The Gulf Menhaden and Our Changing Estuaries

JOHN W. REINTJES
Bureau of Commercial Fisheries
Center for Estuarine and Menhaden Research
Beaufort, North Carolina

Abstract

A brief review of the role of estuaries in the life cycle of Gulf menhaden, *Brevoortia patronus*. Estuaries are a vital link in the life of Gulf menhaden. Surveys of 36 selected Gulf coast estuaries give indexes of the relative abundance of juvenile menhaden. These juveniles enter the purse seine fishery the next year and also the year following as 2-year-olds. Record landings of nearly 1.2 billion pounds were made in 1969. Approximately 90% of the catch are menhaden in their second and third year of life.

ESTUARIES AND MENHADEN are two of the more important natural resources along the Gulf Coast of the United States. The importance of estuaries to the fishery resources of the South Atlantic and Gulf States has been discussed frequently at these meetings for the past 15 years. To review, nine-tenths of the fishery products along the Gulf Coast are from species dependent upon the estuaries for all or part of their life cycle. The more important of these are shrimp, menhaden, oysters, mullet and blue crabs. Gulf menhaden has been the largest fishery in the United States since 1963, when it moved ahead of the Atlantic menhaden, and 1969 is a record year with nearly 1.2 billion pounds landed in Gulf ports. This is further emphasized by the contrast with the Atlantic where the least catch, since 1942, is being made.

The present Gulf menhaden fishery began after World War II with plant locations in Florida, Mississippi, Louisiana and Texas. Landings during the decade prior to 1959 averaged less than 500 million pounds a year. Since 1959 average annual landings have been 919 million pounds, ranging from a low of 696 million in 1967 to a record high of 1 billion 150 million this year. During these 20 years, many changes have occurred in the equipment and technology for catching menhaden.

A fishery that produces a billion pounds annually depends on a complex of many contributing and interrelating factors. The number of vessels has not changed greatly from year to year but modernization and replacement has markedly changed their efficiency. Other factors that have increased fishing power are airplane spotters, aluminum purse boats, power blocks, synthetic fiber nets, fish pumps and refrigerated holds. By 1965, most of the innovations and improvements were completed, nevertheless the catch dropped the lowest for the decade in 1967. Obviously factors other than the ability to fish better were determining the landings. From 1967 to 1969 the catch nearly doubled, helped in part by the addition of more efficient vessels, but again, something other than the ability to fish better was responsible. Apparently the factors that determine the distribution, availability and yield of the menhaden resource must be examined.

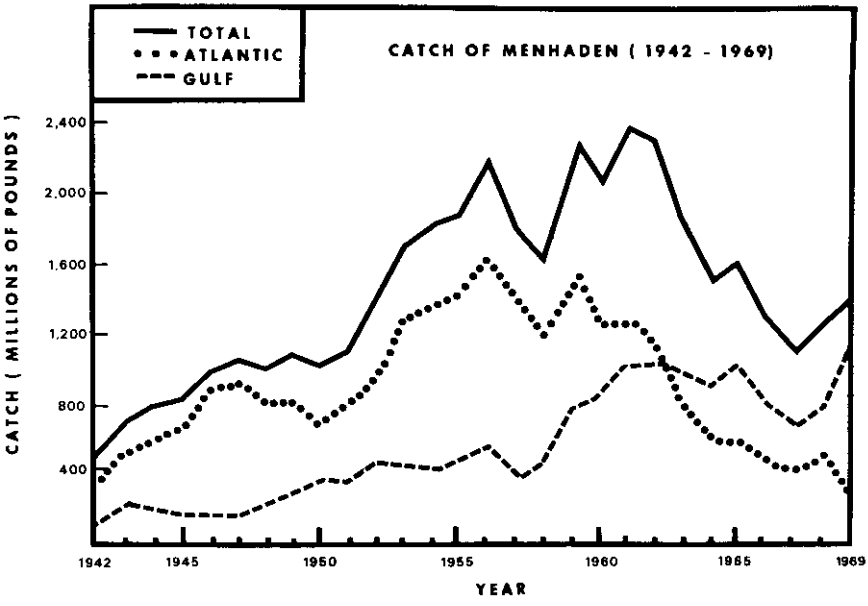

FIG. 1. Catch of Atlantic and Gulf menhaden in millions of pounds, 1942-69.

The menhaden resource is dependent upon three broadly defined factors: (1) spawning success, survival in the open Gulf, and movement into the passes; (2) capacity and suitability of the estuaries for growth and survival and (3) the effects of fishing on the population, the relationship of year classes to each other, and the number that survive to sexual maturity. Knowledge of all of these is essential for an understanding of the menhaden resource and for its best utilization. There are no simple answers to questions in any area. Nor is there a simple way to decide the area that is most important. I will discuss the role of the estuary to the Gulf menhaden resource.

Some of the reasons for selecting this area of interest are: (1) from all we can determine, the estuarine habitat is an essential requirement of menhaden; (2) the estuarine environment is being threatened with extinction (some estimates of elimination are up to 1% per year); (3) estuaries are accessible and small when compared with the open Gulf, consequently they offer some promise for manipulation, improvement and restoration, and (4) the quantity and quality of estuaries are affecting and probably limiting the size of the menhaden resource.

An estuary is a vital link in the life cycle of menhaden. To review this cycle: Gulf menhaden, like their counterpart in the Atlantic, spawn in oceanic waters. Recent findings indicate that the bulk of spawning occurs over the continental shelf within the 50-fathom depth from December to March. The newly-hatched young are swept by currents or swim until they enter the passes into the lower estuary. We do not know how long the journey takes but they range from ½ to 1 inch in length when they arrive and we surmise they are from 3 to 5 weeks old. They find their way from the lower estuary to the upper tributaries near the boundary of fresh and salt water. As they

grow they move back down the estuary so by mid-summer they may occur everywhere within the estuary. By September they are moving in and out of the passes and by late October most have moved into the Gulf of Mexico. Some will overwinter in estuaries but the vast majority have left by the time the first "norther" appears. A few of the juveniles are accidentally caught by the purse seines in late September or October. The ones that survive the winter are the new recruits for next year's fishery. Admittedly this is an oversimplified version of the early life cycle of Gulf menhaden.

Menhaden, in turn, are an important component in an estuary. After they transform from the slender, transparent larvae to juveniles, they become filter feeders. They swim about in schools, usually with their mouths gaping open, to filter the small planktonic animals and plants from the water. They have a complex gill apparatus that forms a basketlike sieve that removes all but the smaller particles from the water. As the bulk of the organisms are algae or the remains of higher plants, menhaden are principally herbivores. Menhaden are one of the few fishes (mullet is another) that live by grazing on the plants in the estuaries. They are at one of the lowest trophic levels near the bottom of the food chain and provide food, in turn, for nearly all the carnivores that are large enough to eat them. This then forms both sides of the coin: the role of estuaries in the life cycle of menhaden and the role of menhaden in the ecology of estuaries.

Productivity changes whenever estuaries are altered by nature or by man. We want to know what nature does to change productivity and how these changes affect menhaden. We also want to know what man does to change productivity, how these changes affect menhaden, and if harmful, what we can do about it. Some of these changes must come about because man thrives and dominates the planet. However, many of the harmful changes are unnecessary and heedless. Some of you heard Arthur Godfrey's comment on October 29, 1969, at the Atlantic States Marine Fisheries Commission meeting in New York. He felt that man would continue to encroach upon the environment and the best we could do would be to slow the process. Lose, we must, but postpone the inevitable as long as possible. I am more optimistic than that. I believe we can hold onto most of our estuarine areas and in some instances reverse the deteriorating process and restore them. Some recent trends in public opinion and state and federal legislation are clearly headed towards protection and, in some cases, restoration.

We have conducted surveys in Gulf Coast estuaries since 1964 to estimate the abundance of juvenile menhaden. We had two preliminary objectives: (1) to determine which estuaries were suitable menhaden nurseries, and (2) to provide an index of abundance to forecast the fishing prospects for the following year.

We found all estuaries supported some menhaden but that there were differences from one estuary to another and from one year to another, for the same estuary. Although we found relationships between temperature, salinity and turbidity, we did not have the resources to determine why one estuary was more suitable than another. By selecting estuaries across the Gulf Coast, we were able to prepare relative indexes of year class abundance. We are surveying 36 estuarine localities by surface trawl and by counting schools of menhaden from the air to prepare these indexes. These surveys lack the precision we would like but they do provide a relative index that has been useful in

forecasting the influence of the incoming year class on the fishery. Our immediate plans to improve these efforts include an ecological study on several selected estuaries to learn about the conditions and the estuaries' carrying capacity for young menhaden. We intend to supplement our relative indexes by estimates of absolute abundance from tagging and recovery of young menhaden. Tagged juveniles, which will be recovered after they enter the fishery the following year, help to measure the importance of certain estuarine areas to the menhaden resource.

Perhaps the most critical feature of the resource is the predominance in the fishery of fish in their second and third year of life. Between 85 and 90% of the fish landed each year are of these two ages. In contrast to the Atlantic menhaden, we are dealing with a shorter-lived species possessing a higher reproductive potential, and accordingly, a greater capacity to recover quickly from the effects of fishing and the ill effects of an adverse environment.

Another point of interest is the evident relationship between the abundance of yearlings and the resulting catch. A strong year class markedly increases the catch during its first year in the fishery and only moderately during its second. Thus, a strong year class will lead to improved landings the year following but, even though it still predominates the second year, it will not compensate for a weak incoming class.

In conclusion, the role of estuaries in the life cycle, population size, and yield of Gulf menhaden is of paramount importance to our fishery economy. A decline in juvenile production in the estuaries results the following year in a decline in the catch. The failure of two successive year classes could mean the collapse of the fishery and should this decline in population size be severe enough, it would lower the reproductive capacity below the minimum requirements for the production of a normal year class. As a result, the fate of the menhaden resource in the Gulf of Mexico is tied closely to the fate of our estuaries.

ACKNOWLEDGEMENTS

I wish to acknowledge the staff members of the Center for Estuarine and Menhaden Research who provided information for this report. Especially helpful were Robert B. Chapoton, catch sampling project; William R. Turner, estimation of juvenile menhaden abundance in estuaries; and Paul L. Fore, early life history studies.