Economic Potential of Utilizing Sub-Tidal Soft Shell Clam Populations In Connecticut – A Historical Review

Harvesting and Aquaculture Strategies for Renewable Natural Resources - Can Depuration Increase Soft-shell Clam Production?

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Timothy C. Visel – January 10, 2009
Text and Appendices – Alex Disla and Susan Weber
Adult Education and Outreach Programs

The Sound School
Regional Vocational Aquaculture Center

“Successful Clam Culture” Shoreline Times, March 8th 1906 and “To Propagate Shellfish” Clinton Recorder January 23, 1903

Abstract:

The 1906 article describes “A Bit of Clinton History and Some Interesting Statistics of the Work in the Pine Tree State” and includes familiar public policy debates of that time. One side details the right of the public to go shellfishing, while the other describes the benefits of organized culture, i.e. private ownership. But why the debate during this period? The answer may in fact be traced to 1898 and a powerful coastal storm that occurred several years previously. The account includes a discussion of an explosive growth of soft shell clams, locally called “Long Clams,” upon new ground or “new soil.” {In Connecticut, a Native American variant, “long clams,” existed until the 1950’s.} With this discussion was a more profound example (event) from the North River in Massachusetts, a new breach which occurred in Marshfield, Massachusetts leading to a new and large soft shell clam bed.

The 1903 Clinton Recorder article reviews a Clinton Harbor experiment involving the placing of sand over “a spot of mud flat” with the result yielding twenty bushels. Although the articles were mostly about public trust issues, both described the concept of “new soil,” with one referring to a large storm event as natural “creation” of clam habitat in Massachusetts, while the other article refers to a much smaller and not natural “creation” – the placing of sand 2.5 inches deep over the Clinton Harbor “mud flats” with the result yielding twenty bushels. A review of the articles is made with special reference to the cultivation of marine soils for soft shell clams.

Key words – habitat creation, marine soils, shellfish management practices, aquaculture and public trust, natural clam beds, increased shellfish production, Mya arenaria, Mercenaria mercenaria, Crassostrea virginica, fisheries environmental history.

Economic Potential of Utilizing Sub-Tidal Soft Shell Clam Populations

Part I – Harvesting and Aquaculture Strategies for Renewable Natural Resources

Introduction

The newspaper articles (Appendix 1 + 2) from the turn of the century highlight a public debate that occurred elsewhere in New England – the rights of citizens to harvest coastal resources. Each state has evolved different legal acts which govern access, a familiar argument about public trust issues. Recently, Connecticut struck down attempts to limit access to shellfish resources by non-residents, and municipalities lost a lawsuit brought by "natural growthers" in the late 1970's. These access issues, or the rights of people living away from the coast to have access to the coast and marine resources, are not new. In Connecticut, those "rights" included gathering seaweed to nourish soil, collecting shells for use in poultry farms, harvesting shellfish and in some cases fishing. An example of this access exists in Madison along Seaview Beach Road. Attempts by Connecticut to clarify what was public trust described those rights to what was a "natural" clam bed. The public policy debate became more local; one group (usually shellfish harvesters) and the other (grant holders) promoting commercial benefits openly debated the benefits from organized culture. At one time, a concept was widely held that residents of a local community were the only ones that had "rights" to town waters. These views did not prevail in the courts as the numerous legal objections filed by the Natural Growth Association in the early 1900's prevailed. In 1919, the State Fish Commission did eliminate the rights of riparian landowners to the "seine fisheries." Prior to that time, adjacent land owners received a "share" of the fishery and could charge fees if it was conducted from their lands.

The 1906 Shoreline Times article, in the face of opposition to what was perceived as the weakening of "colonial rights," sought to justify aquaculture in agricultural terms, improved access to local customers – fish markets, consistent supplies and finally lower prices. What is of interest is a brief look at fisheries history about why and

when such a discussion occurred. What made it such a vigorous debate at that time and the extent of the commercial and scientific viewpoints?

The 1906 article includes a lengthy discussion of the North River and tidal areas of the Massachusetts towns of Scituate and Marshfield. It details the coastal storm of 1898, the loss of the “City of Portland” and the still painful memory of the steamship’s sinking claiming all passengers and crew. The same storm however, cut a new breach improving tidal exchange and “creating,” according to the article, improved clam habitat by destroying the edible {marsh} grasses which had made them “dead flats.” The reference to new ground or “soil” is something that continues to be mentioned by both marine historians and shellfishermen alike. Apparently a dike had been built in the area to create more suitable agricultural land but was vigorously opposed by marine interests represented by both public fin and shellfishermen.

When I was employed by the University of Massachusetts and its Cape Cod Extension Service, I met with several retired shellfishermen and listened to some of their shellfishing experiences. One retired oysterman, John “Clint” Hammond, reviewed shellfisheries of Chatham, Massachusetts, a place where he oystered and purchased clams from local shellfishermen. During one of our conversations, he spoke about the large storms and numerous barrier beaches located within the town. A long barrier beach system called Monomoy Island extended into the sea and from time to time developed new inlet breaches in the barrier beach. After each breach, he noted that soft shell clam populations on each side exploded, but over time, as the “breach” healed or closed, the clam beds would “die out.” He did not know why, but similar occurrences had happened in Pleasant Bay to the north in neighboring Orleans. Breaches were followed by soft shell clams; he suggested that, like oysters, clams were impacted by silt and that these storms’ “wave action” tended to remove silt and washed the “sand clean.” The best set of clams occurred in Chatham at the turn of the century and lasted to the early teens. It occurred when sand was washed over the previous flats. His recollection was confirmed by other retired shellfishmen. This was the period immediately after the 1898 storm. (It is interesting to note that, according to Mr. Hammond, much of the soft shell clam production was salted as bait in the cod long line fishery).

The 1898 New England “Portland” storm was quite severe and several coastal areas took quite a pounding north of Cape Cod as the storm intensified. Commonly termed a “Northeaster” today, from the historical descriptions, it was probably of hurricane strength with 90 mph recorded winds. Such storms have a history of impacting near shore areas and the most fragile were barrier beaches and inlets, usually the first “barrier” between the sea and land and therefore subject to the full force of such a storm which occurred on November 16 to 19, 1898. These types of coastal storms have a history of destroying one type of habitat while at the same time creating others. This was most evident in the 1906 article which describes the North River in Massachusetts. The “Portland storm of 1898 which closed the old inlet of the North River which as a result tied the development of the Humarock section of Situate to that of Marshfield” as recorded in the MHC Reconnaissance survey town report – Marshfield 1981 – US National Park Service, US Dept. of Interior, Massachusetts Historical Commission. The 1898 Portland Gale created the new inlet at the confluence of the South and North Rivers about a mile to the north of its old mouth. It was this event which caused an influx of sand over the marsh which stimulated a dramatic increase in soft shell clams.

Barrier beach systems are constantly changing or at least at risk of changing. The North River cut a new course after the storm changing tidal marsh mud flats to a new type of habitat, one particularly suited for soft shell clams. One storm, like this one in particular, could have created “new” soft shell clam habitats in three areas, the North River off Marshfield, the Monomoy Island area off Chatham Mass and in Clinton Harbor adjacent to a barrier inlet called the Dardanelles. For two of the three areas, we have published first-hand accounts of a sudden, tremendous increase in soft shell clams. The third (Chatham) oral history accounts of new “cuts” washing the sandy bottoms landward. This is also confirmed by Belding (1931) as he documented increased soft shell clam production in Chatham in the early 1900’s.

Marine Soil Cultivation

Shellfish harvesters frequently mention the productivity of “new bottom” or new soil versus older, “foul bottoms.” Foul bottoms frequently are associated with those that

produce hydrogen sulfide, the coastal rotten egg smell. They contain organic debris such as seaweed, leaves and sticks with choking aquatic vegetation and white patches of super-reducing bacteria. Concurrently, shellfishers also consistently refer to the advantages of "working the bottom." The description of the work is the use of shellfish harvesting gear such as dredges, rakes and tongs. Areas of soil consisting primarily of sand free of organic acids, and organic material have been the places of improved clam sets, especially for soft clams. Coastal storms provide the energy necessary to create new habitats in some areas while destroying them in others. Many colonial references include descriptions of vast amounts of shellfish being cast upon the shore in "heaps" following such storms. These physical events provide evidence of shellfish population changes. Fisheries histories include such descriptions, some areas improving while others declining. In the US Fish Commission Report, this peculiar circumstance is described in exact detail on page 591 part 6-Soft Clam Fishery of Long Island (The Fisheries and Fishery Industries of the United State. George Brown Goode section V volume II 1887- Washington DC G.P.O.).

> "The great irregularity observable between localities in close proximity is perhaps not wholly explainable. You will hear that in this place or that (as, for example, Cow Bay) they were abundant formerly, but have now died out, while elsewhere (as at Riverhead) they were reported reappearing."

Thus we have three cases histories regarding historical accounts of a storm creating a habitat shift which supported increased clams. To carry the concept further, coastal storms are nature's "plows" on a large scale providing the soil cultivation to improve the crops, which in this case are clams. In Connecticut, early shellfish harvesters did not wait for nature's plow; by 1878, they had created their own, and the first marine soil cultivation experiments took place in Bridgeport, CT in 1880. The first marine soil cultivator is attributed to Mr. Wheeler Hawley and on page 590- G.B.G. – The Soft Shell Clam Fishery by Ernest Ingersoll.

> "At first small clams, which were bought at 50 cents a bushel for the purpose, were regularly planted in the sand between tide-lines by punching a hole and pushing the young mollusk down into it. This was found too

> slow and laborious work, however, and the method of plowing the seed in was undertaken. After many trials of all sorts of plows and cultivators, surface and subsoil, and providing them unadapted to the turning of the dense, wet, heavy mixture of sand and mud, Mr. Wheeler Hawley succeeded in inventing a light plow, having a thin, narrow, steel mold-board, which did the work satisfactorily. It was three years after the first considerable planting of seed when I was there, and the whole beach, for half an acre in extent, was as full of the holes indicating clam-burrows as a vast colander. When you dug down you found the mollusks shoulder to shoulder and piled on top of one another. This was manifestly too many, yet they seemed to be doing well, except that the growth was slow. The owner was engaged in thinning them out, and increasing the area of his ground by transplanting. This gentleman says that the clam in Long Island Sound spawns in June, grows only a little during the winter months, and increases in size so slowly that the planter must wait four or five years for his first crop. This attained, however, he will find his whole space “saturated” with young clams derived from his transplanted stock, and can draw almost endlessly upon his “bank” as each selling season comes round. I know no branch of mollusk culture likely to prove more remunerative than this so long as it is not overdone.”

Coastal storms and hurricanes function as marine forests fires and provide for the succession of one type of habitat to another. Wave energy is the coastal “roto tiller” so to speak that cultivates marine soils.

Clammers themselves have consistently mentioned the benefits of “working the soil” mostly with hand rakes and tongs. They also noticed that silted, oxygen depleted soils contained few clams while “healthy” soil had sand and shell fragments and was loose and “fluffy” much like “cultivated agricultural soil”. The concept of soil cultivation would be further explained by the presence of a shell cover in the hard clam {round clam} hydraulic clam fishery. Here, fishermen could and did moderate “acid bottoms” by bringing in shells over cultivated soil by hydraulic clam dredges, in basically the same process as liming agricultural fields.

According to clam fishermen, bay bottoms frequently went “sour” and exhibited low pH characteristics, pitted or soft shells, poor sets of living clam with paper thin shells. Soil that contained a large percentage of organic “muck” that smelled “bad” (hydrogen sulfide – the rotten egg smell) were poor areas in which to clam. These areas were often described as having dying or “dead bottoms.” If what fishermen claim is true, then clam beds created by such storm events have a “birth,” a “maturity” and old age or “death.” Cultivation could prolong the life of clam bed, and not cultivating could hasten its end. Coastal storms therefore created a succession habitat event, one that initially favors certain species, in this case, soft shell clams, to be followed by others containing different biological assemblages. It may be natural for some beds to lose productivity over time, despite the presence of fishing regulations. In fact, many retired clammers recalled that just when the beds really needed to be “worked” (i.e. cultivated), the fishery was closed quickening the “end.” This closing was often in response to bacterial contamination. The absence of clams appeared to be due to something else — the “bottom” over time had changed often in texture while other times color and or smell. Excess vegetation was frequently seen as a detriment; seaweeds that “fouled the bottom” or interfered with estuarine circulation were always seen as negative influences by clammers.

In this 1912 report on the quahog and oyster fisheries, David Belding found a negative correlation in relation to eelgrass for quahog growth, if it interfered with (tidal) circulation (page 94) and further that “soils” in which organic acids caused by the decay of plant life are present prove unsatisfactory of any catching of seed (page 51). He also recorded that growth quahog was invariably faster in (sand) boxes then controls on clam flats immediately adjacent. Mackenzie (1979) observed this situation in his bulletin titled “Management for Increasing Clam Abundance” MFR Oct 79 Pgs. 10-22; growth was faster in loose sand free of organics (page 15). It can be speculated that waves suspended fine silts and clays, redistributed sand, and softened previously “hard” bottoms. Once this was done over time, the soils silted in, organic matter percentage increased and the soil itself reverted or succeeded to an unfavorable shellfish habitat.

It therefore seems possible that clam beds, by their very nature, are subject to silting and decreasing soil porosity which impacts circulation and pH of the soil itself. Clean washed sandy soils, the result of a coastal storm, eliminates the previous soil of vegetation, eliminates excess organic materials and lessens organic acids creating the habitat favorable for huge increases in clam sets, especially those for Mya which live in the highly impacted coastal zone. It also gives support to numerous clam fishery statements such as the "clam beds just died out," especially in areas that were harvested after coastal storms. This would explain historical accounts of storms followed by intense local and widespread sets of soft and hard shell clams. This situation may in fact have happened in Clinton Harbor where a natural breach called the Dardanelles has a history of opening and closing by coastal storms; the same coastal storm caused the Dardanelles to breach separating Clinton's Cedar Island from a headline extending from Hammonasset Beach. This made the inner harbor rougher and subject to increased tidal action. After each recorded breach of this barrier island, clamming and fishing in Clinton Harbor improved, as reported by long time residents and those associated in the fishing or shellfish industry (George McNeil, Cecil Wilcox, others). It is interesting to note that the North River had a soft shell clam population explosion at the same time as Clinton Harbor. Could the Chatham – Monomoy, Scituate/Marshfield and Clinton habitat histories be linked by a single storm event?

A January 23, 1903, Clinton Recorder article gives support to this habitat shift. A large expanse of Clinton Harbor, south of the main channel and adjacent to the northerly edge of Sandy Island (now called Cedar Island), an area of about 75 acres was proposed to be leased. This area, I was told, was immensely productive for soft shell clams, but productivity was linked to the opening or closure of a barrier breach called the Dardanelles. In 1898, the breach was opened and apparently a set of soft shell clams followed generating the apparent interest in leasing the natural soft shell beds. Thus the conflict between public trust and aquaculture. The article also mentions cultivation experiments underway in Essex, Massachusetts and the work of Professor Mead of Brown University. The 1903 article also mentions that in 1879, clam productivity was even higher.

When I clammed on the remaining flats in Clinton in 1978, which were no longer exposed at low tide, very few soft shells were found. According to several long time residents, the productive clam flats were covered in muck and had been since the closure of the Dardanelles again in the late 1930's. I found the marine soil laden with silt and organics, old large dead Mya shells pitted and crumbled with age. Living Mya were found in sandy soil in or near the low tide line, but they were scattered and in no way even remotely resembled the densities reported in the 1903 or 1906 articles. It was also difficult to explain to the Clinton Shellfish Commission that this piece of shellfish bottom was actually under the jurisdiction of the Madison Shellfish from a previous 1792 Act when East Guilford, now Madison, separated itself from the Clinton/Killingworth area. (To my knowledge, Madison never excised its right to the shellfish in this area however.)

Habitat creation therefore may be viewed as severe periodic intense events explaining to some extent the life expectancies of both Mya and Mercenaria or hard shell clam. (In Connecticut, the local name for mercenaria, now widely called the quahog, was round clams.) Mya, with a life expectancy of 12 to 16 years living in the shallow coastal zone, would be subjected to more regular "habitat creation" events, with its population quickly responding to favorable habitat shifts brought on by coastal storms. Mercenaria, with a life span of 100 years or longer living in deeper waters, might find new suitable habitat created two or three times a century, primarily occurring after the most powerful of storms such as immense hurricanes. This does indeed appear to be true: large widespread sets of the hardshell clam (quahog) have occurred after major hurricanes (in Connecticut), and tremendous increases in Mya (soft shells) seem to occur after major barrier beach breaks, especially on Cape Cod. The most notable Connecticut set occurred for hardshell clams after the 1938 hurricane according to commercial clammers from Guilford, Connecticut (Frank Dolan, oral history).

Shellfish Management Implications

The current shellfish management practices include spawner sanctuaries, seasons, bag limits, size restrictions or zero harvest. Most of these policies are broadly adapted from terrestrial land game management policies. While serving a public policy purpose, they have consistently avoided

recruitment strategies or how to ensure successful or enhanced sets of shellfish. Such practices require (work) energy in the form of effort (labor), equipment and capital. Thus the entrance of early agricultural practices into the management/production of private shellfish grounds.

The placing of clean oyster shell may be one of the largest examples of marine habitat creation in recent times. A simple concept, though when applied on a huge scale, it did produce significant increases in oyster sets. It created a rapid increase in oyster harvests. However, the practice collapsed when the water because so contaminated that larval shellfish perished in the plankton stage. Although the oyster previously had been over harvested by traditional management practices for nearly a century, and most communities acknowledged their “utter and complete failure,” we continued to focus our management efforts into centuries old failed policies. It is much easier to “let mother nature take its course” than to gather and utilize resources to increase shellfish sets. Often attempts to increase sets did not lead to immediate rewarding returns so that any effort, however modest, was quickly abandoned if it did not produce immense and quick results. Short-term shellfish management efforts often failed to understand the long term environmental history of shellfish populations. In the early 1980’s, Mr. Frank Dolan, a hydraulic clammer for hard shell clams from Guilford, Connecticut, explained the value of knowing the soil. A soil high in clay for example, would be a poor candidate for cultivation. You could cultivate it forever, and it would yield nothing; you might as well try to “grow hay on boulders,” he would say. Trying to plant clams without first cultivating to him was like throwing corn seed out on hard packed soil and merely feeding the birds. To increase growth and survivorship, clams needed to be in soft, cultivated soil so they could live “deeper” in it and be out of the zone of predation. Hard bottoms with poor soil circulation caused clams to be at the surface so they could get eaten by predators and “picked off” the top, as he termed it.

Forestry management is a good example of how shellfish management policies might evolve. Like shellfish beds, forests were also over harvested, and clear cutting practices produced obvious environmental drawbacks. After a period of years, a more sustainable approach evolved. It

often included cultivation and farming practices, the planting of small trees, selective cutting, and the rotation of harvest areas. However, a good deal of resources went into studying the soil characteristics before planting seedlings. Nature also would have a say; floods may wash out newly planted seedlings or drought may destroy young trees with shallow roots. A forest fire could produce huge unanticipated and often catastrophic habitat events. But these factors would be included into the management policy. They were known because they were observable. This has always been a problem with shellfish management practices; it is difficult to see the changes.

A long term fisheries history approach is needed to fully understand and sustain in coastal shellfish populations. As with natural conditions, energy (in this case waves) were capable of producing large new sets of shellfish. Episodic events therefore can be natural and have profound influences upon shellfish populations. Mr. Joseph Dolan, for example, strongly felt that the Guilford, Madison East River had a 30 year (about) cycle of oyster abundance; he had been told that the late 1880's had been good, as had the early teens, 1949 and then 1979. He predicted that if the 30 cycle was correct, good oyster sets would occur again around 2005. They did; from all reports, the East River has had 3 years of abundant oyster sets beginning in 2005.

Shellfish management programs and strategies should include a detailed environmental fisheries history. In this way, natural events, such as soft shell clam increases after storms, may no longer be mysterious. With increased knowledge, one day shellfisheries may be able to enhance and restore environmental characteristics shown to facilitate recruitment. At one Guilford Shellfish Commission meeting, during a discussion about legal size restrictions (a 3 or 4 inch oyster), Mr. Joseph Dolan held up a piece of paper with a pencil point on it. In a loud voice, he reminded all present that every oyster started this big; that was the size he felt (they, the shellfish committee) should be concerned about. He was correct.

The point Mr. Dolan was trying to make is to focus upon nothing short of a quantum change of management strategy. Instead of focusing upon the survivors of natural events, he desired the Shellfish Commission to focus upon increased recruitment with its intervention (agricultural) practices

of enhancement. The management practice important to him was to get a good set, the 3 or 4 inch oyster; debate did not matter. Mr. Dolan explained that to enhance setting was work, work to find out when was the proper time to put down shell, work to record the sets, work to clean the shells, etc. To him, natural was just that – no intervention to prepare the grounds, control the predators, thin out overcrowded conditions so as to increase the productivity. He, as an oyster harvester, did not want to get blamed either way by nature. If there was no set, he did not want to get blamed for taking all the spawn (adults), and if there was a good set, he did not want to be restricted by catch limitations. Many times he would comment that management laws lagged far "behind the resource." When catch restriction were needed, they often came too late; when restrictions needed to be lifted, over crowed conditions led to a huge waste of adult fully grown oysters (shellfish). He confided that when one harvested a public resource, it in many ways became a public event; everyone had a say, good or bad, informed or ignorant. The tendency was to avoid public review which further complicated management efforts. He also felt political turnover could reverse good management, and the other competing resource groups would seek to restrict access such as with the regulation Guilford has against mechanical dredging. He had seen that argued by environmentalists but commented that if natural was what people wanted, he offered to purchase their lawn mowers for double what they had paid for it. No one took him up on his offer. Natural it seemed was open to interpretation. But is that not part of today's debate?

Early in the colonial period, shellfish resources were sought for a winter food, insurance against the long and then harsh winters. People would descend upon the beds each fall and expect their full load. If there were not enough oysters, the Board (of Selectmen) would hear about it. That started to change in the 1960's when people wanted the "fall" year-round and wanted to go shellfishing for fun (recreation) before the fall. So that seasonal aspect started to fade.

Mr. Dolan had seen that in his fishing business out of New Bedford. His vessel would just go out deeper to catch certain species instead of waiting for them to come inshore; seasons did not seem to matter. Access to the resource also had changed, according to Mr. Dolan. After

World War II, outboard motor boat clubs had formed, and recreational fishing had exploded. He had thought about going into the bait business a couple of times. He one said I think I can make more money “selling the bait, than selling the fish.”

In the end, Guilford adopted a more proactive approach to shellfish management policies, with some programs such as mechanically turning oyster shells in the East River to enhance spatfalls.

Can a more proactive approach be taken with clam species? That certainly can be said when Connecticut’s annual production of hard clams, historically about 100,000 to 150,000 bushels, is now approaching 500,000 bushels. Estimates of Connecticut’s historical soft shell clam production have ranged from between 100,000 to 200,000 bushels. Sub-tidal populations were harvested in two towns, Old Lyme and Guilford. This historic soft shell production was linked to only 1 to 2 percent of available habitat, leaving far greater potential from never-before tapped sub tidal populations. Clyde MacKenzie, in his NOAA Technical Report NMFS #127 titled “The U.S. Molluscan Fisheries from Massachusetts Bay Through Rantan Bay” (pgs. 87-117), detailed some early sub-tidal methods for harvesting soft shells. A drag was used in one foot of water (very similar to the drags described by George McNeil that were used in New Haven Harbor after plowing by oxen) with teeth that churned or plowed out the clams. A second device was described as a churned hoe and, by vigorously churning the bed, clams could be then netted. A recent oral history of Old Lyme/lower Connecticut River describes sub-tidal harvesting off Great Island during the Depression years (Old Lyme Historical Society 2007). Here, clam fishermen would dig down in 2 to 3 feet of water and shovel contents on a floating screen called a “riddle.” A shaking motion would screen out the sand and mud leaving the clams on the screen. The author then records sudden and immense sub-tidal sets of soft shells and having to wait until they reached legal size.

In an 1889 US Bureau of Labor Report (Statistics), pages 91 to 140 detail another example of sub-tidal soft shell clam; harvesting, on page 23, the soft clam fishery of Guilford is described as having a sub-tidal component. The tides were not low enough to hand dig the clams so a rather ingenious device was utilized. A cylinder of sheet metal

about twenty inches in length and five inches in diameter was used. The top of the cylinder is closed with a valve that can be opened and closed. Working the pipe down, the valve is closed and the entire “plug” is removed.

Part II

Harvesting and Aquaculture Strategies for Renewable Natural Resources – Can Depuration Increase Soft Shell Production?

A Test Case: The Soft Shell Clam Dilemma, Habitat Quality, Water Quality and a New Regulatory Balance - Can Connecticut Build a Shellfish Depuration Plant?

A recent article about shellfish closures in Maine due to poor water quality mentions that 29 million in landings are

lost each year, lost to the shellfish industry and to consumers. These were shellfish populations in closed shellfish waters that just perished for lack of harvesting. In Connecticut, I estimate that this loss in soft shell clams alone could easily top 25 to 50 million each year. This figure does not include oysters and clams in prohibited areas unsuitable for clean water relays or those populations too small or isolated for transplanting. Almost all of Connecticut's near shore and river soft shell clam habitats are now in waters closed to direct shellfishing and have been since the late 1960's but these clams did not leave, populations still exist, they just have not been harvested.

In fact, most of Connecticut soft shell clams are in sub-tidal areas between 2 to 12 feet of water. The historical Connecticut production of 100,000 bushels in the 1880's was from only 1 to 2 percent of the available habitat, that which was tidal and suitable for hand digging. I am presently conducting some historical research on soft shell clam habitat creation. After coastal storms in the late 1880's, thousands of acres of new soft shell clam producing habitat were created, including in Town of Clinton. It was during this period that Connecticut was a large soft shell clam producer with Norwalk the leading soft shell producing community. Most of the soft shells were hand dug, except in New Haven Harbor, where an oxen, plow, net dredge operation existed following the Civil War. Most of the clams ended up as "hog food" with clam necks salted for the offshore cod fishery (George McNeil, personal communication).

The last commercial Connecticut landings of soft shell clams were 500 bushels in 1950. The clams did not leave; it was just the water quality declined below that of legal direct harvesting. Since 1950, I estimate 2.9 million bushels of soft shell clams have been lost from the tidal areas.

The sub-tidal estimates are far greater; an estimated standing crop of 3.8 million bushels, of which a potential 10% or 380,000 bushels could be harvested each year from sub-tidal areas lost to the industry and consumers. Connecticut has far larger sub-tidal soft shell clams than anyone really suspected. One trial in Niantic Bay in the 1980's, uncovered more than 30 bushels below the low tide line in only one hour. To calculate what this yearly loss

means to Connecticut's economy in "new dollars," I took the pound equivalent, 60 pounds or about 23 million harvested pounds at the wholesale price of $2.00 per pound (includes the cost of a shore side depuration plant similar to Massachusetts) for a $45 million landing value. The seafood industry has a high economic multiplier (3.0), so the enhanced economic impact is a potential $140 million to Connecticut's economy each year. When I calculated a decade loss or more, the numbers became truly staggering! This is a renewable natural resource that could provide employment and a revived commercial fishery.

But could shellfishermen harvest soft shell clams from huge sub-tidal populations, say in the Thames and Mystic Rivers with today's regulatory climate? To do so would require extensive water quality testing, comprehensive habitat quality/resource studies (maps) and a new regulatory look at how bottom disturbance may enhance soft shell clam growth and production. Above all, it would require the use of hydraulic harvesters, both hand held and hand pushed, and small boat mechanical lift dredges. It would certainly generate those 1978 priority use CAM guidelines as the resource assessment studies unfolded. That would require comprehensive review by all regulatory stakeholders. I am cautiously optimistic on how this opportunity would be received by regulatory agencies, so I am keeping an open mind. For a potential $140 million economic benefit, we could do the modest 1978 studies, but in order for that to occur, we need a new and different regulatory climate – a "what is possible" approach rather than a "what is not" approach.

In the late 1980's, several proposals were made to construct a modest size shellfish depuration plant here in Connecticut similar to the one Massachusetts has operated since 1931. It was initially proposed by "SEATECH," a southeastern Connecticut-based business incubation center. The depuration plant proposal became bogged down in regulatory agency concerns and questions. Controlled "purification" has long provided seafood consumers a safe and nutritious product but needs strong state and constituent support. Above all, it requires a positive economic development/renewable natural resource management role by regulatory agencies.

Presently, I am looking at some recent examples of this new regulatory climate in Maine and Rhode Island. In these

states, multi-agency collaboration exists to promote and enhance shellfish production. If only one thing is reported as a result of my presentation today, I hope it would be this. Shellfish resources are a valuable asset to our state's economy. Let's use them wisely in a new open and honest atmosphere, with all the regulatory stakeholders involved. Only by doing so can we put the last two decades behind us; I for one, look forward to such a moment in history, and the economic opportunities it would bring. Thank you and I would be pleased to answer any questions or comments you may have.

Appendix 1

The Shoreline Times – March 8, 1906

Successful Clam Culture

Constantly Growing Commercial Pursuit

"A Bit of Clinton History and Some Interesting Statistics of the Work in the Pine Tree States"

On January 21, 1903 a special town meeting was held here to act on the resolution petitioning the general assembly to grant to the town of Clinton the privilege of leasing certain mud flats in the harbor which were absolutely unproductive of either clams or oysters, to citizens of the town with a view to propagating long clams {mya – "steamers"}. The resolution proposed to lease to citizens of the town one acre tracks at $10 per year with privilege of renewal, these tracts not to be sublets. It was these mud flats which were explained to be too soft for successful clam culture with sand from the harbor bar nearby. A similar experiment in modern clam culture carried on by M. L. Blaisdell here on a limited area had proved very successful. The motion instructing the representative to introduce the resolution was carried after considerable discussion 84 to 24.

On March 3rd a hearing was granted by the committee of fisheries and game and the resolution was favorably reported and later passed the senate. Determined

opposition was met within the house by the person of the representative from Guilford, who presented to the members that this was merely the entering wedge to the passing of a “god given right of the people along the shore” to private ownership which in view of the utter bareness of this harbor mud of every form of absence in life was about as far from the fact as the moon from the earth.

However the resolution was defeated but this matter of scientific clam culture is growing every day and particular forest and stream and atlas fish culturist as well as the daily press are beginning to record its possibilities and triumphs. That something be done to repair the constant drain and rapidly growing scarcity “this god given right” in this vicinity is an evident as the succession of the seasons and the matter of propagating long clams here is not a dead issue by any means.

The following taken from the New London Day of late date shows to some extent what is being done along this line. The members of the Rhode Island Fish Commission were naturally elated when they learned recently that a large stock company capitalized at 300,000 had been organized in the State of Maine for the purpose of raising clams for the market in enormous quantities. This is the first corporation that has ever been established for such a purpose in the country, if not in the world and is a direct outcome of the experiments that have been carried on in this state. Unlike the majority of corporations, this company has been formed for the purpose of cultivating and propagating a food product, universally known and consumed by all people in all countries. The farms of the bivalve have crossed the ocean and although clam cultivation is a comparatively new industry, it is rapidly forging to the front and bids fair in a short time to take its place well up in the ranks of the great fish industries in this and foreign countries. The season unlike the oyster season not only supplies the market with a delicious and dainty food product throughout the year but ships hundreds of barrels daily to Europe and the continent, and the demand for both home and foreign consumption is rapidly increasing to such extent that clam culture today opens one of the greatest fields of its kind.

Until recent years, there has been no domestic clam culture, the supply of the market being relied upon from the original beds, but as the danger of exhausting the

supply is plainly apparently, large plots have been leased from the fish and game commissioners of New York and other states, and beds have been planted occupying hundreds of acres, each acre at a most conservative estimate being valued $1,000. The value of the crop of last season for the State of New York was 110,000 with every prospect of a much greater growth and value.

Clam canning factories have recently opened another field for the industry thus making a further increase necessary and unless some other means of supply are immediately found, there will be few if any, of the popular shellfish left for consumption, clams having been brought to the brink of extermination.

Few people realize that the average cost of clams in the shell is from 1.50 to 2.00 per bushel, and with the supply diminishing and the cost increasing the clam will soon reach that state of food production whence it becomes a luxury.

Commissioner Nickerson of the State of Maine in a recent statement said “I am far more concerned about the clam industry than I am about the lobster, and measures must be adopted of the people of the state would save the enormous losses in the future.” The value of the sold in Maine after the year 1904 was approximately 285,600 of which nearly 70,000 cases were canned. In 1904 Maine had 24 canning factories worth 250,000 which sold 70,290 cases valued at 198,000. Thus some idea can be gained of the business which no doubt, many of our readers are unfamiliar with.

The company owns and controls 450 acres of clam flats situated on the {North River} mass peculiarly adapted to the culture of clams. Previous to 1898 no clams were ever-dug in the North River, but in the great storm of that year (1898) when the City of Portland was lost, the river cut a new deep mouth through the beach, giving free access to the tide, which soon destroyed the edible grasses of the marshes and made them in a large part dead flats. Clams began growing in large quantities and thousands of bushels have been dug and carried away each year.

Professor A. D. Meade, Ph.D. distinguished biologist, a member of the Rhode Island Fish Commission, and probably the best authority in the world on shellfish culture having

conducted experiments there in. For seven years, has twice inspected these flats. Speaking of one place that he looked at said “the set there is thick enough to produce 3,000 bushels to the acre. The main thing is a suitable bottom and the best proof of a suitable bottom is this great abundance where the turf has been sufficiently removed to give them a change to come in.”

By proper turfing, grading, and planting it seems certain that the whole area owned by the company can be made immensely productive. The spat a float in the tides willing to a great extent, if not wholly supply the seed, and planting seed beds and young clams can easily supplement that if necessary. The plant once prepared, nothing remains but together, the crops, there is no sewage or other pollution in the river thus the quality will be of the best and command the highest market prices. The tides feed the clams; ice and frost cannot destroy them, and with the land and seeded it remains forever, and the cost of maintenance is nil. Harvesting for an eager market is the only expense. Nature’s laboratory does all the rest. There is no other business of which this can be said.

Experiments recorded in the published report of the Rhode Island Fish Commissioner show that while on some limited portion of their beds, production was at the rate of over 3,000 bushels to the acre, taking the whole of the tract under cultivation it was at the role of 1,750 bushels to the acre. Their experiments also showed that they attained marketable size at two years of age.

Appendix 2
<January 23, 1903 from Clinton Recorder>

Appendix 3

The Natural Clam and Oyster Beds of Eastern Connecticut East Haven to Stonington, CT – HRI Sub Committee on Shellfish
LIS EPA Meeting, March 26, 2008

Timothy C. Visel

The Sound School Regional Vocational Aquaculture Center
New Haven, Connecticut

Abstract

Much has been written about the ecology of shellfish populations in the last decade. New environmental initiatives around essential fish habitat, estuarine water quality and habitat ecology (termed environmental services) has once again focused attention upon shellfish resources. Many feel that shellfish populations provide a realistic yardstick upon which to measure estuarine quality or its failure, the “canary in the coal mine” so to speak. While this concept is not yet universally held, it is gaining in acceptance as researchers examine entire ecosystems in near coastal areas. Worldwide shellfish populations often have mirrored estuarine health. They can provide indications of environmental problems long before they become extreme. Opportunities to study shellfish populations within natural conditions have been lost, as often the shellfish populations in a given region have been gone for a century or more. This is especially true here in New England as the impact of coastal development has taken its toll in many shellfish producing areas. The Tauton River in Massachusetts, for example, once (a century ago) was one of the largest sources of seed oysters in New England yet no oyster fishery exists for them today. The bay scallop has declined in both range and relative abundance over all of its previously recorded harvests areas. Unfortunately, the location and productivity of many shellfish populations has diminished in the last three centuries. Only with extensive fisheries history research will estuarine researchers be able to determine (if possible) the extent of those resources. Shellfish populations enjoy a distinct advantage over other types of fisheries management with the exception of the bay scallop; they did not move and often leave a record of their habitat history – their shells. A significant research resource has been and continues to be The United States Fish Commission Reports. They contain both references to labor, production and capital investment as well as detailed location/description of shellfish areas. Therefore, it is possible to return to specific sites or locations and determine a habitat/fisheries history for many areas.

Keywords - Eastern Connecticut oyster Crassostrea virginica, tidal natural oyster beds, shellfish habitat history, oyster ecology, environmental services, submerged tidal lands, essential fish habitat.

Introduction – The First Two Centuries

Why were natural shellfish populations important? Oyster and all shellfish resources emerged first as important source of food and then later commerce. The transition from artisanal use to commercial use set the stage for the culture of shellfish private grounds. "Natural beds" were to remain "public" shellfisheries. Some natural beds were court designated, defined by Boards of Selectman or their designated Oyster Ground Committees appointed by the selectman. Changes in Connecticut laws that allowed individuals to stake out bottom for private culture were at times controversial. Several articles at the turn of century (Clinton Recorder Newspaper) in the Town of Clinton openly discussed the benefits and drawbacks to such new rights. They included frank discussions about the concept of private shellfish cultivation and grow out practices. Madelyn Huffmire and Larry Frankel's monograph details the legal and regulatory framework for the designation of natural beds (Sea Grant UCONN "The Influence of Regulatory Policies on the Production and Marketing of Long Island Sound Oyster"). Their report details the statutory history by the Connecticut General Assembly in creating the legal authority for such uses in submerged public trust lands. Other similar articles and discussions were records found in many coastal Connecticut towns'. The terms "free and common" fisheries frequently occur in descriptions of many New England States. They represent the practice of arriving at the shore to harvest what could be termed abundant shellfish resources in the early 1700's. After all, colonial fisheries merely replaced Native American ones, and cultural differences never recognized the ownership of natural resources the way European settlers did. Here in New England, the tribal unit governed resources as a group not individuals. The concept of individual ownership of natural resources was absent in tribal communities. European shellfish harvesting focused on ownership which meant possession, which was deeply rooted in English common law.

To own the “common” resource, one had to possess it, a management philosophy that over time rarely sustained natural resource harvests but carried over from colonial and English laws. Early colonial laws also often gave resource use preference to riparian land owners.* This practice often resulted in scarcity, as recorded in New Haven’s colonial history. To prevent the over harvesting of the resource, it was in many instances “protected” from the free and common use by regulation. It was no longer totally free; therefore, it became a political process and by its very nature, resultant policies tended to spread the resources “among many hands” rather than concentrating them into fewer hands.

The public policy debate in the late 1800’s focused upon the free and common access to the resource as to the other viewpoint of sustained and predictable culture of a commercial product or agriculture. This public policy debate is historic in reference – the exploitation of a natural resource, its collapse (not sustained) and public policy decisions to stabilize or enhance it. The concept of culture and care became linked as in early agricultural practices; one had to “care for crops” or husbandry of the resource. In exchange for the risk of care and investment of capital, shellfish growers now would own “title” by deed to underwater lands. Securing private ownership and protection from the free and common access of previous colonial law was the concept of the first underwater farms here in Connecticut.

* See similar court decision for herring runs and the right to seine fish from upland riparian landowners. This was especially true for Madison and Westbrook regarding the menhaden fisheries.

1900 to Present

Under state statutes, natural beds were not to be designated, and they would remain open as public fishery regulated by the local government. Each community would designate its own areas as provided by state law. These designations were made and recorded in the town halls, many on maps and charts. All such designations were written in the land records as deeds. Tax records and tax bills were sent with just as with upland real estate.

The natural beds in Eastern Connecticut were a part of tidal river ecology and can be separated from the larger offshore natural beds found in western Connecticut. Here, oysters thrived naturally in rivers and away from the largest predators that included the common starfish Asteria forbesi and oyster drills Urosalpinx cinera. Their proximity to upland tidal marshes and fresh water runoff provides a unique ecological role for water quality, fisheries habitat relationships and the morphology of the river itself. Upland changes often had an immediate and measurable impact as recorded by later 19th and 20th century oyster fishers. We have more oral and written history about these natural beds as they were a food source critical to coastal residents. Some records and reports have been published and provide some of the reference materials used today. This report provides one of the most comprehensive written details of the natural oyster beds in Eastern Connecticut during the late 19th century. Although these local oyster fisheries were modest in size, they continued a historical social and cultural connection to the resource as previous Native Americans had. Many communities still have shellfisheries governed by local shellfish commissions; many shellfishers still seek to gather shellfish as coastal residents of Connecticut have for centuries. Municipal shellfish commissions today continue to exercise local control over licensing and harvest levels.

The scope of this paper involves those natural shellfish beds, primarily in tidal rivers between Branford and Stonington. The source of the information is “The Fisheries Industry – US Bureau of Labor Statistics.” Information is from the late 1800’s.

The following document, reprinted without change, is part of the US Bureau of Labor Statistics (1889) pages 91 to 140, “The Oyster Industry” received for record Dept. of Environmental Protection Office of Long Island Sound Programs 1/11/94.

Natural Oyster Beds in the Quinnipiac River – page 181

George G. Hamilton states: “Bringing Virginia oysters in the shell to Connecticut, began some sixty years ago. The Quinnipiac River has furnished native oysters from time immemorial. The river was full of oysters from Chapel Street bridge to Lewis bridge. It was a natural bed. The

river was open for taking oysters from November 1st to April 1st. The people culled off the big oysters and put them in their cellars, and sold them during the winter. Most of the oysters were opened and carried by wagons and teams back into the country, even to Albany, Troy, and Buffalo. In those days the dugouts went with their loads of oysters up to what is now the west curb line of Front Street. The cellars of the houses from Ferry Street to Grand Street were excavated right back into the river bluff, and afforded ample room for the storage of large quantities of oysters. The shells were thrown out in front of these houses, and South Front Street and the docks east of the street came into existence. The original Fair Haven oysters were known as 'Dragon Oysters,' dragon being the nickname by which Fair Haven was identified. Some forty years ago the people began to transplant the river-bed oysters to individual ground. The first southern oysters that were brought to New Haven by sloops were brought about fifty years ago. The Beaver was the name of one of the early sloops. The oysters were carted about in the shell to the houses in Fair Haven, and even several miles distant, and opened and packed in gallon and one-half gallon keys, and then sold though the country far and near. Captain Hamilton says that 10,000 bushel of oysters shells were offered for sale at three cents a bushel in the summer of 1880, but were not sold even at the low price."

Many planters send their seed to Rockaway and other places. The sales by New Haven cultivators for the season of 1889 were about 200,000 bushels. The price paid per bushel varied from twenty-five cents to sixty-five cents. The season began April 1st and ended June 20th. The safest and surest way to make money in the oyster business is by transplanting seed oysters raised in the Sound on shells, to inshore grounds, to fatten and increase in size.

Branford and Guilford Natural Beds – page 138

Branford

Henry H. Stedman, town clerk of Branford, states: "The channel of Branford river, and the harbor, excepting ground

defined as natural bed, has all been designated. Indeed, as town clerk, I refuse to give certificates as required by law, to the effect that any new ground that is applied for has not been designated, for the reason that I consider that substantially all the ground in town jurisdiction has at some time been designated. But at the present time only a small area of ground is under cultivation. The tax rate of the town is twelve mills on a dollar. This makes the valuation of the ground returned for taxation, $4,911.67. There is not a single map of oyster grounds on file. The greater part of the business of the town centers at Stony Creek. No oysters are raised, to sell, in Branford Harbor. No men make a living by working on the natural beds, but, at times, when the law is off, a few bushels are taken. The law limits the quantity to two bushels a day. The natural bed oysters are generally transplanted. They grow too fast and are thin. They are called jack-knives. The outside oyster grounds in town jurisdiction are, as a rule, too shoal for safe cultivation. By an act passed at the 1889 session of the Legislature, the selectmen of Branford, under certain conditions, may lease, for a term of years, portions or the whole of Great Cove natural beds."

Guilford – pages 136-137

E. A. Crittenden of Guilford says: "Fifteen years ago twenty or thirty men caught fifty bushels of oysters daily for two or three months in the East River. The average annual catch is now about 6,000 bushels of two year olds. The oysters sell for from twenty-five to forty cents a bushel."

Fifteen years ago quite a number of men made a living by clamming. Clams have been scarce for two years. The tides have not been low enough to get at the big clams. These clams are to some extent dug by using a cylinder of sheet iron about twenty inches in length and five inches in diameter. The top of the cylinder has a metal head in which is an aircock or hold for a vent-plug. Attached to the pipe or cylinder are two irons through which a handle is slipped. The operation of capturing the clam is performed by placing the pipe over the vertical blow-hole made by the clam through the sand to the surface. The aircock is opened or the vent -plug removed, and the pipe is worked down to the depth necessary to reach the clam. The air-cock is then turned or the plug put in, and the column of material in the cylinder is drawn up and the clam

taken out. These clams are sold for about three cents each.

There are about ten oystermen at Guilford; also about three dozen people that come once or twice a week to get oysters. About 7,000 bushels of seed oysters were taken out of the East River in the season of 1880. The amount taken in 1888 was about 10,000 bushels.

The channel of East River is, on an average, sixty feet in width. Some years ago the channel set full of oysters. If it were not for the two-bushel law, men from back in the country and boatmen from all along the shore would come and clean out the river.

After a heavy west or northwest wind and during very low tides, many of the workmen leave the foundry and go clamming. Sometimes seventy-five or one hundred men will be clamming at one time, but as a general thing, but few people clam for a living. The summer visitors dig up most of the clams, and seem to live mostly on clams, and then brag how cheaply they can live at the shore.

Natural Beds – Madison – page 137

Madison

Elihu Kelsey states: “East River, between Guilford and Madison, and from the railroad to the South, is a natural bed. The oysters are celebrated and are known everywhere. Probably 20,000 bushels of seed were taken from the river last year. It is sold to Stony Creek planters. The oysters are tonged up. The law provides that only two bushels can be taken by any one person in a day, but this law is violated. Out of the daily catch a bushel or two, large enough to eat, would be picked out. Would rather own the river than the whole town of Madison. There are about twenty-six regular oystermen hereabouts. Thirty years ago I have seen a hundred men oystering for a few days at a time in the river. At the present time not over eight acres of designated ground are in use. More ground has been tried for cultivation, but the surf washes the oysters away or the oysters get mud-washed.”

Natural Beds – Clinton – page 138

Clinton

E. K. Redfield states: " All the designated oyster ground in Clinton is in the harbor, and is located in the channel, extending from the west wharf nearly down to White Bar. The length is about 8,800 feet, and the area of ground is about twelve acres. A part of this ground has been planted for thirty-six years. The privilege to plant in the channel was obtained at a town meeting. There was a unanimous vote in favor of allowing the planting of oysters in the channel from the west wharf as far down the channel as the persons applying for the ground saw fit. About ten years later the State passed a law that a committee of the town might designate ground for the purpose of cultivating oysters, and the parties that had previously planted grounds in partly planted each spring with oysters that are from three to five years old. Some of these oysters are used during the summer. The small oysters about double in size during the summer and full, and acquire a fine flavor. The law forbids the taking by one person of more than two bushels of the natural bed oysters at a tide. All of the natural bed oysters taken are two and three years old, most of them two years old. About three hundred gallons of oysters were opened and sold last year."

Luke E. Wood, eighty years old, keeps the natural bed war going. About twenty men work on the natural beds. Their capital is a pair of tongs and a row boat. But many of them have no boat. These men would make four times as much money if they hired out to planters. The natural growth men pack the town meetings with farmers who know nothing of the oyster business. Some of the farmers come down a half dozen times a year and catch a few oysters and clams on the natural beds. The Clinton oysters are sent to Norwich, New London, New York, and up the Hudson River. Mr. Wood states that in the winter time he has seen as many of sixty men working at one time at low tide, catching oysters and clams in Clinton harbor. The clams and oysters are like crops of grass. He believes that there are 80,000 bushels of natural bed oysters in Clinton harbor, which is exactly adapted to oysters.

The Natural Beds of Westbrook – page 139

Westbrook

Judge George C. Moore states: “There is an oyster interest here that is native altogether in its character. It is confined to Patchogue and Menuketesuck rivers, extending from the Sound about one mile up the streams. There are about sixteen acres of prolific oyster beds on the first half mile of the streams. The upper half mile has occasional beds or places where oysters grow and have grown for years. Our oysters law is as follow: In the month of October we allow to be taken not to exceed two bushels in each week by any one person. In November the limit is three bushels. The time is restricted to one day in the week. People come from all the surrounding towns to avail themselves of these privileges. The oysters are all sizes. Some falls as many as 8,000 to 4,000 bushels are taken out of the rivers, but usually not so many. The only designated ground is about two acres in area and situated off Kelsey Point, Westbrook. It appears that the coast is too exposed for in shore coast planting. The oysters wash ashore. But oysters grow naturally on the west side of the Menunketesuck Point. They may be gathered at any time so far as legal restraint is concerned. Sometimes as high as four or five bushels may be had at a tide. The oysters are for the most part attached to the rocks, and it is necessary to get them at low water. This condition of affairs is as recent as four or five years, and is due to the fact that the river changed its course so as to discharged on the west side of the Point.

C. A. Post states: “Fifteen to twenty men living in Westbrook catch clams in the winter time for a living. Clams are dug all along the Westbrook shore, more especially off Westbrook river. The clams are dug with clam hooks.”

The Deep River and Essex men dig the clams with pitch forks. They work in pairs, one man to handle the pitch fork, and one to pick up the clams. The summer residents and visitors do not get the big clams; the tides do not go out far enough. The big clams are taken at extreme low tides. Twenty five hundred people or more clam along the bench.

The Natural Beds of Old Saybrook - page 140

Old Saybrook

R. B. Chalker of Saybrook states: “Oyster River from the Sound, just above the lower public crossway, sets full of oysters every year. There was no limit about taking the oysters this year. About the year 1854, Virginia plants were brought here by David Spencer and David Clark, and put in the river. The oysters grew nicely during the summer. But in the succeeding winter the ice killed so many of them as to render the venture unprofitable. In 1879 another attempt was made by putting gravel in the deeper parts of the river, and planting native seed oysters thereon. The low tides left the heavy ice to press the oysters down and smother them. About ten acres of ground have been designated in the river. Planting on it has proved a failure owing to the settling or river sediment, but some days six or eight barrels of oysters are sent to Hartford from Oyster River. Oysters are found in the Connecticut River, but cultivation is unsafe owing of freshets. About one mile above the railroad bridge, and in forty feet of water, large oysters have been gathered in considerable quantities. It was thought that it would pay to employ divers to gather oysters in this locality. Along in the forties, a bed of large oysters was found just south of the railroad bridge. The bed was about one mile in length, and twenty five to thirty feet in width. The river beds are in veins or streaks, and may be accounted for on the supposition that a rock, boulder, or log makes the beginning for a low bar of earth or sediment which remains till the cutting action of the stream again asserts itself. The river bottom is constantly shifting.

“People come down with wagons for back in the country and catch clams in Kelsey’s Bay. As many as ten bushels of seed oyster have been taken in one day by one person. The spawn came from the planted oysters. The law limits the amount of catch of clams, but it is evaded.”

Ozias Kirtland, town clerk of Old Saybrook, states that some days as many of thirty men will be clamming on the beach near the mouth of Oyster River. Only a few men get a living by clamming, but there are clams enough.

The Natural Beds of Stonington - page 140

Stonington

Dr. George D. Stanton of Stonington, is of the opinion that the natural beds are not very productive. They have not

been mapped out. Clams for home consumption are brought from Rhode Island, except a few from Nepeague. All the ground that is suitable for oyster cultivation in Quiambog Cove, north of the railroad, has been designated. Seed oysters are planted on these grounds in the spring, and they become three fold in size by winter.

Henry Church of Norwich states: "There are probably forty acres of oyster ground designated in Quiambog Cove. Last season the sales from these grounds would have amounted to $5,000 to $6,000 if the oysters on them had not been killed by the excessive amount of fresh water."

Groton - page 141

Poquonock River oysters were not fit for marked this year. Last year about 1,000 bushels were sold for, say, two dollars a bushels. There are perhaps twenty five persons engaged. This is where the raising of oysters on trees began in the State.

Oysters on Trees - page 112

The Poquonock River near Groton is noted for the growing of oysters on trees. In 1881 white birch bushes were placed in the mud about spawning time. The spat adhered to them in large quantities, so the eighteen months afterwards good sized seed was obtained. On some bushes oysters were found large enough for market. One bush bore twenty five bushels, but the average yield is about five. In 1881 fifty one acres were devoted to this method of culture. The bushes are put down in fourteen or fifteen feet of water at low tide, and pulled up with derricks. The natural growing of oysters on trees has long been noticed in southern creeks, where overhanging branches afford the opportunity for a set. Australia is famed as the continent where oysters grow on trees. It is also recorded that oysters were artificially propagated on trees by Roman knights in the eight century, and that the same culture has for years been a curious feature in the oyster industry of France.

New London - page 141

G.M. Long of New London states: "no men about New London make a living by oystering in this vicinity. There are

natural beds in the Thames River near Montville. There is no clamming of any account about New London."

Norwich and Thames River - page 141

It is claimed that the Thames River would be one of the best rivers in the State for fish and oysters if not polluted by the drainage from the manufactories. If there were a fish-way at Greeneville dam that would allow the fish to go up the river about the factories, the fish would spawn and have a chance.

Five years ago there were oysters enough in the Thames River on the natural beds to seed 10,000 acres of ground in the Sound. The oysters were one year old, and were so thick that one man with tongs could take a hundred bushels a day. The natural beds begin about three miles below the city, and extend for six miles down the river, and cover its full width. Five years ago, fifty men worked on the natural beds. At present probably twenty-five men catch oysters on them from October 1st to March 1st, at such times as the river is open. Last season about 10,000 bushels of oyster were taken, two-thirds of which were large enough for immediate consumption; the remainder were transplanted. There are scattered natural beds down the river to the Sound. There are probably sixty acres of designated ground in the river.

Nathaniel Chapman states: "We cannot sell the river oysters owing to their bad taste, except for transplanting into clean, pure water. The oysters then become fit for use. The paper mills at Greeneville turn their dye stuff into the river, and it kills the fish. Shad, dace, suckers, and other fish drift ashore dead."

Natural clam beds - long clams - Colonial name for soft shell clams (steamers)

Clamming - page 112

Long clams abound on our coast, and furnish a livelihood to many men. Besides, there are numbers of persons who make a practice of catching them for their own consumption. It is impossible to more than approximate this branch of the shell-fish industry. For the six towns from Guilford east, these estimates have been prepared: Guilford, 2,000 bushels; Madison, 1,000 bushels; Clinton, 2,500 bushels

Westbrook, 3,000 bushels; Old Saybrook, 2,500 bushels; Old Lyme, 2,500 bushels. It is safe to say that the eighteen other shore towns will average 2,000 bushels, thus making a grand total of 49,500, which is probably far short of the truth.

Appendix 4

Soft Shell Clam Habitat Creation and Associated Population Expansion Following Significant Marine Soil Cultivation/Disturbances

LIS – EPA HRI Sub- Committee on Shellfish
T. Visel April 21, 2008

A Review of Three Case Histories Following The Gale of 1898

Abstract: New England communities have often experienced periodic production fluctuations of the soft shell clam, Mya arenaria. Explanations for such production fluctuations include disease, pollution, loss of habitat, over harvesting, environmental constraints, and predator/prey relationships. While any of the above explanations have site specific merit a look at three fisheries histories provides a more natural system explanation. Large increases in populations appear to be linked to a large natural “habitat creation” event. The soft shell clam is often an opportunistic colonizer of near shore estuarine soils. As habitat is created, other habitats may be lost or gradually become unproductive. Traditional shellfish management and restoration efforts need to consider the impact of storm related significant habitat creation events. Losses of productivity may result naturally from such events while creating new habitats in other areas. Habitat creation therefore could be largely beyond the control of municipal shellfish management agencies.

Within the last century, three New England communities have experienced tremendous changes in soft shell productivity. They include Clinton, CT located in the middle of the state just west of the Connecticut River, Chatham, Mass located at the south east end of Cape Cod opposite Nantucket Island and lastly Marshfield, Massachusetts at the confluence of the North and South Rivers, south of Boston. All three communities experienced dramatic changes in production/productivity for soft shell clams between 1900 and 1910. After reviewing fishery history records and reports some common factors have emerged, all three experienced a barrier beach inlet in which a new split allowed dramatic changes in the soil characteristics of sub tidal habitats. The changes in the barrier beach ecology occurred after a very powerful storm in 1898, the so called "Portland Gale" which hit New England in late November of that year.

Within 5 years, all three communities would record enormous soft shell population increases adjacent to the "new" barrier beach inlets. This paper reviews two basic questions, the impact from storms on estuarine ecology and secondly if such events prepared "marine soils" for sets of the soft shell clams. Written reports, newspaper articles and US Fish Commission accounts appear to confirm that these circumstances were not isolated.

Keywords: cultivation of marine soils – soft shell clams – Mya arenaria habitat creation, population fluctuations related to physical soil changes, fisheries histories, shellfish management policies for municipal shellfish commissions.

Introduction

"The Shellfishery (soft shell) used to be in two areas (1900's) Pleasant Bay and Monomoy. They would find the clams near new cuts on the sand flats. It would be good for a few years and then die out. It was like these clam beds were born as they would suddenly appear. We thought it was from the new sand from the cut but no one could say for certain."

Comments from John Hammond – retired commercial oyster grower Chatham Mass during the December 1982 interview "T. Visel personal communication."

“M. L. Blaisdell said he had experimented with a spot of mud flat about 30 feet square. He had sprinkled such a spot with sand to the depth of about two and one- half inches and in a short time clam holes were found so numerous that he could hardly put his fingers between them. One man he knew of had dug twenty bushels from the tract and another as many more.”

Excerpt from a Clinton Recorder Newspaper Article Clinton, CT Friday, January 23, 1903 “To Propagate Shellfish” about dense concentrations of soft shell clams in Clinton Harbor Connecticut. The dense concentrations occurred east of the barrier beach inlet locally called the “Dardinelles.”

“Previous to 1898 no clams were ever dug in the North River (Marshfield Mass), but in the great storm of that year (1898) when the City of Portland (steamship) was lost, the river cut a new deep mouth through the beach, giving free access to the tide, which soon destroyed the edible grasses of the marshes and made them in a large part dead flats. Clams began growing in large quantities and thousands of bushels have been dug and carried away each year.”

Part of an account by Professor A. D. Mead of Brown University of a new soft shell clam population described in a 1906 Shoreline Times Article “Successful Clam Culture.”

Each of the above refers to a location in which soft shell clams exhibited rapid population increases following a storm event.