MARYLAND'S CHESAPEAKE BAY COMMERCIAL FISHERIES

MARYLAND DEPARTMENT OF NATURAL RESOURCES
TIDEWATER ADMINISTRATION
COASTAL RESOURCES DIVISION

MARYLAND'S CHESAPEAKE BAY

COMMERCIAL FISHERIES

November 1978

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Prepared for the
Energy and Coastal Zone Administration
Maryland Department of Natural Resources

by

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Preparation of this report was
partially funded by a grant
from the Office of Coastal Zone Management,
National Oceanic and Atmospheric Administration

ACKNOWLEDGEMENTS

Special thanks are given to Bill Sieling, Don Webster, Doug Ritchie, Tony Mazzaccaro, and Howard Mueller for sharing their knowledge and experience in assisting in the preparation of this report. Thanks are also due the Maryland Fisheries Administration, Maryland Watermen's Association, and Gordon Hallock and Bob Prier of Maryland's Department of Economic and Community Development's Seafood Marketing Division.

We also thank Matthew Norman for designing the cover for this report.

The cooperation of all those interviewed is greatly appreciated.

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I.
SUMMARY

Introduction

This document has been prepared with support from the Maryland Department of Natural Resources, Energy and Coastal Zone Administration as the first stage of Maryland's participation in the Office of Coastal Zone Management's Coastal Fisheries Assistance Program.

Reported are results from a field interview study conducted around the Maryland Chesapeake Bay shore. Sections following represent a concensus of opinions held by those interviewed (government officials, industry spokesmen, and watermen) rather than an interpretation and evaluation of data collection and analysis.

The Maryland fisheries described and characterized here have been limited to Chesapeake Bay commercial fisheries for oysters, soft-shell clams, blue crabs, and finfish. The Bay habitat itself is described, followed by descriptions of fishing community framework, the harvesting sector, the shoreside support and sale system, and the institutional framework affecting Bay commercial fisheries.

The commercial fisheries system* as detailed in following sections reflects the manner in which the fisheries are actually practiced, starting with the geographic foundations characterizing the Bay habitat and recognizing their major influences structuring community behavior, harvest activities, and shoreside support and product distribution. The waterman and his economic system

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*References to "fisheries system" in the following text are limited to Bay commercial fisheries. Recreational or ocean fisheries are not included.

has more in common with other coastal, estuarine fishermen all along the East Coast of the United States than with many of his fellow Marylanders, suggesting the way of life resulting from rural, small-scale fisheries is defined and characterized mostly by the habitat upon which those fisheries depend. For Maryland Bay commercial fisheries the Bay estuarine system is fundamental to an understanding of individual character, social behavior, and product economics.

This report has been structured to accurately picture the interrelated, holistic nature of all aspects of Bay fisheries. Participants within the commercial fishery system see their actions as a small part of a highly complex, variable natural process, and the following presentation seeks to honestly reflect their views.

Content

Material presented here is based upon extensive field investigation covering 3,000 miles along the Maryland shore, about 35 formal interviews with watermen, dealers, and government personnel, many informal discussions along the waterfront, and a literature review.

The points identified in this summary suggest observations and trends drawn from the main body of this report and have been structured in the same order as the report itself. Supporting detail and background can be found in subsequent text.

Following identification of significant factors (as determined from fieldwork) are several concluding statements concerning how these factors may apply to future management approaches. This section: "Implications for Management" represents the views of the consultants who prepared this report.

The Bay Habitat (Section III-A)

First discussed is Bay geography. The Bay habitat system is described. Concentrations of commercial stocks within the Bay geographical setting are outlined, followed by their relationship to the watersheds feeding the Bay. The quality of Bay waters is finally summarized.

Significant factors drawn from the text include:

- Salinity conditions within Bay waters are an important factor for the Bay's productivity and rich variety of species.
- While all Bay organisms can survive salinity fluctuations (and in most cases require seasonal fluctuations during the year as a major element of their life processes), sudden changes can be fatal. Consequently, those Bay waters experiencing relatively stable seasonal fluctuations from year to year are most productive for commercial shellfish harvest. These areas include waters between the Bay Bridge and the Potomac River, Eastern Bay and upper Tangier Sound.
  - The waters between the Bay Bridge and Potomac River are well south of the Susquehanna discharge and north of most large Western Shore watershed drainages;
  - Eastern Bay and upper Tangier Sound are nearly enclosed systems on the Eastern Shore;
  - Both Eastern Bay and upper Tangier Sound are fed by small watersheds and surrounded by large wetlands with large storage capacities in the event of heavy rain.
- General habitat quality decline is considered a long-term trend, including:
  - Adverse long-term effects from increasing Bay turbidity as a result of soil erosion, nonpoint source runoff, and pollution;
  - Serious concerns about effects of toxic chemicals on Bay organisms;
  - Loss of rooted aquatic plants in the headwaters of most tributaries.
- Closures of Bay acreage to shellfishing have increased tenfold in recent years; today the headwaters of nearly all tributaries are closed to shellfishing.

Community Framework (Section III-B)

The community structure serving Bay fisheries is then detailed, focusing on the following factors:

- Bay geography underlies the entire community system.
- The many separate yet interdependent fishing communities have evolved from and still depend upon biological and environmental fluxes.
- Community structure represents a long-standing tradition of extended family settlement and kinship interaction.
- The small size and dispersion of Bay fishing communities reflects the need for low-overhead, flexible, ingenious responses to those biological fluctuations guiding the fisheries upon which communities depend.
- Many communities face shoreside development pressures as transportation systems improve and facilitate suburban development, today observed spreading south from Kent Island.
- The integrated "make do" community economic framework benefits from the spread of dollars received for Bay species and the many noncash exchanges for materials and services.
- Most fishing communities today are composed of families choosing to remain and follow the water; attitudes for the future are optimistic.

Harvesting Section (Section III-C)

The harvesting sector is introduced with a general discussion of harvesting activities and followed by description of those species sought and their seasonal characteristics. Harvest methods are then outlines, indicating fishing activites by season, the boats used, and the gear types used. Catch summaries for commercial species are provided. Trends observed in the harvesting sector are finally presented. Significant factors drawn from the text include:

- Watermen are required to work closely with the natural conditions of the Bay.

- The seasonal fluctuations of the Bay and associated productivity underlie all fishing activity.
- Watermen must be flexible and ingenious in order to survive; overcoming the risks they face is a source of deep satisfaction.
- Watermen, since the Bruce decision (a 1971 Court ruling invalidating county residency requirements as a precondition to shellfish harvest)* have traveled the Bay increasingly, resulting in a Bay-wide, rather than a county-by-county fishery.
- Although capital equipment aboard boats is growing more sophisticated, watermen respect the gear restrictions they now face, understanding the danger of technology overpowering sensitive fishery stocks.
- The uncertainty of fishery income represents a challenge to be overcome.

Recent and important trends include:

- Generally Bay productivity demonstrates both a cyclical low point as well as a general decline.
- Watermen take great pride in their work and many young men are entering the fishery, nearly all from local families and communities.
- Gross incomes, in conjunction with a partially non-cash economy, appear to be reasonable, although capital costs and operating expenses have increased faster than incomes.
- Gear conflicts among watermen continue to exist, although eclipsed by conflicts with part-timers taking peaks during periods of abundance.
- Since the Bruce decision, mobility and flexibility have clearly increased.
- The Seacoast decision (a United States Supreme Court ruling invalidating State residency requirements for the taking of fish within State waters)** has Maryland watermen concerned fishermen from other states will move into Maryland Bay waters.
- Apprenticeship programs are felt necessary by watermen to avoid more drastic limited entry schemes.
- Most watermen stand opposed to the leasing of public bottoms.

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* Bruce vs. Director, Department of Chesapeake Bay Affairs
** Douglas vs. Seacoast Products, Inc. (1977)

Shoreside Sale, Handling, Processing and Distribution (Section III-D)

The shoreside sale, handling, processing and distribution of Bay products is next defined in the report. Specific quantitative estimates are generally lacking due to the private nature of transactions and insistence upon proprietary information. Purchases over the dock are first explained, followed by handling and processing details, costs (where available) of purchasing and handling, idectification of shucking-picking centers, product distribution techniques, product estimations, and trends observed. Significant factors drawn from the text include:

- Dealer operations are often based on community kinship patterns and Bay geography.
- Most dealers handle all Bay products to some degree; like watermen, they require flexibility and ingenuity to function.
- Serious labor problems exist for the shucking of oysters and the picking of crabs.
- The markets for conventional Maryland products narrow as fresh seafood is replaced by frozen products.
- Most dealers operate on small and variable profit margins, limiting investment in the capital equipment required to maintain economic efficiency.
- A need for automated processing machinery must be met if Maryland is to gain economic multipliers now largely enjoyed by Virginia due to oyster shipment there. Maryland also loses the oyster shell-stock to Virginia in these transactions. Much of the potential value of all Maryland Bay products is reduced by these transactions.
- Dealers function on a personal basis with watermen in associations of mutual benefit.
- Most sales over the dock are cash transactions.
- Extensive product flows occur among dealers to fell and balance individual orders.
- Prices are fixed at the retail level; the dealer is increasingly required to control his costs and purchases from watermen if he is to make a profit.

- Most dealers are required to function on a day-to-day basis.
- Government activities such as OSHA regulations increase the cost of business overhead without increasing productivity.

Important trends include:

- The number of Maryland oysters shucked in Virginia increases on a yearly basis, representing close to eight-tenths of the oysters landed in Maryland.
- Bootleg crabmeat represents a large but unquantifiable home-based industry.
- Sanitation problems are present concerning bootleg crabmeat; poor soft-shell clam quality has caused some shipments to New York to be rejected.
- Dealers are branching into related marine businesses: ice, fuel, marina repairs, and tourist services to broaden their annual business base.
- Products from other states increasingly compete with Maryland products, both within Maryland and elsewhere.
- Transportation costs have risen as have labor costs, decreasing business profit margins even further.
- Despite capital costs, at least two areas of the Bay have developed promising crab-picking machines.
- Several of the larger Maryland processing houses have been purchased by large, out-of-state corporations.
- Some dealers feel the state should promote leasing areas to provide consistent oyster supplies, although this position was taken by a minority of those interviewed.

Institutional Framework (Section III-E)

The institutions affecting Chesapeake Bay fisheries are next discussed in the report. Federal actions are mentioned, followed by a description of the Maryland Fisheries Administration, the Health Department, and the Marine Police. Finally, various industry associations are detailed.

Significant factors include:

- Federal anti-pollution efforts are not yet capable of dealing with nonpoint sources of pollution.

- As yet, not enough is known concerning the effects of such toxics as kepone, sulfuric acid, or other chemicals on Bay species.
- Present federal fisheries management philosophy, oriented toward quantitative processes of control and influence, is not yet suitable to the complex and variable Bay system.
- The existing complex geographically-based state management system, focused on gear restrictions compatible with Bay resource characteristics, strong enforcement, extensive interaction with watermen, and an active oyster propagation program, is highly successful.
- A habitat management approach for the Bay fisheries, in keeping with the structure of the fishery system itself, has been adopted by the Department of Natural Resources.
- Likely exhaustion of present cultch supplies from the Bay in three to five years has raised concerns about future stock abundance.
- A state position has been adopted that oysters are species resident to Maryland in response to the Seacoast decision.
- A strong and cohesive group of watermen's associations from a Bay-wide perspective presently exists, somewhat overcoming political changes resulting from reapportionment of the Maryland Legislature. However, shoreside processors, formerly representing the entire industry, have been less successful since the watermen organized. Currently shoreside organizational activity is increasing.

Significant trends include:

- Expressed fears that court rulings concerning Seacoast will force Maryland to adopt a position in favor of leaseholds.
- The Fisheries Administration today views fisheries management as an art as well as a science. Management focuses on resources rather than people. However, present management actions preserve the traditional way of life for Bay fishery communities.

Following this narrative description of the Maryland Bay commercial fisheries is a section describing the economic relationships among the many units involved in crab, oyster, clam, and finfish activities in the state. This is of particular importance as it sets a framework for methods of further analytical work in the Bay. The subtle and complex interactions which occur among the many factors in fisheries economics are emphasized, indicating the difficulty in obtaining valid data to describe this industry.

A final chapter briefly describes the fisheries in Ocean City, followed by a bibliography and list of industry/government personnel interviewed.

Implications for Management*

Future management actions concerning Maryland's commercial fisheries must be designed in light of the total system, linking habitat, resource and watermen as described in this report. Maryland's fishery system is based upon the efforts of individual watermen and their immediate families. These form the basis of the many fishing communities around the shores of the Chesapeake Bay in Maryland.

The Bay estuarine system connects these communities economically. Each community has links with outside suppliers and customers in state, regional, and national markets. The commercial fishery has developed through a series of necessary adjustments to the Bay's environmental and biological realities. These realities structure the "rules" within which the fishery operates.

Commercial fisheries practiced on the Bay must be resilient, flexible, adaptive, and creative to maintain economic equilibrium in the midst of natural and market uncertainties. The commercial fisheries provide a living for thousands of families in isolated rural communities. The fisheries economic system is complex and delicately balanced, representing an extremely flexible, responsive, "shadow economy" characterized by the strength needed to respond to resource fluctuations in the Bay.

Transactions and business dealings are informal and immediate, conducted among individuals who, if not related, have dealt with each other for many years. Business intelligence, and efforts to maintain economic balance,

* The following material represents the views and opinions of the field investigators who conducted interviews and authored this report.

require instant communication, immediate decision and confidence in the good faith of others. Formal written records, according to conventional business practice, are rare.

Great efforts must be made daily by all individuals to "move the product" as it is perishable and working capital is expensive and scarce. External influences on markets and prices steadily decreases.

This rural, family-oriented, geographically-dependent, self-sufficient fishery system requires management based upon an understanding of the following factors:

- Although natural fluxes in fishery stocks historically predominate, the threat of a natural depression occuring in phase with a pollution-induced productivity decline represents the greatest threat to the stability of the Bay's fishery.

- The foundation of Bay communities and the fishery system of which they are a part is the Bay itself.

- The Bay-wide estuarine system has replaced county political boundaries with respect to where fisheries are practiced and management policies followed. The Fisheries Administration choice of a habitat-wide management approach respects this fact. The Seacoast decision may ultimately require joint Maryland-Virginia Bay management.

- Community integrity and social structure provide the strength and relative stability of the present way of life with regard to resource harvest. Any changes imposed on this system based upon management and economic theory involving conventional definitions of "time," "money," and "value " will result in dislocation, displacement, and fundamental change. Bay residents are extremely sensitive to this issue. They feel they should be allowed to continue their current life if they so choose.

- Threats facing the Bay fisheries include: (1) water quality decline from actions taken elsewhere in the Bay watershed, (2) possible loss of control over fishery activities within the Maryland portion of the Bay as a result of recent Court decisions (these may allow residents of other states to take Maryland oysters, thus cancelling Maryland's incentive to continue the seeding program and driving the state to a leasehold posture), and (3) management emphasizing analytical determination of "efficiency" regarding license availability, gear technology, and traditional ways of doing business.

- If mechanized processing is introduced in conjunction with aggressive and coordinated marketing programs, careful attention must be paid to the need to coordinate such efforts with resource supplies.

- The issue facing watermen in a "shadow economy," including many non-cash exchanges which hide important economic values, is achieving net income.

- Any changes involving the imposition or replacement of fishing methods or technology must be undertaken with great care as they may bring about unexpected and destructive changes to the existing delicate balance between resource and industry.

- Of greatest significance is Maryland's heavy dependence upon the commercial Bay fishery system defined and characterized here. The industry is a critical economic factor to Maryland, providing revenue, employment and increasing tourist income. More importantly, this fishery is fundamental to maintenance of the existing, workable and healthy social balance so necessary to the quality of life for State residents.

II.
REPORT BASIS AND METHOD

A. APPROACH

The findings presented in this study are the result of intensive fieldwork undertaken on the Eastern and Western shores of Maryland. In addition, a thorough literature review was conducted, as well as many interviews with state, federal, university, extension, and industry association individuals with interests in every aspect of Chesapeake Bay, its ecology and use.

In the course of the fieldwork task over 3000 miles were travelled. Over 50 dealers, processors, and watermen were formally interviewed at their places of business or while engaged in shoreside fishery activities in their communities. Many additional, yet important dockside conversations took place with unidentified watermen whose contributions to this study were significant.

The volume of information acquired in a necessarily short period of time was substantial, yet underlying quantitative data (in some instances spontaneously offered), was not pursued intensively. As the first definition and characterization stage of a long-term fisheries program, it was felt inappropriate, and perhaps prejudicial, to focus too intensively on this area.

The information presented is based directly on the literature review and fieldwork mentioned although not in every case specifically referenced. Both the narrative sections and tabular presentations, then, represent as comprehensive a description and characterization of Maryland's Chesapeake Bay commercial fisheries as possible, given budget limitations.

B. REFERENCES EXPLANATION

This study, "Maryland's Chesapeake Bay Commercial Fisheries," is a direct outcome of activities initiated under the provisions of the Coastal Zone Management Act of 1972 (PL 92-583) as amended in 1976 (PL 94-370). Congressional findings state (Section 303[h]):

> The key to more effective protection and use of the land and water resources of the coastal zone is to encourage the states to exercise their full authority over the lands and waters in the coastal zone by assisting the states, in cooperation with federal and local governments and other vitally affected interests, in developing land and water use programs for the coastal zone, including unified policies, criteria, standards, methods, and processes for dealing with land- and water-use decisions of more than local significance.

Further definition of the intent of Congress with respect to the water resources of the coastal zone are contained in the Coastal Zone Management Act of 1972 Conference Report, "Joint Explanatory Statement of the Committee of Conference" (Section 304):

> Therefore, what the Conferees agreed upon was basically a water-related coastal zone program administered by the Secretary of Commerce with required full coordination with and concurrence of the Secretary of Interior. This compromise recognizes the need for making coastal zone management fully compatible with national land-use policy, while making use of the special technical competence of the National Oceanic and Atmospheric Administration in the Department of Commerce in managing the nation's coastal areas.

Maryland's Coastal Zone Management Program's Goals and Objectives are also relevant to the study approach and program.

GOAL 1: Preserve and Protect Coastal Resources

> To protect, maintain, and improve the quality of the State's tidal waters for propagation of wildlife, fish and aquatic life, and for human use and enjoyment.

To protect coastal aquatic areas of significant resource value and where possible, restore presently degraded areas of potentially significant resource value, such as viable oyster bars and clam beds, important fish migratory pathways, spawning, nursery and feeding areas, and wintering and resting areas for migratory birds.

To protect, maintain, and where feasible, restore the integrity of the tidal wetlands of the State.

To protect coastal terrestrial areas of significant resource value--areas having scenic, scientific, geological, hydrologic, biological or ecosystem maintenance importance--such as nontidal wetlands, endangered species habitat, significant wildlife habitat, and wintering and resting areas of migratory birds.

GOAL 4: To Promote Appropriate Methods of Use of Coastal Areas in Order to Prevent Deterioration of Coastal Resources

To promote use of State's coastal resources to meet social and economic needs in an environmentally compatible manner.

GOAL 5: To Promote Intergovernmental Coordination and Public Participation in Coastal Zone Management Program Development and Implementation.

To undertake studies and inventories, where needed, to provide the most complete and accurate information base possible for all levels of government and the public to use in management decisions and activities affecting coastal resources.

To ensure coordination and use of existing state and local government programs to achieve the CZMP's objectives.

To provide full opportunity for participation by relevant federal, state, and local government agencies, concerned organizations and the general public, in development and implementation of the Coastal Zone Management Program.

Finally, the criteria and standards established under the Office of Coastal Zone Management Coastal Fisheries Assistance Program directly lead from the Act to the objectives, tasks and method inherent in this project.

III.
MARYLAND CHESAPEAKE BAY COMMERCIAL FISHERIES: DEFINITION AND CHARACTERIZATION

A. THE CHESAPEAKE BAY ENVIRONMENT

1. The Bay - Geographic Basis*

The Chesapeake Bay is the largest estuary in the United States and one of the largest in the world. Practically an inland sea, the shallow water depths and extensive intermixing of salt water with fresh water runoff assure an extensive nutrient flow associated with high productivity.

The Bay, located within the states of Maryland and Virginia, is nearly 200 miles long and from 4 to 30 miles wide. The "upper" Bay, within Maryland, extends from the Susquehanna River in the north down to the Virginia border, a line drawn from the mouth of the Potomac River (Smith Point) across Smith Island to the Eastern Shore and thence east across Chincoteague Bay to the Atlantic beaches of Assateague Island. Water depths in the Bay average slightly over 20 feet, with deepest portions lying in the submerged channel of the Susquehanna River at the Bay's center. Great expanses, especially on the Bay's Eastern Shore, are less than 10 feet deep.

The Bay's watershed drains an area of about 64,000 square miles. Much of this area has been settled and farmed for centuries, characterized by good soil, extensive mixed hardwood forests, and abundant rainfall. The

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*Sources include conversations with federal, state Potomac River Commission industry, and watermen representatives. Literature sources supporting field-work include: Reference 5: Beautiful Swimmers; Reference 7: Chesapeake Bay Future Conditions; Reference 8: Chesapeake Bay in Maryland; Reference 9: Chesapeake Research Consortium Progress Reports; Reference 25: Guide for Cruising Maryland Waters; Reference 34: Maryland Coastal Zone Program; Reference 42: Patuxent Watershed Report; Reference 51: Susquehanna Basin.

Susquehanna River is by far the largest watershed in the Bay, with an area of 27,510 square miles, or 43 percent of the total drainage into the Bay. The Potomac River, entering the Bay on the middle Western Shore, with a watershed area of nearly 15,000 square miles, drains 23 percent of the Bay system. Further south, still to the westward and in Virginia, are the Rappahannock River (less than 5 percent of the Bay system), the York River (less than 5 percent of the Bay system), and the James River (16 percent of the Bay system).

On the Western Shore a great metropolitan complex has developed along the Baltimore-Washington axis, with associated port facilities, industrial activity and urban waste. The Eastern Shore remains largely rural, isolated and undeveloped, although the Bay Bridge, Chesapeake Bay Tunnel, and related road improvements have greatly increased traffic and development in the region during the past two decades. Eastern Shore uplands remain primarily devoted to farming activities. Large areas of wetland and crop residues in the fall and spring provide shelter and food for millions of migratory waterfowl, and the Bay is well known as a major waterfowl wintering area.

The salinity of Bay waters varies considerably. At the mouth of the Bay, off Norfolk, freshwater dilution is rarely observed whereas the head of the Bay is predominately fresh due to the large Susquehanna outflow. On a general basis, the Western side of the Bay, closest to the major rivers draining the coastal uplands, is characterized by a net inflow of fresh water. The Eastern side of the Bay experiences a greater salt water intrusion. However, because salt water is denser than fresh water, net inflow of salt water occurs along the bottom throughout the Bay. Of greatest importance with regard to the living marine resources of the Bay, all of which

are affected by salinity, are the relative proportions of salt water and freshwater. These proportions change with seasonal weather patterns, winds, tides (to some extent), and rainfall (primarily). Each of these factors affects the degree of intermixing and associated salinity. As salinity changes, so may concentrations of organisms - aquatic plants, commercial species, and predators. On a very general basis the middle portion of the Bay (between the Bay Bridge and the Potomac River) experiences the steadiest year-by-year conditions of seasonal salinity, for the Susquehanna outfall lies far upstream and the Eastern Shore Watersheds are composed of small, gently flowing rivers. Further south the Nanticoke and Wicomico Rivers drain into Tangier Sound, far to the east of the Western Shore river discharges. These two areas have had the most stable and greatest long-term production of commercial shellfish over time in Maryland waters.

Changes in salinity through intermixing are seasonal. During winter months the Bay is more saline because freezing conditions along most Bay watershed rivers "lock up" fresh water in snowfall and ice. In addition, fresh water within the Bay freezes before salt water. Much of the Upper Bay has been known to freeze over during hard winters.

In spring river discharge into the Bay is greatest due to melting snow and increased rainfall. During this period salinity is much reduced, especially at the head of the Bay and along the Western Shore. Also during the spring, erosion and soil runoff into the Bay is most severe and great volumes of sediment enter the Bay system.

With the coming of summer the waters warm and biological activity increases. As the watersheds are drained of spring runoff, fresh water intrusion into the Bay steadily drops. By the end of August salinity has again

risen as salt water intrusion continues, aided by prevailing southwesterly winds. Saline water flows far up the gently sloping estuaries all around the Bay. In autumn, greater rainfall produces increased freshwater discharge once again, although not in the volumes experienced during the spring.

Chesapeake Bay location on the hurricane storm track has also been important, most recently felt in 1972 when tropical storm Agnes flooded the Bay with an enormous quantity of rain. The sudden addition of great volumes of runoff rapidly lowered Bay salinities, causing widespread mortality in fish and shellfish populations.

These general seasonal fluctuations provide the cycles and changes driving the entire Bay ecosystem, and all Bay organisms must adjust to these cycles in order to survive. Large changes in year-to-year environmental conditions are sometimes reflected in large changes within Bay marine populations, changes with natural rather than man-made causes.

The traditional use of rivers and the Bay as a "sink" for pollutants of all kinds throughout the history of the Chesapeake region demonstrates the remarkable strength and resiliency of this estuary.

2. The Bay - Concentrations of Commercial Stocks*

Commercial species sought by Bay watermen include oysters, blue crabs, soft-shell clams, eels, and several species of finfish (among them striped bass, bluefish, menhaden, and perch). Of these species the shellfish are subjected to steady or increasing fishing pressure; commercial finfishing has declined substantially for a variety of reasons.

Oysters

Oysters were once found throughout Chesapeake Bay. Overharvest in the late 1880s, several outbreaks of disease, siltation at the head of the Bay during the past century, and removal of oyster shells from Bay waters for various purposes have much reduced the area now inhabited by oysters. Oyster concentrations result from specific habitat conditions. The oyster is a shellfish with rather complicated biology. While a very young organism, the oyster drifts in the water column for a period of time while growing and developing from larval form. Eventually, the oyster must find a suitable surface upon which to attach itself. The best surface found in nature (cultch) are the shells of other oysters. An oyster, once "set," cannot move. The oyster

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*Sources include conversations with State officials, industry and watermen representatives. Literature sources supporting fieldwork include: Reference 3: Aquatic Resource Areas; Reference 5: Beautiful Swimmers; Reference 6: Oyster Propagation in Maryland; Reference 20: Maryland Oyster Resource Expansion Task Force, Final Report; Reference 21: Fishery Resources of the Patuxent River System; Reference 22: Follow the Water; Reference 23: Groundfish Resource Assessment; Reference 37: Predicting Stock Requirements for Oyster Producing Areas; Reference 41: The Oystermen of the Chesapeake; Reference 43: Plans for Management of Fisheries, Tidal Potomac; Reference 44: Potomac Estuary Biological Resources; Reference 49: Striped Bass in Maryland Tidewaters; Reference 50: Survey of Commercial Finfishing Areas; Reference 60: Natural Oyster Bars.

feeds by passing Bay water through its system. Oysters may live as long as twenty years. When environmental conditions are favorable during the period June - October and water temperatures reach 20°C, the oyster spawns. Fertilization occurs in the water. The period oysters drift lasts about a month. During this time the developing "spat" is moving as the water moves. The "set" oyster grows fairly fast and is ready for commercial harvest when three years old.

Oysters can survive within quite varied salinities (from 7 to 35 ppt), reflecting Bay ranges during the year, but areas of too little salt content can be fatal, while areas of regularly high salt content permit various predators (drills, starfish) to successfully deplete oyster populations. Also important is the oysters' vulnerability to siltation. An animal feeding by filtration requires water with low suspended solids. Silt and sediment may suffocate oysters unless the current is strong. Other rivers of large volume emptying into the Bay do not contain the same proportion of oyster beds as do the areas close to the mouth of rivers found on the Eastern Shore, possibly in direct proportion to the sediment carried steadily downstream and certainly in proportion to salinity reductions at certain times of the year.

Oysters prefer specific water depths and are found in water fifteen to twenty-five feet deep. Many areas in the Bay covered by fifteen to twenty-five feet of water and free of silt once supported oyster bars. Greatest concentrations today are in water slightly less saline than the waters supporting predatory organisms.

Certain spots consistently receive "spatfalls" of greater quantity than other areas (the State of Maryland has designated some of these areas as "seed" areas for the State propagation program - Section III-E), while other areas, not known for good spatfalls, produce better mature oysters because of more favorable growing conditions. There are many formerly productive bars now "played out" and others occasionally receiving a good "set." While in a broad sense "good" areas remain "good" from year to year, there are significant changes in oyster abundance from bar to bar. Finding the good spots - "following the oysters" - is the skill of the successful waterman.

At one time, the major oyster concentrations were located near Crisfield in Tangier Sound, but the advent of MSX in the southern Bay destroyed most beds. While siltation north of Rock Hall and MSX south of the Potomac River reduced oyster populations elsewhere in the Bay, those bars between Rock Hall and the Potomac River have remained productive. Today the most abundant concentrations of oysters are located within Talbot County and Dorchester County, that portion of the Bay characterized by steady salt-water intrusion, relatively small fluctuations of fresh water inflow (save seasonal changes and the occasional hurricane), and distance from major urban concentrations.

The oyster bars were last charted before the First World War (over 900 were charted). Like other shellfish beds (the sea scallop, for example), each bar produces oysters characterized by particular colors, shapes and sizes. The general oyster population throughout the Bay, while one stock, is composed of various bars inhabited by sub-populations characterized by local food supply and environmental conditions. At present, the major con-

centrations of oyster bars are found in the middle Bay along the Eastern Shore as well as off the Potomac River. Both areas are subject to extensive seeding programs. In recent years, concentrations of oysters have been much affected by human activities, generally restoring bars in traditionally productive areas. Presently charted are 326,000 acres of oyster bars in Maryland and 1,217 acres of seed-producing areas.

Soft-Shell Clams

Soft-shell clams, another shellfish species of commercial importance, were first harvested intensively during the early 1950s to meet market demands in New England as New England soft-shell clams in tidal areas became exhausted as a result of overfishing and disease.

Soft-shell clams are found throughout the Bay in waters between 10 and 20 feet with a salinity range of 5-20 ppt. Soft-shell clams occupy sandy or sandy-mud bottoms, unlike the harder bottoms preferred by oysters. Slightly lower salinity requirements, a preference for shallower areas, and a need for soft bottom cause clam beds to be further up tributaries than oyster bars and most frequently shoreward of oyster bars.

Spawning occurs twice a year: early May to mid-June and from late August to early December.

The habitat occupied by soft-shell clams often overlaps with oyster habitats, and clams are found beneath oyster cultch on many occasions and frequently directly adjacent to oyster bars.

Soft-shell clams are vulnerable to high water temperatures and extremely low salinities, as are oysters. However, the shallower depths preferred by clams more frequently experience higher temperatures during

the summer, with associated mortalities. The shallower depths of clam bed locations near the mouths of tributaries are also extremely sensitive to large fresh water discharges. For these reasons, Hurricane Agnes was especially destructive to soft-shell clams in 1972.

Commercial stocks of soft-shell clams, like oysters, are today primarily found in the middle Bay area, with highest concentrations in Talbot, Dorchester and Queen Anne's counties.

Blue Crabs

Blue crabs move over rather extensive areas of the Bay during their life cycle. From June to October, near the mouth of the Bay in saline water (27 ppt), young crab larvae are hatched. These larvae progress through several stages as the summer passes, drifting with the tidal currents and moulting six times in five weeks before seeking bottom as a recognizable crab. During this period the larvae require water salinities of about 20-25 ppt and water temperatures ranging from 68 to 85°F.

When mobile on the bottom, immature crabs move north up the Bay into the brackish (17 ppt) waters of estuaries and tributaries, moulting several times. With cooler autumn weather the crab buries itself in the mud and hibernates throughout the winter.

Hibernation ceases during spring and by the second summer of life the crab has moulted about fifteen times and is an adult, seeking waters as low as 10 ppt. Mating occurs during the second fall of life when the female is soft from her final moult. The fertilized female then migrates south to more saline waters (17 ppt), hibernates for the winter, and during her third spring moves south again to the lower

bays (25 ppt) where she spawns. Most females die before the fourth summer.

Male blue crabs do not migrate but rather remain in the deeper channels of the upper bays and estuaries, moving steadily deeper with the onset of cold weather. The male crab often mates again during his fourth summer before death.

Commercial concentrations of blue crabs in the Bay, therefore, are widespread. Many large crabs today are taken from the Tangier Sound area in northern Virginia Bay waters. A winter fishery for hibernating females (the "scrape" fishery) is practiced in Virginia waters at the lower end of the Bay.

However, commercial crab concentrations are found in most Bay tributaries, with greatest abundances found along the Eastern Shore, most notably in Eastern Bay (where large males are found). The mobility of the adult crab allows this species to adjust to changing conditions of salinity. With low rainfall, more saline waters move further up the Bay as do associated crab concentrations; after heavy rains crab populations are found in deeper, southern Bay waters. As with oysters and clams, year-to-year crab concentrations are found in those areas of the Bay experiencing reasonably stable cycles of salinity: in Maryland waters, that portion south of Rock Hall, with heaviest concentrations observed in the relatively enclosed Eastern Bay and Upper Tangier Sound.

Finfish

The major species of finfish sought by Bay watermen include striped bass, alewives, menhaden, fluke, white perch, and eels. Striped bass are

anadromous, spawning at the heads of Bay tributaries in waters less than 1.5 ppt. Eels are catadramous, spawning in the ocean but seeking shallow estuarine waters for growth to adulthood. Other species of value are anadramous or estuarine, taken largely when concentrating in the less saline headwaters of the Bay.

Such species often scatter when they migrate to the ocean but concentrate in the upper estuaries for their spawning and developmental stages. The shallow, nutrient-laden marsh waters provide food and shelter from predators.

Extensive losses of upper tributary rooted aquatic plants have recently occurred with unknown, but possible severe effects upon fish populations. In addition, the reliance of these species upon fresh water rivers for spawning activity has made eggs and larvae particularly vulnerable to pollutants, reducing recruitment. For these and other reasons the commercial finfisheries have declined greatly in importance. Whereas much of the Bay shoreline once had extensive netting activities (drift nets, gill nets, pound nets, stake nets, and use of beach purse seines), today most commercial finfishing exists in two areas: along the shores of the Potomac River and along the reaches of the head of the Bay, although other rivers (Nantocike, Chester) also support fishing activities. In these areas nets are set to capture finfish species when they concentrate and school and move upstream to spawn (or when they gather to begin their migration to the open sea).

Some striped bass are known to remain in the upper Bay year-round and the fisheries reflect that fact.

Eels are taken in many of the estuaries in shallow water during the spring and are found throughout the Bay.

Commercial concentrations of oysters, soft-shell clams, blue crab and finfish vary considerably as the habitat varies. Generally, greatest concentrations of immobile shellfish are found where the Bay experiences relative stability from severe and sudden changes in salinity - those portions of the Bay characterized by distance from the Susquehanna River, drainage of smaller rivers into extensive wetlands with a high storage capacity (thereby serving as a "buffer" to sudden salinity changes) and a steady salt water intrusion from the south. Oyster concentrations today depend greatly upon Maryland propagation programs.

Crabs are mobile and throughout their life may travel considerably, especially the females. Greatest commercial blue crab concentrations are found in Eastern Bay (for large males) although the sources for most Maryland blue crabs today are the waters of Virginia (Tangier Sound) and imports from other states.

For commercial purposes, finfish concentrations are mainly in the head of the Bay north of Rock Hall, along the Potomac River, and in the upper waters of many tributaries.

3. The Bay - Watershed Relationship*

Most of the watershed area draining into the Bay lies west and north of the Western Shore. Most freshwater inflow results from the Susquehanna River entering the head of the Bay. The Chesapeake-Delaware Canal, part of the Inland Waterway, also enters the head of the Bay, slightly increasing the low salinities found there. However, north of the Potomac River the major influx of fresh water results from the Susquehanna, draining a watershed of 27,510 square miles.

Between the head of the Bay and the Potomac River, over one hundred miles further south, are many small river systems. Collectively, these watersheds account for a minor portion of Bay drainage. North of the Potomac River on the Western Shore are the Patuxent, West, Rhode, South, Severn, Magothy, Patapsco, Back, Middle, Gunpowder, and Bush Rivers. The Patuxent River is the largest watershed; all others drain small areas. Western Shore terrain rises fairly rapidly; consequently, these watersheds have significant gravity flow. In addition, the marshland areas at the mouths of these rivers are significantly smaller than across the Bay on the flatter Eastern Shore.

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*Sources include conversations with State officials, industry and watermen representatives. Literature sources supporting fieldwork include: Reference 7: Chesapeake Bay Future Conditions; Reference 8: Chesapeake Bay in Maryland; Reference 9: Chesapeake Research Consortium Progress Report; Reference 12, 13, 14, 15, 16: County Plans (all); Reference 31: Effects of Turbidity and Siltation on Aquatic Life; Reference 34: Maryland Coastal Zone Program; Reference 36: Applying Research to Environmental PLanning and Management; Reference 42: Patuxent Watershed Report; Reference 43: Plans for Management of Fisheries, Tidal Potomac; Reference 45: Potomac River Basin Directory; Reference 51: Susquehanna Basin; Reference 55: Water Quality Goals for Chesapeake Bay; Reference 57: Water Quality Management Program.

Watersheds on the Eastern Shore above Kent Island Narrows include the Northeast, Elk, Bohemia, Sassafras, Worton, and Chester Rivers. The Chester drainage is greatest in area.

North of the Bay Bridge, then, the major watershed entering the Bay system is the Susquehanna. Salt water inflow is restricted by Kent Island Narrows to some extent, and Bay salinities north of Kent Island tend to be significantly lower than further south. The upper Bay today supports a greater proportion of finfish than shellfish, being suited for anadramous spawning activity in the many square miles of virtually fresh water.

The Potomac River watershed, entering the Bay at the northern Virginia border, is the second largest within the Bay system. Like the head of the Bay, the Potomac sees extensive anadramous fish activity, although both the Potomac and Susquehanna have suffered under pollution from human activities. The large size of the Potomac, like the Susquehanna, assures greater fresh water inflow from these systems than the smaller watersheds elsewhere in Maryland. Both the Potomac and the Susquehanna have relatively deep channels and steep banks.

The general passage of Western Shore outflow south along the western bank suggests one reason most commercial concentrations today exist along the Eastern Shore, for the rapid outfall from western rivers and associated pollutants partially prevents intermixing associated with the tidal inflow to the eastward.

Watersheds draining the Eastern Shore occupy flat, marshy terrain. None of the river systems is large in comparison with flows from the westward. While extensive agriculture is practiced on the Eastern Shore as

well as poultry farming (with associated nonpoint agricultural discharges and pollutants from chicken wastes), heavy industry and major urban concentrations are relatively absent.

The Chester River drains into a large bay bounded by Rock Hall to the north. From the Chester River to the south all watersheds drain into large shallow bays surrounded by extensive wetlands. Draining into Eastern Bay (located west of Kent Island) are the Wye and Miles Rivers. These are small watersheds entering a nearly enclosed Bay and possibley a significant basis for Eastern Bay's consistently high production of shellfish and crabs.

South of Tilghman Island are the Tred Avon, Choptank, and Little Choptank Rivers, likewise entering protected waters with associated high productivity.

South of Little Choptank the Bay again narrows just north of Solomon's Island. The area from Kent Island to Solomon's receives no major freshwater discharges from the Western Shore, and watersheds on the Eastern Shore are usually characterized by gentle gradients, large wetlands, and excellent storage capacity in the event of nonhurricane rainfall. All these factors contribute to the relative stable salinity of this portion of the Bay.

The lower Maryland Eastern Shore drains several watersheds: the Nanticoke, Wicomico, Manokin, Big Annemessex, Little Annemessex, and Pocomoke Rivers. All these rivers discharge into Tangier Sound, somewhat isolated from the Patuxent and Potomac outfalls across the Bay by distance and the Bloodsworth-Smith Island chain. As with the Choptank drainage system, great expanses of the mainland are marsh and wetlands, providing

great storage capacity for fresh water and serving as a buffer from sudden changes in salinity.

Viewed from this perspective, the relationship of the Bay fisheries to watershed systems indicates the importance of those watersheds draining flat terrain, containing broad expanses of marsh, isolated from the major river discharges along the Western Shore, and entering waters experiencing steady tidal intrusion from the south.

4. The Bay: Water Quality Summary*

To summarize water quality factors indicated previously:

- Conflicting evidence exists concerning eutrophication. Observers interviewed, who had lifetime residence along the Bay, pointed to its "increasing cloudiness." Certain reports indicate increasing amounts of chlorophyll but not as high as in 1970.
- Observers indicated Potomac River pollution and its impact upon finfish (rock) and shellfish was creeping downstream. It is also clear that the Patuxent River has been seriously degraded as a result of pollution.
- Little evidence has accumulated concerning the impact of toxic or hazardous wastes upon the Bay. The influence on marine life is apparently unknown. Evidence accumulating elsewhere, however, indicates a whole series of chemicals are possibly becoming the greatest water quality hazards now entering the Bay.

These conditions result from the Bay's location on the fringe of one of the largest and wealthiest metropolitan areas in the United States, as well as one of the highest growth areas in the United States. Land development along the Western Shore presents the greatest danger to the Bay from organic wastes, toxic and hazardous wastes, and sedimentation. The amount and rate of land development on the Western Shore is certain to continue to mushroom in the coming years as the Washington area continues to expand.

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*Sources include conversations with State officials, industry and watermen representatives. Literature sources supporting fieldwork include: Reference 7: Chesapeake Bay Future Conditions; Reference 8: Chesapeake Bay in Maryland; Reference 9: Chesapeake Research Consortium Progress Reports; References 12, 13, 14, 15, 16: County Plans (all); Reference 31: Effects of Turbidity and Siltation on Aquatic Life; Reference 34: Maryland Coastal Zone Program; Reference 36: Applying Research to Environmental Planning and Management; Reference 42: Patuxent Watershed Report; Reference 43: Plans for Management of Fisheries, Tidal Potomac; Reference 45: Potomac River Basin Directory; Reference 51: Susquehanna Basin; Reference 55: Water Quality Goals for Chesapeake Bay; Reference 57: Water Quality Management Program.

Pollution has different connotations on the Eastern Shore. Here, except for suburban development on and near Kent Island, and resort development in Ocean City, housing and commercial development has scarcely touched the land. Its use is largely agricultural, producing corn, soy bean, and chicken products. Unstudied and apparently unknown are impacts from nonpoint sources along the Bay or the impact of the large amount of chicken feces produced by the poultry industry.

Land development, primarily for housing, along the Eastern Shore, is limited by distance from major employment centers. The kind of pattern occurring in Kent Island will slowly move down the Bay and, as it does, impacts upon water quality similar to those resulting from development upon the Western Shore will occur. In addition, the Eastern Shore may represent an important potential powerplant site.

Discussions with representatives of several organizations indicate that, from their viewpoint, the impact of pollution upon fish and shellfish is not given high priority in Section 208 planning activity in terms of preventing the pollution. This is most true in areas of toxic and hazardous wastes as well as nonpoint sources. The passing of new legislation to prevent pollution from chemical wastes will clearly improve the former condition but effective control of nonpoint source pollution has not yet evolved.

B. COMMUNITY FRAMEWORK*

The geography of the Bay--the long necks, the islands, the extensive marshes--and the separation of the Eastern Shore from the Western Shore until construction of the Bay Bridge underlies the entire basis of the commercial fisheries system examined here. Communities serving the Bay fisheries have developed goegraphically to use those Bay habitat characteristics detailed previously: water quality, shallow depths, suitability for small boats, and seasonal cycles. Locations of fishing grounds and relative access to those grounds form the basis for all fisheries-related economic activity, particularly in the many remote locations where most fishing communities are found.

Communities dependent upon Bay fish and shellfish resources remain small and relatively distinct from the increasing development pressures of suburban spread (now crossing the Bay Bridge and observed on and near Kent Island) and growth of recreational boating and associated marinas. Even along the Western Shore south of Galesville are found small settlements located on necks or small rivers seemingly unchanged in the past half-century. The Eastern Shore, while containing the larger municipalities of Easton, Cambridge, Pocomoke City and Salisbury, remains truly rural.

*Sources include conversations with watermen representatives, community leaders and staff observation. Literature sources supporting fieldwork include: Reference 5: Beautiful Swimmers; Reference 10: Commercial Fisheries News; Reference 22: Follow the Water; Reference 38: Mobility of Oystermen; Reference 41: The Oystermen of the Chesapeake; Reference 54; The Waterman's Gazette.

Bay fishing communities are characterized by tight-knit, extended kinship interactions. Many waterman's operations and shoreside supporting systems are based upon these relationships. Within a single community are found brothers who are watermen, other brothers (or uncles and cousins) serving as buyers and processors, in-laws operating neighborhood garages and groceries, and other relatives building boats. These family enterprises have evolved over long periods of time; we frequently spoke with watermen or dealers whose families had pursued the Bay fisheries for as many as five generations.

Rather than adopting the recent American phenomenon of mobility in search of a career, those living on the Bay are fundamentally territorial. Their work has evolved with a deep appreciation and love for the environment in which they have been raised. They remain on the Bay by choice in nearly all cases.

Those dependent upon Bay fisheries hold their land within family groups. When there is property turnover, land or businesses are most often sold to relatives or other community families.

The harvest system used by watermen has developed on a low-capital, low overhead basis, reflecting Bay cycles and the need to function with a minimum investment so as to survive periods of low abundance. As detailed elsewhere, until 1971 watermen could only fish within their country of residence. They were thus vulnerable to county-by-county biological variation; while Bay production as a whole held fairly steady, enormous differences among counties were common.

Bay fishing communities have developed complete local support systems for their watermen. Each community saw development of local mechanic services, local boatbuilders (there are six located near Wingate alone), local buyers, processors, and product transporters. Further reflecting a need for self-sufficiency, watermen themselves (with their families) carry out much shoreside support work on their own, adapting machinery from auto and farm equipment, performing their own boat maintenance, making up their own gear, and often selling and moving their own product.

A later section (Shoreside Sale, Handling, Processing, and Distribution) details the development of several product handling centers, where large wholesalers are located, but the bulk of the product flow system is tied directly to the many outports with trucks, local buyers and shippers, and dealers from individual communities often shipping directly to distant markets in the middle and far west, for instance.

Bay fishing communities generally function on a local basis, but product flows and watermen mobility create interdependency and overlap in many complicated ways. Although each community is distinctive, together they form a Bay-wide system. A generally low-technology system capable of being constructed and maintained within each individual community has evolved. Close personal relationships result in services exchanged on a noncash basis: trucks are borrowed, people help other people out (e.g., for hauling a boat or building a home), and barter exchange of products occurs frequently.

Most families in fishing communities own their land outright, and have done so for generations. Mortgage payments are thus lower than in newer developments. Noncash services and barter exchanges for materials

and labor further reduce the cash requirements for day-to-day living. Traditional economic measures of income often have little to do with a quality of life developed according to tradition, family relationships, and nonmonetary values. Those earning a living from the Bay are confident they can reach reasonable solutions to most problems through compromise. Their survival, depending as it does on a history of natural fluxes, requires compromise and flexibility for success.

A fundamental and often overlooked aspect of small-scale inshore fisheries is that each dollar received for the product is widely dispersed throughout the community. The inherent dynamic nature of seasonal fisheries and noncash exchanges within close kinship systems finds many people supported on relatively small amounts of cash. While in conventional terms their income may be inadequate, people in these fishing communities often expressed satisfaction with their way of life as it is.

Fishing communities around the Bay are composed of both white and black settlements. Although most businesses are owned by whites, large numbers of black watermen work on the Bay and many other blacks work in processing plants ashore. Because blacks are not fully integrated into the economy and have lower income, capital accumulation is difficult, upward mobility is limited, and many young blacks today leave the area. However, the influences of the Bay geographic system and associated way of life causes the values and attitudes held by blacks and whites to often be similar, particularly for watermen.

Several community trends have importance to Bay fisheries. A continuing problem of labor supply for shoreside processing results from

many blacks leaving the area. Most Bay product leaves the state in raw form, losing the opportunity for economic multipliers associated with processing activities.

A steady growth of recreational boating has caused land values to rise and marinas to spread in all directions from the Bay Bridge. Communities have responded by providing tourist-related services. Recreational boating activities have reduced isolation and independence from urban attitudes and found many fish and shellfish buyers responding to fisheries resource supply uncertainties by broadening their business base.

A most significant trend is seen in the great development pressures from the westward. As roads are improved and suburban services expand, related construction of commuter housing will continue to move south from Kent Island. Rising land values and inflation may result in similar activities as have occurred elsewhere (e.g. Vermont farmers have been forced to sell land to cover taxes for increased municipal services). However, this trend may be tempered by the strong feeling of Bay fishing community residents to keep their areas as they now are.

Reapportionment of the Maryland legislature has seen rural control of the Statehouse shifted to a more urban orientation. The previously strong voice of the remote Maryland communities, which has had great effects upon state legislation concerning watermen (e.g., a state position favoring public rather than private shellfish bottoms) and thus on community structure, has weakened. We often heard concerns raised on this point.

As detailed in the following section (Harvesting Sector), attitudes and views of the watermen themselves are optimistic, reflecting

deep-seated community attitudes. Today many young watermen are engaged in the fishery. Given the development and changes seen so often in other rural areas of the country, the Bay community trend to maintain life as it is today may be the most important trend noted anywhere in this report.

C. HARVESTING SECTOR*

1. Introduction

While each fishery on the Bay is characterized by different harvest methods according to the characteristics of the species sought and various conservation regulations, those who make a living from the water generally do not consider themselves "oystermen" or "crabbers" but rather speak in terms of being a "waterman." Although severe conflicts do exist, particularly between oystering and clamming (detailed below), the manner of making a living on the Bay from a privately-owned, small, shoal-draft boat, often alone and rarely with more crew than one sternman, is similar in all Bay fisheries (although the 28-30 remaining skipjacks carry larger crews). Like other coastal small-boat fisheries (e.g. the Maine lobster fishery) people choosing a livelihood guided by the natural forces of seasonal weather in search of organisms known for variable abundance deeply enjoy the personal satisfaction arising from "finding the fish." The occupation, although a life of uncertainty, economic risk, vulnerability to natural changes, and lack of control over price at the dock, provides personal freedom, working conditions out-of-doors, and close contact with the rhythms of the Bay. In an area offering little other work, the Bay fisheries provide full-time

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*Sources include conversations with industry and watermen representatives, and staff observations. Literature sources supporting fieldwork include: Reference 5: Beautiful Swimmers; Reference 22: Follow the Water; Reference 26: How to Catch a Crab; Reference 30: Laws Concerning the Commercial Harvesting of Shellfish; Reference 29: Laws Concerning the Commercial Harvesting of Finfish; Reference 33: Sport Fishing Survey; Reference 39: The Maryland Oyster; Reference 40: The Maryland Soft Clam; Reference 41: The Oystermen of the Chesapeake; Reference 47: Recreational Boating, Maryland; Reference 50: Survey of Commercial Finfishing Areas.

employment (i.e., all personal income derived from fishing activities) for over 9,000 watermen. Those liking the life and choosing to work on the Bay may be following a family tradition, but as the work requires hard physical labor outside under frequently severe conditions, the major reason is finally one of personal choice.

Having seen abundances rise and fall, a waterman often mentions cycles. His skill is making the best of those cycles. On land he is most often part of a community that first arose because there were protected anchorages close to Bay commercial stocks. The Eastern Shore especially was geographically remote and unsuited for major urban concentrations, providing little competition for labor. Some people left; the watermen stayed. During the late 1950s and early 1960s, virtual depression struck Bay fisheries as clams became scarce and oysters suffered from poor abundance. Subsequently, a Maryland oyster seeding program and some stabilization of clam yields enabled the industry to adjust. Literature from a decade ago often mentions the high average age of the watermen and the "dying" way of life. However, today many young men operate boats with their fathers or boats of their own. Harvest methods (detailed below) are, in one sense, "inefficient," yet such methods provide a living for more watermen than there are fishermen in all New England. Watermen do not speak of their gear as "antiquated," but rather as "in balance." They do not feel they must "overcome" the Bay but rather are a part of the Bay, in "synch" with the Bay. Like most small-boat fishermen, they work on the water because they choose to. The uncertainty of the work itself results in deep respect for the large Bay habitat of which they are a part. Lacking control over natural events, when a

waterman's task is accomplished, his pride in his skill also recognizes the influence of luck. The need to respond to unforeseen changes in species abundance require great personal flexibility and willingness to change gear types and fisheries as conditions demand. The many "part-timers" along the shore, single-species fishermen, or those unable to afford a larger boat, may only work on the water four months a year. However, those four months may be most important to the individual; he works ashore only to provide himself the ability (income, residency, etc.) to fish when he can.

While many watermen in the Bay solely fish for clams or oysters, more often a waterman will change fisheries several times over the years as well as within the year. His livelihood is what the Bay provides; if he is unwilling to change as the Bay changes, he is not a waterman for long.

2. Species Sought

The species taken from the Bay by watermen are oysters (by far the most important Bay fishery), blue crabs, soft-shell clams, and finfish.

Watermen we interviewed all spoke of the Bay as presently in a "down cycle," particularly concerning soft-shell clams. Yet there was also a feeling shellfishing was holding its own; while on a down cycle today, abundances would rise in the future. Harvest limits on oysters (25 bushels per man per day using tongs of any kind, 150 bushels per day for skiff-pushed skipjacks twice a week, and 150 bushels when dredging under sail) and clams (15 bushels per boat per day) conserve the resource yet allow adequate income when the price is right. In addition, the state seeding program partially replenishes oyster bars during the spring. These resource conservation measures combined with shell size limits (three inches for the oyster, five and a half inches for hard crabs, three and one half inches for soft crabs and three inches for peelers) have aided in stabilizing the industry from the wild fluctuations observed decades ago.

These factors and the seasonal characteristics of the fisheries (following section) cause most commercial fishing for oysters to occur in the fall and winter with strong efforts for crabs during the summer. Many soft-shell clammers work year-round. An eel fishery is conducted during the spring for crab trotline and pot bait. Recently several foreign markets, notably Japan, have expressed interest in Bay eels. Striped bass are by far the most important finfish, taken with various nets at the head of the Bay or along the Potomac River and Eastern Shore. Other fish species sought include alewives, menhaden, fluke, and white perch. An occasional sturgeon is taken as well.

3. Seasonal Characteristics

The seasonal characteristics of the Bay fisheries closely follow the natural fluctuations of the stocks themselves throughout the year.*

The oyster fishery is practiced from September 15 to March 31. The oyster season, regulated by law, permits oyster harvest following spawning activity during that period of the year when oyster meats fatten and gain in taste. Skipjacks are permitted to begin oystering November 1.

Greatest demand for oysters in the shell and in fresh form is during the period from Thanksgiving to Christmas. At the end of this period winter has arrived, and time may be lost because of weather: Ice on the Bay, strong cold northwesterlies forming ice on those boats out in the Bay, or severe snow storms may hinder fishing.

Fishing pressure for oysters picks up in February, but a general opinion among oystermen holds a man must "make out" before Christmas or he will have a poor season.

The oyster fishery, then, is the Bay's winter fishery and its most valuable fishery, with highest landings during the period from September to December.

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*See Section A-2: "The Bay: Concentrations of Commercial Stocks" for the biological seasonal patterns upon which the major commercial fisheries depend.

Oyster harvests for the period 1965-1976 were as follows:*

Year	Amount/Bushels
1965	1,340,177
1966	1,645,144
1967	3,014,670
1968	3,000,272
1969	2,509,791
1970	2,533,275
1971	2,395,528
1972	2,900,547
1973	2,925,236
1974	2,845,924
1975	2,511,424
1976	2,369,017

The soft clam fishery occurs throughout the year with heaviest landings during the late winter, spring, and summer. The gear required for clam harvest (following section) does not readily allow quick conversion to another fishery although many clammers switch to oystering in the fall.

Soft-shell clam harvests (fiscal year) for the period 1965-1975 were as follows: *

Year	Amount/Bushels
1965	509,393
1966	296,252
1967	278,462
1968	107,563
1969	438,875
1970	610,098
1971	476,501
1972	424,561
1973(Agnes)	15,845
1974	112,960
1975	173,978

*Source: Maryland Fisheries Administration.

A review of catch summaries for the representative year 1975, by month, demonstrates seasonal variations in the harvest of oysters and clams:*

Month	Oysters/Bushels	Clams/Pounds Soft Shell Meats
January	318,325	128,016
February	284,262	112,788
March	261,461	116,832
April	19,989	182,472
May	7,966	165,528
June	4,908	161,460
July	3,819	203,844
August	3,435	119,718
September	230,798	41,712
October	403,595	30,912
November	462,169	14,472
December	440,266	8,280

The blue-crab fishery, like the oyster fishery, is strictly seasonal, primarily a summer fishery. Crabs are first caught in Maryland waters when winter hibernation ends and the crabs start moving. Crabs are not taken in great quantities until June and are then found until September, when the males move to deeper water and females travel south.

During the spring the crab harvest includes crabs preparing to moult (indicated by signs of color on the shell) for the soft-crab market. These crabs are placed in trays ashore in flowing water or in floating cages until they have shed their shell. They are then sold as soft crabs.

*Source: Maryland Fisheries Administration.

Crab production in pounds for the period 1965-1976 was as follows*:

Year	Hard Crabs (Pounds)	Soft & Peeler Crabs (Pounds)
1965	31,998,000	2,694,000
1966	30,373,000	1,884,000
1967	24,587,000	2,186,000
1968	9,216,000	1,001,000
1969	23,014,000	2,250,000
1970	24,935,000	1,579,000
1971	26,077,799	1,531,083
1972	23,471,700	1,568,800
1973	19,218,000	1,505,000
1974	23,000,000	1,806,000
1975	24,263,961	1,653,928
1976	19,412,860	1,472,651

Crab landings, by month, for the representative year 1975, were as follows*:

Month	Hard Crabs (Pounds)	Soft & Peeler Crabs (Pounds)
January	-----	-----
February	-----	-----
March	-----	-----
April	868,264	-----
May	1,280,397	527,936
June	3,244,220	478,634
July	6,132,548	336,313
August	5,084,958	244,365
September	3,567,057	63,664
October	3,532,250	3,017
November	449,875	-----
December	104,392	-----

Finfish landings for Maryland waters have declined considerably in the past several years. While several million pounds of such species as shad and herring were once taken, summary landings for all species for the years 1974 and 1975 were as follows*:

Year	Total Landings in Pounds
1974	14,234,300
1975	15,009,006

*Source: Maryland Fisheries Administration.

Of finfish landings, those taken in quantities greater than one-half million pounds were: alewives (1,388,200 - 1974; 720,363 - 1975); bluefish (558,600 - 1974; 276,728 - 1975); fluke (708,800 - 1974; 892,702 - 1975); menhaden (5,523,100 - 1974; 6,106,556 - 1975); striped bass (3,502,500 - 1974; 2,896,820 - 1975); and white perch (510,700 - 1974; 527,118 - 1975).* Over half the landed value of all fish species came from striped bass landings.

The bulk of fish landings occurred during the period March-October, with April and May the heaviest months.

Total ex-vessel value of Bay fish and shellfish landings has generally been in the range of twenty-three million dollars per year; one-half of which has resulted from the oyster fishery. Landed values, by species, for the years 1974 and 1975 were*:

Species	1974	Percent Total	1975	Percent Total
Oyster	$12,707,575	56.8	$11,667,379	50.9
Hard crab	$ 4,054,299	18.0	$ 4,275,798	18.7
Soft clam	$ 1,779,004	7.9	$ 1,174,340	5.1
Soft crab	$ 1,030,390	4.6	$ 868,516	3.8
Striped bass	$ 919,136	4.1	$ 1,146,631	5.0
Other	$ 1,888,740	8.4	$ 3,676,562	16.5
TOTAL	$22,379,144		$22,900,226	

*Source: Maryland Fisheries Administration.

4. Harvest Methods and Gear Types

The required flexibility on the part of the waterman to make best use of his boat is first characterized by the seasonal characteristics of the species mentioned above.

Seasonality and Movements

Clammers tend to operate in the same fishery from January to August, although some clam vessels also double as charter vessels for sportfishermen during the spring/summer if the owner is willing to remove his clam escalator. Clam landings drop significantly during the first four months of the oyster season (September to December) when many clammers enter the oyster fishery.

Finfishermen, most active during the spring, often convert to crabbing summers and go oystering winters if crab and oyster concentrations are found not far from those upstream areas where they set their nets. They will drive the stakes for their staked gillnets or pound nets in early spring to be prepared for the spring run. On the other hand, those finfisheries at the head of the Bay are far from the shellfish grounds to the south. The long run south for oystering and crabbing prevents daily trips. While a few boats are "trip" boats (i.e., move away to fish another area during the week, returning home weekends), most of the remaining "head-of-the-Bay" finfishermen run gillnets, drift-nets, or fyke nets the year round.

Most watermen, however, follow crabs during the summer and seek oysters during the winter. However, successful oystermen often fish commercially only during the winters, either running charter parties summers, taking a shore job, or otherwise occupied during the crab season.

Many crab watermen first take eels during the spring. In addition, some of the finfishermen harvest eels for sale as bait to crabbers.

Skipjack operators, in the Deal and Tilghman Island areas, sail skipjacks winters but have boats of their own for spring eeling and summer crabbing. Skipjacks are the only boats on the Bay making trips lasting longer than one day.

Regulations limit oyster and clam harvesting to daylight hours. The boats make day trips, returning to shore each afternoon/evening, selling their catch, and returning to the Bay the following day.

Watermen activities were also traditionally restricted to resources in their county of residence. Natural factors caused abundances on the bars and clam beds to alter widely from year to year within the same county. The watermen, unable to move around the Bay, were thus forced to be as flexible as possible for alternative species. On occasion severe economic stress resulted--the MSX disease south of Crisfield wiped out county oyster beds and quickly plunged Crisfield, once a major oyster port, into decline. Watermen from the county either had to move elsewhere to establish residency or scrape by on crabs and clams with hopes of the oysters' return. Strong county line demarcation, furthermore, influenced development of craft designed for specific circumstances--short runs to the grounds, small carrying capacity (enough to haul the daily take), and varying lines according to general water conditions. Most important, given the uncertainty of future conditions, was a Bay-wide need to work on the Bay for as little capital as possible, resulting in ingeneous and highly effective automobile engine conversions, inexpensive boats maintained to last, and consistent efforts to keep costs as low as possible.

The Bruce decision in 1971 radically altered Bay harvesting methods. With regard to watermen's movements, Bruce made county residency requirements for the taking of shellfish invalid. Suddenly, Maryland watermen were free to travel throughout the Bay depending upon personal interest and stock abundance. While hand-tong oyster techniques, practiced from quite small open boats, remained close to home, vessels with hydraulic patent tongs or clam escalators, as well as crab vessels, began to move around the Bay after their species of choice. Boats were built of somewhat larger size. At the same time many boats were outfitted with CB radio, providing instant information concerning activities far from local waters.

The effects of these developments caused establishment of a significant "trip" fishery. Many oyster patent tongers began travelling the area from Rock Hall to Solomon's, working distant beds during the week, unloading in any one of a large number of communities to trucks sent by a prearranged buyer or to local buyers, and returning home weekends. Presently about 400 patent tongers and 230 clam escalators fish the Bay, and many move from county to county. Greatest clam effort remains concentrated in the designated clamming areas in Talbot, Dorchester, and Queen Anne's Counties. Patent tongers may move from the Bay Bridge to the Potomac River.

A major effect from travelling watermen has been more consistent effort on those bars and beds fished by "trip boats." Abundant finds are quickly reduced, but freedom to leave the area prevents excessive effort on a badly depleted stock. Instead of great county-by-county fluctuations, as seen earlier, fluctuations from fishing pressure within Maryland waters are now Bay-wide.

Travelling is facilitated because the original county system made necessary the establishment of dozens of commercial communities rather than a few centrally-located communities. While the Bay has few public landings for recreational use, there is always a place close by for the waterman to meet a truck and conveyor.

Harvest methods depend ultimately on the operator's ability to learn the bottom--the locations of beds, bars, the water depths, likely places for finding crabs, and areas where finfish are found. Only recently were electronic sounding devices allowed, which indicate fish concentrations as well as bottom contours. Although this equipment can shorten a new operator's learning time considerably, his skill ultimately develops through time on the water.

The Boats

The boats used by watermen are distinctive designs evolved to provide stable platforms in the Bay waters (which, being shallow, quickly rise to a short chop with a breeze), speed to provide range, and very shoal draft. Most Bay boats, ranging in size from 20-foot open skiffs to 50-foot patent tongers, are so-called "deadrise" designs: cross-planked from the keel to the chine, rising from the keel forward but nearly flat aft, straight-bottomed and narrow. Such hulls are easily driven and produce little wake. The flat bottom rolls less than a rounded bottom. Forward on the larger craft is a cabin for shelter and protection while underway. The aft area is open with the engine located close to the stern and covered by a box.

These boats are usually powered by converted automobile engines, keel-cooled, with dry exhaust rising from a pipe set astern of the engine. The

boats are steered from the cabin and from a stick-tiller rig beside the engine. The open work area does not cover a fishhold; oysters, crabs, and clams are carried in boxes or baskets. Some boats have flat roofs stretching aft for shade from the sun.

It is said one familiar with these Bay boats can tell where a boat is built by the lines and design details. On a general basis, the Bay boats have higher bows toward the south, where the more exposed Bay waters produce larger seas.

Skipjacks are sloop rigged with similar hull lines as the smaller craft (hard-chine cross planked bottom). Skipjacks working today number about 28-30 and indicate through their age how important attention and maintenance have been. Skipjacks carry skiffs with power for maneuverability in calm, close quarters, and twice a week for pushing a dredge. Buy boats, of which only seven to ten still may be operating, though hundreds once roamed the Bay, are burdensome craft about 60 feet long with a house aft. These craft do not fish but buy oysters on the Bay from other boats. Buy boats have been largely replaced due to the widespread use today of trucks with portable conveyors for unloading at any landing.

Gear Types - Oysters

The gear and harvest techniques used on the Bay are strongly influenced by conservation regulations, designed to protect the resource while allowing fair return.

Skipjacks tow large dredges under wind power. These dredges are essentially metal bags with rings towed over an oyster bar. The dredge scoops oysters into the following bag. When the skipper feels the dredge

is full, or has passed beyond the bar, a winch hauls the dredge aboard where the oysters are dumped on deck, culled according to size regulations (three inches pinch to mouth), and stowed. Under sail, skipjacks can land 150 bushels of oysters for a day's work. On two days a week the powered skiff is allowed to push the skipjack hauling the dredge. On these days 150 bushels are the limit. Skipjacks remain on the bars for a number of days (usually four or less) and either sell to a buy boat or return to port to unload. Most skipjacks today operate from Tilghman and Deal Islands, working the northern Bay until Christmas, and then move south to Tangier Sound.

Many watermen share a view the oyster dredge "cultivates the bottom," i.e., as it passes through the oysters, some are taken and others are shifted and moved to fall back onto the bed for further growth. This view is exactly the same as that of New England sea scallop fishermen, who often remark scalloping is like "cultivating a field," and is a major element behind Virginia's dredge-oriented gear regulations.

A second type of oyster gear is the patent tong. A patent tong is a hydraulically operated metal basket operating on the same principle as a backhoe. The patent tong consists of two metal "jaws" composed of metal bars no more than forty-one inches wide. The rig is suspended from a long metal boom which in turn is mounted on a mast just aft of the wheelhouse. A series of ropes, pulleys, and counterweights allows the patent tong to be dropped into the water alongside the hull about amidships. When striking bottom, hydraulic foot pedals are used to close the jaws and haul the patent tong back aboard. The jaws are opened over a culling

table, the oysters and other debris dropped, and while the operator (standing just aft of the table) culls the yield, the patent tong is again dropped. Many of the larger boats (over forty feet) are double rigs; i.e., work two patent tongs at the same time, one to port, one to starboard, with one man behind each table.

An efficient rig can make three passes every minute. During the period the tongs are operating, the boat is drifting with winds and currents over the bar. Special skill is needed to achieve proper drift so the tongs strike new bottom each time without skipping large sections. Depending on wind and tide, various weights and anchors are cast off the stern to control drift speed.

Patent tongers are limited to twenty-five bushels per man per day.

Hand tonging, the oldest method of oyster harvest, requires strength and balance. Hand tongs are long wooden poles arranged so an operator can, through a hinge mechanism a few feet from the lower end, open and close a small basket on oysters lying on the bottom. Different water depths require different length tongs, most of which are from between fifteen and thirty feet long.

Hand tonging is practiced as follows: when the watermen believes he is over good bottom he anchors his boat, either from bow or stern according to his preference. He stands on the wide washboard around the gunwale, "working" along the bottom as he moves around the washboard. When a circuit is complete he will move the boat a short distance and anchor once more.

Hand tongers are numerous on the Bay and, like patent tongers, are limited to twenty-five bushels per man per day. Most hand tongers are single-handed; i.e., operate alone.

Because patent tonging has developed relatively recently, concerns were raised by hand tongers that patent tonging was destructive to oyster beds. Fears are often expressed the patent tong digs a hole which then fills with silt, smothering oysters. This possible biological problem caused the Maryland Fisheries Administration to limit certain specific bars for patent tonging, particularly given the mobility potential arising from the Bruce decision. Facing restricted bottom and operating more capital-intensive operations than the hand tongers, more patent tongers than hand tongers have become "travellers."

Blue crabs are taken on trotlines, in pots, and with a scraping dredge. The dredge is towed behind a boat and scoops buried crabs from the mud. Dredges are used mostly in the lower Bay in Virginia, primarily a winter fishery for hibernating females. However, some dredging occurs in Maryland waters for males hibernating in the deeper water.

The trotline fishery requires bait. Long lines are set from a boat, buoyed at each end. From the lines are many short gangions or leaders, each of which has a piece of bait tied to the end. The bait is usually salted eel from the spring eel fishery. The lines are baited and coiled in a small basket, "shot" from the boat as the boat moves ahead, and allowed soaked for a time to allow the bait to fish. Crabs will move to the baits and seize the salted pieces with their claws. The line is then picked up and taken back aboard. The boat moves toward the other end and as the line comes aboard, hauled by hand or using a small winch. A net is used to take the crabs as they come to the boat. Once free of the water, the crabs let go of the bait; they are taken just before they break the surface. The line

is recoiled and crabs are placed in bushel baskets. Salted bait can be used repeatedly.

A trotliner will set several strings of gear for the day's fishing. One or two men work on the boat. A waterman alone must steer the boat and scoop the crabs, allowing the line to fall into a tub from the winch. With two-handed trotliners, one man steers while the other scoops crabs or coils.* There are no limits established for crab harvest and a good day will see up to 1500 pounds landed.

Trotliners work the entire Bay although crabs in deep water late in the season do not come to the surface as readily as do crabs from shallow depths. The resistance from being pulled upward cause many to lose hold of the bait and drop back to bottom. Many hand-tong boats work as trotliners during the summer. Like hand tongs, trotliners are inexpensive gear and easily placed aboard.

Many hand tongers and most patent tongers seek crabs during the summer with pots. Crab pots are round or rectangular wire cages with interior wire or mesh funnels. Pots are baited with eel or other fish, placed in the water, and retrieved the following day. Crabs caught in the pots are removed, the bait replaced, and the pot placed in the water again. The choice of areas for the placement of crab pots is very important.

A waterman will fish up to four hundred pots. Over three hundred can be hauled in one day. Pots are buoyed; if placed singly, a buoy floats above each pot. Often several pots are strung together in a line, with a buoy at one or both ends.

*The maximum length of gear allowed a non-licensed trotliner is 100 yards; greater lengths require a commercial license.

Crab pots may not be used in the mouths of the rivers, which are restricted to trotliners. Pots are used extensively in the deeper portions of the Bay. Crab pots can "follow" the hard males as they move deeper with the coming of autumn. Crabs about to shed may be left in a pot until they have lost their hard shell, or they may be brought ashore.

Like lobster fishermen, watermen using crab pots use specially marked buoys to identify their gear among the buoys of other potters fishing the same ground. Good crab pot fishing lands as many or more crabs in a day as the top trotliners.

The pots themselves are often homemade during the spring after the oyster season. Often other members of the family make pots during the winter. Each pot requires less than five dollars in materials for fabrication. While single pots are inexpensive, a waterman running a full string of gear leaves a substantial investment on the bottom every day he is fishing. Lost buoys are common and lost strings of gear are sought with a grapnel dragged across the area where the pots were placed. Losses of pots are common after a storm has moved buoys or torn them free. A serious problem has been and remains theft of pots by recreational boaters.

Winches are often used to haul crab pots, especially in the deeper water. The winch may be powered by an auxiliary gasoline engine (also used to power the hydraulics needed for patent tonging) located on deck. Many patent tongers run crab pots during the summer as a result. Changing gear is not difficult--the patent tongs are removed, a winch gurdy is placed aboard, and pot fishing can start at once.

Although crab potters are found throughout the Bay, the greatest effort is toward the south in Tangier Sound. Crisfield, to the southeast, is a

major crab center; most crabs landed in Crisfield are taken in the Virginia waters of Tangier Sound.

There are presently slightly over two hundred soft-clammers working the Maryland portion of the Bay. Most of these boats are based just south of Annapolis or near Kent Island Narrows in Grasonville. Clam boats travel. Their present concentration indicates the center of commercial clam abundance on the Bay.

Clam boats work a hydraulic escalator conveyor-type system. Hanging from one side of the boat are conveyors with foot-wide belts, twenty or twenty-five feet long. The belts are hydraulically operated. As with patent tongers, an auxiliary engine mounted on the opposite side of the deck provides power.

During clamming operations the belt is dropped into the water. One end reaches bottom and the other remains at the gunwale. As the boat inches ahead, a special system flushes water vigorously just ahead of the leading edge of the belt. The water flow washes aside mud and the belt immediately behind carries the clams found in its track to the surface.

Clammers are limited to fifteen bushels per day per boat. They are further limited to several designated clamming areas. Because clams are often found close by oyster bars, major conflicts have arisen between clam operators and oyster watermen. Many feel the clam dredge stirs up bottom sediments which will suffocate oysters.

Since the Bay was charted in 1913, some designated oyster bars, long barren, have been redesignated as clamming areas. Most of these designated clamming areas are located near Kent Island and in Eastern Bay.

Hurricane Agnes had severe effects upon soft-shell clams, yet those knowing the resource feel clams were diminishing prior to Agnes for other reasons.

Nearly all clams taken from the Bay are consumed in New England.

The cumbersome and expensive clam dredge requires a significant investment. Most clam boats seek clams year-round save for conversions to oystering in the fall.

Commercial finfishing, currently a small element within the Bay fisheries, is most often practiced using gill nets, drift nets, fyke nets, and pound nets. Pound nets and "staked" gill nets require use of stakes driven into the bottom upon which these nets are hung. Years ago there were such "trap" nets all along the Bay shore, but today the costs for stakes, labor and the nets themselves are excessive given the likely return. Pound nets remain along the Potomac, but have nearly disappeared from the northern Bay. Pound nets essentially "herd" fish into a pound from which they cannot escape. The fish are brailed from the enclosure into the boat. Lately fyke nets--a funnel-type arrangement--have replaced many pound nets.

Gill nets--either staked, anchored, or drifting--are nets forming walls in the water column. A fish can enter the mesh of the net but becomes gilled, cannot escape, and suffocates (fish must continue moving water past their gills to receive oxygen). Gill nets are limited by law with respect to the distance, or length, one operator can fish.

Some gill-net fishermen set their nets out one day and haul them the next. On the other hand, drift-net fishermen (their gill nets float and move as the water moves), usually remain with their gear while it "fishes."

Maryland prohibits use of monofilament (single-strand synthetic twine) nets in the Bay. Manila or cotton will, if lost, rot; polypropelene or nylon, if lost, may keep fishing until the action of trapped fish and weather roll the lost stretches of net into a clump. To haul the larger drift nets, a special gillnet hauler, used in many gillnet fisheries on the east and west coast, is often powered by a separate engine rather than a power take-off from the propulsion engine.

Commercial finfishermen often also operate charter services for sportsmen.

Recently, efforts to take fish with traps (i.e., submerged pots of wire or twine and frame with mesh funnels inside to guide and trap fish) have proven somewhat successful.

The eel fishery is practiced with eel pots, cylindrical wire cages placed in the estuaries. Possible emerging markets overseas have stimulated a potentially large eel fishery to spring up in many East Coast estuaries. If such markets were firm, a much larger eel effort might be seen than the minor bait fishery of today. Expanded effort was observed in the Potomac River and aquaculture eel development is an increasing trend.

5. Current Trends in the Harvesting Sector

Harvesting sector trends are observed with respect to biological fluxes, the attitudes of watermen, technological developments, gear conflicts, and the impact of recent legal decisions. Market influences and regulatory actions (following Sections) also impact upon harvesting activities. The trends mentioned here refer specifically to harvest methods.

Biological Fluxes

Biological fluxes, recognized, but as yet poorly understood, form the basis of all harvest activities and decisions. Oysters, heavily regulated by the Fisheries Administration, have stabilized in yields since introduction of the statewide seeding program in the early 1960s although market influences have also had important impacts. State propogation programs--detailed in Section E: Institutional Framework--may be responsible for a third of the oysters currently taken from the Bay, although opinions as to effectiveness differ greatly. There is a general consensus, however, that seeding programs avoid dramatic down-surges in oyster abundance during years of poor spatfall. Watermen we interviewed stated a belief the Bay is currently on a "down cycle" and has been for the past two or three years.

The clam fishery has experienced dramatically reduced landings since 1972, although in areas of designated clam harvest landings have held rather steady since 1973. There is a general view in the industry, however, clam populations were on a down-turn when Agnes struck in 1972; the effects of Agnes have disguised in some measure this natural drop in abundance.

The blue crab fishery (for which there are no landing restrictions contrasted with other shellfish) is currently a stable fishery, although increasing

numbers of crabs are imported into Maryland from other areas as Maryland has experienced a loss of large male hard crabs for market sale. While Eastern Bay still produces large male crabs, many of the large males now processed by Maryland firms are taken in the Virginia waters of Tangier Sound.

In general, although shellfish yields are reduced from the banner landings of decades past, today's harvest levels are holding their own as constrained by market restrictions as well as abundance.

Finfish trends have been steadily downward. Abundances are much reduced. Increasing competition with sportsmen and reduced water quality at the head of the Bay and the upper tributaries have placed commercial finfisheries in a steady decline. Costs for gear and materials have steadily risen, further forcing watermen from finfisheries.

As detailed previously, there is a general view the Bay system is not as productive as it once was, expressed most frequently in reference to the increasing turbidity of Bay waters. However, few of the watermen we interviewed held the Bay was "dying."

Attitudes

Much of the literature concerning watermen concludes the "way of life" is doomed, referencing a high average age, loss of the younger men to other areas, and increasing development pressures along the Eastern Shore with associated loss of watermen-related services. Today, however, there is a trend toward increasing numbers of watermen, with many young men choosing to follow the water rather than seeking employment ashore. The general attitude within the industry is one of pride and self-reliance despite uncertainties and risks.

A young person can work on the water for very little capital. All he requires is a small boat, hand tongs, a trotline, and possibly some crab pots. We observed many father-son combinations and nearly as many men in their twenties operating vessels as within older age groups. Those familiar with the industry all stated full-time watermen number between eight and nine thousand. While the larger patent-tong and clam boats represent significant investments of capital (a new hull today with power costs between $20,000 and $40,000; the gear costs an additional several thousand dollars) most of those making a living from the Bay work smaller boats, often constructed in their backyard or carefully preserved over the years. As with any fishery, those new to the business start small and work up with time. Many watermen first spend a couple of years working as a sternman for another skipper.

Successful watermen are capable of earning a good living. Within the complicated management structure and harvest limits for oysters and clams, presently in effect nevertheless incomes often exceed $20,000 a year, although the average income for watermen as a whole is considerably less than $20,000.

Generally, returns are sufficient to make a decent living in the view of those interviewed and current optimistic attitudes reflect that fact. Dollar income is in any case a poor measure of standard of living, for watermen often engage in barter relationships where cash does not change hands. In addition, other family members (wives, children) are also actively involved in related aspects of the business--building crab pots, overhauling trotlines, baiting trotlines, helping outfit the boat when hauled out of the water--not involving cash exchange. Home picking of crabs produces unreported cash income as well.

Gear Technology

Trends in technological aspects of the Bay fisheries indicate few changes in gear. Gear types are regulated such that the gear is "inefficient" and thus compatible with the status of the resources sought. Even the patent tong, the most recently developed harvest method, has been used unchanged on the Bay quite some time.

Most of the boats used on the Bay are locally built. Many small boat-builders are located along the shore and the status of the industry is well demonstrated by their backlog for new orders. Reflecting the greater mobility of boats since the Bruce decision, the boats tend to be somewhat larger than years ago, with higher bows, diesel power, and often engine power take-offs rather than auxiliary gas engines.

Electronic fish finders were allowed to be placed aboard recently and many boats have now installed them, as depth readings are very helpful at night in twisting shoal channels.

Several boats have invested in radar, a most expensive piece of machinery and not widely adopted by the Bay fleet. Radar can be extremely helpful when running in fog or plotting position against the shore, for the range markers on the scope allow for pinpoint distance estimation and excellent crossbearings.

Although most of the new boats being constructed for watermen remain wood, lumber is increasingly hard to find and fiberglass is now used. Fiberglass boats are cheaper initially than wooden boats and less expensive to maintain.

Recently, watermen have purchased New England lobster-style designs from up north, most often made of fiberglass, in the 30- to 40-foot range.

These boats are round-bottomed and tend to roll in the Bay chop, but their seaworthiness is excellent and they have greater displacement than deadrise craft.

A most significant technological trend has been the widespread adoption of CB radio. CB sets have a range of about 30 miles under good conditions and are used extensively for boat-to-boat communication, boat-to-buyer communication, and emergency transmissions when necessary. Of greatest significance, the CB radio allows the watermen to determine the price received for catch all along the Bay shore, with consequent effects upon cash received at the dock (e.g. if a buyer to the south offers more than a buyer close by the boat in question, the waterman can either sell to the higher offerer or negotiate with his nearby buyer for the higher price).

Gear Conflicts

Gear conflicts, mentioned briefly previously, always exist when different fishing techniques are used in the same area. Bottom areas have been designated for clamming, patent tonging, or crab potting in efforts to reduce these conflicts, but problems continue. The Fisheries Administration marks these areas with buoys, but watermen complain the buoys are so far apart they are difficult to see. A waterman can believe he is fishing within a line between two buoys but finds himself arrested because an aerial observation has found him inside the restricted area. From the air the line between two buoys is easily determined, but sea-level observations, especially in a chop, are difficult.

An important gear-conflict trend, although not a new trend, concerns the part-time fishermen. Part-timers tend to operate during periods of

resource abundance, thereby "skimming" the good catches from the full-time watermen. In addition, part-timers are often unfamiliar with traditional gear location practices, and gear snarls are common. The crab fishery experiences most of these problems. Effects from part-time fishing on the full-time waterman are twofold. The full-timer has fewer days to take abundance peaks. Those times of poor stock abundance are extended, leaving the full-timer with smaller cash reserves than would be the case without part-time activities.

Legal Decisions

Recent legal decisions have profoundly influenced harvest activities. The 1971 Bruce decision invalidating county residency requirements for the taking of fish within county jurisdictional boundaries has allowed watermen to "travel" considerably throughout the Bay, especially patent tongers and clammers. One contributing reason for the numerous and widely scattered locations of fishing communities throughout the Bay was the original county residence requirement. There was no need for a boat capable of extended cruising and overnight trips. The entire harvesting infrastructure arose in response to the need for a boat just big enough to travel within its home county. The closer one lived to the resource, the less expensive and smaller the necessary boat.

A waterman limited to working within a single county could not overcapitalize his effort and survive county-by-county fluctuations in resource abundance. While the entire Bay may have produced relatively stable yields, individual counties had resource fluctuations, forcing great flexibility on the part of the watermen. As detailed in the following section (Sale and Product Distribution), each of the many fishing communities (many located at

the end of long necks and a long drive from other fishing areas) developed a complete service sector to provide resident watermen's needs: builders, mechanics, chandleries, and buyers, all of a size compatible with the scale of the fishing operations themselves. Rather than a central supply source serving outports (e.g. in New England all southern Massachusetts ports use New Bedford as a central supply depot), as may have happened had there not been the county closure to nonresidents, the Bay commerical fisheries saw development of a highly differentiated system of essentially self-sufficient fishing communities along the entire shore.* Although factors from Bay geography may have had more influence, county jurisdictional power prior to Bruce had a fundamental impact upon the structure of the commercial fisheries today.

However, Bruce discarded county residency requirements in 1971 and immediately the larger Bay boats began to travel. The Bruce decision created a truly Bay-wide fishery, allowed resource abundance peaks within one county to be taken by boats from many other counties, and initially resulted in severe gear conflicts between patent tongers and hand tongers, and all tongers with clammers. The Fisheries Administration designated certain bottoms for clamming; on occasion (because clams are found close by oyster bars), designating barren 1913 survey oyster bars as clam areas. This trend continues; while oyster bottom is designated as clam bottom (a sensitive political procedure is needed), clam bottom has never been redesignated for use by oystermen. In addition, the Fisheries Administration has restricted patent

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* In the case where one community became a central depot--Crisfield when oysters were abundant in Tangier Sound--the effects of the loss of county oysters on the large shoreside development remain visible today; smaller communities had greater flexibility to adjust.

tongers to certain bars in response to hand tongers' concerns the patent tongs are destructive to oysters.

Today, the major travelling boats are those facing restricted, designated bottom areas and these are generally larger boats, fishing away from home for days at a time. An increased capital investment for such boats has resulted, as fishing competition is now Bay-wide, requiring more sophisticated gear and machinery to make the most of the increased opportunities.

Presently great concern exists with respect to the Supreme Court decision: Douglas vs. Seacoast Products, Inc. (1977). The Seacoast decision held state residency requirements for the taking of fish (in this case menhaden in Virginia) within state waters to be invalid. While Seacoast is clear with respect to free-swimming fish, uncertainty about the status of oysters--a sedentary species--now exists. Maryland's position is that oysters are a resident shellfish, consistent with the laws of many states, and thus remain the property of the state. However, until a Virginia waterman takes oysters from Maryland and the case is tested, doubts remain. The basis of the Seacoast decision is necessarily vague as to whether state residency requirements for any marine species, or just free-swimming fish, are invalid.

Virginia also produces oysters (mainly on leasehold) and MSX has severely diminished their stocks. Fears exist Virginia boats may move north onto Maryland oyster beds. Were such an event to occur, gear conflicts of a major nature would ensue.

Thus, whereas one legal decision (Bruce) has opened the Bay in Maryland to watermen from different counties, with generally beneficial results, a

similar decision (Seacoast) may reduce opportunities for Maryland watermen. As detailed following, most Maryland oysters go to Virginia for shucking; were Virginia boats capable of taking Maryland oysters, quite likely much of the Maryland Bay fishery as practiced by Maryland residents would disappear.

Trends with respect to harvest activities, then, include (1) relative resource stabilization by virtue of oyster propogation, area designation, gear restriction, and catch limits; (2) a spirit of optimism among watermen as evidenced by young men entering the fishery, vessel replacement or new construction, and a chance to receive a decent income; (3) the introduction of sophisticated equipment aboard boats--diesel power, hydraulics, electronics--reflecting commitment to the future; and (4) establishment of a Maryland Bay-wide, rather than county-wide, fishery with fears Maryland's jurisdiction may be altered through interpretation of the Seacoast decision.

D. SHORESIDE SALE, HANDLING, PROCESSING, AND DISTRIBUTION*

1. Introduction

The purchase and handling of Bay seafood, like the activities of the watermen themselves, is a highly individualistic, fragmented industry composed of many small firms reaching many markets across the United States. As with harvest activities, shoreside establishments are structured in response to Bay conditions. They are extremely flexible and tend to operate seasonally with the fisheries.

Many existing purchase and processing establishments are owned by ex-watermen or members of their extended family, especially those located in remote locations serving a small isolated community. Each dealer has an assortment of watermen with whom he usually does business, and likewise a group of customers built up over time. In a sense he operates a territorial business. After Bruce there have been some changes; most often, however, a travelling waterman sells to a buyer from near his home port: the buyer will send a truck. Because supply sources are uncertain and the product is highly perishable, dealers frequently exchange product among themselves to

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* Sources include conversations with industry and watermen representatives. Literature sources supporting fieldwork include: Reference 1: Analysis of Future Demand; Reference 2: Analysis of Transportation of Maryland Seafood; Reference 6: Oyster Propagation in Maryland; Reference 11: Commercial Fishing and Processing Industries, Chesapeake Bay Area; Reference 17: Annotated Code of Maryland: Crab Packers and Shippers; Reference 19: Factors Affecting Demand for Oysters; Reference 20: Maryland Oyster Resource Expansion Task Force, Final Report; Reference 24: Growth Prospects for the Oyster Industry in Maryland; Reference 28: Interstate Certified Shellfish Shippers List; Reference 29: Laws Concerning Commercial Harvesting of Finfish; Reference 30: Laws Concerning Commercial Harvesting of Shellfish; Reference 35: Maryland Preliminary Transportation Planning; Reference 38: Mobility of Oystermen; Reference 52: United States Regional Oyster Product Flow; Reference 56: Wholesale Seafood Marketing.

to fill specific orders. Product flows from the dock to the consumer vary considerably.

The dealer must find a supply either through direct purchase from watermen or by filling orders with purchases from another dealer. Orders must be matched with specific quantities and qualities. With the exception of limited freezing capacities, a dealer works mostly on a day-to-day basis: on the telephone early in the day to line up orders, then at the dock for supplies, then later on the telephone to other dealers to fill orders not supplied directly by "his" boats. Products bought from boats in excess of orders is sold to other dealers. Although made up of small independent firms, the need for product exchanges has established an extremely valuable information network without which shoreside establishments could not function.

Not only are sale and distribution establishments widely scattered geographically around the Bay, their need for flexibility in the face of resource uncertainty is expressed (like the watermen's) in a variety of ways of doing business. There is the buyer of oysters, who buys oysters and delivers them to someone else for further processing. There is the buyer who also shucks his own oysters. There is the buyer of crabs for further shipment. More often the buyer of crabs also picks the crabs, although the resulting meat may go elsewhere for further processing and packaging. There is the buyer of clams. Most clams go directly to New England, fresh in the shell, although sometimes the buyer of clams also removes the meat. Presently no processing houses in Maryland handle Bay finfish; most buyers of fish sell the fish to other distributors or retail markets.

Most often, buyers handle everything: oysters during the winter, crabs summers, and clams year-round. Processors of Bay resources are limited to shucking houses for oysters, picking houses for crabs, and removing meats from clams. Usually a winter oyster shucking house picks crabs summers. Recently labor has been hard to find; today between sixty and eighty percent of Maryland oysters leave the state as shellstock to be shucked elsewhere (sixty-five percent to Virginia). Presently, there are an estimated 2500 people in the shoreside seafood business in Maryland, as contrasted to nearly four times as many watermen. Individual plants ashore employ from six to thirty-five people; there are possibly two hundred seafood plants in the state of all kinds. Many of these are family operations supporting several watermen families in a close-knit community. Processing enterprises require stable supply; each packer must estimate in the morning what he has or will have to sell and he must sell it all by evening. Most processors handle diversified products for several reasons: to keep labor (a difficult task), to keep boats (i.e. to buy consistently from a boat, a buyer must take whatever is landed), to enhance flexibility given resource fluctuation, to operate as nearly as possible year-round to lower overhead, and to broaden markets to keep up demand.

A typical Western shore operation, for example, will handle crabs (steamed soft crabs sold locally), fish (frozen or sold locally), and oysters (shucked, packed, and shipped by virtue of an agreement with a Virginia buyer.) Some Eastern shore plants pick crabs during summer at a loss to ensure a labor supply in winter, as seasonal open-shut operations have great problems finding steady labor. Many plants have abandoned oyster shucking recently, electing instead to ship oysters to Virginia.

A serious and across-the-board problem for shucking and picking house owners is finding labor, a difficulty considered far more serious than market reliability or even resource supply. The problem has existed for twenty years, made worse recently with inflation (which has far outstripped the sales value of oysters to retail establishments), government unemployment assistance programs, and other employment opportunities. As serious, however, has been the problem of the work itself. Shucking and picking are semi-skilled jobs requiring training; two to four weeks are needed to bring a new employee up to speed. Pay is piece-work pay; i.e. the more meat produced, the more money is made. Some establishments have recently offered a guaranteed minimum wage. However, a possible week's pay of $250 is uncertain for twelve months a year. Most importantly, the work is stagnant; i.e. opportunities are seriously limited to move into management. Today's workforce is composed of elderly people, particularly for oyster shucking; the more modernized crab lines see younger women. Oyster shuckers are mostly black. Unlike the watermen's way of life (many black watermen run boats as hand tongers, clammers and patent tongers, as well as comprising most skipjack crews), work in a shucking house provides little opportunity for advancement.

The processing plants themselves carry severe limits regarding the price they get for their product; in fact it was said that water is often added to oyster meats to create weight. Low prices for shucked meats - given short shelf-life, likely market gluts during the period Thanksgiving - Christmas, and a steady loss of a mass market for fresh meats - are squeezed by the prices demanded by watermen. Plant overheads are high due to utility bills, maintenance, transportation costs, and many recent government health, safety, and environmental standards increasing the cost of doing business.

The state of Maryland provides significant unemployment compensation, which when compared to the average wage received for piece-work less withheld tax, is only about one-fourth less than take-home pay for a week's work.

Some shucking and picking establishment employees work enough weeks to qualify for unemployment compensation and then leave. Furthermore, crab pickers are not considered by the State Unemployment Office to be oyster shuckers; therefore, processors employ different groups at different times of the year. Occupational and safety regulations prevent the hiring of children although children commonly work on the nearby farms.

Although all processors we interviewed stated a desire to see development of automated shucking and picking machinery as a means of expanding their business activities, few have chosen to invest in such equipment. Crab picking machinery is fairly well developed and currently being used with success in Crisfield and Wingate; oyster shucking equipment must steam the shells open, somewhat altering the product. Although such alteration may have little effect for breaded portions or soups, most of Maryland's supply processed within the state is sold raw. Thus, any alteration in product taste or texture is a source of concern. Reflecting the great uncertainties of doing business because of uncertain product supplies and considering the needs for low overheads, the large financial investment required for mechanized lines has not been taken; rather, processing within the state of Maryland has steadily declined.

The seasonal nature of the fisheries has caused remaining processors to utilize more and more imported product. Blue crabs are imported from many other states. These are picked in Maryland, packaged, and distributed. There are many fish processing houses, but all of them use imported fish

rather than Bay fish.

The smaller establishments (those without steady supplies from elsewhere) have steadily branched into other related areas of business. Many dealers now operate marinas, yacht service facilities, ice-making machines, and transport-fleets moving a variety of goods. While unwilling to invest large sums in expensive equipment, they have demonstrated great initiative and flexibility to make best use of their location on the Bay.

All dealers we spoke with decried increasing government regulations, which in their view vastly increased their costs. Most buyers and processors are located on the waterfront. Effluent restrictions (e.g. being unable to wash mud off oysters - mud dredged from the Bay - back into the Bay) and various safety, occupational, and environmental regulations were particularly mentioned.

Because most buyers and dealers rely upon associations of trust with the watermen, they often act as suppliers for many of the watermen's needs. Ice, fuel, and miscellaneous spare parts are often seen in a seafood establishment. Dealers will provide ice at no cost to watermen during the summer. Since Bruce, travelling boats tying up at a distant dock need to purchase food as well; many dealers serve as grocers for transient watermen.

2. Purchases Over the Dock

Nearly all transactions at the dock are on a cash basis. A waterman unloads his catch, the weight is calculated, he receives cash money, and rarely are "tabs" run up unless by mutual agreement. Watermen with crews function on a "lay" or share system as in most American fisheries, receiving a percentage of daily landing revenues. Boats, save skipjacks, take one-third of gross stock. The boat share covers maintenance, finance cost, and major gear items. Expenses are then deducted (fuel, bait, food, possibly some gear expenses) and the remainder is divded equally between captain and crew (if he has a crew). Recent Federal legislation (the so-called Sternman Bill) has strengthened the long tradition of self-employment; crew on small fishing vessels are considered self-employed rather than, for tax purposes, employees of the boat owner.

Opinions differ among watermen and dealers as to who controls the price. Watermen feel the buyer controls price; the buyer argues the price is set by the watermen's demands and distant purchasers of product. We often heard the oyster price was established before the start of the season by chain stores and other customers; yet soon after the oyster season opened in 1978 a group of watermen refused to fish until they received a higher price. Use of CB radio on boats has led to Bay-wide knowledge of higher prices received, reducing buyer flexibility in this regard.

At present, watermen receive between $5.00 and $7.00 a bushel for oysters ($7.00 is considered a high 1978 price). Given existing catch limits, daily gross incomes are limited to $175.00 for single-handed tongers and $350.00 for two-handed boats.

Clammers, limited to fifteen bushels per boat per day, have seen prices as high as $25.00 per bushel this year. However, the high price reflects scarcity of supply; a good day for a single-hander is ten bushels ($250.00).

A good trip for crab boats is 1500/1600 pounds per day. Prices vary seasonally. A June price of 50 cents a pound yields a gross stock as high as $800.00; a September price of 25 cents a pound cuts the gross in half. Crab boats have higher expenses than tongers or clammers to cover costs for bait and gear.

Skipjacks can gross over $600.00 a day, of which three quarters goes to the boat. On good days under sail the figure can be much higher. A skipjack season, however, is only five months long.

1971 estimates of profitability for the oyster harvest demonstrate hand tongers enduring as successful operations, eclipsed only by double-rig patent tongers. The figures reflect the high expenses required for skipjack activities.

ESTIMATES OF PROFIT FOR OYSTER HARVESTERS:
CHESAPEAKE BAY, 1971*

Gear Type	Percent Profit
Hand Tong	16.97
Patent Tong	
Single	13.49
Double	17.31
Dredge	4.1

*Source: Growth Prospects for the Oyster Industry in Maryland, Figure 5.

Watermen we spoke with mentioned their gross income has not kept pace with inflation. Since 1971, (when the above figures were calculated), fuel costs have quadrupled for diesel fuel, costs have more than doubled for gas, oil prices have tripled, and costs of synthetic rope made from petrochemicals have quadrupled. However, the ex-vessel price received for oysters (as an example) was between $4.00 and $5.00 a bushel ten years ago and has since risen less than fifty percent. Many watermen stated their net income a decade ago was greater than the returns they receive today.

Although crab prices have risen more than oyster prices, the labor shortage for pickers has forced many dealers to place limits on boats selling to them, reducing potential returns to the watermen.

Generally, when supplies are scarce the price is more or less controlled by the watermen, as dealers must pay premium dollar for product; when supplies are abundant the price is directed by the ultimate customer. Use of CB radio by watermen, many product sales among buyers to fill orders, and extensive exchange of information among buyers while moving product tends to average Bay prices paid watermen over the year.

3. Handling and Processing Details

Although many firms buy and sell all Bay shellfish species of commercial value, the handling and processing characteristics of each species differ significantly.

Oysters serve a narrow market based on tradition and seasonal market demand. Christmas and Thanksgiving are the essence of the business. Oysters are landed in bushel containers and those shucked in Maryland are moved to shucking houses. Shuckers stand along a waist-high bench shucking oysters with a special knife and placing the meats in a bucket. A few establishments use automatic conveyor systems. Here oysters are automatically dropped into small baskets from a central store; the baskets move along a continuous track, passing overhead the seated shuckers and providing a constant supply. When the baskets again pass the central store (usually located close by a dock at the end of the building) an automatic trip-lever system releases additional oysters if the level in the passing basket is low. When full, the bucket of meats is emptied into containers and chilled for further shipment or sale. Many oyster operations follow the watermen's tradition of working with low overheads--for as little capital as possible. Oyster shucking houses are often old, poorly-lit, and small. Owners of such establishments are reluctant to invest in capital improvements because both supply and labor to shuck that supply are uncertain.

Paid on a piece-work basis, shuckers understandably refuse to work if oyster meats cut small. Sometimes bars produce small oysters; or early in the season, before "fattening up," a bushel yields only four pints instead of six or seven. Processors cannot get shuckers under these conditions.

Oysters not marketed in the shell may be sold raw, canned, breaded, smoked, or frozen. Oysters do not have a very long shelf life in raw form. In the shell as taken from the Bay an oyster will last a week, if chilled, before spoiling. Meats removed from the shell are suitable for two additional weeks under proper conditions. The seasonal market and oyster perishability cause many chain stores to add 50 percent to the price to cover internal losses if all the oysters are not sold promptly.

Due to labor shortages, 75 to 80 percent of landed oysters leave Maryland while in the shell. Processors we interviewed often stated they were shucking only 10 percent of the oysters they were handling.

Most oysters are sent into Virginia for shucking there. Shucking labor is available in Virginia because the workers are far from other job opportunities, Virginia offers less unemployment compensation, and large leasehold companies employ steady shuckers to handle product replacing Virginia's oyster grounds lost to MSX. Maryland provides the primary supply of oysters to Virginia today; oysters from Virginia waters are supplemental.

Some Maryland firms ship oysters to Virginia for shucking and then re-transport the meat to serve long-term customers. Many oysters from Maryland are shipped to Chincoteague Bay as higher salinities there heighten flavor and increase price. Oysters are placed in Chincoteague water for two weeks before reshipment back to the sender or sale to another shucking house.

As detailed in a later section (Chapter E: Institutional Framework) the loss of oyster shells to Virginia represents both a financial and resource loss to Maryland. Some fresh shells (which form the best cultch material of all) are purchased from Virginia by the Fisheries Administration or the Potomac River Commission, amounting to about one-half million

bushels every year, less than one-third of the total lost by Maryland annually. Most shells remain in Virginia, used by seafood firms as cultch on their privately-held leaseholds.

Most of the oysters landed by Maryland watermen, while representing the state's most valuable commercial Bay species, leave the state in the shell. Opportunities for economic multipliers as a function of shoreside processing activity are lost. With the loss of the shellstock oyster to Virginia is a resulting loss of market control for Maryland firms and an inability to affect the prices offered by customers. Valuable cultch material is also lost.

In addition, most other coastal states produce oysters, competing with Maryland product although when most consumers think "oyster" they think "Chesapeake Bay." Several foreign nations are exporting oysters to the United States for use in breaded and fried portions as additional competition.

Blue crabs are landed and sold alive. A great portion of the market for steamed and soft crabs is within Maryland itself; many dealers sell all hard crabs in the state. The growing tourism around the Bay has resulted in crabs being landed, steamed, and sold directly to retail customers without further processing. Soft crabs, held in trays ashore until shedding is complete, are likewise sold without further processing; soft crabs are fried whole and consumed in sandwiches or seafood platters.

Many establishments remove the meat from steamed crabs and sell the meat to other customers canned or frozen. Crab picking houses, like oyster houses, find labor a problem, although the workforce is composed of many more young people (usually women), whose dexterity is advantageous.

The crabs are purchased from boats unloading at the plant or trucked from outports. Crabs are first steamed; i.e. large baskets are filled with crabs, placed in a cooker, or steamer, and steamed 15 to 20 minutes. Such cooking baskets can weigh 500 pounds when full of crabs.

When cooked, crabs are sent to the picking line or refrigerated until the line requires them. Those removing meat from the cooked crabs break the shell, remove the back-fin lump (the most valuable and prized portion), and the rest of the body. Meat is placed in a small container, shells and entrails are disposed of.

Crab picking like oyster shucking is piece-work. The small container holding the meat, when full, is taken to a scale in the plant and the meat weighed. The weight produced by each picker is recorded.

Crabmeat is then canned or frozen. Meat placed in cans is run through a conveyor. As the cans pass under a rotating plate, the cans stop until the plate has pressed a lid on each can; several sets of lids are located around the plate and about one can every second can be topped.

The covered cans are then placed in a cooker at 185°F to be fully sterilized and pasteurized. They are then labeled (if sold under a specific plant logo) and distributed to retailers or other buyers. Pasteurized and refrigerated crabs have a long shelf life.

Frozen crab meat is produced by placing picked meat in plastic bags, freezing the bags, and then distributing the portions in insulated containers. Frozen meat is purchased by large buyers.

Culls (crabs with one or both claws missing or otherwise incomplete) and females (smaller than the males) are difficult to pick. Less meat is produced within the same time required to pick top-quality males. Productiv-

ity of the picker is reduced. Buyers try to ensure a good balance between large males and the more difficult smaller crabs; too many culls or females cause workers to refuse to pick. As mentioned previously, watermen are often limited in the quantity a buyer will accept; the buyer cannot handle more crabs than can be picked. During the summer many houses hire high school students and generally sufficient labor is available at that time.

With the exception of Eastern Bay, Maryland crab quality is considered poorer today than in the past--crabs run smaller than imports from elsewhere.

Crabs are easy to ship. Crabs are usually trucked, and at least three companies are air-shipping frozen soft-shell crabs to United States destinations.

Maryland has strict sanitary restrictions for acceptable meat and makes efforts to limit a large and steady production of home-picked crab meat. Many watermen work with their families to produce meat picked in the kitchen or in a small picking house in the yard. Such meat, called "bootleg" meat, is shipped to many sources in small trucks or sold directly to Maryland restaurants. Figures on quantities of such bootleg meat are unknown but suspected to be "large." Catch and landing figures for crabs are not nearly as precise as those for oysters and clams, as buy slips, the state landing recording system, are not required for crab sales.

Despite state regulations, watermen find crab picking at home as advantageous. Incentive to produce top-quality meat is higher, sanitary conditions in a home setting are considered at least as high as in picking houses, and prices received for such meat are high. A very large market exists for bootleg crab meat. Prices paid watermen by the dealer are always compared to potential prices from bootleg picking and if the dealer's price is much

lower the waterman may change buyers.

Soft-shell clams are presently a low-volume, high-priced product. Further processing of soft-shell clams beyond meat removal is seldom done; most leave Maryland in the shell.

Many shucked clams go directly to New England. Shell-stock clams and shucked meats are shipped to Fulton Market in New York; we heard nine-tenths of the clams shipped from the state go through Fulton, which once refused Maryland clams due to a high bacteriological count in samples taken from Maryland distributors.

Whereas soft clams once provided breaded and fried portions for New England use, during the past decade the surf clam (landed from ocean-going vessels along the mid-Atlantic coast) has substituted for the soft clam in increasing amounts.

4. Costs for Purchase and Handling

Costs for the purchase and handling of Bay shellfish are a function of raw material cost (price paid the waterman), transport, labor, overhead, and packaging. While specific figures for all categories were beyond the scope of this study, general costs can be estimated for many categories.

Transport costs to move oysters from an outport to a shucking house (recognizing the lack of shucking capacity and resulting need to move product to remaining shucking houses) range between 50 cents and one dollar per bushel.* Oyster yield varies according to the time of year and the oyster bar of origin, ranging between four and eight pints per bushel.

An oyster dealer pays (1978) about $6.50 for bushels received from watermen. Shuckers are paid about three dollars a gallon for meats produced. Eight pints are contained in one gallon; the shucker must cut two bushels at four pints per bushel as opposed to one bushel at eight pints per bushel (rarely are yields so high) to receive three dollars. When a good shucker makes fifty dollars in a day, yields must be high; at least twenty bushels must be cut.

In addition, fixed costs and packaging are included in the processor's cost. Many shucking houses own their own trucks; transport costs of oysters from the plant also must be covered. Final transport figures were unavailable, but the average cost of processing fresh oysters had 12 percent of the total cost applied to fixed fees (utilities, overhead, management) and three percent applied to packaging.**

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*Reference 52: U. S. Regional Oyster Product Flow, p.2.
**Ibid, p. 3.

For example, assume the landed price of oysters is $6.00 per bushel and yields are six pints per bushel. Costs to the processor would require at least the following sales price to break even:*

	Landed Cost		Transport Cost		Cost at Plant
A.	$6.00/bushel	+	$.75/bushel	=	$6.75/bushel

B. a) 6 pints/bushel requires 1.3 bushels shell-stock to yield a gallon of meats; or

	Landed Cost		Transport Cost		Cost at Plant
b)	$6.00 x 1.3 = $7.80/gallon	+	$.75 x 1.3 = $.98/gallon	=	$8.78/gallon

C.

Landed Cost at Plant for One Gallon Meats		Labor to Cut Meats		Fixed Cost Plus Packaging		Cost at Plant Outlet
$8.78	+	$3.00	+	$2.07	=	$13.85/bushel

D. Assuming a transport cost double the cost to move oysters from the dock to the plant, recognizing the greater distances to be traveled, cost to the processor totals:

Cost at Plant Outlet		Transport Cost		Bare Cost to Processor
$13.85/bushel	+	$1.50/bushel	=	$15.35/bushel

The above calculation must be measured against a value of $18.00 per gallon--the price paid the processor for small containers of shucked meat. The processor must pay taxes, unemployment insurance, advertising, and miscellaneous overhead charges from the difference, as well as repacking costs (see below).

Value		Cost		Net Gain
$18.00	-	$15.35	=	$2.65

*These figures have been drawn from interviews and do not reflect total costs to the processor.

However, processors we spoke with stated yields of between four and five pints per bushel landed early in the 1978 season. Yields of four pints per bushel, calculated as above, result in processor costs of $19.50 for one gallon of meat while the price received remained $18.00.

Landed Cost		Transport Cost		Labor Cost		Fixed Cost & Packaging		Cost at Plant Outlet
$6.00 x 2 = $12.00	+	$.75 x 2 = $1.50	+	$3.00	+	$3.00	=	$19.50

These very general cost estimates indicate the thin profit margin often facing shucking houses. When yields are low (or when supplies are low with higher prices to watermen), processors will lose money. While practiced in some areas more than others, sometimes as much as 40 percent of shipped weight may be added water to make up the difference between costs and prices received. Water additions are well-known throughout oyster markets and have further reduced Maryland's outlets in favor of "denser" packed oysters from elsewhere.

Most Maryland shuckers sell to repackers who sell to chain stores. Chain stores are the price-setters on one-half to one pint containers of shucked raw meats. Retail prices are usually increased 50 percent to cover shelf-life losses. The price paid by chain stores is negotiated before the oyster season starts and as a consequence is fixed at one end. Processors must manipulate prices paid watermen according to yield of meats and other costs; a difficult task given the watermen's widespread use of CB radio. A processor producing over 1,500 pounds in a day is rare.

Crab handling costs like oyster costs are limited by retail prices received for end product. The following example considers packed, pasteurized meat, currently selling at retail for $10.00 per pound.

Landed crabs vary in ex-vessel prices from 50 cents per pound early in the season to 25 cents a pound in September. Good production of meat, like the oyster houses, is 1,500 to 1,600 pounds a day.

Crab processing is more profitable than oyster shucking. A packer must place a value on raw meat produced from the steamer at between $1.80 per pound (14 percent yield at 25 cents a pound) and $5.00 per pound (10 percent yield at 50 cents per pound).

Labor costs for picking meat average about $1.25 per pound. A top picker is capable of producing eight to ten pounds per hour, although four to five pounds per hour is average.

Costs for overhead, machinery, financing, packaging materials, and transport from the plant to customer were unavailable, although estimates given quoted $3.00 per pound.

Prices received by the processor for a pound of meat ranged between $7.00 and $9.00 per pound.

Summary figures are following, assuming an average meat cost of $3.00 per pound (midway between the $1.80 and $5.00 figures given above):

Cost for Meat		Labor		Overhead, Utilities Packaging		Total
$3.00	+	$1.25	+	$3.00	=	$7.25

Crab products are sold to individual customers--distributors to restaurants, restaurants directly, smaller traditional customers, and some institutions. Crab processors can net between 50 cents and $1.75 per pound depending upon yields of picked meats from supplies.

Many high school students work in crab houses during the summer when school closes; for this reason, labor is not as serious a problem as for oyster houses.

Maryland crab houses import large quantities of crabs from southern areas along the Gulf Coast. Such imports are usually large select male crabs, air-shipped or trucked north. Imported crabs serve to stabilize the Maryland industry, although direct shipments to retailers from other states are reducing local markets for Maryland firms. Transport costs are also high for imported crabs, increasing costs to the processor.

The rough product cost estimates presented here, recognizing their incomplete nature, demonstrate the thin margin often present for Maryland processors. Margins vary day to day. Supply uncertainties force processors to function on a day-to-day basis when operating their business, hindering long-range planning or investment. Many dealers we spoke with felt the higher values of raw product and variations of supply increased their difficulty to make a profit.

5. Identification of Shucking-Picking Centers

The large number and small size of most processors result in locations scattered throughout the Maryland shore.

Local buyers are situated in most fishing communities. Often they purchase product for shipment elsewhere in Maryland for further processing. Many local buyers operate crab picking houses in summer. Oyster shucking establishments are not spread as widely as crab picking establishments.

Generally fish taken in the Bay are sent to Rock Hall or companies along the Potomac Shore.

Crab picking has concentrations in Grasonville, Wingate, Deal, and Crisfield, with greatest effort seen in Crisfield. However, bootleg operators function in most small communities.

Oyster shucking centers are found in Grasonville, Annapolis, Tilghman, and Cambridge.

Clam buyers and distributors are centered in Grasonville.

6. Product Distribution

The small buyers ship product to many wholesalers, retailers, and distributors. Product flows change regularly although most wholesalers are found in Annapolis, Grasonville, Easton, Cambridge, Tilghman, Crisfield, and Pocomoke City. The smaller buyers we interviewed felt the large wholesalers set prices in many cases.

The wholesalers distribute product widely to many markets located all over the United States. Most wholesalers owned their own trucks (as did the smaller buyers), sending shipments on regular routes as far north as Montreal, south as far as Texas, and west to Chicago and Los Angeles. Buyer-shippers move the product in live chilled form, frozen, canned, or cooked. Trucks moving product after Maryland processing are large, often insulated trailer ten-ton or semi-rigs. Many are refrigerated.

All categories of dealers (primary, wholesale, primary/wholesale) when purchasing oysters from watermen send trucks with conveyors; clams and crabs are most often delivered directly to the dealer's dock.

The product distribution system is generally controlled by the telephone and use of trucks. Buyers own "buy trucks" which work on short- or long-term arrangements with watermen. Product is bought on the road wherever watermen land, arranged by radio or telephone. Some watermen have trucks of their own. Such "buy trucks" are small, insulated one-half to five-ton single chassis units. Many converted pick-ups serve as buy trucks. Different distribution methods are a function of individual preference on the part of waterman and buyer. Many different arrangements exist on the same dock; we observed three watermen unloading next to each other on the Western Shore: one was loading his own truck for shipment to Annapolis, another was unload-

ing into a truck sent by a local buyer, and the third was unloading to a truck up from Virginia.

In addition to dealer-owned trucks (either small units for direct purchase at the dock or the larger distribution units), several commercial carrier firms move Maryland product. These firms often follow the same routes on the same days, often to meet an early-in-the-week chain store delivery; dealers and watermen using such firms make efforts to meet their schedules. Many trucks from Virginia travel to Maryland, mostly purchasing shell-stock oysters for shipment back to Virginia. Often trucks moving highly processed Maryland fisheries products (surf-clam portions or frozen fish from the Coldwater plant in Cambridge) will take Bay products if they have space.

Hundreds of "gypsies" transport Bay products, especially crabs. Many small trucks are sent into the Bay region from the westward to fill one or several small orders for out-of-state retailers. While the product distribution system is highly competitive, rates have been increasing with fuel cost increases. Presently many small lots are shipped to many spots, and buyers we contacted felt there was no difficulty in shipping truckload lots anywhere.

The movement of shell-stock oysters into Virginia for seasoning (Chincoteague) or shucking, and then the shipment of those oysters back to Maryland dealers, doubles transport costs and has increased product costs.

Air transport remains extremely expensive, although frozen soft crabs have been air-shipped recently.

Very little rail transport now occurs compared to years ago.

7. Product Destination

There is no one central market for product distribution in Maryland though the Baltimore market distributes fish/shellfish to both the Baltimore and Washington metropolitan areas. Baltimore does not appear to be an organizing factor for distribution, but is considered a market area for product with a wide variety of retail and wholesale outlets. While most clams pass through Fulton in New York, Fulton is avoided by Maryland dealers whenever possible.

Markets tend to be widely scattered and composed of many individual outlets: restaurants, retail establishments, chain-stores, and institutions. Markets exist all across the country. Each distributor has a carefully built-up market system on the basis of personal knowledge and geographic routes.

Bay fluctuations in abundance, geographic isolation, a resulting lower scale of operations, product perishability, and seasonality have made the distribution and market system for Bay species similar to the harvesting systems upon which sales depend: requiring flexibility, individuality, low overhead, and uncertainty about the future. Dealers and processors, directly facing such factors as import competition, labor supply, and the need for heavy investment to modernize, unlike the watermen selling raw product over the dock, feel trapped in a steady and vigorous economic squeeze.

8. Shoreside Sale, Processing and Distribution: Trends

Changes in the shoreside aspects of Maryland Bay fisheries include product supply trends, marketing trends, and resulting product handling trends.

Product Supply Trends. Supplies to dealers have changed greatly during the past decade. Within the Bay, oysters have remained in good size condition, crabs are smaller than those from other coastal areas, soft-shell clams are growing scarce, and finfishing has dropped tremendously from years ago.

On the other hand, the Bruce decision has found buyers receiving steadier supplies from watermen who have begun traveling. The evolution of the present shoreside system was as much affected by county lines as were the activities of watermen. Small buyers today still operate a territorial business as they did prior to Bruce, designed to serve the small boats from a nearby area; yet today the CB, telephone, mobility of watermen,and a truck/conveyor system adjust cupply variations to Bay-wide resource abundance rather than county-wide. Competition among buyers for Bay resources has also increased.

The seasonality of supplies, coupled with a business need to operate year-round, and improved transport and refrigeration techniques, has found many buyers depending on imports from out of state. Several dealers we interviewed had business interests in other states to promote more consistent supply.

Crabs now arrive from the entire Gulf and Southeast Atlantic Coast. In the spring nearly 400 cases of crab enter Maryland every night from the Gulf Coast alone. Crab imports have increased considerably since hurricane Agnes.

Oyster imports compete with Maryland oysters for breaded and fried portions. Most other coastal states produce oysters with increasing government support as aquaculture techniques are improved.

Many of the larger Maryland buyers today do not depend upon Maryland products for supply to the extent they used to. Supply sources are now from national sources rather than Bay waters alone.

A potential new supply source may soon be oysters raised in hatcheries. Technology today is nearly capable of producing hatchery oysters commercially; costs for algae to feed oyster larvae remain high. An oyster hatchery currently supplying seed oysters is located in Cambridge. A current effort on the part of watermen carries promise: oyster spat are to be transferred into crab shedding trays and there raised before placement on natural bars.

Much literature (and several Maryland planning reports) argue that public oyster bars be joined by private leaseholds on currently barren oyster bars. Virginia's experience has shown leaseholds to be more productive than seeded public bottoms, although resistance to disease when oysters are so concentrated may be much reduced. While several dealers we spoke with were in favor of leaseholds, most were not, stating current labor forces were insufficient to handle potential harvests from public bars today, let alone leaseholds.

The state of Maryland has not generally favored leasing, although some leaseholds exist. A desire to transfer privately held oysters from condemned areas into rafts anchored in public waters for depuration has been expressed. Were such a step taken, were it successful and legally operable, significant changes might ensue regarding Bay oyster supply.

Marketing trends. Marketing trends are first influenced by Maryland seafood products increasingly becoming gourmet items. Oyster and crab prices are as high or higher than other shellfish; today shellfish are considered luxury items by most consumers.

However the markets for fresh oysters have also been decreasing. Dealers told us fresh oyster eaters are an aging generation; young people have not maintained the market. In an era governed by convenience foods and passive appearance of product, oysters suffer.

Markets for crabs have shrunk somewhat as other suppliers have taken to dealing directly with customers rather than moving product through Maryland firms.

Soft-shell clam markets are increasingly filled with surf clams and ocean quahogs, especially for chowders. Recently several foreign nations sent delegations to Maryland firms in search of product, especially Japan. Such markets are expanding as other nations adjust to supplies lost to their fleets under 200-mile limits; they now seek similar product. For example, Japan seeks Maryland crabs to fill demand that can no longer be met with Alaskan crabs formerly taken in the United States Fishery Conservation Zone.

Although the Bay is well known for striped bass, markets for Bay finfish are nearly entirely local or sent to freezing establishments handling vast quantities for fast-food chains.

Product handling trends. The first and most significant product handling trend has resulted in additional loss of market control: shipment of the most valuable proportion of Bay products out of Maryland in raw form. The shipment to Virginia of most Maryland oysters prior to shucking has lost economic multipliers and direct market access to the state. The lack of a

labor supply, working conditions, and acceptable wages has forced many Maryland shucking houses to close down. Crisfield, once a large oyster center, today has shifted entirely to crab processing; other shucking areas are often forced to export nine-tenths of the oysters they buy. Losses to Maryland processors as a result of inadequate processing capacity have been estimated to exceed $57,000,000 of business between 1969 and 1973.*

The problems of inadequate labor and product movement from the state have existed for 20 years. These problems have significantly hindered capital improvements.

All dealers we interviewed expressed interest in automated processing machinery, feeling such machinery was essential for future business. Crab picking machines are currently under experimentation in Crisfield and Wingate with promising results. Such machines continue to experience problems. For example, cleanliness of the conveyor moving crabs through the machine remains a problem. Dealers hope machines can handle crabs in times of surplus supply (unlike today when boats are put on limits). Pickers would perform other tasks (feeding the machines, packaging, etc.) and thus employment would not be reduced.

Oyster shucking machinery is universally considered a major need if Maryland firms are to gain multipliers from state-processed product. To date, such machines (like automated calico scallop shucking machines) open shells using steam, slightly altering the oyster in the process. Concerns have been raised the Maryland market cannot accept altered product for the fresh trade, yet such trade only directly supports 30 percent of Maryland's oyster business.

*Reference 24: Growth Prospects for the Oyster Industry in Maryland, p. viii.

Presently no processor has invested in an experimental oyster shucking machine because of these concerns.

Freezing is increasingly used for oysters and soft crabs. Oysters are frozen for the institutional trade, and crabs are frozen for air shipment overseas contributing flexibility to marketing.

All shoreside interviews included references to increasing government safety regulations, sanitation standards, and environmental restrictions. Although many dealers felt sanitary conditions required improvement for better competition in the marketplace, many regulations have the effect of increasing overhead without increasing productivity.

Buyers/processors today feel they must work closely with government to work out problems, operate their business from day to day to make a profit because margins are so close and losses cannot be made up, function within a Bay-wide information network (CB radio and telephone), and above all, respond to supply conditions.

Business difficulties have caused two particularly recent changes in shoreside sale and processing establishments. The smaller dealers (and some larger wholesalers) are forced to expand into related businesses such as ice, marine repair, yacht services, retailing, and providing services to the tourist industry. Increasingly expensive operating and legal standards raise fears the smaller processor cannot survive.

Recently, several larger processors have been purchased by corporate conglomerates, indicating a nationwide trend in the seafood industry: national corporations catering to the frozen and fast-food markets, bought

from many sources and sold nationally. As in New England, Maryland's Bay seafood industry has focused on fresh, relatively unprocessed product to serve a steadily shrinking market, as people turn more and more to convenience foods.

E. INSTITUTIONAL FRAMEWORK*

1. Federal Activities

Federal agencies currently have little effect upon the Bay fisheries: rather, federal activities focus upon the condition of the Bay habitat.

Water pollution control legislation, environmental standards, and wastewater treatment activities are very much controlled by federal agencies, particularly the Environmental Protection Agency. Federal action will ultimately have a most important impact upon the Bay's productivity. EPA actions presently focus upon water quality as well as materials introduced into the water. EPA has not considered Bay species as the measure of anti-pollution efforts. EPA actions are considered by watermen as often inconsistent with Bay biology or the needs of the Bay fisheries. Those making a living from the Bay feel nonpoint pollutants (agricultural runoff primarily) are the major cause of the decline of Bay productivity, yet EPA's actions have not focused on preventing such materials from being applied to the land. Only recently have Federal efforts focused on a second major problem: toxics and hazardous chemicals.

The EPA is currently undertaking a major Chesapeake Bay Study but results are not yet available.

Federal Coastal Zone Management activities represent a second federal action influencing Bay fisheries, with a recent federal decision to focus

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*Sources include conversations with Federal and State officials and industry and watermen representatives. Literature sources include, but were not confined to, the following: References 12, 13, 14, 15: County Plans (all); Reference 17: Annotated Code of Maryland, Crab Packers and Shippers; Reference 29: Laws Concerning Commercial Harvesting of Finfish; Reference 30: Laws Concerning Commercial Harvesting of Shellfish; Reference 34: Maryland Coastal Zone Program; Reference 45: Potomac River Basin Directory; Reference 48: Potomac River Commission Regulations.

on those living resources within the Coastal Zone as well as shoreside land development activities. This report represents the first stage of Maryland's participation in OCZM's newly created Coastal Fisheries Assistance Program. Many sources we interviewed were concerned that the management philosophy of OCZM (or any environmental management bureaucracy) is focused upon management theory applicable only to predictive rational activity within a fiscally oriented, tight time schedule. Yet the Bay habitat -- and the communities based upon that habitat -- must be flexible and timeless if they are to survive.

The Fishery Conservation and Management Act, also recent federal legislation, does not apply to fisheries management within the territorial sea, although the close relationship between inshore-offshore waters has many observers holding the view that federal influence in state waters must grow. One immediate species of value to the Bay fisheries -- striped bass -- will be managed on an interstate basis, most likely through the Atlantic States Marine Fishery Advisory Commission, rather than a Regional Council.

Federal activities concerning power plant siting (Federal Power Commission and Nuclear Regulatory Commission) and transportation (United States Coast Guard and Federal Highway Administration) may also influence Bay habitat conditions.

The Supreme Court of the United States has quite possibly had greater potential effect upon Bay fisheries in Maryland than any other federal entity. As outlined earlier, Douglas vs. Seacoast Products may result in the invalidation of Maryland's residency requirements for the taking of oysters. Currently Maryland's public oyster bars are twice as productive as those located in

Virginia, possibly a result of Maryland's seeding program (detailed below). Were residency requirements invalidated, Virginia boats would surely move north. The Fisheries Administration has taken the position oysters are a resident species to Maryland waters and thus not covered by the Supreme Court ruling. The uncertainty at the present time of this issue has many people seriously concerned. Were nonresidents allowed into Maryland waters, very likely Maryland would lose its incentive to replete its public bars for Maryland watermen.

Furthermore, if leaseholds are exempt from Seacoast, but not public bars, Maryland would likely be forced to totally change the structure and operation of the present harvesting system, completely altering the entire fisheries system with profound effects.

2. Maryland Activities

Maryland institutions having significant bearing on the Bay fisheries are the Fisheries Administration (Department of Natural Resources), Coastal Zone Unit, and the Health Department.

The Health Department is responsible for the opening and closing of fishing areas according to established biological standards. A Shellfish Advisory Committee, made up of Health Department Fisheries Administration and Coastal Zone Unit members, meets monthly to review status of closures and establish future actions. In addition the Health Department is charged with inspecting shoreside product handling establishments to ensure they meet standards necessary for good product quality. The Maryland program emphasizes sanitation inspections to support Maryland seafood quality control--in hopes of avoiding such actions as Fulton's refusal in 1978 to accept soft-shell clams. But many dealers we spoke with pointed out that one effect of Maryland's stricter standards than those of Virginia's is to move product, business and market control to Virginia from Maryland.

Currently over 60,000 acres of the Chesapeake Bay in Maryland are closed to fishing activity, including the upper reaches of nearly every estuary upon which many finfish species are dependent during the early stages of their life cycle. A generation ago less than a tenth of this area was closed.

Of all institutions affecting Bay fisheries, the Fisheries Administration actions are guided by a state position in favor of public shellfishing and a general view that the major focus of Fisheries Administration actions is to preserve the traditional way of life for fishing communities. As with

the commercial fisheries system itself, the regulatory structure has evolved in response to an extremely variable and complicated habitat.

Management principles include regulation of gear in accordance with the biology of the species sought, elaborate area restrictions with size and landing limits, strong enforcement, a highly successful public propagation program, and consistent interaction with watermen. Currently the Fisheries Administration is preparing management plans for Bay species. The process has just begun and is being structured within the framework of a habitat approach rather than on a species-by-species basis.

As outlined previously (Harvesting Sector) the gear allowed for commercial fishing has been limited to so-called 'inefficient' technologies: hand tongs, trotlines, pots, serious limits on patent tongs and clam escalators, and careful restriction on dredging under power. Much of this gear -- save patent tongs and clam rigs -- has not changed in over a century. The gear used today is 'in balance' with the stocks themselves yet provides a livelihood for thousands of families. We found no watermen speaking in favor of 'more modern' gear. Many management restrictions are results of legislation passed by a statehouse dominated by rural, fishing-based counties (before reapportionment), a common factor in fisheries management among all coastal states. However, the economic success -- to the harvester -- resulting from antiquated gear commensurate with stock biology suggests management based on 'inefficient' gear promotes economic efficiency in the broadest sense. In this respect Maryland may be unique and lessons gained from the success of such an approach may be highly useful elsewhere.

In addition to gear restrictions are a host of species specific regulations: size, location, and seasonal limits. Oyster season runs from September 15 to March 31. No more than 5 percent of a landed bushel -- by count -- may be oysters with shells less than three inches wide, no more than twenty-five bushels per day may be landed by one tonger, and all oyster harvest must take place between sunrise and sunset. Skipjacks operate under different regulations limited to 150 bushels a day and restricted to two days a week during which power may be used.

The oyster bars within the Bay were last charted in 1913; over 900 bars were then charted. A survey and mapping of the Bay has been occurring for the past five years; to be completed by 1981. This survey will chart current productive oyster bar locations.

Soft-shell clammers are limited to fifteen bushels per day per boat. Clams must be two and one-quarter inches wide. Boats must fish between sunrise and sunset. Certain areas have been designated for clamming, generally shoreward from oyster bars. Clammers may not operate on nondesignated bottom, a regulation protecting oyster cultch under which clams may be found. The Fisheries Administration will occasionally change oyster bottom to clam bottom after extensive negotiations with watermen.

Crabs are virtually unregulated except the shell of landed crabs must measure five inches across for hard crabs, three and one-half inches across for soft crabs and three inches for peelers. Any amount may be landed, although as detailed earlier, buyers often limit boats to weights that can be picked by pickers. Crab potters cannot run gear in the mouths of rivers and estuaries, which are restricted to trotliners. The crab season is not regulated as the biology of the species creates its own season.

Finfish regulations include mesh restrictions on nets, prohibition of otter trawling and purse seining, prohibition of mono filament, and length limits as to yards of gillnets one can operate.

As the New England groundfishery has recently demonstrated, no fisheries management system will work unless adequately enforced. In Maryland the Marine Police enforce management regulations. As might be concluded from the above paragraphs, Bay management is complex, geographically focused, and must control thousands of small harvest units. The Marine Police are located throughout the Bay and, in the words of one waterman, "They are everywhere." Presently, about 200 men serve on the Marine Police, about half from fishing communities. Marine Police have the same police powers as other enforcement agents. Although many watermen resent Marine Police, having been boarded on the Bay for minor reasons. All agree the police are essential to proper functioning of the management system.

While jurisdiction in many fisheries matters is limited -- for instance the Potomac River Fisheries Commission has no authority over tributaries -- the management system briefly detailed here, although complex to the outsider, is well understood by all Bay watermen and is most often respected. Watermen, we were often told, accept the need for regulations.

A fundamentally important action carried out by the Fisheries Administration (and the Potomac River Commission) is the oyster propogation program, initiated most recently in 1960. Maryland spends two to three million dollars a year on oyster restoration; the Potomac River Commission spends between 200 and 300 thousand dollars.

The Fisheries Administration has several designated seed areas; areas known for consistently good spatfall closed to fishing. Every spring, seed

oysters are moved from seed areas to bars known for good growing conditions.

As oysters require good cultch for setting and as other oyster shells provide the best cultch, the state also contracts with a local firm to "mine" the fossil beds at the head of the Bay. Shells are dredged from these beds, washed, and redeposited on productive bars.

Because most Maryland oysters are shipped to Virginia for shucking, both Maryland and the Potomac River Commission purchase shells from Virginia shuckers. Less than one-third of those shells entering Virginia are purchased back. Maryland assesses a tax on oysters leaving the state.* The state presently pays between 25 cents and 30 cents a bushel for spent shells from Virginia. The best oyster cultch are freshly shucked shells; Maryland is thus annually losing much of the state's future oyster potential unless other supplies are found.

The fossil beds currently being mined are expected to last another three to five years before exhaustion.** While other states contain vast beds of fossil shells (for example, Gulf Coast states)***, competing uses for those shells (for road materials, poultry feed, cement mixture additives) do exist and costs would be high.

Experiments have been attempted, with some success, on bagless dredging of shells, washing, redeposit, and quicklime application (3 tons per acre), which may improve oyster sets. Presently, however, such practices are not followed to any great degree in Maryland.

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* Reference 62: Oyster Industry in Virginia, p. 470.

** Reference 6: Oyster Propogation in Maryland, p. 12; personal communication, Fisheries Administration Offices.

***Reference 61: National Fisherman, November, 1978.

The Maryland seeding program has been successful and may be a major reason the public bars are so productive today. Between one-half million and one-million bushels of seed oysters are planted annually:*

Year	10^6 Bushels	Cost $1000	Cost/Bushel
1971	1.1	427	.39
1972	.9	422	.45
1973	1.1	489	.45
1974	.4	168	.45
1975	.8	395	.47
1976	.6	290	.50
1977	.5	258	.50
	5.4	2,449	

A bushel of planted seed has a survival of 13-25 percent by the time the oysters are commercially available three years later. However, as the meats in the surviving oysters gain considerably in size, a rule-of-thumb has been that a seed bushel will, as a minimum, yield a commercial bushel when harvested. Examination of Maryland catch figures for the years 1974-1976, when compared to seed bushels planted three years earlier, will indicate the importance of the seeding program to the fishery:**

Seed Planted Year 10^6 Bu	Quantity from Seed for Harvest Three Years Later 10^6 Bu	Maryland Harvest 10^6 Bu
1971 - 1.1		
1972 - .9		
1973 - 1.1		
1974	1.1	2.8
1975	.9	2.5
1976	1.1	2.4

*Reference 6: Oyster Propogation in Maryland, p.23.
**Reference 6 as above, Maryland Fisheries Administration.

Assuming oyster yields have stabilized recently, as we frequently heard, between one-quarter and one-third of commercial harvest today is a direct outcome of the seeding program. It would appear that the state receives a return from oyster harvest and shipment taxes twice the cost of setting the seed three years earlier. However, some of the total Fisheries Administration budget comes from general state funds rather than license and tax revenues.

Associations

Throughout this entire management process watermen's associations are frequently consulted. Decisions as to where to place cultch and seed oysters are made following negotiations with harvesters. Likewise, all area designations and regulatory restrictions are first reviewed by watermen. Every spring the Fisheries Administration hires about 300 watermen to move seed oysters, providing spring employment during a low period of the annual Bay fishery. Thus, although conflicts exist between the regulatory agency and the watermen in the present system watermen have become an important and necessary part of the management structure. As evidenced in other fisheries management difficulties elsewhere in the United States, management only succeeds if those being managed provide general support. In Maryland, the complex regulatory system is well balanced by communication with watermen and a highly important stock restoration program. Like other elements of the Bay fishery system characterized here, the procedure works well.

Watermen's associations represent an active element of the Bay fishery. First established on a county-wide basis, the growing use of CB, the Bruce decision, and wider product flows have seen development of a statewide association that through its efforts has more than compensated for loss of political

power through reapportionment. The Association lobbies in the State House, carries out various study contracts on matters regarding Bay fisheries (a finfish survey and recent contract using crab shedding trays for larval oyster growth), and produces a comprehensive newspaper. Recently a clammers' association has been formed.

Possibly nowhere else in the country (save Alaska) are fishermen so active in government matters. Marketing associations have less authority. The Seafood Association lost much of its representative authority when watermen formed their own association. Dealers and processors feel the DNR has promoted and encouraged watermen at their expense. Efforts continue today to better organize shoreside elements of the Bay fishery system. The serious difficulties faced by dealers and processors with respect to market losses and product movements from the state in raw form, when considered with possible Seacoast developments, carry serious implications for the watermen themselves, for ultimately they require a strong shoreside marketing system for continued success.

IV.
FISHERIES SYSTEM: INPUT-OUTPUT CHARACTERIZATION

The Category, Transaction, and Network tables presented here provide a logical and realistic picture of functions and activities within Maryland's Bay fisheries. Efforts to quantify in detail this 'shadow economy' with its 'invisible transactions and values' are extremely difficult. Concepts of 'efficiency' and 'satisfaction' are personal and subjective, driven largely by social rather than economic values. The categories as presented in the following tables, with associated restrictions as detailed in the accompanying explanatory text, although not suitable for direct translation into economic models, do provide substance and direction for such modelling efforts.

1. MARYLAND CHESAPEAKE BAY COMMERCIAL FISHERIES SYSTEM
BY DISAGGREGATED CATEGORIES

WATERMAN/ HOUSEHOLD

Oysters
- handtong
- patent tong
- dredge
- lease bed

Crabs
- trotline
- pot
- scrape

Clams
- hydraulic dredge

Finfish
- drift net
- set net

Eels
- pot

Multi-purpose Fishery
- (any combination of above including charter)

SERVICES TO WATERMEN

Boatbuilder
- boats, engines
- propulsion, fittings
- repair, maintenance

Manufacturer
- boats, engines
- propulsion, gear & equipment
- containers

Distributor
- engines
- propulsion, gear & equipment
- hydraulics, chandlery

Marina
- propulsion, chandlery
- fuel, ice, docking

Boatyard
- engines
- propulsion
- chandlery, fuel
- lubricants, docking

Garage
- engines, propulsion, gear & equipment
- maintenance & repair
- lubricants

Welder/machine shop
- gear & equipment
- maintenance & repair

Hardware
- gear & equipment
- chandlery

PRIMARY BUYER/PACKER

[IN COMMON]

Oysters

Oysters/crabs

Oysters/crabs/finfish

Crabs

Clams

Mariculture/bait
- eels
- oyster rafting
- crab peeling

SERVICES TO WATERMEN (continued)

Grocer
- food

Buyer
- ice, fuel, food
- bait, docking

Finance/insurance

Legal/accounting

Government services
- (federal)

REGIONAL SECONDARY WHOLESALER/DISTRIBUTOR

SERVICES TO BUYER...DISTRIBUTOR

Casual labor
- (proportion)

Garage
- expendable supplies
- repair & maintenance

Welder/machine shop
- repair & maintenance equipment

Hardware
- expendable supplies
- equipment

Manufacturer
- containers (whsle & retail), equipment

Distributor
- expendable supplies
- equipment

Transportation
- contract trucking

Energy/utilities

Wholesalers
- consumable supplies
- retail inventory

Boat services
- (as watermen)
- buy boat, yard boat
- fishboat

Finance/insurance

Legal/accounting

RETAILER & EX-REGION WHOLESALER

Buyer/packer retail

Wholesaler/distributor retail

Restaurant
- local
- regional
- distant

Retail
- local
- regional
- distant

Ex-region wholesale Market
- Baltimore
- Philadelphia
- New York
- Norfolk
- New England (Boston)

Ex-region distributor

STATE

Cultch

Seed

Transport cultch and seed

Management/ Administration
- committees
- commissions
- research
- statistics
- extension
- enforcement
- sanitation
- standards

2. MARYLAND CHESAPEAKE BAY COMMERCIAL FISHERIES

TRANSACTION TABLE BY RELATIVE MAGNITUDE

PURCHASER / PRODUCER	WATERMAN/ HOUSEHOLD	SERVICES TO WATERMEN	PRIMARY BUYER/ PACKER	REGIONAL SECONDARY WHOLESALER/ DISTRIBUTOR	SERVICES TO BUYER... DISTRIBUTOR	RETAILER & EX-REGION WHOLESALER	STATE
WATERMAN/ HOUSEHOLD	2	-	4	3	-	2	2
SERVICES TO WATERMEN	4	1	1	1	1	-	-
PRIMARY BUYER/ PACKER	1	-	3	4	-	3	-
REGIONAL SECONDARY WHOLESALER/ DISTRIBUTOR	1	-	2	2	-	4	2
SERVICES TO BUYER... DISTRIBUTOR	2	-	4	4	-	1	-
RETAILER & EX-REGION WHOLESALER	-	-	1	2	-	1	-
STATE	3	-	2	2	-	1	-

CODE 4 very large
3 large
2 small
1 very small
- insignificant

(Code numbers indicate relative values)

3. MARYLAND CHESAPEAKE BAY COMMERCIAL FISHERIES PRODUCT AND SERVICE TRANSACTION NETWORK

PRODUCER \ PURCHASER	WATERMAN/HOUSEHOLD	Oysters	Crabs	Clams	Finfish	Eels	Multi-purpose fishery	PRIMARY/SECONDARY BUYER...DISTRIBUTOR	Oysters	Oysters/crabs	Oysters/crabs, finfish	Crabs	Clams	Mariculture/bait	RETAILER & EX-REGION WHOLESALER	Buyer/packer Retail	Wholesaler/distributor Retail	Restaurant	Retail	Ex-region wholesale market	Ex-region distributor	STATE	Cultch	Seed	Transport cultch and seed	Management/administration
WATERMAN/HOUSEHOLD																									
Oysters								x	x	x				x		x	x	x	x					x	•	•
Crabs			x						x	x	x			x		x	x	x	x							
Clams													x			x	x	x	x							
Finfish											x					x	x	x	x							
Eels			x				x							x												
Multi-purpose fishery			x						x	x	x	x	x	x		x	x	x	x						•	
SERVICES TO WATERMEN																										
Boatbuilder		•	•	•	•	•	•		•	•	•	•	•	•												
Manufacturer		•	•	•	•	•	•																			
Distributor		•	•	•	•	•	•																			
Marina		•	•	•	•	•	•																			
Boatyard		•	•	•	•	•	•																			
Garage		•	•	•	•	•	•																			
Welder/machine shop		•	•	•	•	•	•																			
Hardware		•	•	•	•	•	•																			
Grocer		•	•	•	•		•																			
Buyer		•	•	•	•	•	•																			
Finance/insurance		•	•	•	•	•	•																			
Legal/accounting		•	•	•	•	•	•																			
Government services (federal)		•	•	•	•	•	•																			
PRIMARY/SECONDARY BUYER...DISTRIBUTOR																										
Oysters									x	x	x	x	x			x	x	x	x	x	x		x	x		
Oysters/crabs									x	x	x	x	x			x	x	x	x	x	x		x	x		
Oysters/crabs/finfish									x	x	x	x	x				x	x	x	x	x		x	x		
Crabs									x	x	x	x	x			x	x	x	x	x	x					
Clams																x	x	x	x	x	x					
Mariculture/bait			x						x	x	x	x	x													
SERVICES TO BUYER...DISTRIBUTOR																										
Manufacturer	•	•	•	•	•	•	•		•	•	•	•	•	•												
Distributor	•	•	•	•	•	•	•		•	•	•	•	•	•												
Casual labor									•	•	•	•	•	•												
Garage	•	•	•	•	•	•	•		•	•	•	•	•	•												
Welder/machine shop	•	•	•	•	•	•	•		•	•	•	•	•	•												
Hardware	•	•	•	•	•	•	•		•	•	•	•	•	•												
Transportation									•	•	•	•	•	•												
Energy/utilities									•	•	•	•	•	•												
Wholesalers									•	•	•	•		•				•	•							
Boat services									•	•	•	•		•												
Finance/insurance	•	•	•	•	•	•	•		•	•	•	•	•	•												
Legal/accounting	•	•	•	•	•	•	•		•	•	•	•	•	•												
RETAILER & EX-REGION WHOLESALER																										
Buyer/packer Retail																										
Wholesaler/distributor Retail																										
Restaurant																										
Retail																										
Ex-region wholesale market									x	x	x	x									x	x				
Ex-region distributor									x	x	x	x									x	x				
STATE																										
Cultch		•																								
Seed		•																								
Transport cultch and seed		•																								
Management/administration		•	•	•	•	•	•	•	•	•	•	•	•	•				•	•	•	•	•	•	•	•	•

CODE: x Product • Service

1/2. Maryland Chesapeake Bay Commercial Fisheries System by Disaggregated Categories

Watermen/Household

The Watermen/Household economic unit has been selected recognizing that in most cases a waterman's fishing activities are conducted as part of a family operation. Other family members make a significant contribution to his efforts particularly in areas of financial management, accounting, transportation, and in some instances as direct participants in shoreside fishing activities. Household crab-picking, although not legally recognized, must also be noted as part of family business activities.

The "Multipurpose Fishery" is the major fishing effort category. Watermen (according to their geographic location, access to resource, and personal preferences) harvest an assortment of species using various gear combinations through the seasons. However, the more heavily capitalized the boat and its gear, the more likely a waterman is to concentrate on certain species and move about the Bay. It is important to note many periods of conversion to full-time charter work.

Services to Watermen

The services mentioned are purchased in different combinations by watermen according to their individual fishing patterns. In essence, watermen use in one way or another all the marine trade services on the Bay.

The "Chandlery" subcategory includes items such as paint, cordage, anchors, etc. These items can also be obtained from a number of other sources.

The "Propulsion" subcategory refers to propellors and shafts, the purchase of which requires careful selection and installation.

"Hydraulics" and systems components can also be assembled by local shops and garages.

"Ice" used aboard boats is most often supplied free by buyers.

"Bait" can also be obtained from other watermen.

"Containers" used aboard boats can come from a number of sources and many probably circulate indefinitely in the fishery until they are no longer usable.

"Government Services" include such functions as financial aid programs, and Sea Grant funded activities including extension services.

A waterman's household most often supplies small truck transport in support of direct fishing activities.

Primary Buyer/Packer
Regional Secondary Wholesaler/Distributor

The term "dealer" when used refers generally to all buyer/packer/wholesaler/distributors. Differentiation among dealers by species handled is impossible to determine, although the Table indicates there are some specialists and most smaller dealers concentrate on a group of products.

Fish products are freely traded among dealers to make up quantities and a "mix of species" to satisfy orders. This flow is also impossible to quantify. Many sales and purchases may also be on a cash basis.

Regional wholesale/distribution focal points where larger "lots" of species are "made up" and with which many primary dealer/packers trade are: Rock Hall, Grasonville, Cambridge, Crisfield, and Galesville. With the possible exception of clams, however, enough buyer/packers bypass these centers in their operations to draw too many conclusions from this observation. On a smaller scale, many primary dealers perform as secondary whole-

salers, including pasteurizing, freezing, consumer packaging, and retailing. Many serve distant ex-regional markets.

In conclusion it can be said that most buyer/packer, wholesaler/distributor categories cover the entire range of dealer activities over the species they handle.

In many instances the profitability of a dealer business is dependent on food, marine and tourist services selling ice, fuel, beer, as well as retail fish with a narrow range of items for sale to the general public. Rather than "integrating forward," dealers, almost without exception, have chosen to diversify into related businesses, using their geographic location as a competitive advantage.

The form in which species are sold also ranges over the entire spectrum of dealer businesses including steamed whole, picked, pasteurized and canned crabs, and fresh, in shell, and canned oysters at all levels of distribution. Many dealers freeze a proportion of their finfish for sale.

Although not usually described as such, many dealers are already engaged in various stages of mariculture, if oyster rafting and crab peeling, not to mention recent developments in eel culture are taken into account.

Services to Buyer--Distributor

As most labor is casual and this labor is directly applied to production, it is categorized as "Casual Labor".

"Containers" include those used in handling and shipping crabs and finfish and also cans used for processed oysters and crabs.

"Transportation" refers to outside contract services performed, recognizing that dealers invariably own an assortment of trucks ranging from pickups to large over-the-road tractor trailer rigs.

"Retail Inventory" includes all items for direct resale to retail customers ranging from marine supplies to groceries, beer, wines, and liquors, and restaurant supplies and food.

"Boat Services" are specificed in support of buy boats, yard boats, or the occasional fishing boats operated by dealers.

Retailer and Ex-Region Wholesaler

Generally, most dealers in Maryland operate retail markets. Business connections with more distant wholesalers, distributors, or retailers follow a random pattern, each dealer following his own path into regional or more distant markets.

Product form follows the same pattern, each dealer servicing his particular "demand mix". As stated before, dealers often supplement production with items bought from other dealers.

It would appear the breadth of market served and not type of market served forms the distinction between primary buyer/packer and wholesaler/distributor. Dealers in the wholesale/distributor cateogry, however, will usually (but not always) serve more distant markets.

State

Maryland's Department of Natural Resources provides an important economic function for Chesapeake Bay fisheries which has been described previously. These functions have been categorized to reflect these services in economic terms all of which have an economic value in the fisheries system. Note particularly that cultch is obtained from dealers, and seed from watermen.

Watermen themselves provide certain services to the state such as serving on county committees, also many state departmental services are used by dealers, the product inspection service being an example.

3. Product and Service Transaction Network

The network diagram is confined to those activities directly relating to fish product flow through the system. The categories displayed (on all tables) represent those functions with majority dependence on resource existence, production, distribution, and sale.

Categories without purchase transactions are not displayed.

Dealer sections (Table I) have been displayed as one category, 'Primary/Secondary Buyer...Distributor.'

APPENDIX ONE
OBSERVATIONS ON MARYLAND'S COASTAL FISHERIES OCEAN CITY

The problems and opportunities represented by the fisheries conducted from Ocean City are typical of those associated with many inlet ports on the Northeast Coast. An exceptional advantage held by Ocean City, however, is an already developed fishing harbor. In terms of present usage this may appear crowded, but with proper allocation and use of existing space and hinterland, this facility could support more fisheries activities.

Among the factors impeding the natural growth of Ocean City as a fishing port is the well-known shoaling of the inlet. Frequently, wind and sea make normal vessel operations hazardous when cruising the shoals. Surf clam vessels face particularly dangerous conditions in light of fishing day regulatory measures imposed by the current Federal Surf Clam Management Plan; they can only fish certain days regardless of weather.

The present scarcity of traditionally sought-after mid-Atlantic bight finfish also limits initiatives to expand operations. And, although commercial vessels are concentrated in the West Ocean City area apart from the main sport and recreational Ocean City fisheries, pressures from this sector for valuable berthing space are already apparent.

Although an extremely lucrative species in the recent past, present Ocean City dependence on the vulnerable surf clam resource could in the long run, through overconcentration of existing resources on this diminishing fishery, inhibit opportunities in other directions. The same long-term problems may also occur with ocean quahogs. Many vessels in this fishery are owned and managed from other ports, most of them as units in company

fleets. This has the effect of orienting the port around one type of operation. Local initiatives to build or purchase individual vessels to be owned and operated out of Ocean City with more direct economic benefits for the region may be thwarted by the 'company fleet' phenomenon. This point was specifically mentioned in Ocean City conversations with local fishermen.

Port opportunities in the coastal finfisheries may best be represented by access to stocks slowly rebuilding under the auspices of the Fisheries Conservation and Management Act and even greater limitations of the foreign fishing effort in the mid-Atlantic bight. Ocean City has an advantageous geographic position to transfer effort to several so-called 'underutilized species' which are abundant in the mid-Atlantic area. Many of these species are heavily fished by foreign vessels. Coordinated attempts to replace this effort, together with maintenance dredging of the inlet, could result in additional stimulus for expanding Ocean City's commercial fisheries.

The Ocean City fisheries system infrastructure is well established, represented by off-loading activities conducted by operating fishing companies. Presently many of these activities are dependent on transient vessels using the port seasonally as fish migrations are followed up and down the coast. This leads again to the conclusion that most basic fisheries potentials in Ocean City exist. If given a firmer foundation and properly directed and channelled in concert with changing patterns and opportunities in the mid-Atlantic fisheries, additional benefits would result.

Two existing fisheries, offshore lobster and red crab, appear to be reasonably strong and substantial considering the size of the port and its orientation. The existence of these fisheries is an example of what can be

accomplished under reasonable circumstances, individual initiatives, taking advantage of natural assets and market opportunities.

The lobster fishery (conducted in specialized modern vessels) is probably dependent for a large part of its market on local trade associated with the regional tourist industry.

The red crab fishery, however, represents a particular and interesting aspect of west Ocean City's fishing operations. The development of the red crab resource is a recent event. Based on stock assessments and Fisheries Management Council recognition of informal catch statistics, it appears that Maryland's offshore red crab industry dominates the fishery, accounting for close to two-thirds of what is generally thought to be its maximum sustainable yield. Again, this example of success is suggestive of what could be accomplished using existing Ocean City assets.

It is estimated that approximately 25 clam vessels, 6 offshore lobster boats and 4 red crab boats regularly use Ocean City's commercial fishing harbor. Without further investigation there is no estimate of the number of permanently based or transient finfishing vessels using the port.

In conclusion if Ocean City's fisheries are to grow and prosper, the problems and opportunities represented by the fishery and the port must be more clearly delineated and recognized to further encourage local initiative.

APPENDIX TWO
MARYLAND SURVEY INTERVIEWS

Al Woodfield	Hubbard's Pier and Seafood Inc. Rock Hall
Mrs. Don Edwards	Edward's Seafoods Rock Hall
Sam Turner	Bellvue Seafood Bellvue
Jack Coulbourne	Coulbourne & Era Secretary
Spark Woodland	Dorchester Crab Co. Wingate
Hank Pazetti	Byrds Inc. Crisfield
Burley Price	George A. Christy and Son Crisfield
Jim Whalley	Boat "Missy L" Ocean City
C. K. Dukes	H. D. Dukes Girdletree Landing
W. R. Woodfield	Woodfield Fish & Oyster Galesville
Paul Thompson	Thompson's Breton Bay
Bill Bray	NMFS Oxford
Doug Ritchie	Marine Advisory Agent Prince Frederick
Mike Paprella	Maryland State Seafood Lab.
Larry Simns	Watermen's Association Annapolis
Maryland Shellfish Advisory Committee	Baltimore, Maryland

Doug Ritchie	Marine Advisory Agent Prince Frederick
Don Webster	Marine Advisory Agent Cambridge
William Harris	W. H. Harris Seafood Grasonville
William R. Prier	Maryland Seafood Producers
Robert Rubleman	Fisheries Administration
Ben Florence	Fisheries Administration
Nick Carter	Fisheries Administration
Clayton Tolley	Merideth and Merideth, Inc. Wingate
Captain Parks	Former Skipjack Skipper Tilghman Island
Loren Stirling	Milbourne Oyster Co. Crisfield
Buck Garvin	Harrison Oyster Co. Tilghman
George Olds	Old Salt Seafood Co. Easton, Maryland
Larry Ames	Maryland Watermen's Association President
Nick Carter	Fisheries Administration Wye Mills
Robert Norris	Potomac River Fisheries Commission
A. C. Carpenter	Potomac River Fisheries Commission
William Sieling	Department of National Resources
Gordon Hallock	Department of Economic & Community Development
Jack Larkin	Larkins Seafood Baltimore

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