

**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 (large scale) 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.

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 growers" 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 than 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 became 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.

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 tracts 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 rate of 1,750 bushels to the acre. Their experiments also showed that they attained marketable size at two years of age.

Reproduction is granted by Joyce Mletschnig, Assoc.
Editor
Shore Line Newspapers