

Open-Ocean Culture of Sea Scallops Off New England

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Abstract

A nine-square mile site for the experimental culture of the giant sea scallop *Placopecten magellanicus* has been established in the U.S. Exclusive Economic Zone (EEZ), south of Martha's Vineyard, Massachusetts. The goal of the project is the development of sustainable production practices for the New England sea scallop industry and the promotion of economic growth. In the project, a variety of methods of contained and on-bottom culture methods are being evaluated both biologically and economically.

The experimental site is only the second in the U.S. to receive a permit from the Army Corps of Engineers for aquaculture in the EEZ. It is the first project to have been granted exclusive use of an area of the EEZ for aquaculture purposes. It is also the first site to involve large-scale suspended containment systems designed for full exposure to the rigors of the Northwest Atlantic Ocean.

This paper will briefly describe the project and its research agenda. The permitting process required of the project proponents will then be described as it serves as the only example of a fishery management council exercising its role in facilitating EEZ aquaculture. The issues associated with regulating aquaculture under the Fisheries Conservation and Management Act (FCMA) and coping with competing EEZ users will also be discussed.

Sea Scallop Culture Around the World

Scallop culture, as practiced today, was pioneered in the Mutsu Bay region of Japan (Aoyama, 1989). Before 1935, the scallop fishery in that area was subject to significant fluctuations in abundance. Today

seventy percent of Japan's scallop harvest is cultured. The harvest is now stable from year to year and is an order of magnitude larger than the previous wild harvest fishery. There are over 1900 scallop harvesting firms in the Mutsu Bay region alone and many other regions also produce cultured scallops.

Since the 1970s, countries in other parts of the world have begun scallop culture operations based on the Japanese model (Kirk, 1979; Paul et al., 1981; Reyes, 1986; Naidu and Cahill, 1986). Scallop culture operations depend on obtaining a large supply of spat, commonly called seed. The two sources of seed are hatcheries and spat collecting devices. Hatcheries take sexually-mature scallops from the wild population and spawn them in captivity. Scallops are easily induced to spawn by raising the water temperature (Gruffydd and Beaumont, 1972; Costello et al., 1973; Ito et al., 1975; Naidu et al., 1990). There are variations in the rearing techniques, with different levels of difficulty, depending on the species of scallop. In Japan, commercial growers have found spat collection from natural production to be the most economical approach to generating seed (Ozaki et al., 1991).

Scallop spat, if placed directly on the bottom, suffer high mortality. Therefore most culture operations hold the scallops in an intermediate culture phase until the scallops are about 20-30 mm in size. The most common method of holding utilizes strings of specially-designed nets attached to arrays of submerged long lines. Holding the scallops in these nets, up off the bottom, reduces predation and provides better feeding conditions, enhancing growth.

Final culture, or grow-out, can be conducted at a commercial scale using suspended culture or bottom culture (sea ranching). The most common form of suspended culture utilizes a lantern net. This cylindrical cage of netting has about ten compartments stacked one on top of another with a specific quantity of scallops placed in each. Scallops are periodically thinned and moved into larger-mesh lantern nets. Another form of suspended culture is ear hanging, where the scallop is tied to a string by means of a hole drilled in

the hinge, or ear, of the shell. A third method involves gluing scallops to a hanging rope (Cropp, 1985). All these methods tend to be very labor-intensive.

The least expensive method of grow-out is bottom culture where scallops are released onto appropriate bottom to grow to market size (Frishman et al., 1980). In some cases, the bottom is cleared of predators such as crabs and starfish to reduce losses. Upon reaching market size the scallops are harvested by dredges or divers.

Re-Engineering the New Bedford Scallop Industry

The giant sea scallop, *Placopecten magellanicus* is the main stay of the New Bedford fishing industry. Declining resources of this species has recently lost New Bedford its position as the leading U.S. fishing port in landed value. The industry and fishery managers have had to come to grips with the problems associated with open-access fisheries. As with groundfishing, a strict days-at-sea program has been imposed to allow scallop stocks to rebuild.

Some participants in the New Bedford sea scallop industry believe that increasing natural productivity is a better solution than scaling back effort. From that seed of an idea, the Westport Scallop Project has been initiated to apply to New England the scallop culture techniques that have been proven in other parts of the world. The project is a collaboration of scalloping interests and a science and technical support base as listed in Table 1.

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Table 1. Westport Scallop Project technical and science support.

Aquaculture in the U.S. EEZ is a popular discussion topic but as of 1996, it is not yet a reality. For this reason, attaining the needed permits for our project has taken on national significance. The U.S. Army Corps of Engineers (COE) has authority under Section 10, Rivers and Harbors Act of 1899. This Act relates to activities affecting U.S. navigable waters and the COE scrutinizes the placement and adequacy of aquaculture structures and moorings.

In addition to these issues of safety and adequacy, the COE application sees a public review process and it is forwarded to other federal agencies for their review. Table 2 lists these agencies and their basis for interest.

The COE permit process is a mature regulatory function and its application to aquaculture operations has been honed by years of state-waters permitting experience. Our COE application for a three-mile by three-mile square located south of the island of Martha's Vineyard, Massachusetts was submitted in September 1994 and was issued in January 1995, the second such permit ever issued for federal waters. Due to our use of a native, filter-feeding species, the typical agency concerns over feed and waste accumulation or the genetic consequences of escaped finfish were not voiced.

However, the COE permit simply allows the placement of equipment and conducting of activities. It does not deal with issues of "property rights" or "exclusivity." Our proposed site was in the middle of commercial fishing grounds and an essential part of our project was the seeding of this bottom. We needed some measure of exclusivity to properly conduct our experiments. In addition, the sea scallop is a species regulated under the Fisheries Conservation and Management Act (FCMA) and for which the New England Fisheries Management Council (NEFMC) has management plans in effect.

The authority of the NEFMC would have been less clear had we intended on raising a species for which they do not have a Fishery Management Plan (FMP).

However, under current legislation, the management councils are the only bodies able to deal with the conflicts associated with the use of federal waters and any impacts aquaculture might have on wild stocks (Brennan, 1995). In spite of the relevancy, aquaculture

National Marine Fisheries Service	Biological & marine mammal issues
U.S. Fish and Wildlife Service	Biological impacts
U.S. Environmental Protection Agency	Water quality (NPDES)
U.S. Coast Guard	Aids to navigation
Department of Defense	Naval activities
Department of State	International Treaties
Department of Interior	Minerals management

Table 2. Agencies consulted in the COE permit process.

is an area of regulation in which neither the NEFMC, nor any of the other seven regional councils, have experience.

We first approached the NEFMC in August 1994. The subsequent two years reveals the inadequacy of the council process for dealing with aquaculture applications. In Table 3, a schedule of events and milestones is revealed, all related to meeting the Council's requirements. The two-year duration of this process is not a measure of opposition to our project. Indeed, all votes on our project have been nearly unanimous in favor of our request. The delay is simply the result of the complex FCMA process combined with the enormous pressures on the Council staff and membership to deal with more pressing fisheries matters.

EEZ User Conflicts

The nature of the Council's role in the future of EEZ aquaculture is the topic of considerable discussion. In an analysis of the Council's responsibilities and

opportunities with respect to EEZ aquaculture, a neutral stance was recommended since the Council would be the arbitrator of the unavoidable debate over user conflicts (Brennan, 1995).

The Westport Scallop Project was viewed favorably by the Council due to its broad industry base and its short-term (18 mo.) duration. The Council members accepted our arguments with respect to the appropriateness of our site selection. The objections that were voiced at Council meetings, committee meetings, and the January 1996 public hearing in Woods Hole we generally dismissed as not-in-my-backyard rhetoric.

Apply to Council for area closure	Aug. 1994
Presentation to full Council	Sept. 1994
Presentation to Scallop Committee	Oct. 1994
Presentation to Interspecies Committee	Nov. 1994
Council vote	Dec. 1994
Submit Amendment 6 Draft	Feb. 1995
Presentation to Aquaculture Committee	June 1995
Council vote on Amendment 6	Dec. 1995
Council public hearing. Woods Hole, Mass.	Jan. 1996
Council vote	Feb. 1996
Industry meeting, Martha's Vineyard, Mass.	April 1996
Industry meeting, New Bedford, Mass.	April 1996
Council vote on site relocation	April 1996
Second public hearing, Wareham, Mass.	May 1996
Presentation to Scallop Committee	May 1994
Council vote on site relocation	June 1996
Estimate Fed. Reg. comments closed	July 1996
Estimated closure of site	Sept. 1996

Table 3. Events associated with the NEFMC aquaculture process.

The best available data on the spatial distribution of commercial fish catch is compiled by NMFS from vessel-landing reports. This information is based on blocks of 10 minute latitude by 10 minute longitude, an area of almost 200 sq. km. The annual landings reported for the block in which our site was located were significantly less catch than the blocks nearby. However, this NMFS data is too coarse to allow identification of local "hot spots." As we came closer to having our site become a reality, specific information was made available to us revealing an inordinate level of trawling through the middle of it.

Our amendment specifically prohibits trawling, gillnetting, and non-project dredging within the site boundaries. This evidence of high trawling effort indicated that our location was not optimal from a minimum-user-conflict standpoint. Therefore, we organized meetings on Martha's Vineyard and in New Bedford to discuss with fishermen how we might adjust the site location to reduce our impact on their operations. From the meetings a consensus evolved for moving our experiment eight kilometers to the west. This new site meets all the requirements of the project regarding depth, temperature and bottom types (see Figure 4).

The move has been approved by the COE, however, the Council and NMFS were concerned that users or concerns over the new site might not have been aired at the original public hearing. A second public hearing was held and, with no objections aired, the Council approval process has resumed, but with a two-month setback.

The lesson learned from this experience is that the current COE and NEFMC aquaculture review processes do not adequately identify commercial fishing user-conflicts. The detailed harvest strategies of commercial fishermen are closely-held "trade secrets." That information is not found in any public data base nor will it be revealed during initial public hearings or comments. Only when a project becomes reality will the specific basis for opposition emerge.

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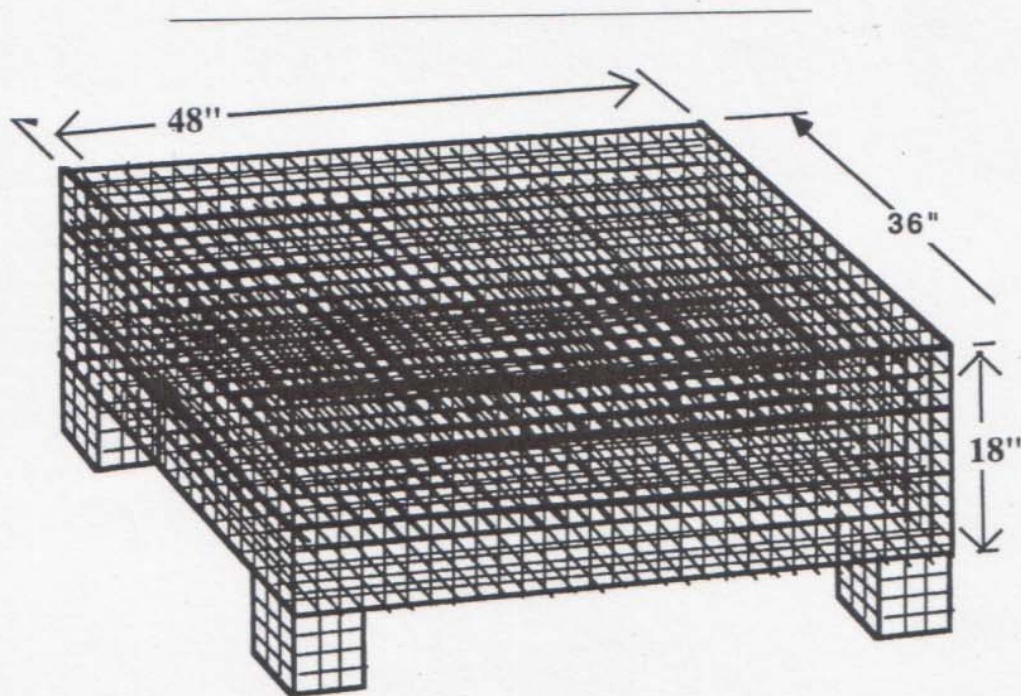


Figure 1. Bottom Cages.

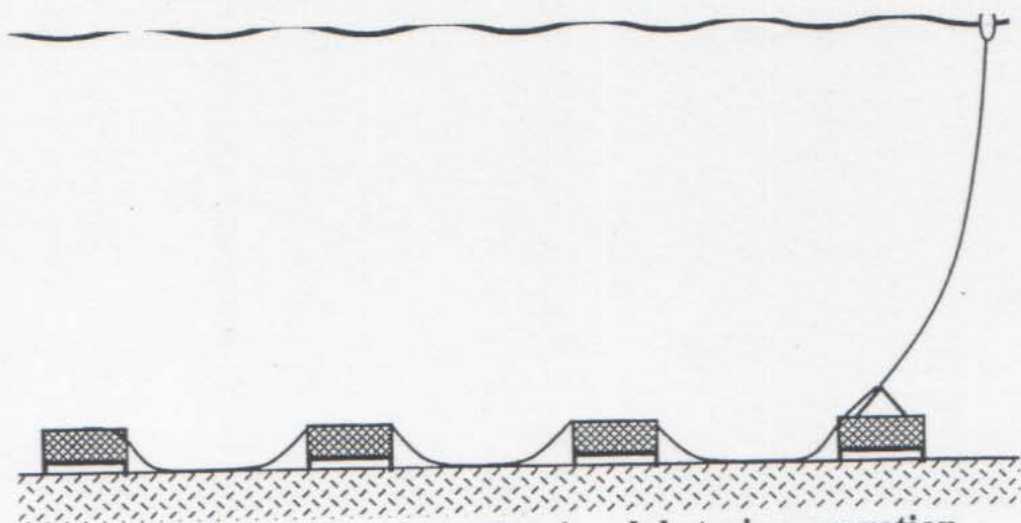


Figure 2. Bottom Cages rigged as in a lobstering operation.

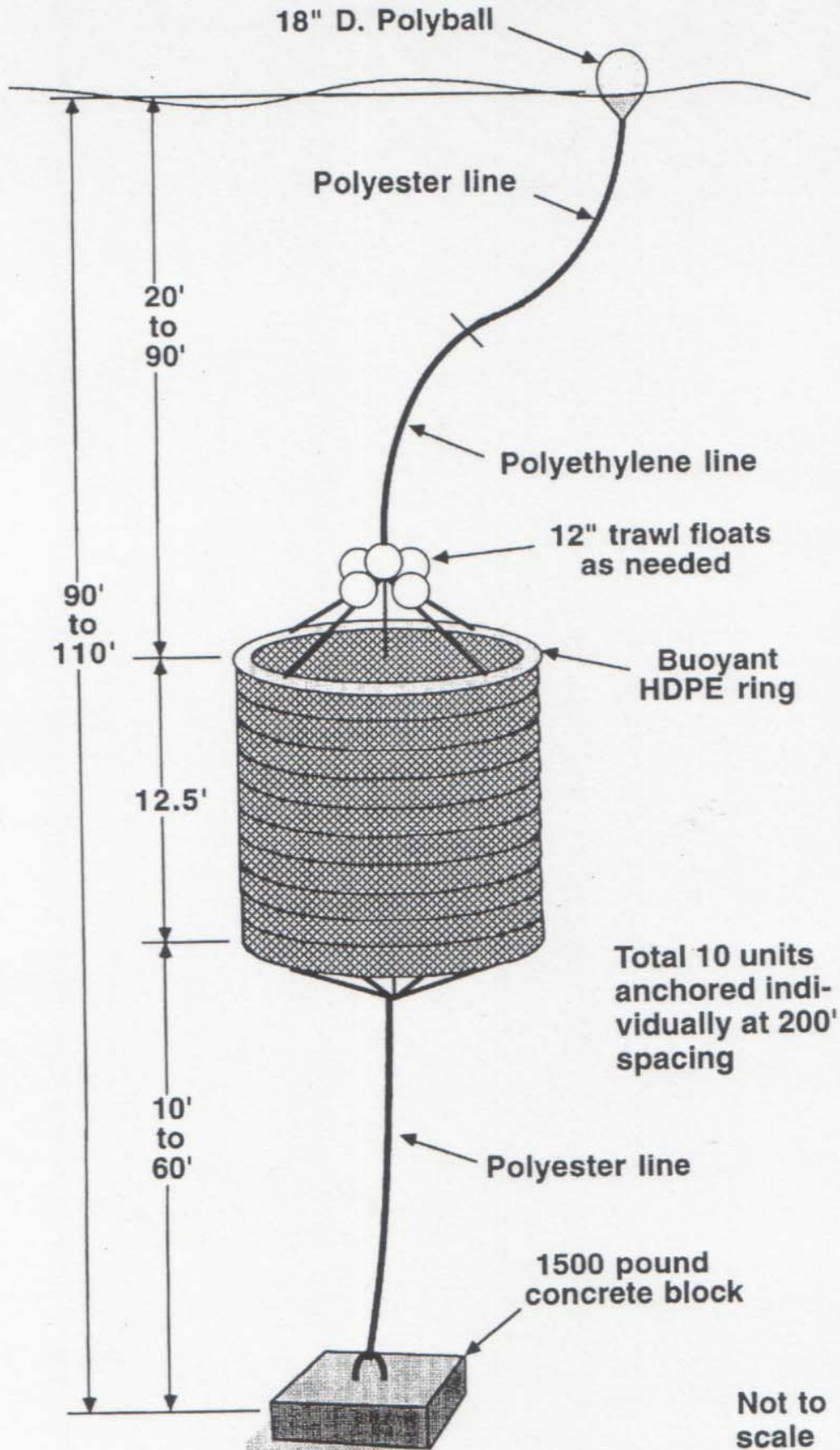


Figure 3. Suspended "super-lantern" grow-out units.

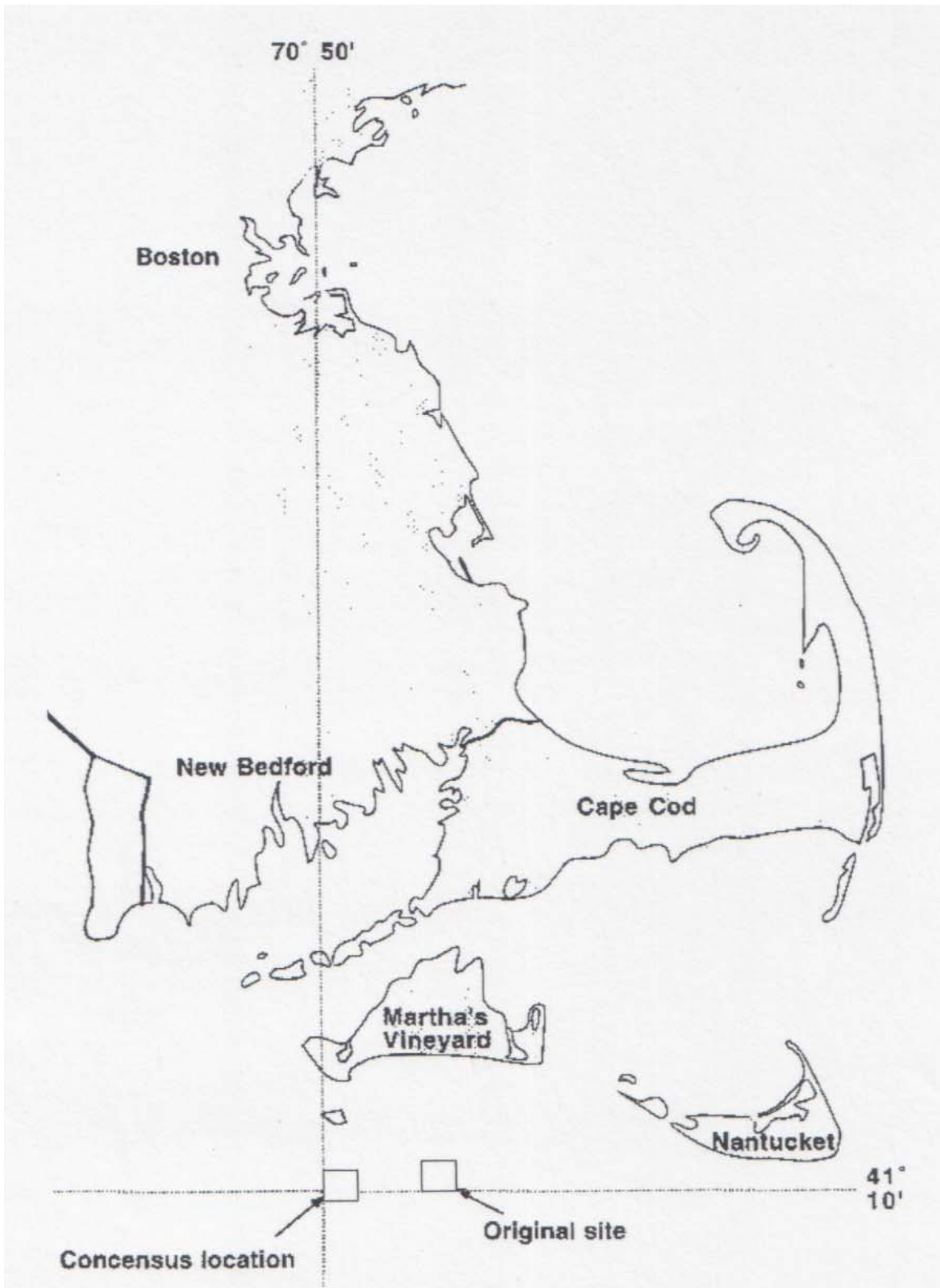


Figure 4. Original and consensus site locations.