

**BLACKBACK FLOUNDER AND OYSTER HABITAT ASSOCIATIONS,  
A HISTORICAL PERSPECTIVE  
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For over a century, Connecticut, Rhode Island and New York oyster growers cleaned, shelled and modified bottom habitat to support shellfish aquaculture, especially for the eastern oyster. Aquacultural practices included shell base (cultch) planting, recultivation schedules and transplanting of seed shellfish. Commercial oyster growers soon noticed increases in flounder on or near recently prepared and shelled areas indicating a habitat association or preference. Adult and pre-spawned flounder were also observed to seek out mature oyster beds. The oyster industry in New England developed quickly in winter from 1870 to 1910. This period marked large acreages of planted and prepared oyster bottom, cultivation and harvest from near shore natural oyster beds and seed oystering from tidal rivers. Much later, a second although much smaller increase in oystering activity occurred in Connecticut between 1975 and 1990.

Two specific time periods are examined for oyster production and increases in flounder landing (catch statistics) for 1890 to 1920 and young of the year recruitment for 1985 to 1998. Both time periods appear to show increases in oyster cultivation followed by increases in flounder. The role of oyster culture and habitat enhancement for the oyster reef community is also discussed.

## Introduction

The decline of Black Back Flounder pseudopleuronectes americanus in Connecticut has been reviewed for nearly three decades. Auster (1980) detailed high incidences of fin rot in New Haven Harbor flounder. This was followed by research on egg viability (Pereira, et al, 1994) and spawning area (Pereira, et al, 1994), and in 1999 distribution of flounder by Habitat type (Howell, et al, 1999). A series of winter flounder seminars, hosted by the National Marine Fisheries Service for nearly two decades, invited papers on a wide range of topics - key to gathering a complete picture of what was impacting our winter flounder populations here in Connecticut.

My interest in black back flounder dates back to 1972. I was very fortunate to meet with and discuss oyster aquaculture with J. R. Nelson, retired president of Long Island Oyster Farms which operated out of New Haven Harbor. Mr. Nelson was part of a family of famous oyster biologists that included Thurlow Nelson and Julius Nelson. What caused the meeting was my request for employment. While I did not obtain a job, he did arrange for a few trips aboard the Quinnipiac, a hydraulic dredge boat for removing drills Urosaphinx cinera and starfish Asterias forbesi from lot 151, a very productive seed oyster recruitment area in New Haven Harbor. The experience would guide my interest in flounder/oyster habitat associations from then on.

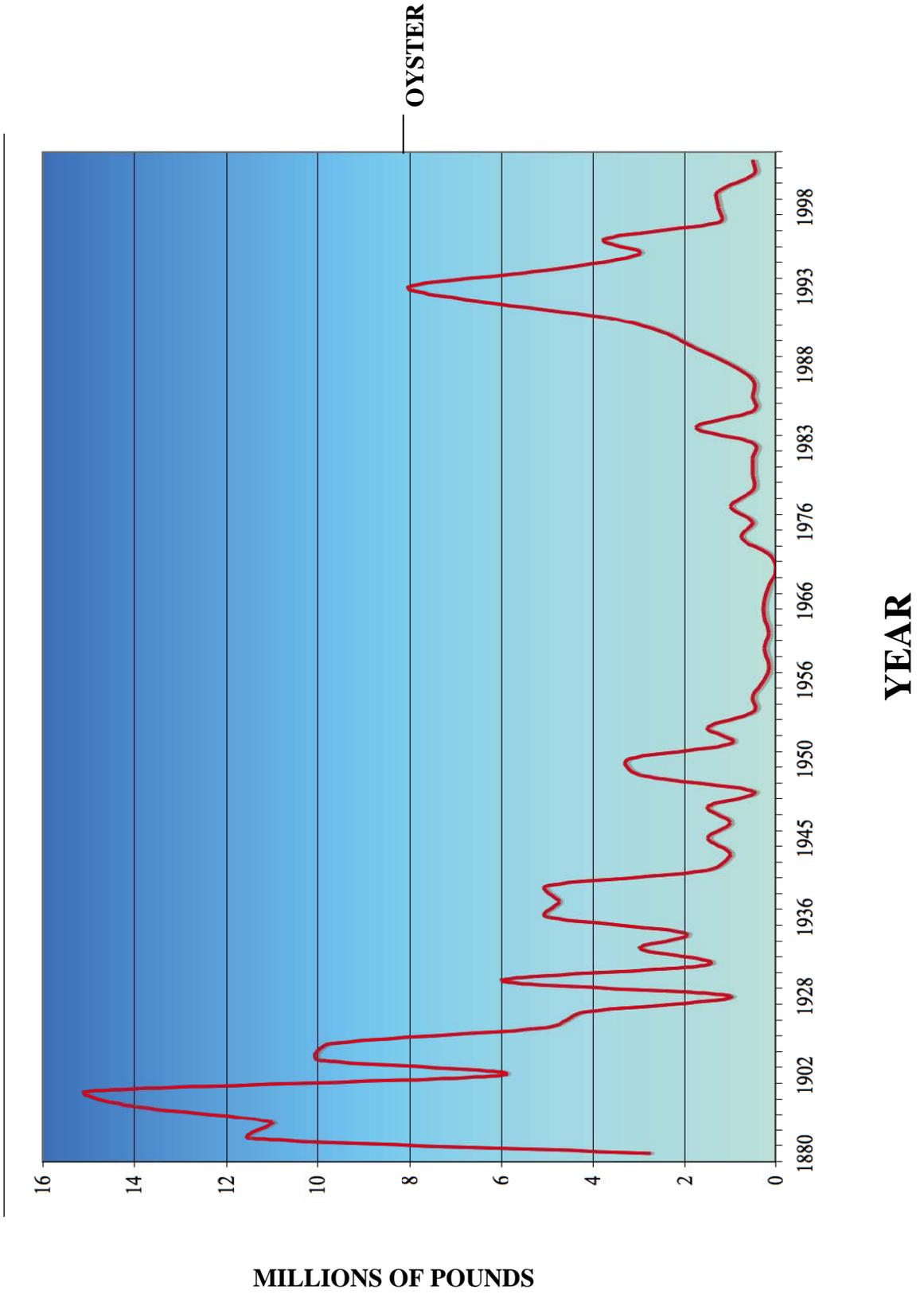
The Quinnipiac was a rectangular steel powered barge. Its purpose was to clean, by hydraulics, suction material from the seed oyster beds. A dredge head was utilized and any light objects (shells, oysters drills, starfish, crabs, etc.) would come up, be dewatered and transported by convey or belt to the center deck. About every 20 minutes, a pail of hydrated lime water was dumped over the pile to kill the starfish and drills. Eventually that would become part of my "job." The following morning, we would steam outside the New Haven Breaker and dump the pile away from any oyster beds.

During my brief tour as a deckhand, I observed what came up in the dredge material and that included all sizes of flounder but mostly juvenile flounder. I was sensitive to this, having purchased a 30-foot Wilcox flat otter trawl to catch flounder off Madison - the town in which Mr. Nelson and I both lived. Otter trawling involved towing a net over sandy bottom to catch them. The area along Hammonasset Beach in the early

morning was a good spot to trawl for flounders. In the process, all the undersized small flounder were released alive and large ones iced for market. Seeing hundreds of small ones in the pile and liming them became a topic of discussion during the follow-up visit. (I had a series of trips aboard production and starfish boats as well and a second series on the same vessels during graduate school research while attending the University of Rhode Island.)

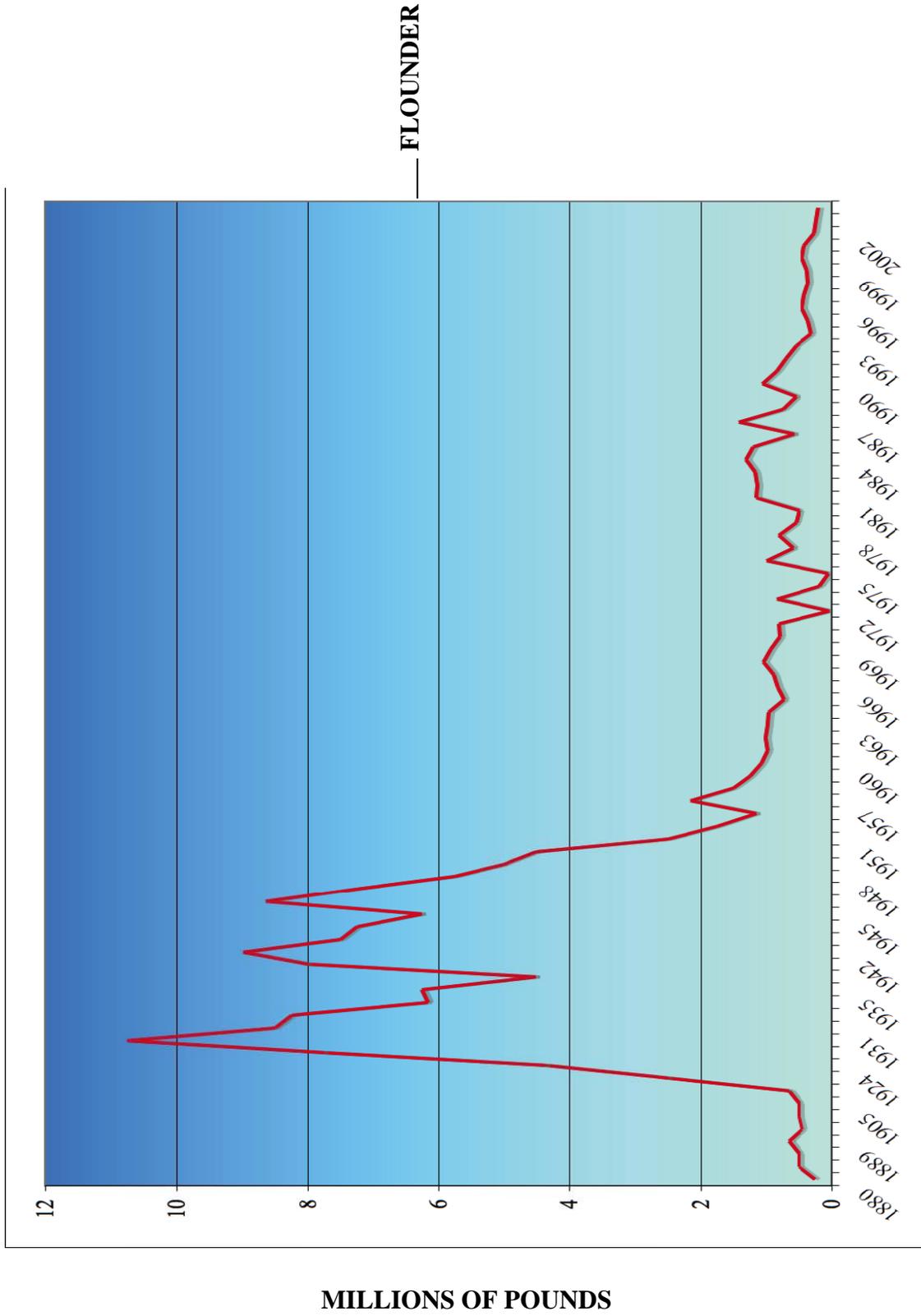
Mr. Nelson acknowledged the problem but countered that the oyster industry had provided the habitat in which they thrived, "We built the homes and they moved in." He then continued with a description of flounder seeking out the habitat to spawn and grow. He felt the oyster shells provided both cover and a source of food. All the oyster growers knew about this habitat relationship. Mr. Nelson was sensitive to this issue and stated that when the small flounders were most prevalent, - especially after a good oyster set in the fall he would not use the Quinnipiac but sent in the "mop" boats to control starfish instead. My observations and Mr. Nelson's comments about "home building" would begin an investigation that continues today did we or the oyster industry provide the homes for enhanced flounder harvests and was an oyster shell environment a positive indicator for flounder habitat, especially if related to a predator/prey relationship so often mentioned by Mr. Nelson? Was the placing of the estuarine oyster shells one of the largest examples of habitat creation during the last century?

# CT COMMERCIAL OYSTER LANDINGS 1880-2001



He also reviewed some of the habitat history. As more shell (cultch) was put out, more flounder arrived, and flounder in general became more prevalent in New Haven Harbor. Mr. Nelson also felt that New Haven Harbor flounder returned to New Haven Harbor to spawn, so the oyster industry considered them to be "home grown." He doubted that such a huge flounder population could be sustained without the "cover" the oyster shell habitat the oyster industry had provided. He summarized by stating that what I saw on deck was just a fraction of what had been near the dredge head, most he claimed swim away from the danger. He also felt that the neighboring states of Rhode Island and New York had similar situations. He commented that recreational flounder fishermen also realized this. He said several people he knew sought out and followed oyster dredge boats because that is where the big flounder would be. Mr. Nelson believed that the oyster industry provided a habitat in which flounder could live and escape most prey. Did flounder prefer shell bottoms or did the presence of this habitat favor the flounder? Was it possible that the fast rise of the Connecticut oyster industry created or enhanced increased flounder landings in the commercial fishery? These are some of the research questions that continue today.

# CT FLOUNDER LANDINGS 1880-2004



## Connecticut's Second "Oyster Boomlet"

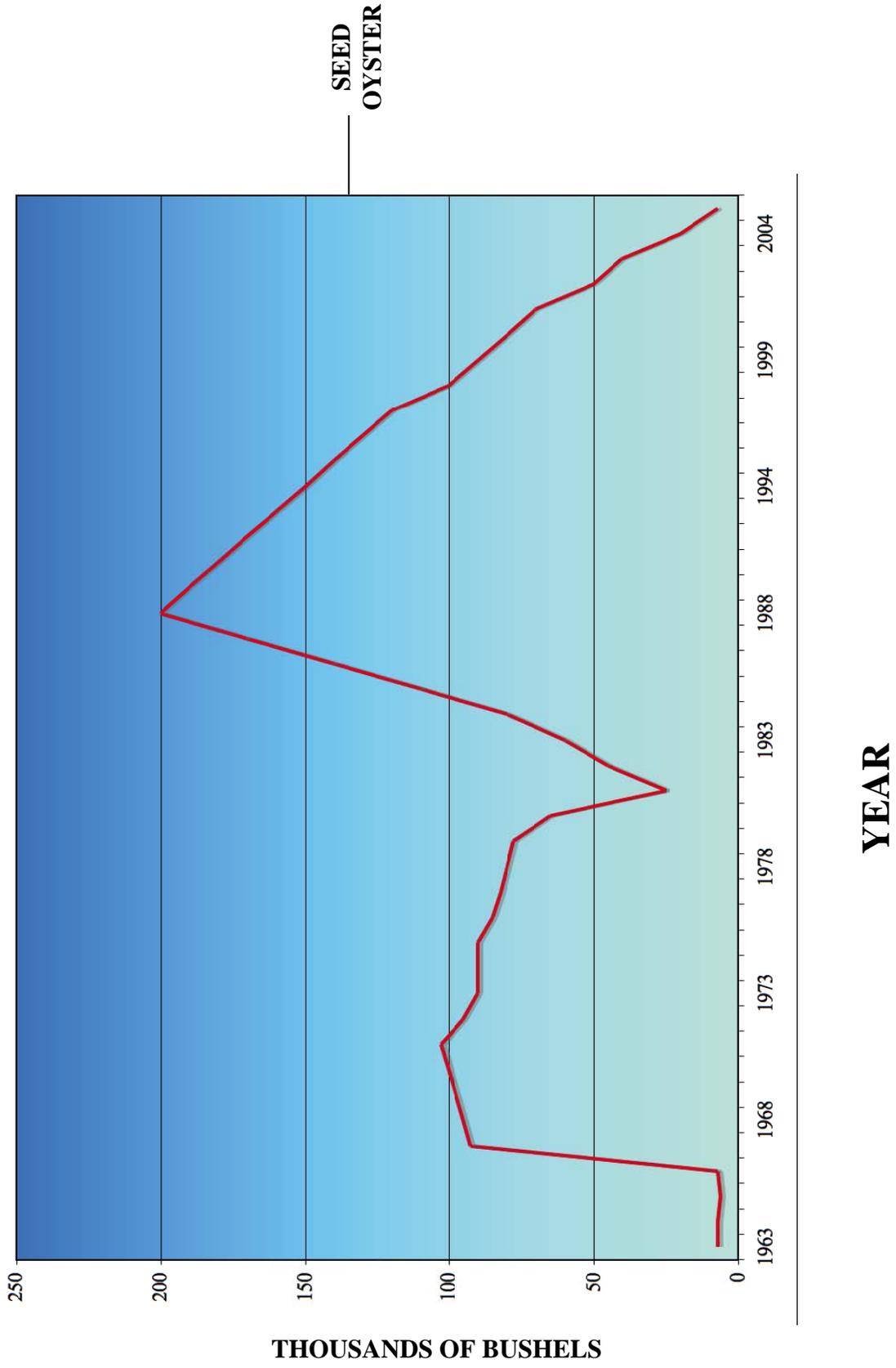
1972 to 1995

In 1968, the National Marine Fisheries Service applied for emergency resource disaster funding for the Connecticut Oyster Industry. Connecticut had not experienced a strong state-wide natural oyster set for a decade (1958-68). Underwater observations conducted by Clyde MacKenzie, a biologist at the NMFS Milford laboratory showed most of the oyster shell base upon which oysters could set was covered by silt or sediment. The resource disaster funding provided for the cleaning and re-shelling of 25 locations along Connecticut's coast. Spawner oysters also were transplanted to each location. Concurrently, the State of Connecticut lifted a century-old ban on hand-dredging changing from tongs to hand hauled "seed oyster dredges." A pressure or wash plate was added to the traditional oyster dredge design. Nicknamed the "Mackenzie Plate," its function was to wash sediment and silt from long covered shell bases and lift oysters into the dredge. The effort worked well. From less than 10,000 bushels of tonged seed oysters in 1969, the Housatonic River would produce 120,000 bushels in 1974 using the modified hand dredges. Connecticut obtained its first strong oyster set in 1973 and additional river systems experienced strong sets in 1975, namely the Farm River, West River, East and Neck Rivers, and the Hammonasset River. Those areas started to produce significant quantities of seed oysters commencing in 1978-79. The Hammonasset would produce some 30 thousand bushels of set and seed oysters in 1978 alone.

By 1984, oyster sets were occurring regularly prompting the State Department of Agriculture-Aquaculture Division led by then Chief John Volk, to ask for and obtain state funding to re-shell portions of the states natural beds in western Connecticut. The Bridgeport natural bed was re-shelled and obtained a strong set. When these seed oysters grew, it was commented that they were the best quality oysters the State had seen in decades. By 1989, the State was producing close to 200,000 bushels of oyster seed and set from natural beds. The number of "natural growth harvesters" seed oyster fishermen also had increased from about 12 full and part-time fishermen to over 50. More areas opened to seed oystering (much of Connecticut's waters for direct harvests were closed from 1966 to 1971), and more shell base was cleaned and

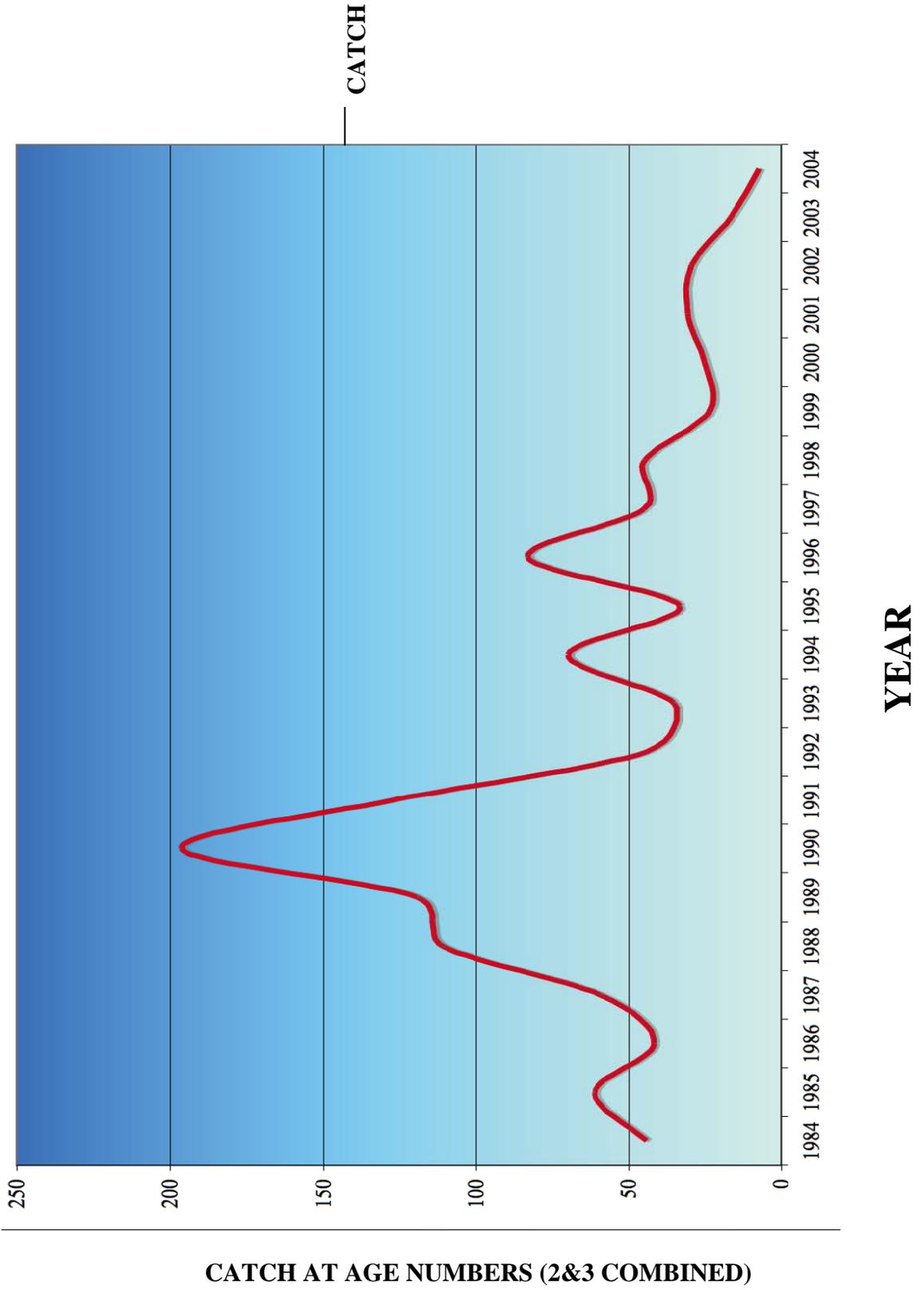
recultivated. The peak production year occurred in 1992 at close to one million bushels. The most recent lowest production year was 1972, at 32,468 bushels. It created a second, although much smaller, "oyster boomlet" here in Connecticut as compared to the one at the turn of the century.

**CONNECTICUT LANDINGS OF SEED OYSTERS (PUBLIC BEDS) 1965 -2005**



How did this second "oyster boomlet" impact flounder and flounder recruitment? If flounder prefer a mud/shell-littered habitat as confirmed by Howell et al (1999), then it could be argued that an increase in juvenile flounder recruitment into the flounder fishery also could be anticipated.

# WINTER FLOUNDER INDICES 1984-2004



## **More Questions Than Answers**

### Habitat Creation

Similar to returns of anadromous fish, how did the increase in a flounder spawning population eventually contribute to a combined spawning event created by exponentially larger numbers of healthy adults? Could this explain the explosive growth in Connecticut flounder landings between 1900 and 1930? As fish grew and then spawned along Connecticut's coastline each year class could reinforce the spawning potential as thousands of newly created habitat acres (oyster aquaculture) was established as the oyster industry grew. If so, this is probably one of the largest case histories of habitat creation in recent times. If what Mr. Nelson felt was true and confirmed by other oyster growers, some fishing practices should be recognizable in the recreational or sports fishing sector. Did sports fishermen actively seek out oyster beds to catch flounder? Commercial trawling over oyster beds is not allowed so larger fish would be captured away from the commercial oyster beds.

### Predator/Prey Relationships

Mr. Nelson mentioned "cover" or "homes" in his explanation of why flounder were so prevalent on seed oyster beds. We know that camouflage is critical to winter flounder. Did a shelling habitat assist in this relationship or was a shallow environment needed to escape deeper benthic predators that occupied a different ecological niche? If this niche degraded or was significantly reduced, did it force flounder to live in areas where it would be subjected to new and potentially worse predator/prey relationships?

### The Early Flounder Fisheries

Evidence insists that Native Americans set brush weirs for flounders here in Connecticut. This is especially true for the Indian River in Clinton, CT. Later, European settlers established a successful flounder fyke net fishery in the 1870's. By the turn of the century, multi-hooked tub trawl flounder hookline fisheries (described as large hook trawls) were in Niantic Bay and other rivers. Although catches were significant, they would become miniscule compared to the catch

increase from 1900-1930 from otter (bottom) trawls. If the oyster shell habitat provided critical spawning grounds, did it fuel the large trawl fishery of the 1920's and 1930's from eastern Long Island and Block Island Sounds? Was Connecticut an incubator for a larger blackback flounder fishery offshore?

### Habitat Preference or Index as Related to Recreational Fishing

Did the recreational or sport fishing sector seek out oyster habitat or shell bottoms for flounder fishing? That is the topic of my research at present. If what the oyster growers repeatedly claimed, then sports fishermen would seek them out to hook line fish over oyster beds? Could oyster shells determine biodiversity in some shallow water habitats? In 1987, an attempt was made to study macro fauna responses to oyster shells as proposed in the Dowd's Creek project, but this effort was not completed. Observations made by Wayne Castonguay at the time are available however in part of an uncompleted study. Work by Penny Howell, et al (1999), showed that in this later study, a mud/shell matrix had a higher habitat preference by juvenile flounder.

### **Methods**

As both the Connecticut oyster industry and commercial flounder landings are currently severely depressed, I choose to review the historical catch statistics, and later winter flounder indices-at-age from 1984-2004, developed by the Connecticut Department of the Environmental Protection Bureau of Natural Resources, Marine Fisheries Division. If the species are habitat independent, no correlation in landings should exist. If anthropogenic conditions dictated fisheries health, then specific events should be discernable, such as the impacts of spills or major anoxia. The use of landing statistics does present problems. The age of flounder recruitment into fishing landings has increased from management/regulatory changes. In addition, juvenile flounder was needlessly wasted as lobster bait as by-catch incidental to commercial fishing during the 1970's. Those fish never made it to be recorded as future landings. I utilized the fishery statistics of the U.S. for flounder landings and Connecticut commercial oyster landings (Blake, et al, 1984), DEP Marine Fisheries, and more recent production figures provided by the Connecticut Department of Agriculture, Aquaculture Division summarized by Holzmen (2005) and David Simpson of DEP marine fisheries provided commercial landings. Seed oyster production was from my own research. According to

the CT Dept of Agriculture/Aquaculture, it no longer maintains data on seed oyster production.

### **Sources for Graphs**

#### Sources for Flounder Landings

- 1) Study of Means to Revitalize the Connecticut Fisheries Industry pages 3/43 to 3/44 General Dynamics Electric Boat Division 1965.
- 2) A Marine Resources Management Plan for the State of Connecticut, Blake, et al DEP Marine Fisheries Program 1984 (Figure 11).
- 3) Landing Statistics Provided by Dave Simpson DEP Marine Fisheries 2006.

#### Sources for Winter Flounder Indices 1984-2004

- 1) A Study of Marine Recreational Fisheries In Connecticut - State of Connecticut Dept of Environmental Protection Federal Aid in Sport Fish Restoration F-54-R-24 Annual Performance Report, March 1, 2004 - February 28, 2005, Pg 110.

#### Sources for Connecticut Oyster Production

- 1) A Management Plan for the State of Connecticut, Blake, et al DEP Marine Fisheries Program 1984 (figure 35).
- 2) Connecticut Oyster and Hard Clam Market Harvest Production 1990 to 2003 CT Dept of Agriculture Bureau of Aquaculture. And also Volk personal communication-date November 23, 1992
- 3) Connecticut Oyster Production - A review of the Connecticut oyster harvest Hoffman 2005 unpublished.

#### Source for Seed Oyster Production 1968 to 1988

Visel, T.C. (1988) Shellfish Management Procedures for Southern New England Towns. A Plan Prepared for the Town of Old Saybrook, Connecticut, Connecticut Sea Grant Program CT - SG-88-06 Edited by Margaret Van Patten, Groton, CT.

## Other New England Examples

If what oyster growers in Connecticut experienced with oyster shell cultch and seed oysters beds, perhaps planted oyster grounds in Rhode Island and New York also may have been similarly impacted. Although not so extensive as Connecticut's oyster industry growth, sufficient acreage of planted oyster ground may have been locally significant in enhancing flounder populations. Information from New York and Rhode Island areas that had planted or cultivated oyster beds may provide additional confirmation regarding this resource question.

## Summary

### ***Blackback Flounder and Oyster Habitat Associations - A Historical Perspective***

Two specific time periods are examined, the two periods that show rapid increases in oyster cultch shelling and riverine natural bed harvests: 1890's to 1920 and 1975 to 1990.

Oystermen would report increases in flounder on or near recently shelled areas. Other research indicates a preferred habitat association between oyster shells and juvenile flounder (Howell, et al, 1999). Reports from oyster growers also mention that large pre-spawning females would seek out oyster beds on which to spawn (Castonguay/Visel, A Winter Flounder Habitat Index for Connecticut 1988.)

In 1986-88, the East River natural oyster bed was significantly restored for oyster setting (Journal of Shellfish Research (vd. 7pp 267-270). Dive Team reports from the University of Connecticut as well as under water video documentation showed juvenile winter flounder living among the oyster shells. This evidence was turned over to the US Army Corps of Engineers in 1988. Other river natural beds that were dredged may provide habitat study locations. Evidence of similar oyster shell habitat associations reported on created oyster beds in New York and Rhode Island also would help confirm this theory. Connecticut rivers natural oyster beds may have been an important habitat niche for winter flounder. The rapid growth of the oyster industry in Connecticut and the planting of thousands of bushels of oyster shells in harbors may have created an unprecedented habitat shift for the winter flounder. When the oyster industry collapsed, this habitat would cease to

provide key elements of cover, protection and food. A decline in this habitat could also then be expected, reducing flounder recruitment into the commercial and recreational fishery.

Today, these in-shore environments have been subjected to wide ranges of negative constraints: pollution, loss of bottom, anoxia, eutrophication and most recently, warmer winter temperatures. Therefore, placing oyster shell in a eutrophic or anoxic environment will not necessarily bring the winter flounder back. It may have been the natural oyster bed ecology in rivers that provided the original key or baseline flounder habitat. The rapid expansion of the oyster industry out of the river areas created additional winter flounder habitat. But in the length of only one century, this aberration of the ecology is perhaps an unprecedented opportunity to review the impacts of such a large scale and organized habitat creation effort.

### **Acknowledgements**

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Tim Visel

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