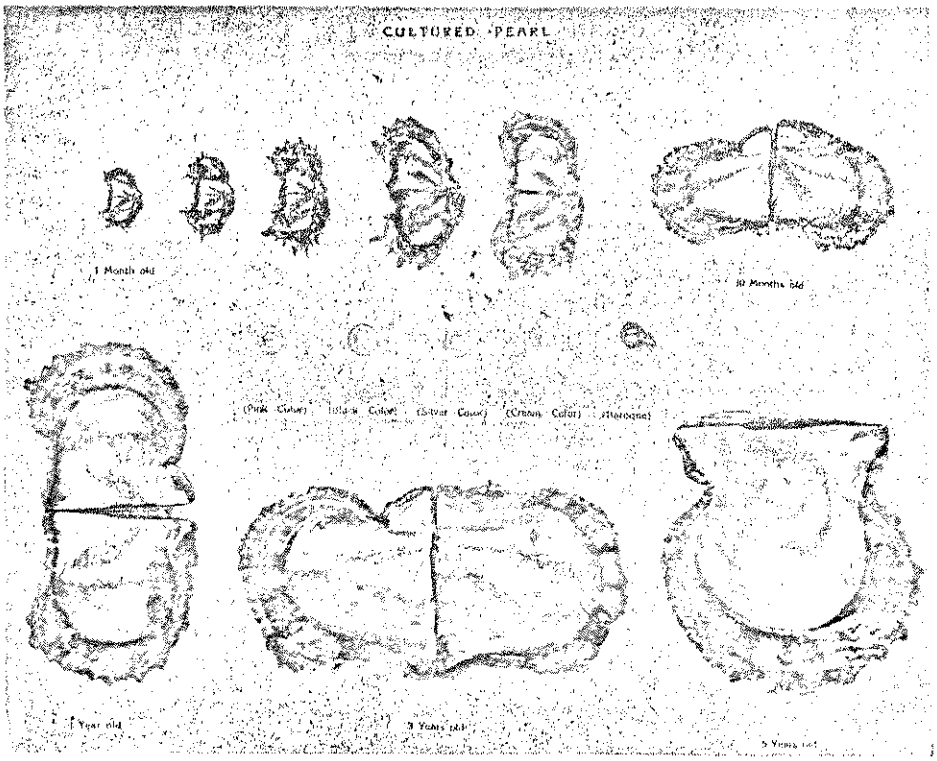
There are artificial pearls on the market today that closely resemble cultured pearls. However, they are inexpensive glass or plastic beads which have been painted with a paste made from fish scales.

One-third of the cultured pearls produced in Japan today have their origin from Wabash River mussel shells. This river currently produces the most valuable shells in the United States. There are only two places in the world that have suitable freshwater shells for producing cultured pearls; one is the Mississippi River Valley, and the other is a river system in Red China. Presently Japan purchases all of its freshwater shells from the United States.

The cultured pearl is a unique and valuable gem. The simple string of cultured pearls which adorn milady's neck is the product of Oriental ingenuity and patience.



FAR FROM the sycamore-lined Wabash, in southern Japan, pearl farmers send girl divers to bottom to collect three-year-old oysters. Nucleus made from freshwater mussel is inserted in foot portion of oyster, and oyster is placed into wire cage which hangs from large bamboo raft. The "mother oyster" remains in cage from one to five years before enough nacre is deposited to form cultured pearl.



COMPARATIVE SIZE of oyster as it grows to maturity. In center are several varieties of cultured pearls.

LIST OF SPECIAL FISHERIES REPORTS ISSUED

Publication Number	Title
A	1962 Mississippi River Sport Fishing Creel Census Procedures - Out-of-print.
B	1962 Mississippi River Sport Fishing Creel Census - Out-of-print.
C.	1962 Inventory of the Fishes of the Wabash River - Out-of-print.
D.	Submerged and Floating Aquatic Plants of Illinois - A Preliminary Illustrated Manual - 1965 - Out-of-print.
E	1965 Annual Report of the Division of Fisheries - Out-of-print.
1	Illinois Surface Water Inventory - 1964 - Out-of-print.
1A	Illinois Surface Water Inventory - Revised 1966.
2	Illinois Daily Fee Fishing Areas - 1964.
3	Inventory of the Fishes of Four River Basins in Illinois - 1963.
4.	1963 Fox Chain O' Lakes Fishery Investigation.
5	1963 Farm Pond Survey.
6	1964 State Conservation Lake Creel Census.
7	1963 Survey of Redear Sunfish Stocking in Farm Ponds.
8	Inventory of the Fishes of Four River Basins in Illinois - 1964.
9	Illinois Organizational Water Inventory - 1965.
10	1965 State Conservation Lake Creel Census.
11	Aquatic Plant Survey - 1965.
12	Summary of Fishery Management on Four State Conservation Lakes - 1966.

LIST OF SPECIAL FISHERIES REPORTS ISSUED

Publication Number	Title
13	Inventory of the Fishes of Four River Basins in Illinois - 1965.
14	Illinois Daily Fee Fishing Ponds - 1966.
15	1966 State Conservation Creel Census.
16	1965 Survey of Redear Sunfish Stocking in Farm Ponds.
17	1966 Carlyle Reservoir and Tailwater Sport Fishing Creel Census.
18	Inventory of the Fishes of Six River Basins in Illinois - 1966.
19	1966-1967 Ice Fishermen Creel Census of the Fox Chain O' Lakes.
20	1967 State Conservation Lake Creel Census.
21	1967 Carlyle Reservoir and Tailwater Creel Census
22	1967 Fox Chain O' Lakes Creel Census
23	1967 Mississippi River Pool 13 Sport Fishing Creel Census