

# The Atlantic Coast Surf Clam Fishery, 1965-1974

JOHN W. ROPES

## Introduction

An intense, active fishery for the Atlantic surf clam, *Spisula solidissima*, developed from one that historically employed unsophisticated harvesting and marketing methods and had a low annual production of less than 2 million pounds of meats (Yancey and Welch, 1968). Only 3.2 percent of the clam meats landed by weight in the United States during the half-decade 1939-44 were from this resource, but by 1970-74 it amounted to 71.8 percent. Landings from this fishery during the three-decade period 1945-74 increased the post-World War II per capita consumption of clams in the

United States twofold from 0.268 pounds in 1947 to 0.589 pounds in 1974 (NMFS, 1975). Much of this consumption was in the New England region (Miller and Nash, 1971).

The fishery is centered in the ocean off the Middle Atlantic coastal states, since surf clams are widely distributed in beds on the continental shelf of the Middle Atlantic Bight (Merrill and Ropes, 1969; Ropes, 1979). Most of the vessels in the fishery are located from the State of New York through Virginia. The modern-day industry

John W. Ropes is with the Northeast Fisheries Center, National Marine Fisheries Service, NOAA, Woods Hole, MA 02543.

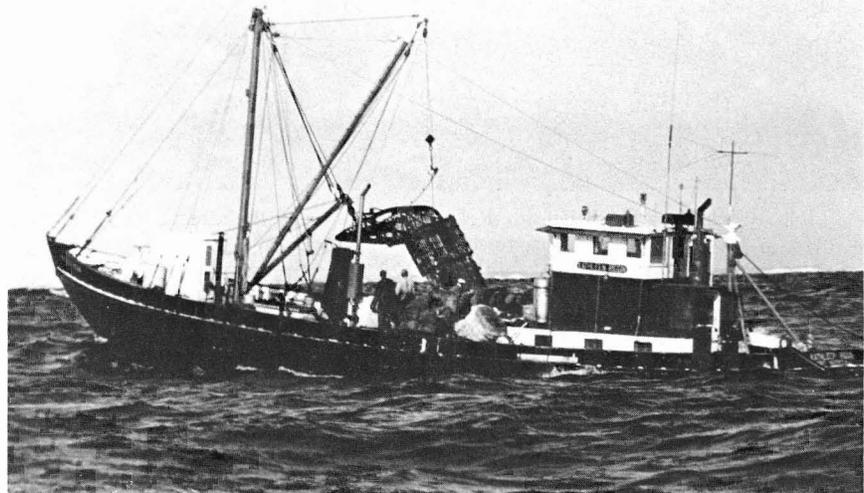
made several innovative technological advances in equipment for catching and processing the meats which significantly increased production.

The industry steadily grew during the 1950's with an increase in demand for its products, but by the early 1960's industry representatives suspected that the known resource supply was being depleted and requested research assistance (House of Representatives, 1963). As part of a Federal research program begun in 1963 (Merrill and Webster, 1964), vessel captains in the surf clam fleet were interviewed to gather data on fishing location, effort, and catch. Ten annual reports on the fishery during 1965-74 are available

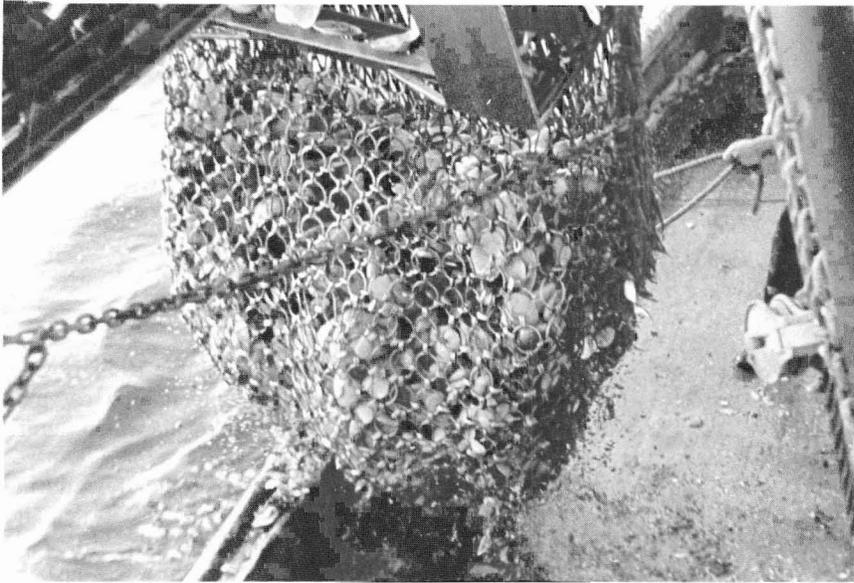
*ABSTRACT—This report includes historical highlights of the Atlantic coast surf clam, Spisula solidissima, fishery, and summarizes fishing operations during 1965-1974, a period of increased exploitation and growth in the Middle Atlantic Bight. Landings increased almost every year during the 10-year period, often setting new catch records, and accounted for more than half (about 60 percent) of the domestic clam meat landings (by weight) in the United States; landings averaged 44.7 million pounds annually during the first 5 years and increased to 72.3 million pounds in the last 5 years. This latter value included the peak 96.1 million-pound yield attained in 1974.*

*During the 10-year period, the most significant events were increased effort, in the form of additional larger vessels with greater fishing capabilities; a drastic decline in surf clam stocks off Point Pleasant, N.J., one of the traditional and principal ports for landings; and transfer of vessels to more southern ports and expansion of fishing operations on newly discovered beds off the Delmarva Peninsula and Virginia. These latter stocks sustained the very high annual yield in the 1970-1974 period. Major pre- and post-study period events through 1977 are discussed.*

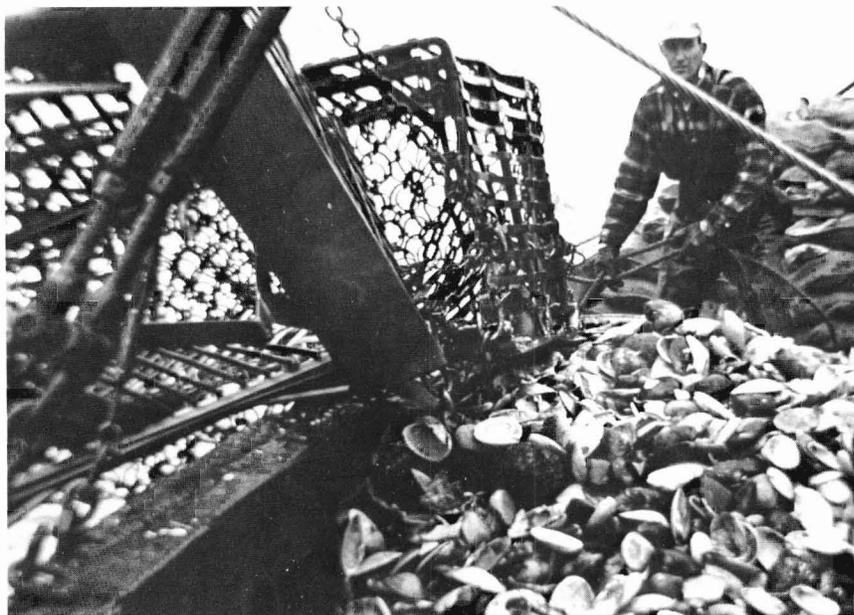
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Dredge hanging in the rigging to dump the catch of clams.



Ring-bag full of clams and shells just before dumping.



Pile of clams and shells on deck; crewman tying the dredge ring-bag preparatory to setting and the next tow.

following summarizes the data collected during the 1965-74 study period and major pre- and post-study period events in the fishery through 1977. Similar interview data were not collected in the New England region because the fishery there produced relatively insignificant landings, although records of landings are included for comparison with those of the Middle Atlantic region.

### The Resource and Fishery

The modern-day surf clam fishery operated for almost two decades (1945-65) with limited knowledge about the location and extent of the resource on the northwestern Atlantic continental shelf. Federal programs of exploration, gear improvement, and biological research were developed expressly to provide such knowledge (Merrill and Webster, 1964). Surveys focusing on known and suspected surf clam fishing areas begun in 1963 complement observations on the general distribution of surf clams reported below (Parker, 1965, 1966; Parker and Fahlen, 1968).

The first major biological surveys of ocean clam resources were conducted in 1965. The survey area was from Cape Hatteras, N.C., to Montauk Point, N.Y., and from nearshore to depths beyond commercial exploitation. Data from these surveys and other records were used to describe the general distribution of surf clams by Merrill and Ropes (1969) and have been made available by Ropes and Merrill (1971). The survey results provided similar observations on ocean quahogs, *Arctica islandica*, a species considered only of potential use in fishery products at that time. Ropes and Merrill (1976) provided additional data for surveys in 1965, 1966, 1967, 1969, 1970, and 1974. Ropes (1979) reviewed the biology of ocean clams and summarized available survey data through 1977 for a comprehensive account of distribution in the Middle Atlantic Bight. Serchuk et al. (1979) reviewed historical trends in landings as they relate to stock abundance and provided a current assessment of the

Groutage and Barker, 1967a,b; Yancey, 1968, 1970; Barker and Ropes, 1971; Ropes and Barker, 1972; Ropes et al., 1972; Ropes, Barker, and

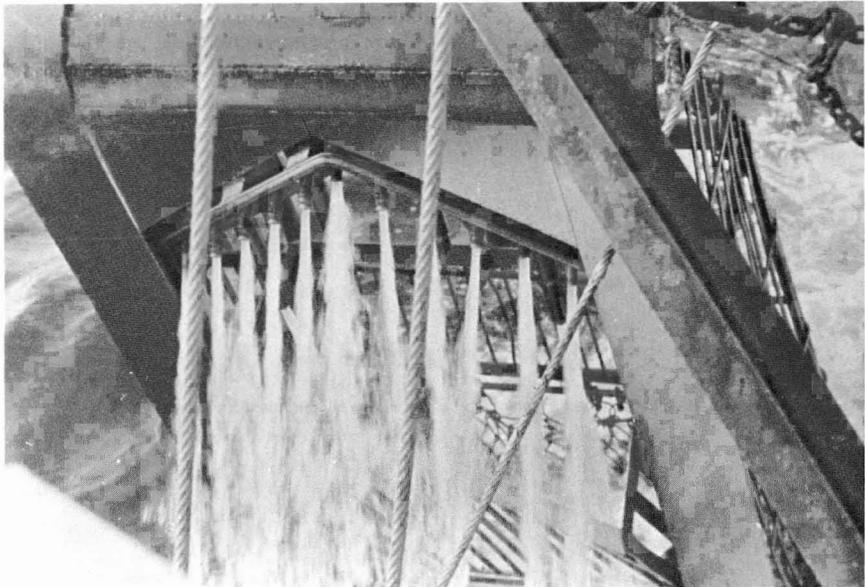
Ward, 1975; Ropes, Merrill, and Ward, 1975; and Ropes and Ward, 1977); and a summary report for the period 1965-69 (Ropes, 1972). The

Middle Atlantic Bight surf clam resource.

The generic name *Spisula* is used for several bivalves commonly known as surf clams (Ropes et al., 1969). Three species of *Spisula* inhabit the northwestern Atlantic continental shelf (Abbott, 1974; Bousfield, 1960). A maximum shell length of 226 mm (8.9 inches) reported for *S. solidissima* by Ropes and Ward (1977) characterizes it as the largest species of *Spisula*. Its latitudinal range extends from the southern Gulf of the St. Lawrence, Canada, to Cape Hatteras, N.C. (Merrill and Ropes, 1969; Ropes, 1979). *S. polynma*, a boreal species, attains a shell length of 150 mm (5.9 inches) and inhabits deep-water locations north of Long Island; *S. raveneli*, a littoral species, rarely is larger than 75 mm (3.0 inches) and is found south of Cape Hatteras. Both the latter species are thought to be distributed beyond the areas fished for *S. solidissima* in the Middle Atlantic Bight. In this area *S. solidissima* is found from the coastal beach zone to 36 fathoms (65.5 m) depths and in about 13,000 n.mi.<sup>2</sup> (44,600 km<sup>2</sup>) of the oceanic shelf (Ropes, 1979). It occurs in sand, gravel, and mixed silty-sand substrata. Survey records suggest it is probably one of the dominant infaunal macro-invertebrates throughout much of its distributional range in the Middle Atlantic Bight (Steimle and Stone, 1973; Carlo et al., 1974). The concentrations of interest to the fishery occur from shore to depths of about 10 fathoms (18.3 m) off Long Island, N.Y., and to 20-fathom (36.6 m) depths off New Jersey. Off the Delmarva Peninsula (Delaware, Maryland, and Virginia) and the Virginia-North Carolina coasts, they are concentrated at 10-20 fathoms (18.4-36.6 m).

### Vessels and Gear

Many of the vessels in the surf clam fleet were converted from other fisheries or other uses. Some were built with the express purpose of fishing for surf clams, although the original design of many of these was for use in the shrimp fishery. Their age composition varied, and a few almost 100 years



Bottom view of a hydraulic dredge hanging alongside a vessel with water jetting out of the nozzles and between the 10-inch-wide runners. The jets of water loosen the sand and wash clams into the dredge as it is being towed.



Clams are sorted into a bushel metal hopper that is inserted into the mouth of a bag. The hopper and bag are picked up sliding the clams into the bag, which is then stacked on deck.

old were active throughout the 10-year interview period (Table 1). In 1965, 77 percent of the vessels had been built before 1950. By 1969, several newer

**Table 1.—Surf clam fleet age composition in 1965, 1969, and 1974**

Year vessel built	Percent of fleet		
	1965	1969	1974
1875-1899	6	6	4
1900-1924	21	13	16
1925-1949	50	40	31
1950-1965	23	—	—
1966-1969	—	41	42
1970-1974	—	—	7

**Table 2.—Gross tons of vessels in the surf clam fishery in 1965, 1969, and 1974**

Gross tons	Percent of fleet		
	1965	1969	1974
≤25	11.3	7.1	6.3
26-50	38.7	34.0	27.3
51-75	43.6	37.7	25.3
76-100	3.2	16.5	21.1
>101	3.2	4.7	20.0

**Table 3.—Number of vessels landing surf clams in five Middle Atlantic states, 1965-74.**

State	1965	1966	1967	1968	1969	1970	1971	1972	1973	1974
New York	5	5	7	7	7	7	7	7	7	6
New Jersey	48	55	60	72	67	55	48	44	50	44
Delaware	—	—	—	—	4	7	8	8	3	3
Maryland	1	1	3	7	14	14	13	18	17	13
Virginia	—	—	—	— <sup>1</sup>	— <sup>1</sup>	4	16	23	21	32
Total	54	61	70	86	92	87	92	100	98	98

<sup>1</sup>Migrant.

vessels had entered the fishery, and the proportion built after 1949 increased from 23 to 41 percent. Steel-hulled, stern-dredge vessels specifically designed for surf clamming entered the New Jersey fleet in 1969 (Ropes, 1972). These were the forerunners of vessels built or converted in the next 5 years for more intense, long-distance fishing. By 1974, almost half (49 percent) of the vessels in the fleet had been built after 1949. Many of the new vessels added to the fleet were of the stern-dredge design and others had made the conversion.

Vessel size, as reflected in gross tons (GT), increased during the interview period (Table 2). In 1965, most vessels (82.3 percent) ranged from 26 to 75 GT and more (11.3 percent) were less than or equal to 25 GT than over 75 GT (6.4 percent). Most (71.7 percent) of the vessels were again of the 26-75 GT size range in 1969, but more (21.2 percent) were in the over-75 GT category. The greatest change occurred after 1969. In 1974, 41.1 percent of the fleet were vessels over 75 GT. Vessels of 76-100 GT and equal to or over 101 GT were almost equally represented in the fleet. Larger vessels, then, had

been acquired to handle the stern-dredge and ramp systems, which permitted greater participation in a rapidly expanding fishery during the study period.

Dredge size has increased since 1945 (Parker, 1971) and continued to increase during the 10-year interview period. Although exact data are not available since dredge construction varies in specific details, some of which are dimensional and others operational, knife-width measures one dimension of the area fished and is constant for any particular dredge. An experimental hydraulic dredge with a knife width of 9 inches (22 cm) has been constructed that is fully functional in sampling clams (Snow<sup>1</sup>) and is about the size used in the earliest active fishery for surf clams. In 1965, the knife widths were mostly 40-48 inches (102-122 cm), and by 1969, larger dredges with 60-inch wide (152 cm) knives were common in the fishery (Ropes, 1972). With the development

<sup>1</sup>Snow, H.F. 1976. Snow Food Products, P.O. Box F, Old Orchard, ME 04064. Pers. Commun.

of the stern-dredge system, dredges with 100- and 120-inch (254 and 305 cm) knives were in operation by 1974, although most were not wider than 84 inches (213 cm).

### Ports, Number of Vessels, and Landings

Several ports received landings of surf clams during the study period: Freeport, Long Island, N.Y.; Point Pleasant, Barnegat, Atlantic City, and Cape May-Wildwood, N.J.; Lewes, Del.; Ocean City, Md.; Chincoteague, Cape Charles, Kiptopeake, Oyster, and Little Creek, Va. Although small quantities of surf clams for bait were sometimes landed at some of these ports, landings at Brooklyn, N.Y., and Brielle, N.J., were exclusively of this type of product.

The number of surf clam vessels landing surf clams in the five states varied throughout the study period (Table 3). At New York ports, the numbers were relatively low and stable, ranging from 5 to 7. The number of vessels was greatest and

Heading for port with the dredge and bags of clams stowed on deck.



more variable at New Jersey ports. They increased from 48 to 72 during the early half-decade of the study period and declined thereafter to 44. This decline resulted from vessel transfers to ports in the more southerly states, particularly after the discovery of unfished beds off the Delmarva Peninsula coast during the early surveys mentioned above. Landings in Delaware were reported only for the years 1969-74; the number of vessels landing in Delaware ranged between 4 and 8. The home port of these vessels was in New Jersey, with most of their catch originating in New Jersey waters. Surf clams were landed in Maryland by a few vessels in the 1950's, but their numbers had dwindled to only one by the beginning of the study period. The two vessels added to the fleet in 1967 were the forerunners of a displacement of vessels away from New Jersey ports. By the last half-decade of the study period, from 14 to 18 vessels landed in Maryland. Landings were made at Virginia ports in 1968 and 1969, but the quantities were low, suggesting that a few vessels had explored the nearby waters and dock facilities. In 1970, four vessels operated from Virginia ports; that vessel number increased to 32 by 1974.

Vessel occurrence in an area varied from month to month and some vessels were considered migrants (Ropes, Barker, and Ward, 1975; Ropes, Merrill, and Ward, 1975; Ropes and Ward, 1977). The numbers of vessels shown in Table 3 are those consistently making landings in a particular state for a year.

Monthly surf clam landings during 1965-74 for five Middle Atlantic coastal states have been graphed and the mean monthly values for each year plotted to show trends (Fig. 1). New York landings were relatively low and stable throughout the study period. Monthly values ranged from less than 0.1 million pounds for January 1965 to 0.5 million pounds for September 1970. Mean monthly landings ranged from 0.1 to 0.4 million pounds in 1965 and 1970, respectively. The average monthly landing for the 10-year period was 0.25 million pounds, and 30.0 million pounds was harvested.

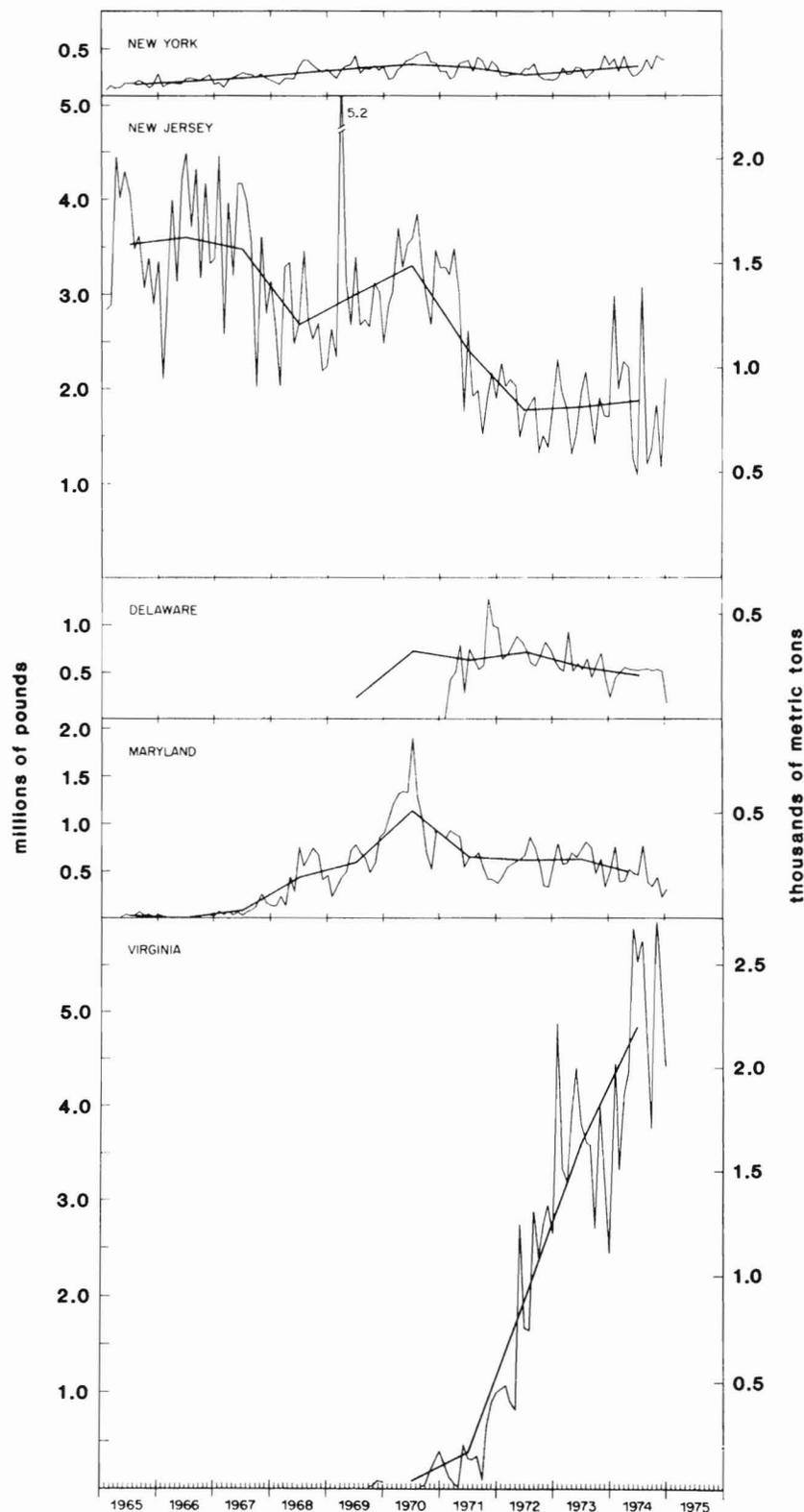


Figure 1.—Monthly landings of surf clams by weight in New York, New Jersey, Delaware, Maryland, and Virginia, and mean monthly values during 1965-74.



The dredge and bags of clams viewed from above.

New Jersey landings declined to the lowest levels after 1970 from earlier relatively stable and high monthly values. During 1965-69, monthly landings ranged from 2.0 million pounds in February 1968 to 5.2 million pounds in March 1969. Mean monthly values each year ranged from 2.7 million pounds in 1968 to 3.6 million pounds in 1966. In 1971-74, monthly landings ranged from 1.1 million pounds in June 1974 to 3.5 million pounds in March 1971. Mean monthly landings during this 4-year period of lower values ranged from 1.8 million pounds in 1972 to 2.4 million pounds in 1971. The average monthly landing for the 10-year period was 2.83 million pounds, and 329.3 million pounds was harvested.

No Delaware landings were reported for 1965-68 and landings for 1969 and 1970 were only annual totals. Monthly values ranged from less than 0.1 million pounds in January 1971 to 1.3 million pounds in October 1971. Mean monthly values during 1969-71 ranged from 0.2 to 0.7 million pounds, averaged 0.56 million pounds, and totaled 40.2 million pounds harvested.

Maryland landings showed signifi-

cant increases and decreases during the 10-year period. During 1965-70, monthly values ranged from 0.007 million pounds in December 1966 to 1.9 million pounds in June 1970. The significant increase occurred after August 1967. Mean monthly values ranged from less than 0.1 million pounds in 1968 to 1.1 million pounds in 1970. After 1970, landings declined to moderate and somewhat more stable levels. Monthly values ranged from 0.2 million pounds in November 1974 to 0.9 million pounds in February 1971; mean monthly values ranged from 0.7 million pounds in 1971 to 0.5 million pounds in 1974. The average monthly landing was 0.46 million pounds for the 10-year period, with 55.6 million pounds harvested.

Virginia landings showed the most dramatic increase. No landings of surf clams had been reported at Virginia ports before 1968, and a 0.017 million-pound quantity for August 1969 was the first. Landings of much less than 0.1 million pounds were reported for September-December 1969 and less than 0.1-0.4 million pounds for August-December 1970. These low quantities suggest that the effort was

exploratory to locate beds and develop dock facilities. Thereafter, landings were made throughout the year and increased from a low of less than 0.1 million pounds for April 1971 to 5.9 million pounds for October 1974. Mean monthly values for the 4-year period ranged from 0.4 million pounds in 1971 to 4.9 million pounds in 1974 and averaged 2.72 million pounds. A total of 130.3 million pounds was harvested in the four years.

### Interview Records

Interviews were conducted by one port sampler during 1965-70. Efforts were concentrated at Point Pleasant, N.J., in 1965-67 and were about equally divided between the Point Pleasant and Cape May-Wildwood, N.J., ports in 1968 (Table 4). Thereafter, and until 1972, most interview records were gathered at Cape May-Wildwood, N.J. In 1970, another interviewer began collecting records at Ocean City, Md., and thereafter visited this and Virginia ports. In total, over 16,000 interviews were accomplished during the 10-year study period.

### Areas Fished

Based on interview records, the areas fished by the surf clam fleet expanded greatly during the study period. In 1965 and 1966, about 360 n.mi.<sup>2</sup> were fished by the New Jersey fleet, mostly off Point Pleasant (Table 5). By 1967, the areas fished increased to 510 and 470 n.mi.<sup>2</sup> by the Point

Table 4.—Approximate number of interview records.

Year	Number	Port interviewed most
1965	1,000	Point Pleasant, N.J.
1966	1,400	Point Pleasant, N.J.
1967	740	Point Pleasant, N.J.
1968	1,240	About equal, Point Pleasant and Cape May-Wildwood, N.J.
1969	1,950	Cape May-Wildwood, N.J.
1970	3,580	Cape May-Wildwood, N.J.
1971	2,850	Cape May-Wildwood, N.J.
1972	2,520	Cape May-Wildwood, N.J.
1973	290	Ocean City, Md.
1974	530	Ocean City, Md.
Total	16,100	

Pleasant and Cape May-Wildwood fleets, respectively. Almost one-third of the area fished by the Cape May-Wildwood fleet was off the Delaware and Maryland coasts, indicating an initial shift in effort southward. The fishing areas off New Jersey continued to expand in 1968 and 1969, but much of the increase resulted from trips to locations between the two major ports in that state.

In 1970, the Point Pleasant vessels fished a smaller area (550 n.mi.<sup>2</sup>) than in the preceding 2 years, but the area covered by the Cape May-Wildwood fleet remained almost equal to that of 1969 (1,100 n.mi.<sup>2</sup>). In 1970, interview records from Maryland-based vessels first became available and indicated that approximately 800 n.mi.<sup>2</sup> were being fished, with activity dispersed off the entire Delmarva Peninsula. By 1971, the Point Pleasant fleet increased its area coverage to 650 n.mi.<sup>2</sup>, the Cape May-Wildwood fleet activity decreased to 875 n.mi.<sup>2</sup>, but the area fished by the Ocean City, Md., fleet increased greatly to 1,400 n.mi.<sup>2</sup>

Interview records for vessels fishing from Virginia ports became available for the first time in 1971, and indicated that fishery operations were concentrated in a 175 n.mi.<sup>2</sup> area. During 1972, the area fished by Point Pleasant vessels increased to 975 n.mi.<sup>2</sup>, that of the Maryland fleet decreased to 1,000 n.mi.<sup>2</sup>, and the area fished by the Virginia fleet increased to 300 n.mi.<sup>2</sup>. Interviews were available only from



At the dock, the bags of clams are off-loaded and stacked on a pallet.

Maryland and Virginia ports in 1973, and indicated a decrease in the fishing area occupied by Maryland vessels to 725 n.mi.<sup>2</sup> and no change from 1972 in the area fished by Virginia vessels. In 1974, interviews available only for April-August for Point Pleasant showed a decrease in area coverage of this fleet to 500 n.mi.<sup>2</sup>. Maryland and Virginia vessels increased the areas fished to 1,225 and 525 n.mi.<sup>2</sup>, respectively.

### Fleet Operations

Surf clam vessels usually operated on a day-trip basis, returning to port each evening. A few overnight trips were made, but these were the exception.

The Point Pleasant fleet fished consistently at an average depth of 71-78 feet (21.6-23.8 m) each year, within a depth range between 24 and 120 feet (7.3 and 36.6 m). Fluctuations in depths fished by the Cape May-Wildwood fleet each year were influenced by a seasonal effort to fish shoal, with inshore depths averaging 40 feet (12.2 m) during the winter months and deeper, offshore depths averaging 70 feet (21.3 m) during the summer. A depth

range of 12-120 feet (3.7-36.6 m) was recorded. The Ocean City, Md., fleet fished depths averaging 45 feet (13.7 m) in 1970, but thereafter fished at average depths of 64 feet (19.5 m) each year. A depth range of 10-120 feet (3.1-36.6 m) was recorded. The Virginia fleet fished average depths of 60 feet (18.3 m) and a depth range of 30-100 feet (9.1-30.5 m).

The annual average daily effort per vessel by the Point Pleasant fleet during 1965-74 varied from 8.8 to 9.8 hours, or no more than 1 hour during the 10-year period; average daily effort for the Cape May-Wildwood fleet varied from 6.0 to 8.0 hours, or 2 hours variance; the averages for the Ocean City, Md., fleet varied from 6.1 to 8.1 hours, 2 hours variance; and the averages for the Virginia fleet varied from 6.9 to 8.9 hours, 2 hours variance (Fig. 2). There were records of trips as short as 1 hour fishing time, due usually to equipment failure, and as long as 30 hours.

A high annual average catch-per-hour value of 678 pounds was recorded for the Point Pleasant fleet in 1965, but declined thereafter and reached a low of 315 pounds in 1972 (Fig. 2). For

Table 5.—Estimated square nautical miles fished by vessels from ports interviewed, 1965-74

Year	Ports			
	Point Pleasant, N.J.	Cape May-Wildwood, N.J.	Ocean City, Md.	Several Virginia ports
1965	220	140	—	—
1966	330	30	—	—
1967	510	470	—	—
1968	640	780	—	—
1969	780	1,100	—	—
1970	550	975	800	—
1971	650	875	1,400	175
1972	975	875	1,000	300
1973	—	—	725	300
1974	500	—	1,225	525

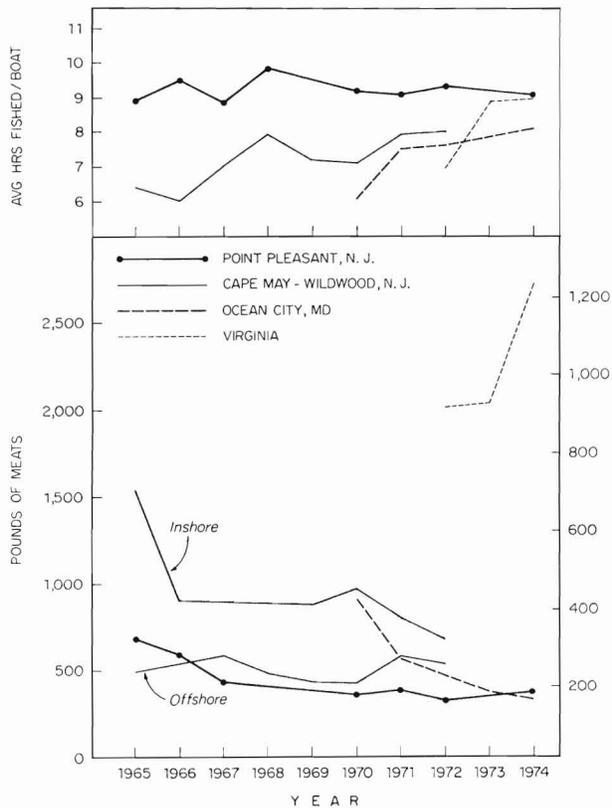


Figure 2.—Annual average daily effort and catch-per-hour of surf clams for vessels fishing from Point Pleasant and Cape May-Wildwood, N.J., Ocean City, Md.; and Virginia ports in 1965-74.

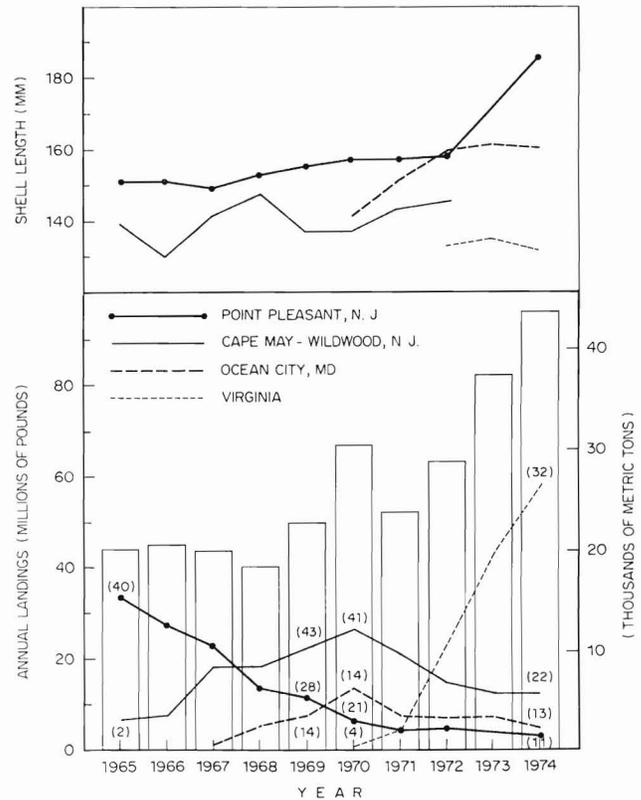


Figure 3.—Annual mean shell lengths of surf clams, millions of pounds of meats landed, and numbers of vessels (in parentheses) fishing from the Point Pleasant and Cape May-Wildwood, N.J.; Ocean City, Md.; and Virginia ports in 1965-74.

the Cape May-Wildwood fleet, the highest catch-per-hour value of 1,542 pounds was recorded in 1965 and when fishing occurred on inshore beds, but declined to a low of 680 pounds in 1972. On the offshore beds, the highest catch-per-hour value of 578 pounds was recorded in 1967 and 1971, and the lowest value of 415 pounds was recorded in 1970. A high catch-per-hour value of 901 pounds was recorded for the Ocean City, Md., fleet in 1970, but thereafter declined to 319 pounds in 1974. Average catch-per-hour values were the highest for the Virginia fleet, ranging from 2,006 to 2,737 pounds.

The Point Pleasant fleet consistently caught clams of a large average shell

length each year, varying from 149 to 186 mm (5.9 to 7.3 inches) (Fig. 3). This latter mean size was higher than all others reported during the study period and included the largest specimen to date (Ropes and Ward, 1977). Minimum and maximum sizes were 105 and 226 mm (4.1 and 8.9 inches). The Cape May-Wildwood fleet caught clams of an intermediate average shell length each year, varying from 130 to 147 mm (5.1 to 5.8 inches). Annual values included clams from inshore beds, averaging 127-131 mm (5.0-5.2 inches), and clams from offshore beds, averaging 155-160 mm (6.1-6.3 inches). Minimum and maximum sizes were 95 and 195 mm (3.7 and 7.7 inches). The Ocean City, Md., fleet caught clams

averaging 141-161 mm (5.6-6.3 inches) each year. The minimum and maximum sizes were 95 and 200 mm (3.7 and 7.9 inches). The Virginia fleet caught clams of the smallest average shell length each year, varying from 132 to 135 mm (5.2 to 5.3 inches). Minimum and maximum sizes were 86 and 188 mm (3.4 and 7.4 inches).

### Trends, Predictions, and Major Post-Study Period Events

#### Long Island Fishery

The modern-day fishery for surf clams began operation during the mid-1940's in the shallow, near-shore waters from East Rockaway to Fire Island Inlets off Long Island, N.Y.

(Yancey and Welch, 1968). This same general area has been fished continuously to the present, although most of the industry moved to New Jersey by the early 1950's. After surveys were made in 1965, Ropes (1971) rated surf clam abundance off Long Island the second lowest of four Middle Atlantic Bight areas and the lowest after a survey made in 1974 (Ropes<sup>2</sup>). Franz (1976) conducted an intense survey off Long Island in 1974 and found surf clams most abundant from Shinnecock Inlet to Montauk Point and west of Rockaway Inlet. Although the few Long Island vessels fish in an area of low clam abundance, expansion to areas of higher abundance is unlikely. The fishery has usually avoided dredging beds west of Rockaway Inlet because of suspected contamination of the resource by effluents from New York Harbor. In 1974, these beds were closed to shellfishing, except for bait purposes, by the Food and Drug Administration (Verber, 1976). Channels to ports east of Fire Island Inlet can be hazardous to navigation by the types of vessels in the fleet, and shore-side off-loading facilities are poorly developed. These factors limit the Long Island fishery and result in relatively low, albeit stable, production. In the years 1975, 1976, and 1977, landings at Long Island ports were 4.6, 3.5, and 3.4 million pounds, respectively. Future landings may be at about the 3 million-pound level, barring significant changes in fleet composition or catastrophic environmental phenomena.

### New Jersey Fishery

Industry explorations begun in 1949 located extensive beds of surf clams yielding high quantities of meats per bushel off New Jersey (Yancey and Welch, 1968). Docks were developed for landings and plants built for processing the clams in the state. The in-

dustry established itself as an important fishery by relying heavily on the New Jersey beds.

The importance of the New Jersey beds is obvious from a landing record of 195.3 million pounds in 1965-69, which accounted for 87.6 percent of the 223.0 million-pound U.S. 5-year total. During this period, however, landings at Point Pleasant showed a drastic decline from 33.5 million pounds in 1965 to 11.8 million pounds in 1969 (Fig. 3). Landings at the Point Pleasant port continued to decline and by 1974 were 3.5 million pounds, due in part to fewer vessels operating from the Point Pleasant port after 1965, but also to lower catch rates, as given earlier. Concurrently, landings at Cape May-Wildwood increased from 8.4 million pounds in 1965 to 26.1 million pounds in 1970 (Fig. 3). Thereafter landings at Cape May-Wildwood also declined to 12.6 million pounds in 1974. The increase in landings paralleled an increase in the number of vessels operating from the Cape May-Wildwood port and the decline paralleled a reduction in vessels. The reduction was effected despite an increase in the number of vessels entering the fishery, several of which were of the new and more efficient stern-dredge type. Four conditions probably influenced the reduction: 1) The declining catch rate of clams in offshore Point Pleasant beds; 2) low, but apparently stable, catch rates of clams in offshore Cape May-Wildwood beds; 3) a decline in catch rate of clams from the New Jersey inshore beds after 1970; and 4) the potential for high catch rates from unfished beds discovered during resource surveys off Delmarva Peninsula. The net result was that fewer vessels operated from New Jersey ports by 1974. Landings during 1970-74 of 134.0 million pounds at these ports comprised 37.0 percent of the U.S. 5-year total of 361.7 million pounds.

The results of biological research surveys indicated that over-exploitation of the surf clam resource has been particularly serious in the New Jersey offshore area. After surveys in 1965, Ropes (1971) rated the surf clam

abundance off New Jersey the highest of four Middle Atlantic Bight areas, but only second after a survey made in 1974 (Ropes, footnote 2). More recently, Serchuk et al. (1979) reviewed surf clam survey data and landing records for 1965-77. The New Jersey offshore surf clam resource was divided into northern and southern areas. In the former area, fished mostly by vessels of the Point Pleasant fleet, a continuous and rapid downward trend in abundance and prerecruit indices was observed after 1969. An almost parallel decline in annual landings from the area reached the lowest levels for any of the areas in the Middle Atlantic Bight. In the years 1975, 1976, and 1977, landings were 4.2, 2.5, and 1.8 million pounds respectively, at the Point Pleasant port. Declines in resource abundance and landing levels in 1976 and 1977 were further exacerbated by reduced oxygen concentrations occurring in the water over the northern New Jersey beds during June-October 1976, causing extensive faunal mortalities (Sharp, 1976; Steimle and Sindermann, 1978). The NMFS Northeast Fisheries Center staff estimated that 61.5 percent of the New Jersey surf clam biomass was lost (Ropes et al., 1979).

In the southern New Jersey area, fished mostly by vessels of the Cape May-Wildwood fleet, a continuous decline in inshore stocks from 1972 onward was reported by Haskin (1978). Offshore survey indices declined after 1969 and stabilized at levels slightly higher than those for the northern area, but annual landings from it were relatively low. Landings in the years 1975, 1976, and 1977 at the Cape May-Wildwood port were 16.4, 11.5, and 16.5 million pounds, respectively.

### Ocean City, Md., Fishery

The industry explorations mentioned above for the New Jersey fishery also located beds of surf clams off the Delaware and Maryland coasts (Yancey and Welch, 1968). Landings of slightly more than 0.1 million pounds of meats were reported for the first time at the Ocean City, Md., port in 1950, and a continuous, low pro-

<sup>2</sup>Ropes, J.W. 1975. Allowable surf clam harvest estimates—1974. Northeast Fisheries Center, National Marine Fisheries Service, NOAA, Woods Hole, MA 02543. Unpubl. manusc.

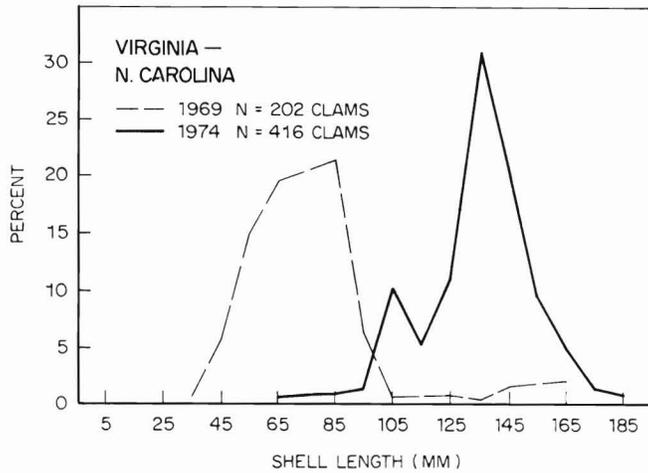


Figure 4.—Frequency distribution of surf clams by shell length in survey samples from off Virginia-North Carolina during 1969 and 1974.

duction thereafter never exceeded 2.5 million pounds until after 1967. Vessels began shifting from more northern ports to the Maryland port by 1968 and fished dense beds of surf clams north of the inlet and in Delaware waters. Shell length measurements of clams in interview records averaged 135 mm (3.5 inches) in March-July 1970, but for the remainder of the year, the fleet moved to larger clams offshore, which increased the annual average to 140 mm (5.5 inches) (Fig. 3). Landing records reached a peak of 13.7 million pounds in 1970. Subsequent landings declined to about half the peak amount, although similar fishing patterns were observed in 1971 as in 1970. Thereafter the fleet expanded southward and more to offshore beds of large clams. The Ocean City, Md., inlet water depths and dock facilities were limiting factors for some vessels which prompted expansion to more distant beds and the development of docks in Virginia. The fleet stabilized and was only one less in 1974 than in 1970 (Fig. 3). A production of 12.8 million pounds in 1965-69 was only 5.7 percent of the U.S. 5-year total, but these figures increased to 41.6 million pounds and 11.5 percent in 1970-74.

Ropes (1971) rated surf clam abundance off the Delmarva Peninsula the

second highest of four Middle Atlantic Bight areas, but the highest after a 1974 survey (Ropes, footnote 2). An inshore resource was not found in a 1974 survey by Loesch and Ropes (1977). Vessels from the Maryland port fished the offshore Delmarva Peninsula area almost exclusively during the study period. A few landings by vessels of the Virginia fleet came from the southern part of the area.

Significant post-study events include landings increases at the Ocean City, Md., port from 5.4 million pounds in 1975 to 7.1 and 8.4 million pounds in 1976 and 1977, respectively. Serchuk et al. (1979) considered that survey abundance and recruitment indices had been relatively stable and moderately high during the 1965-76 period off Delmarva Peninsula, but in 1977 a sharp decline was noted. Fishing effort by vessels in the southern New Jersey and Virginia fleets probably contributed to the decline, since many had the ability to make long-range trips into this last area of relatively high-density clam beds.

#### Virginia Fishery

No Virginia fishery existed at the beginning of the study period, but its establishment in the early 1970's was fostered by research survey discoveries

of new fishing beds off the Delmarva Peninsula. Concurrent with expansion of fishing onto more southern grounds was the development of ports for clam landings. The bulk of the Virginia landings was made at Cape Charles, Kiptopeake, Oyster, and Little Creek, since the inlet for Chincoteague was difficult for navigation by most clam vessels in the Virginia fleet. The fishery concentrated its effort in a relatively small area off Cape Henry, and catch rates of unprecedented magnitude indicated this fishery was the most intense to date (Fig. 2, 3). Although less than 1 percent of the U.S. production of surf clam meats was landed at Virginia ports in 1965-69, it increased to 36 percent during 1970-74, almost equal to the same 5-year landing record at New Jersey ports.

The potential for this tremendous production was not indicated in early survey results. Surf clam abundance was rated lowest of four Middle Atlantic Bight areas by Ropes (1971) after surveys in 1965. By 1969, a significant distributional change had occurred; research survey abundance indices in 1969 in the Virginia area were tenfold higher than during 1965-66 (Serchuk et al., 1979). The 1969 survey data indicated a recent settlement of small clams east of Virginia and Currituck Beaches at 44-102 feet (13.3-31.1 m) depths and 3-30 n.mi. (5.6-55.6 km) from shore. Measurement data indicated that most (76.3 percent) of these clams ranged from 66 to 99 mm (2.6 to 3.9 inches) in shell length, with a modal length of 85 mm (3.3 inches), corresponding to 2- and 3-year-old clams by the age-length relationships presented in Loesch and Ropes (1977) (Fig. 4). In a 1974 survey, 73.1 percent of the clams from this area ranged from 121 to 149 mm (4.8 to 5.9 inches) long, with a modal length of 135 mm (5.3 inches) corresponding to 7-year-old clams by the age-length relationship presented in Loesch and Ropes (1977). This modal length was also the average size of clams landed at Virginia ports in 1974, given earlier.

The major post-study period conclusion about this fishery is that the

Virginia resource could not sustain the heavy rates of effort after 1974. In the years 1975, 1976, and 1977, landings were 39.1, 14.1, and 15.8 million pounds, respectively, at Virginia ports, much lower than the peak landing of 58.2 million pounds in 1974. In the review by Serchuk et al. (1979), the most recent (1976) survey indices indicated clam abundance in the Virginia-North Carolina area was low and recruitment was the lowest of any area. Future harvests are expected to be minimal from the area.

### New England Region

Surf clams had an early history of use as a food in the New England region and were eaten by the Indians, colonial settlers, and beach visitors (Thoreau, 1834; Goode, 1887; Parker, 1971). A small fishery was organized on Cape Cod during the 1970's to supply bait for the cod fishery (Yancey and Welch, 1968). Thereafter, levels of production were sporadic and low. The more accessible and favored soft- and hard-shelled clams (*Mya arenaria* and *Mercenaria mercenaria*) generally supplanted utilization of surf clams in the region.

During the study period, surf clam landings ranged from much less than 0.1 million pounds in 1965 to almost 0.3 million pounds in 1971 (values not shown in Figure 1 because of the low production). Landings in 1975 and 1976 were also low (about 0.1 million pounds), but increased significantly in 1977 to almost 1.1 million pounds (USDOC, 1979). An interest exists for a surf clam fishery in the region. A few high-density locations were found during surveys off southern New England, but the bottom was hazardous for dredging and the densities of clams appear too localized and sporadic to sustain a fishery comparable to that in the Middle Atlantic region.

### Worldwide and U.S. Clam Fisheries

Even with the increased production of surf clams during 1965-74, the United States was second in the world to Japan in landing the largest quantities of clams (NMFS, 1975; FAO,

1975). Japan consistently leads the world in catching the largest poundage of molluscan shellfish, such as squid, cuttlefish, octopus, several species of clams, oysters, and snails; but the United States is first in harvesting bivalve mollusks such as clams, oysters, and scallops (Merrill and Ropes, 1977). These latter resources are far greater on the Atlantic than Pacific coast (Merrill and Ropes, 1971), partly owing to the large area for shellfish beds in the substrata of Georges Bank and the Middle Atlantic continental shelf.

Many Atlantic coast estuaries contain habitats for soft- and hard-shelled clams (*Mya arenaria* and *Mercenaria mercenaria*), two species that were the traditional sources of clam meats since colonial days (Tiller et al., 1952; Hanks, 1963; McHugh, 1977; Ritchie, 1977). During the study period, landings from the soft-shelled clam fishery ranged from 8.6 to 13.5 million pounds and averaged 11.0 million pounds annually; landings from the hard-shelled clam fishery ranged from 14.5 to 16.7 million pounds and averaged 15.5 million pounds (Fig. 5). Of the total United States clam meats landed, soft-shelled clams amounted to a low 7.9 percent in 1974 and a high 16.7 percent in 1968; hard-shelled clams comprised a low 12.1 percent in 1974 and a high 22.7 percent in 1967. Landings from the surf clam fishery ranged from 40.6 to 96.1 million pounds and averaged 58.6 million pounds during the study period, supplying more than 60 percent of the United States total clam meats, averaging 61.8 percent annually in 1965-69 and 71.8 percent in 1970-74. The peak 96.1 million pounds landed in 1974 supplied 79.0 percent of the U.S. total.

The post-study events indicate that increases in clam supplies from the above fisheries are not imminent in the near future. In fact, sizable decreases in surf clam landings during 1975, 1976, and 1977 equaled 9.6, 48.9, and 46.9 percent fewer pounds of meats, respectively, than the peak 1974 landing; but soft- and hard-shelled clam landings remained relatively stable (Fig. 5). It is important to note that the

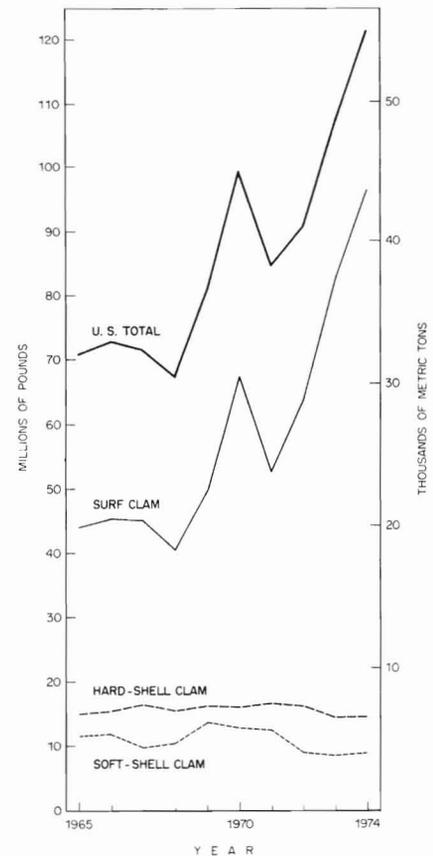


Figure 5.—Annual landings of the meats of soft-shelled, *Mya arenaria*; hard-shelled, *Mercenaria mercenaria*; and surf clams, *Spisula solidissima*, and total U.S. clam-meat landings, 1965-74.

lower landings of surf clams in 1975 and 1976 were made before annual quota limitations were in effect under a fisheries management plan for the surf clam resource (USDOC, 1977, 1979).

In recognition of probable future decreases in surf clam supplies, the industry increased the utilization of the ocean quahog, *Arctica islandica*, resource. Rhode Island has had a fishery for this bivalve for about three decades, but annual production was less than or equal to 2 million pounds (Ropes, 1979). The species has a far greater geographic distribution than surf clams, occurring along the east coast of North America north of Cape



Fork-lifting a pallet for movement into the shucking plant.



A modern stern-dredge clam vessel.

Hatteras, around Iceland and the Faroe Islands, and on the European continental shelf. Ocean quahogs were most frequently taken in survey

samples at 120-240 feet (36.7-73.2 m) depths in the Middle Atlantic Bight and were most abundant and nearer to shore off Long Island and New Jersey.

Surf clam dredges can be quickly converted to harvest ocean quahogs, and the processing plants have developed several marketable products for the meats. Landings of 5.7 and 16.5 million pounds in 1976 and 1977, respectively, were dramatic increases over previous records and most (71-83 percent) of this production was landed at New Jersey ports. The species is included with surf clams in a management plan to regulate harvesting (USDOC, 1977, 1979).

#### General Comments

The early history of the surf clam fishery was characterized by sporadic operations producing low levels of landings. After a developmental period from 1943 to 1949, the principles of the hydraulic dredge and processing technology had been discovered, giving impetus to the establishment of an important fishery in the northern half of the Middle Atlantic Bight. From 1950 to 1965, landings of surf clams increased mostly at New Jersey ports, although ports on Long Island, N.Y., and in Maryland were also active. By 1960 and thereafter, the volume surpassed landings of the two traditional hard- and soft-shelled clam species. Clearly the products from the surf clam resource had gained acceptability in the market to fill the demand for clam meats.

Interviews of vessel captains taken from 1965 to 1974 recorded information about trip operations during a period of expansion of the fishery into most of the southern half of the Middle Atlantic Bight. The tremendous increase in intensity of fishing effort on previously unfished beds coincided with an observed decline in the offshore New Jersey resource, although considerable effort continued on the inshore resource. Improvements in vessel harvesting capabilities and processing technology resulted in landings during 1970-74 greater than had ever been seen in the fishery.

Landings declined after 1974, and low levels of resource abundance were primarily attributed to overfishing. Improvements in vessel and harvesting capabilities have continued to occur,

but continued unrestricted harvesting has been considered detrimental to the economic viability of this important fishery. To address these concerns, a Fishery Management Plan for Surf Clams was developed by the Mid-Atlantic Regional Fishery Management Council and implemented by the Secretary of Commerce in November 1977 (USDOC, 1977, 1979).

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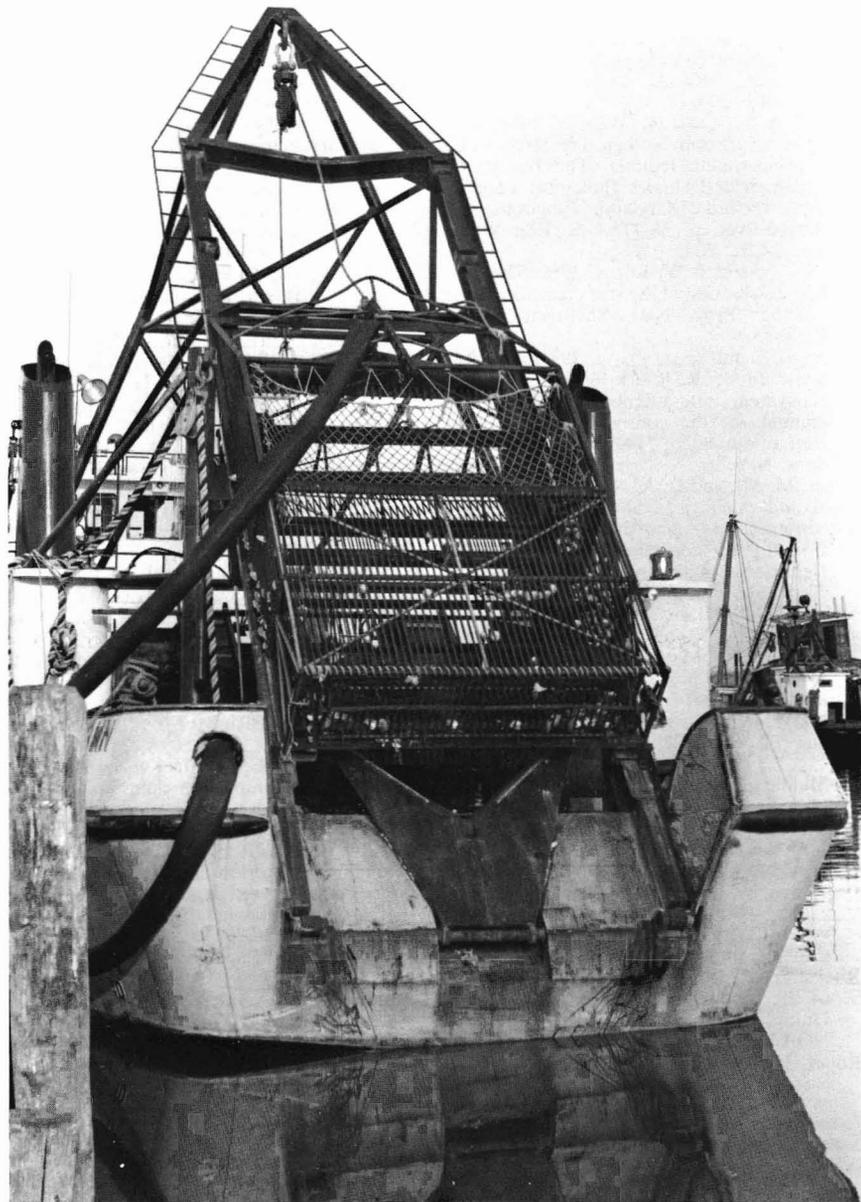
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