

Using Oysters for Nitrogen Filtration in Cape Cod; Water Quality Considerations for Oyster Aquaculture and Reef Restoration Sites

Background

Excess nitrogen and phosphorus coming from anthropogenic sources has been known to compromise watersheds and coastal areas in both agricultural and urban regions of the country. An abundance of these nutrients in the water column promotes rapid algal growth. The resulting algal blooms not only increase turbidity but also create anoxic zones as they decompose at the bottom of the water column. This process of eutrophication can severely disrupt natural coastal ecosystems.

In Barnstable County, population growth has increased nitrogen levels in Cape Cod coastal waters coming from both surface water runoff and groundwater. The Cape Cod Commission is currently exploring alternative technologies to address this problem. Increasing oyster populations through both aquaculture and reef restoration is one proposal that has gained increasing attention because of its potential to be highly cost effective and its many co-benefits.

Oysters from both aquaculture and restored reefs filter nitrogen that has already entered the water column by consuming phytoplankton and other organic particles. The nitrogen is then either incorporated into their shell and tissue or bio-deposited onto the sediment surface. This process of filter feeding improves water clarity and mitigates the main symptom of eutrophication.

Recent studies have documented the potential of oysters to filter nitrogen. The suitability of an area to support oyster populations and the rate of nitrogen filtration is dependent on a number of site specific variables. This project presents Cape Cod specific water quality considerations for determining if an area is suitable for oyster aquaculture or reef restoration.

Sources

- MassGIS Data- Shellfish Suitability Areas (2011)
- MassGIS Data- Designated Shellfish Growing Areas (2013)

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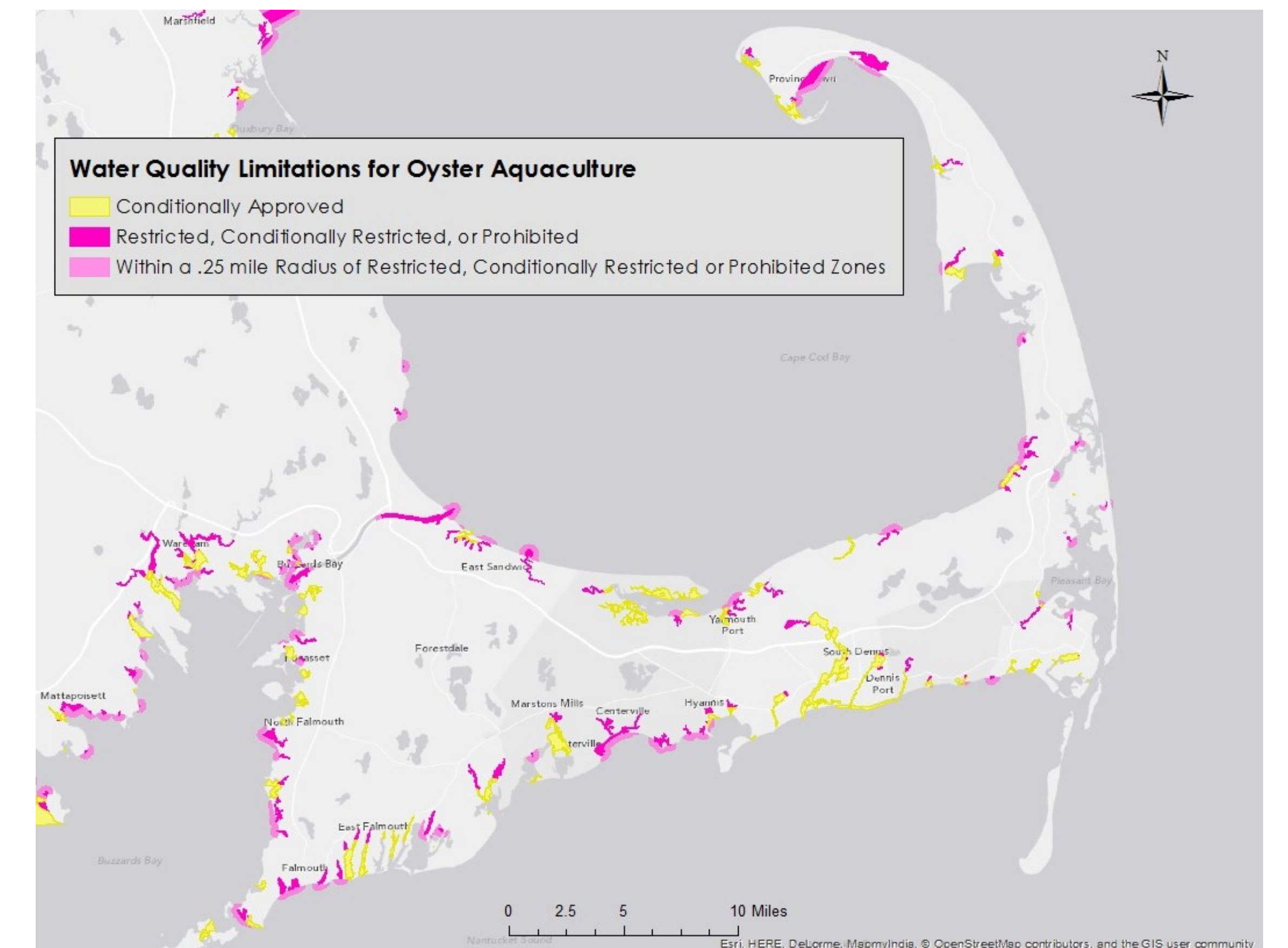
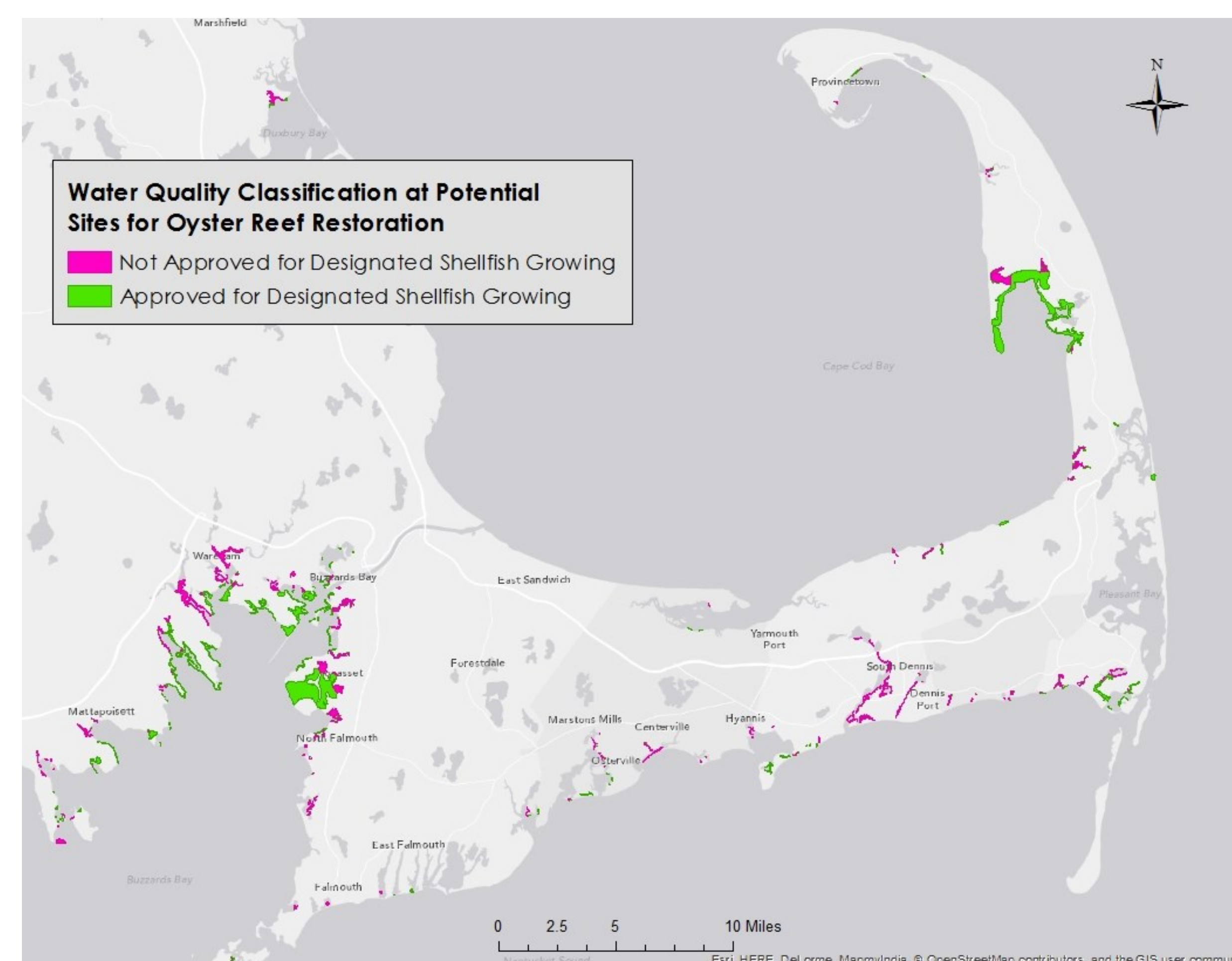


Methodology

For this analysis I used data on the classification of shellfish growing areas to see what limitations water quality will present to aquaculture expansion and reef restoration projects in Cape Cod. Designated shellfish growing areas are classified by the MA Division of Marine Fisheries and range from approved to prohibited based on pathogen levels in given areas that could render oysters unsuitable for human consumption. Reef restoration projects and the expansion of Oyster aquaculture will only be permitted in areas classified as approved.

The first map (located below) shows water quality classifications at potential sites for oyster reef restoration projects. All areas highlighted in green and pink represent sites where there have been known shellfish populations in the last 40 years. These areas were created from a dataset that identifies areas believed to support shellfish populations. These areas do not necessarily represent current locations of wild oyster populations but rather potential habitat areas where environmental variables will likely be conducive to reef restoration. The water classification in these areas is depicted in green for approved and pink for all non-approved classifications. Although oyster growth will not be affected by water quality, if a person were to get sick after consuming oysters from a reef restoration site, the reputation of oyster aquaculture industry in Cape Cod would suffer.

The second map (located to the right) shows the extent to which water quality classifications will limit sites for Aquaculture expansion. Aquaculture permits can be granted only in zones in which water quality has been determined by the DMF and the state Department of Public Health to be clean enough for safe harvesting. The areas in yellow and dark pink do not have the necessary classification of approval to be suitable for an aquaculture grant. The area in light pink represents a quarter mile buffer around restricted, prohibited, and conditionally restricted zones.



Limitations

Additional data is required in determining if an area is suitable for an oyster aquaculture grant or an oyster reef restoration project. To complete a suitability analysis would require data pertaining to regulatory barriers, competing uses of space, and the location of supporting land-based technologies.

Several regulatory considerations could limit the area available for aquaculture. In Massachusetts, private property extends to the low water mark; landowners own the intertidal area. Another important regulatory consideration is aquaculture's potential impact on endangered species or species of special concern.

Many activities take place along the shore of Cape Cod that could conflict with aquaculture and reef restoration. The use of space by tourists, residents, and fishermen should be considered when selecting project locations.

Oyster aquaculture and reef restoration has the potential to be most effective when it is implemented in conjunction with land-based nitrogen control efforts. Reef restoration and aquaculture can help filter nitrogen that has already entered coastal waters, but is not intended to replace technologies that address the source of excess nutrients. Oyster aquaculture and reef restoration should be implemented as part of a broader nutrient management strategy that includes strategies that intercept nitrogen before it enters the estuaries.

Conclusion

Water quality will restrict some estuaries for projects that use oysters as a mechanism for nitrogen filtration on Cape Cod. With the majority of the shoreline classified as approved for shellfish growing, water quality is not expected to be a major factor limiting sites available for aquaculture grants. With significant overlap between areas believed to support shellfish populations and areas that are not approved for shellfish growing, water quality classifications may present a greater barrier for siting potential reef restoration projects.