CONTAMINANT PROBLEMS AND MANAGEMENT OF LIVING CHESAPEAKE BAY RESOURCES

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Chapter Three

A SOCIO-ECONOMIC OVERVIEW OF THE CHESAPEAKE BAY FISHERIES

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ABSTRACT

The marine resources of the Chesapeake Bay are believed to provide substantial benefits to residents of the States of Maryland and Virginia. However, the possibility of overfishing and degradation of the marine environment seriously jeopardize the possible benefits. In this section, a brief overview of the economic importance and characteristics of the Chesapeake Bay marine resources is presented. The potential for economic losses are discussed relative to observed economic values.

The resource base of the Chesapeake Bay is important to the economic well being and community structure of many Maryland and Virginia coastal communities. The bay, once important for providing subsistence and a basis for a barter economy, now provides a wealth of commercial and recreational opportunities. Unfortunately, a detailed description and analysis of the importance of the bay is not possible because of inadequate data.

In this section, a brief overview of the socio-economic characteristics of the Chesapeake Bay fisheries is presented. Included in the summary is information on landings, value, employment, and general economic conditions. However, inadequate data preclude a comprehensive overview and limit the period of time over which the characteristics may be summarized.

ECONOMIC IMPORTANCE OF COMMERCIAL FISHERIES

The Commercial Chesapeake Bay fisheries are primarily comprised of many small scale operators.[a] Vessel size is between 11 and 200 feet; however, most of

[a]The description of the Chesapeake Bay fisheries is based on a 1985 survey of licensed Virginia Fishermen, Maryland and Virginia State reports, and selected issues of Fishery Statistics of the United States. Also, inadequate data prevent a detailed discussion of the menhaden fishery. Thus, the menhaden fleet is only briefly discussed.

the vessels are between 20 and 40 feet in length (table 1). In comparison, the minimum size of offshore vessels is approximately fifty feet. The traditional fisheries are blue crabs, oysters, hard and soft clams, and various finfish (fluke, sea trout, scup, sea bass, menhaden, spot, and striped bass).

In 1985, approximately sixty percent of the fishermen held crab-pot licenses, and forty-four percent were licensed to fish with a gill net. In terms of species, approximately 55 percent of the fishermen are licensed to harvest oysters, and 68 percent are licensed to harvest crabs. In addition, approximately 80 percent of the fishermen were licensed to fish with more than one gear type. The types of licenses most frequently held by fishermen were various crab gear, oyster gear, crab pot and gill net, and oyster and gill net gear.

In 1982, 222.3 million pounds of fish with an ex-vessel or first sale value of $94.6 million were landed in Maryland and Virginia.[b] Landings of fish from the Chesapeake Bay accounted for approximately 64 percent of the total landed value. In comparison to the United States, Chesapeake Bay landings accounted for 2 percent of the total landed value in 1982.

Since 1975, landings have declined while the ex-vessel value has increased (Table 2). The value in 1982 represents a 50 percent increase over the nominal (unadjusted for inflation) value of 1975. The major commercial species, in terms of value, have traditionally been menhaden, blue crabs, hard and soft clams, and oysters.

In 1985, Chesapeake Bay fishermen derived approximately 71 percent of their total income from fishing. An estimated fifty-six percent of Bay fishermen earned more than fifty percent of their income from fishing. Thus, slightly less than half of the fishermen are part-time while more than half are full-time fishermen.[c] The U.S. Department of Commerce estimates that annual average earnings were between $3,000 and $4,000 in 1983. A 1985 survey by the Virginia

TABLE 1

*Selected characteristics of the Chesapeake Bay Commercial Fishing Fleet**

Characteristics	Minimum	Maximum	Mean
Vessel length (feet)	11	64	30
Vessel age (years)	new (0)	83	17
Vessel cost ($)	150	30000	6682
Engine cost ($)	150	21800	3234
Age of fishermen (years)	16	79	46
Years of fishing (years)	1	60	19
Percentage of income from fishing	1	100	71

*Summary statistics are based on a 1985 survey of Virginia fishermen. The survey was conducted by Virginia Polytechnic Institute and Virginia Institute of Marine Science. The results are preliminary. The data may not be indicative of the Maryland commercial fishing fleet. Menhaden vessels are excluded from the summary.

[b]Chesapeake Bay landings are defined in this report to be all landings other than ocean landings. Chesapeake Bay landings data are not available for all years.

Polytechnic Institute and the Virginia Institute of Marine Science found annual earnings to be approximately $4,500 in 1985.

Typically, the economic importance of an industry is measured by total income generated. However, the necessary information for assessing the economic importance of the Chesapeake Bay fisheries is not available.[d] Lipton[1] in a 1986 report on the status of Maryland's seafood industry estimated the contribution of fisheries to Maryland's economy to be 3.5 times the value of processed products. Briggs et al.[2] estimated a harvesting sector multiplier of 1.39 for Maine. Norton et al.[3] estimated a multiplier of 2.03 based on commercial and recreational expenditures. Grigalunas[4] estimated the multiplier for the Southern New England harvesting sector to be between 3.30 and 3.56. Cox[5] in a 1986 study estimated the total multiplier for forestry and fishery products in Virginia to be 1.9489. If the multiplier of Cox is applied to the 1982 ex-vessel value of Maryland and Virginia Chesapeake Bay landings, the total economic impact of the harvesting sector was approximately $118.6 million.

The economic impact or contribution of the Bay fisheries, based on Cox's analysis, appears to be highest for the fisheries sector, repair and maintenance business, food products, wholesale and retail trade sectors, and households in the forms of wages and salaries. That is, production of seafood primarily benefits these sectors of the economies of Maryland and Virginia. Alternatively, an increase in expenditures by the fishing industry yields increased earnings primarily for the above listed industries or sectors.

The Chesapeake Bay commercial fisheries are also quite important in terms of employment generated. The exact number of people currently employed in harvesting, processing, and related activities is not available. The most recent official published data on number of fishermen for the Chesapeake region indicate there were approximately 28,000 fishermen in Maryland and Virginia in 1977 (National Marine Fisheries Service).[6] More than seventy percent were Maryland fishermen. In contrast, the Bureau of Census[7] reported 7,500 individuals as full time employees in agricultural services, forestry, and fishing in Maryland in 1984. Fisheries of the United States for 1985 reports 7,704 employees in processing and wholesaling during 1984 for Maryland and Virginia.

Despite the limitations of available data for determining the employment generated by commercial fisheries, the fishery resources are believed to be important in terms of employment opportunities. For example, Norton et al. estimated that one new job was created for every $20,000 of expenditures on only striped bass commercial and recreational opportunities. Alternatively, one job was created for every $40,000 of total output.

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[c]The National Marine Fisheries Service defines a full-time fisherman as one who earns more than fifty percent of their income from fishing.

[d]Typically, an output multiplier is obtained from an input-output analysis and multiplied by an industry's direct contribution to the economy to determine the total impact.

MAJOR COMMERCIAL SPECIES OF CHESAPEAKE BAY

The Chesapeake Bay is characterized by a wealth of living marine resources. More than fifty species of fish are commercially harvested. However, four species account for most of the income or gross revenues of the Chesapeake Bay fisheries (Table 3). Menhaden accounts for 75 percent of the landings and approximately 24 percent of the ex-vessel value. Excluding menhaden, more than 80 percent of the annual value is from the harvesting of blue crabs, clams, and oysters; all of which are shellfish.

There are differences in the Bay fisheries of the two states. First, there is no major menhaden fishery in Maryland; Virginia fishermen harvest more than 95 percent of the reported harvest of menhaden in the two states. Maryland

TABLE 2

Maryland and Virginia commercial landings and value[a]

Year	Maryland		Virginia	
	Bay	Total	Bay[b]	Total[b]
	---------- Thousands of pounds ----------			
1975	53662.9	64317	73460.9	172875
1976	45669.0	58094	59081.5	134228
1977	47767.5	62033	143060.0	207803
1978	45312.0	59726	61048.2	138676
1979	49649.9	66283	62496.3	139347
1980	55484.2	79571	96908.5	135566
1981	91194.6	115115	89942.6	113977
1982	68752.6	100478	86145.1	121827
1983[c]		90359		130839
1984[c]		89301		117882
1985[c]		91931		122658
	---------- Thousands of dollars ----------			
1975	20254.8	22898	13742.7	26455
1976	25057.5	30808	15442.1	31739
1977	24404.0	31429	16092.7	36368
1978	27037.5	33557	17373.5	53441
1979	30134.3	36945	20558.7	62531
1980	33625.9	44658	22570.0	59292
1981	45591.3	56640	21575.7	52680
1982	39328.2	51438	21531.4	43170
1983[c]		45497		56909
1984[c]		54979		58957
1985[c]		47418		76535

[a]National Marine Fisheries Service data summarized by Clooney Stagg, University of Maryland, Chesapeake Bay Research Laboratory.

[b]Menhaden landings and values are excluded from data summaries.

[c]Maryland and Virginia Chesapeake Bay landings and value data are not available or are inconsistent with previous data.

TABLE 3

Ratio of species ex-vessel value to total Chesapeake Bay landed value

Year	Species									
	alewives	eel	sea trout	shad	spot	striped bass	white perch	blue crab	clams	oysters
	Percent of ex-vessel value									
1970	1.7	1.1	1.0	1.6	2.1	3.9	1.1	20.3	10.4	54.4
1971	1.0	1.3	1.0	1.0	.1	3.7	1.0	24.1	12.7	52.1
1972	1.1	.7	1.0	1.3	1.1	4.8	.1	26.3	6.5	53.7
1973	1.1	.5	1.8	1.6	1.0	7.1	.7	25.4	4.2	53.0
1974	1.4	1.4	1.1	.8	1.0	3.8	.4	27.0	8.1	51.3
1975	1.3	1.5	1.1	1.0	.6	4.8	.4	28.4	5.5	51.2
1976	.4	.6	1.2	.7	.5	3.6	.4	27.0	8.8	52.8
1977	.1	.4	1.5	1.3	.8	3.7	.4	32.7	7.9	47.4

Source of data: National Marine Fisheries Service, Fisheries Statistics of the United States, Selected issues (1970-1977).

fishermen have traditionally harvested the majority of striped bass and white perch; the harvesting of striped bass has been severely restricted in the past few years. Virginia fishermen harvest considerably more sea trout. In the blue crab fishery, a larger volume of hard blue crabs in landed by Virginia fishermen whereas Maryland fishermen have higher reported landings of soft and peeler blue crabs. The fishery for clams is also quite different; soft clams are primarily landed in Maryland and mostly hard clams are landed in Virginia. Annual landings of oysters in Maryland are more than double the landings of Virginia.

The economic importance of each Bay fishery has not been examined. However, Norton et al. did examine the economic importance of striped bass commercial and recreational activity. They noted that in 1980, $24 million was spent by commercial and recreational fishermen on harvesting striped bass in the Chesapeake Bay. The associated value of total output was $48.7 million. Corresponding employment was 1,214 jobs. In comparison, the Virginia Marine Resources Commission reports more than 8,000 fishermen in 1980; this excludes the number of fishermen in the Menhaden fishery.

Fishing occurs in several counties of Maryland and Virginia. However, Dorchester County in Maryland and Northumberland County in Virginia are two of the major counties in terms of Chesapeake Bay fishing activity. Northumberland county, though, is home to the menhaden fleet which accounts for its importance. More than 15 percent of the total landed value of all Maryland and Virginia fisheries are menhaden landings in Northumberland County.

In 1983, personal income per capital in Northumberland was $9,959 (Overman[8]). Average income per capita for individuals employed in agriculture, forestry, and fishing was approximately $12,000 (Virginia Employment Commission[9]). In comparison, reported per capita income for Virginia was $12,122 in 1983. The Bureau of Census' County Business Patterns provide

statistics for Maryland which are comparable to Virginia. The per capita income of individuals employed in agriculture, forestry, and fisheries was $12,600 in 1983; it was $16,700 per capita for all individuals employed in Maryland.

THE RECREATIONAL FISHERIES

Although the commercial fisheries of the Chesapeake Bay are important to the coastal economies of Maryland and Virginia, the recreational fisheries are also quite important. The recreational fisheries are perhaps more important in terms of generating income and benefits. However, inadequate information prohibits documentation of the importance of recreational fisheries.

In the Chesapeake Bay, several species of fish are recreationally harvested. Bluefish, white perch, sea trout, croaker, spot, flounder, and striped bass are the more common species sought by recreational anglers. In past years, striped bass was the major recreational species. There also is likely to be substantial harvesting of blue crabs by recreational anglers although the number of anglers and the catch has not been documented.

Despite the problem that necessary data are not available to determine the value of recreational fishing, fishing for pleasure is likely to be very important to coastal economies. Murray and Lucy[10] estimated the number of registered power boats in Virginia to be 139,734 in 1980. More than 90 percent were less than 26 feet in length which is a typical size range for recreational fishing boats. Murray and Lucy also indicated that the average boater uses a boat for recreational fishing about 44 percent of the time. However, recreational fishing also occurs from beaches, piers, jetties, charter boats, and party boats. Thus, it would appear that recreational fishing may be quite important to coastal economies.

Results presented in the study by Norton et al. illustrate the potential economic importance of recreational fisheries. They estimated that Chesapeake Bay recreational anglers spent $22,861,000 in 1979 trying to catch striped bass. In comparison, the total value of commercial landings of all species in the Chesapeake Bay was $72.8 million in 1979. Norton et al. also estimated that the economic value, total benefits less total costs, of the recreational fishery for striped bass in the Chesapeake Bay was approximately double the economic value of the commercial fishery.

DECLINING RESOURCES AND ENVIRONMENTAL DEGRADATION

Declining resources and overfishing are inherent results of open-access common property resources such as fisheries. However, industrial expansion, manufacturing, and increased standards of living in the last twenty years have brought a new source of pressure on fishery resources. Pollution or man's

TABLE 4

Annual landings and maximum sustainable yield of selected Chesapeake Bay species

Species	Year								Maximum sustainable yield[a]
	1970	1971	1972	1973	1974	1975	1976	1977	
	Thousand of pounds								
Shad	5134	2460	3006	3018	1741	1279	803	1487	4000
Alewives	21110	13079	12141	11300	14730	12078	4363	1491	25000
Striped bass	4702	3683	5181	7323	5331	3934	2752	2620	60000
Menhaden	392712	303103	513309	435119	354144	278049	400045	489981	300000
Spot	5900	468	2833	2260	2054	1449	1029	1590	3000
Croaker	121	210	384	1007	971	3015	3927	7095	n/a
Sea trout	2025	2058	2140	4394	2439	3031	3234	3632	2000
Fluke	154	140	162	453	425	426	306	289	3000
Bluefish	641	660	1125	2839	3315	3123	4437	3357	n/a
White perch	1925	1965	1388	1009	677	700	607	831	3000
Yellow perch	110	88	107	37	42	38	24	17	250
Oysters	23742	24690	23455	24799	24424	21882	20772	17519	30000
Blue crabs	67564	74570	71362	55738	63039	56809	46152	57231	65000
Soft clams	6221	5986	1950	668	2099	1246	1751	1654	60000
Hard clams	468	938	868	747	948	723	838	399	n/a

[a]Estimated maximum sustainable yields are taken from U.S. Army, Corps of Engineers, Future Chesapeake Bay Conditions Report (1978).

Source of Data: Selected issues of Fishery Statistics of the United States (1970-1977).

degradation of the natural marine environment may very well reduce the reproductive capabilities of some species of fish and inflict high mortality on other marine species. In some instances, neither the reproductive capability nor stock size changes as a result of pollution, but severe economic hardships and losses still occur because harvesting in prohibited. The economic effects can also extend well beyond the local fishery directly affected as a result of consumer resistance to a species which is contaminated.

OVERFISHING

Overfishing is a term with many definitions. It may be defined in biological or economic terms. It may imply recruitment failure, an inadequate age class distribution, or simply more fish are being removed from a fish stock than are being added to the stock. In economic terms, overfishing usually implies that more resources are used to harvest a given level of fish than are necessary. Consequently, the cost of harvesting is higher than it need be and profit approaches the value of zero.

For the Chesapeake Bay fisheries, many species are believed to be biologically and economically overfished. Irrefutable scientific evidence of either case, however, does not appear to be available. Reductions in landings are most frequently cited as indicators of overfishing in the absence of survey abundance indices. However, commercial landings data also reflect economic responses, and thus, may be inadequate indicators of the fish stocks.

In a 1978 study, "Chesapeake Bay Future Conditions Report," by the U.S. Army Corps of Engineers,[11] nine species were identified as being biologically overfished based on catch statistics, survey measures of abundance, and estimates of maximum sustainable yield (MSY). The species identified as being overfished were shad, alewives, striped bass, menhaden, sea trout, croaker, oysters, soft-shell clams, and hard-shell clams (Table 4).

As indicated in table 4, landings exceeded MSY in several years for some species. It should be noted that landings less than MSY does not imply no overfishing; low landings could be the result of overfishing in previous years, economic conditions, pollution, regulations, natural factors, or other conditions.

ENVIRONMENTAL DEGRADATION

Mortality from pollution or environmental degradation has not been rigorously examined. Little is known about the relationship between the population dynamics and environmental conditions. A possible reason why such information is not widely available is the difficulty of determining the individual effects of overfishing, environmental degradation, climatic conditions, disease, and predation. Species which are believed to have been affected by environmental degradation include shad and striped bass. However, many sedentary species such as clams are believed to be very susceptible to environmental contamination (Moore[12]).

Mortality, however, is not the only effect of environmental pollution. Frequently, fishing areas are closed and the removal of a species is prohibited. This results in lost earnings or income. On occasion, the mere announcement of a contaminated product from one area is accompanied by lower U.S. sales of that product as well as similar products. Thus, the impacts of environmental degradation can extend well beyond mortality.

The combined effect of overfishing and environmental degradation is a reduction in current and future economic opportunities. Simply, man will have fewer resources to exploit and incomes and economies dependent on the marine environment will decline.

However, early recognition of the problems by society offers some hope for preventing economic losses. Efforts to improve the environmental conditions of the Bay are well underway. Maryland and Virginia are both exploring more

sound and rational approaches to fisheries management. In the final analysis, though, only the passage of time will determine the success of these efforts.

CITED REFERENCES

1. Lipton, D. 1986. "The status and health of the Maryland seafood industry." Maryland Department of Natural Resources. Annapolis, Maryland.
2. Briggs, H., R. Townsend, and J. Wilson. 1983. "An input-output analysis of Maine's Fisheries." Marine Fisheries Review 1:1-8.
3. Norton, V., T. Smith, and I. Strand. 1983. "The economic value of the Atlantic coast commercial and recreational striped bass fisheries." (UM-SG-TS-83-12, University of Maryland, Sea Grant.
4. Grigalunas, T.A. 1978. "Input-output study of marine related activity in southern New England." Unpub. manuscript, University of Rhode Island, Kingston, Rhode Island.
5. Cox, R.W. 1986. "An input-output table for Virginia." Tayloe Murphy Institute, The Colgate Darden Graduate School of Business Administration. Univ. of Virginia.
6. U.S. Department of Commerce, National Marine Fisheries Service. Selected issues of Fishery Statistics of the United States (1970-1977). U.S. Government Printing Office, Washington, D.C.
7. U.S. Bureau of Census. 1986. County Business Patterns, 1984, Maryland. U.S. Government Printing Office, Washington, D.C.
8. Overman, W.C. and Associates. (1986) "Virginia counties and cities databook," 1986. Cleveland Place, Virginia Beach, Virginia.
9. Virginia Employment Commission, Bureau of Economic Analysis. 1985. "Virginia personal income by city and county, 1978-1983." Reproduced by Tayloe Murphy Institute.
10. Murray, T., and J. Lucy. 1981. "Recreational boating in Virginia: a preliminary analysis." Special Report in Applied Marine Science and Ocean Engineering No. 251, Virginia Sea Grant Program, Virginia Institute of Marine Science. College of William and Mary, Gloucester Point, Virginia.
11. U.S. Army Corps of Engineers. 1978. "Chesapeake Bay Future Conditions Report." Volumes 3 and 9. Dept. of the Army, Baltimore District.
12. Moore, J. 1979. "A preliminary oil spill impact analysis for Eastport, Maine." Unpublished manuscript.