

Gloucester's Maritime Economy: Opportunities and Challenges

October 2009

- Key Findings
- Overview
- Marine Research
- Marine and Maritime Education
- Marine and Maritime Industries
- Small Technology-based, Professional, and Creative Enterprises

Objectives of the Discussion Paper

- Identify current and emerging segments of the maritime industry with growth prospects for Gloucester.
- Explore the opportunities and challenges involved in developing these industry segments.
- Provide a basis for community discussion about what forms of maritime industry development would be most economically beneficial to Gloucester and most complementary to the existing harbor economy.

Key Findings

- Overview
- Marine Research
- Marine and Maritime Education
- Marine and Maritime Industries
- Small Technology-based, Professional, and Creative Enterprises

Key Findings

- While unlikely to attract a major marine research center on the scale of Woods Hole, Gloucester has a number of assets that make it a desirable location for certain kinds of applied research, particularly those that benefit from the availability of commercial vessels with experienced captains and crew, skilled technical labor, and proximity to the Stellwagen Bank and Gulf of Maine. Particular opportunities exist in areas such as cooperative fisheries research, aquaculture, chemicals and biologics derived from marine organisms, marine robotics and marine renewable energy. Some research centers have expressed interest in relocating or establishing field stations in Gloucester.
- Opportunities to bring more research and educational activities of the multi-campus University of Massachusetts School of Marine Sciences to Gloucester remain largely unexploited. Developing a stronger relationship with UMass could result in its increased use of Gloucester harbor as a location for marine research and education.
- There are a number of short- and long-term opportunities to increase educational programs in Gloucester at the K-12, technical and professional levels.
- Expanding applied research activities in areas such as aquaculture, chemicals and biologics derived from marine organisms, marine robotics, and renewable marine energy will increase the likelihood that firms in these fields will eventually locate in Gloucester.

Key Findings

- Gloucester has the potential to develop a niche in advanced small vessel design involving small-scale production and employment for skilled marine tradesmen.
- Available evidence suggests that there is little prospect for growth in some marine industries, including maritime transportation, frozen fish processing, fish processing technology, and marine equipment. Coastal protection and restoration, while holding the potential for long-term development, does not offer short-term growth prospects.
- Gloucester harbor can be a desirable location for small technology-based, professional, and creative enterprises looking for an attractive working environment at reasonable cost. These businesses could fit within the “supporting use” category under Designated Port Area use regulations. Improving harbor amenities such as high-speed internet access, walkways, a harbor shuttle, and eating places could help to attract these firms.

Key Findings

Overview

Marine Research

Marine and Maritime Education

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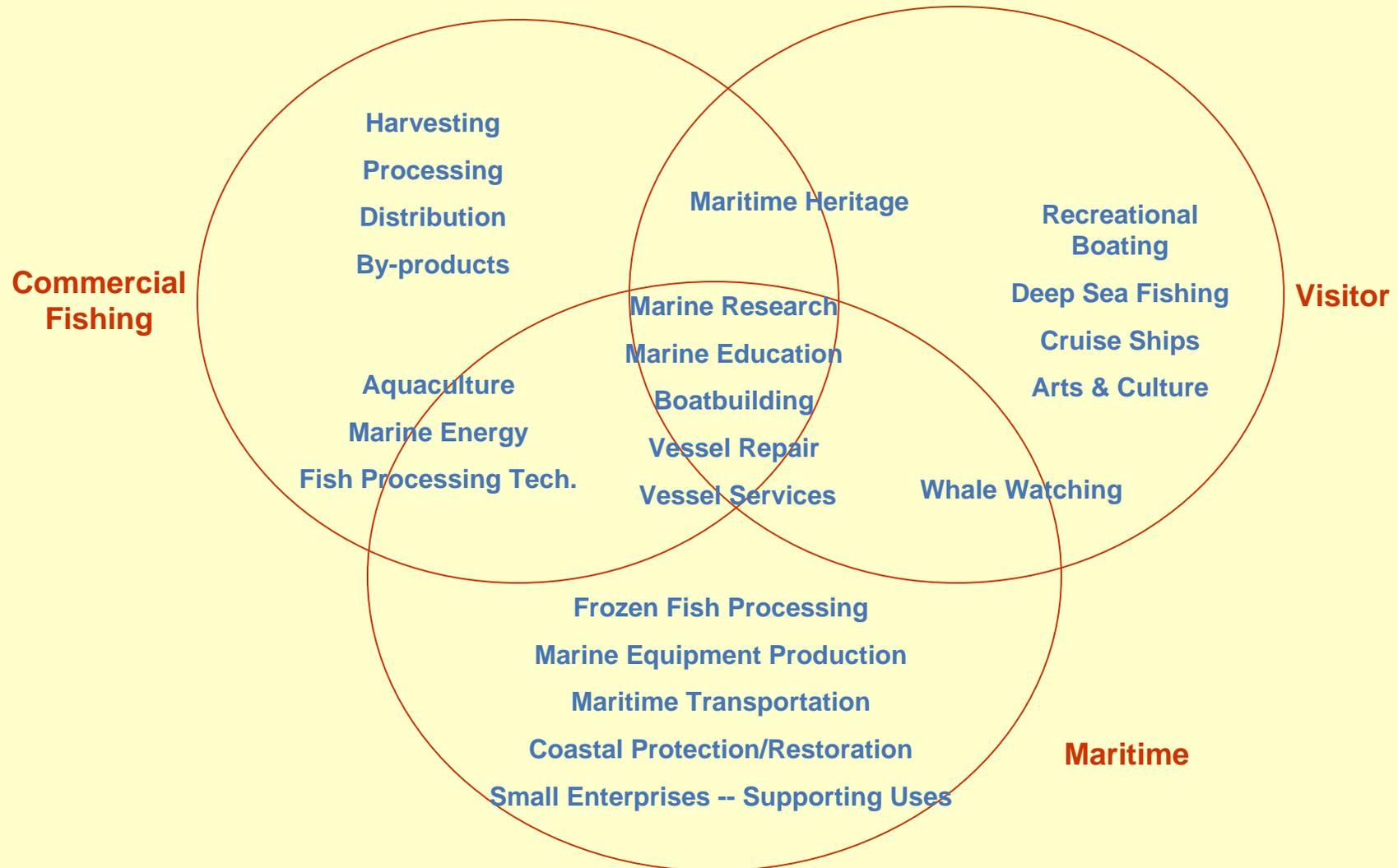
Definition of the Maritime Economy

- For the purposes of this discussion paper, the maritime economy is defined as activities that require water access or are otherwise allowable within the Designated Port Area but do not primarily involve commercial fishing or tourism, which are addressed in other discussion papers. However, some of the activities discussed overlap with and are complementary to these other industries. In particular, some activities may provide supplementary work and income to the commercial fishing industry. (See diagram on following page.)
- The paper divides the marine economy into four segments. The first three involve marine and maritime activities, while the fourth involves activities that may be allowable as DPA supporting uses. The four segments are:
 1. Marine research
 2. Marine and maritime education
 3. Marine industries; and
 4. Small technology-based, professional and creative enterprises

Definition of the Maritime Economy

- This categorization was used because each category represents a distinct “market” for economic development efforts. As efforts to develop the local maritime economy are organized, each of these maritime segments will require different approaches to and tools for development.
- That being said, overlap does exist between these market segments. For example, marine research and marine education are closely related. And the outcomes of marine research can determine the level and nature of some types of marine industry development.

The 3 Legs of the Harbor Economy



Key Findings

Overview

Marine Research

Marine and Maritime Education

Marine and Maritime Industries

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Overview

- Marine research is a large and growing field. It includes:
 - Marine biology — the study of fish, whales and other marine mammals, plants, and other marine organisms, including:
 - Fisheries research to monitor the status of the fisheries and to provide data and develop methods to improve fisheries management.
 - Aquaculture — developing methods for rearing aquatic animals or cultivating aquatic plants for food, diagnostic testing and ornamentals.
 - Monitoring the marine environment to identify impacts on marine life, coastal communities, and global climate.
 - Marine biotechnology — the study of chemicals and biologics derived from marine organisms to develop products including pharmaceuticals, biofuels, and environmental treatments.
 - Marine technology.
 - Developing vessels, instrumentation, and equipment for exploration and monitoring of the marine environment .
 - Developing energy sources from wave and tidal movements.
- While not a major center of marine research, Gloucester hosts a number of marine research organizations.

Overview

- Gloucester has a number of assets that make it a desirable location for marine research, including availability of commercial vessels with experienced captains and crew, skilled technical labor (e.g., welders, electricians, diesel engine mechanics, commercial divers/underwater welders, electronics specialists, and refrigeration specialists), harbor front real estate, and proximity to the Stellwagen Bank and Gulf of Maine.
- While Gloucester is in relatively close proximity to a number of major institutions conducting marine research, it has the disadvantage of not being the home of any such institutions.
- An informal group led by research scientists and technology firm executives Lynn Klotz and Joe Rosa has been working with city and state officials to identify and conduct outreach to marine research institutions with a potential interest in field laboratories in Gloucester.
- As an indication of interest in Gloucester as a location for marine research, the University of Massachusetts' initial exploration of options for reuse of its Gloucester Marine Station has already generated a number of proposals from other marine research and educational institutions.

Overview

- Location of research facilities in Gloucester Harbor generate a number of economic benefits:
 - Creating direct employment
 - Stimulating Investment in harbor properties and infrastructure
 - Use of vessels and marine services
 - Drawing visitors engaged in research and educational activities to Gloucester Harbor
 - Providing additional visitor attractions
 - Increasing the potential of formation of new business enterprises that seek to collaborate with research personnel or commercialize new products developed through research

Whale Research

- Gloucester is becoming a significant center of whale research:
 - The Whale Center of New England conducts field research from its research vessel *Mysticete*, and from public whale watch boats. In addition to being one of the leading research institutions in its field, it develops educational materials, offers internships for college and post-college students, and is involved in conservation efforts involving marine animals and their habitat.
 - The Ocean Alliance, currently based in Lincoln, recently acquired the paint factory buildings for its new headquarters and is conducting a fundraising campaign to complete renovations to the complex. The Alliance studies the behavior of sperm whales, develops methods of acoustic census taking, and is creating a digital database of photo-identified whales to share with cetologists and oceanographers worldwide. It also develops educational programs, including an internship program aboard its research vessel, *Odyssey*, and the CETA program, which trains interns to serve as naturalists on Cape Ann whale watch trips and to do basic whale research.

Fisheries Research

- Gloucester fishermen have occasionally participated in cooperative fisheries research with federally-funded research scientists and could become more involved as funding for cooperative research increases.
 - The National Atmospheric and Oceanographic Administration (NOAA) funds cooperative research between marine research scientists and commercial fishermen to monitor the condition of the fisheries and develop sound methods for fisheries management. Most of the research conducted in the Northeast is through the Northeast Fisheries Science Center based in Woods Hole. Most of the research vessels are based in southeast Massachusetts because of proximity to the Center's laboratories.
 - While funding for cooperative research has been limited, the Magnuson-Stevens Fishery Conservation and Management Reauthorization Act of 2006 mandates expansion of cooperative research projects focused on improving data collection for stock assessments, assessing the amount and types of bycatch or post-release mortality, conservation engineering designed to reduce bycatch, identification and conservation of habitat areas of particular concern, and collecting of socioeconomic data.
 - More cooperative research will help to bridge the gap between researchers and fishermen on fisheries science.
 - Participation by commercial fishermen in cooperative research can supplement income earned through fish harvesting.
- While there are no fisheries research centers based in Gloucester, at least two non-profit research centers have recently expressed interest in relocating to Gloucester.

Aquaculture

- Growing demand for seafood and declining global supplies of many seafood species have led to increasing aquaculture production. This has also led to an increase in aquaculture research, both to develop methods to increase aquaculture production and to ensure that these methods are safe and environmentally sustainable.
- NOAA's Marine Aquaculture Initiative invests in aquaculture research, education, and outreach activities, primarily through its National Sea Grant College Program, in an effort to establish a profitable and sustainable offshore aquaculture industry in the U.S. Through offshore aquaculture, fish are raised in fully enclosed cages stationed below the surface of the water in an open ocean area, away from the fragile coastal environment.
- Massachusetts Institute of Technology's Sea Grant Program operates a finfish hatchery at the Gloucester Maritime Heritage Center. The hatchery is involved in several research projects related to the aquaculture industry. The director of MIT's Sea Grant Program reports that he is planning to invest additional resources to upgrade some of the facility's capabilities. Other hatcheries for ocean aquaculture farms could be housed in a number of waterfront facilities.

Aquaculture

- Salem State College's Northeastern Massachusetts Aquaculture Center (NEMAC) has expressed interest in using the University of Massachusetts's field station at Hodgkins Cove for its aquaculture field research. Hodgkins Cove would provide direct water access to its field sites, specifically an ongoing mussel study. Currently, three mussel set-ups are deployed in the Gloucester-Rockport area.
 - The facility would be used to berth its boat and process samples adjacent to the study sites. It would also be used to monitor the spawning and seeding cycles of natural shellfish populations and monitor water quality at the shellfish beds.
 - NEMAC would undertake outreach efforts with growers, educators, and community leaders. Its long-term goal would be the development of a learning-research center.
 - Its initial needs are for a laboratory building, a mooring site, and a seawater line on the pier to support the maintenance of specimens and allow for basic research projects in portable tanks.
 - While it is currently interested in the Hodgkins Cove site, uncertainty regarding UMass' future plans for the site and the likely significant costs of rebuilding the laboratory building there might lead it to consider an alternative location in Gloucester Harbor.
 - NEMAC is already working with the Conservation Commission on its mussel demonstration project and providing technical assistance on restoring and enhancing tidal flats targeting soft shell clams.

Marine Environmental Research

- Concerns about threats to the marine environment caused by such factors as pollution and global warming have fueled increasing levels of marine environmental research.
- One example of a major marine environmental research project along the New England and eastern Canadian coast is red tide research. Multiple institutions including the University of Massachusetts, Woods Hole Oceanographic Institution, University of Maine, and University of New Hampshire cooperate in this research. A research faculty member at University of Massachusetts has suggested that Gloucester's proximity to the Gulf of Maine could make it a convenient base for research cruises and a potential site for a field laboratory. While some institutions have their own research vessels, they also sometimes hire commercial fishing vessels and crews if the vessels can be properly outfitted.
- Gloucester's proximity to major fisheries could also make it a convenient base for research on the impact of climate change on the marine environment. Areas of focus for this research include the impact of climate change on marine species, the evolution of fish in the marine environment and their genetic adaptability to climate change, impacts of ocean acidification, sustainable exploitation and appropriate management of fish stocks in order to give fish the best chance of adapting to environmental change, and development of advanced ecosystem models and interdisciplinary research to improve the detection, prediction, and forecasting of the response of the marine ecosystem to climate change.

Marine Biotechnology

- Both commercial and institutional marine biotechnology are still very much emerging fields. While a number of Massachusetts research institutions are engaged in marine biotechnology research, the state is not one of the major research centers in this field.
- NOAA, through its National Sea Grant College Program, has been an important source of support for marine biotechnology research, which has led to such developments as new anti-cancer drugs from marine invertebrates and genetically engineered microbes for use in oil spill cleanup. Sea Grant is making significant advances in a diverse range of other biotechnology research including the development of synthetic antifreeze, water-resistant adhesives, and super-absorbent materials from the proteins in various marine organisms, as well as the genetic engineering of marsh plants to create salt-tolerant crops and molecular research targeted at combating shipworms, corrosion and other problems.
- The NOAA Research Office of Ocean Exploration has supported several “bioprospecting” expeditions to search deep-water habitats for marine organisms that may contain bioactive compounds that could be synthesized and manufactured as pharmaceutical products or biomedical research tools. With proximity to the resources-rich Georges Bank, Gloucester can potentially serve as a base for such expeditions and provide field laboratories for analysis of marine microorganisms.

Marine Biotechnology

- One area of marine biotech research that appears to have short-term commercialization potential in Massachusetts is marine biofuels. The biofuels company Plankton Power recently joined with the Regional Technology Development Corp. of Cape Cod in a public-private consortium to build a production facility to produce renewable biofuels from algae. It has submitted a \$20 million proposal to the U.S. Department of Energy that would add to \$4 million in private funding. It is working on identifying local algae that would be best to integrate with algae from the Patagonia region of Argentina.
- The director of MIT's Sea Grant Program is preparing to expand research and education activities in algae energy, and is considering Gloucester as a location for field experiments if resources can be obtained.
- Neptune's Harvest on Commercial Street in the harbor, which already produces organic fertilizers and insect repellants from fish wastes, has expressed an interest in partnering with marine biotechnology researchers to develop new products from marine materials, including pharmaceuticals, fertilizers, and protein supplements.

Marine Research Technology

- Development of technologies for ocean research and exploration include ships, submersibles, new diving technologies, and observation tools that allow examination of the oceans in systematic, scientific, and noninvasive ways. This includes undersea robotics technology.
- While Gloucester has not been a center of the development of technology for marine research, it has an opportunity to become the site of some of the MIT Sea Grant Program's research on autonomous underwater vehicles and communications equipment. The director of the program reports that he is looking for space on the harbor to test vehicles and equipment. His requirements include a pier with 3- to 4-foot water depth at mean low water, ability to access water directly, a small crane, electricity, and approximately 600 square feet of indoor space. He might also need to hire local fishing vessels and crews to conduct some of the research.

Marine-based Renewable Energy

- Marine-based renewable energy includes ocean, tidal, and offshore wind energy.
- According to the recently released national report *Priorities for the Incoming Administration* by the Ocean Research and Advisory Panel, “The ocean represents an immense resource for renewable energy that could revolutionize energy production and job creation in the U.S. If only a small fraction of the tidal, wave, and current energy in the ocean that is directly adjacent to our country were captured, we would substantially reduce our dependence on hydrocarbons, especially foreign oil.” However, they remain largely undeveloped at present.
- The Obama Administration has proposed \$2.4 billion for ocean renewable energy in the 2010 Department of Energy budget.
- In 2005, the Electric Power Research Institute (EPRI) released a series of reports on wave energy potential in the United States, identifying Massachusetts as one of six states with potentially attractive wave power sites. Demonstration wave power projects are being examined for various locations in New England.
- EPRI also released a series of reports identifying sites in the United States and Canada with tidal potential. The Massachusetts coastline was one of five areas identified.

Marine-based Renewable Energy

- The University of New Hampshire Center for Ocean Renewable Energy, founded in January 2008, provides multiple-scale research, technology development, and evaluation, education, and outreach on issues related to ocean renewable energy systems. Gloucester's proximity to this research center, access to the ocean and tidal areas, and its extensive port infrastructure, may make it a desirable base site for demonstration projects. Specially outfitted boats fitted by skilled technicians and manned by trained crewmen are required to install and maintain the energy devices.
- Significant federal and state funding is also being invested in offshore wind energy research. In Massachusetts, the new State Wind Technology Testing Center in Charlestown will test commercial-sized wind turbine blades to help reduce cost, improve technical advancements and speed deployment of the next generation of wind turbine blades into the marketplace. The center received \$25 million in federal stimulus funding in May 2009, supplemented with \$13.2 million in grants and loans from the Massachusetts Renewable Energy Trust. Once finished, the Center will be the first commercial large blade test facility in the nation, allowing for testing of blades longer than 50 meters. More research and development into longer blades will quicken the creation of large-scale offshore wind power facilities. The facility will help to attract companies to design, manufacture, and test their blades in the United States. It will also promote the growth of American companies that are part of the supply chain for wind turbine production.

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- With its maritime history, working harbor, active commercial fishing industry, and access to key sites for marine research, Gloucester has the potential to offer a continuum of educational programs at all points in the spectrum of marine and maritime education.

Existing Activities

- Gloucester Harbor already has a significant cluster of marine educational activities.
 - The Whale Center of New England offers internships for college and post-college students. The Ocean Alliance also plans to offer a number of educational programs.
 - The Maritime Heritage Center's Marine Education Center, which targets elementary and middle-school students, features six digital microscope assemblies, each wired to its own computer terminal, which introduce students to live organisms invisible to the naked eye. The adjoining auditorium provides teaching space.
 - The SEA Initiative, established in 2007, is a multi-year partnership between Gloucester Public Schools, the Gloucester Education Foundation and the Massachusetts Institute of Technology's Edgerton Center. The SEA Initiative pledges to enrich Gloucester schools at every level, from elementary to high school, in STEM curriculum (science, technology, engineering and mathematics). Gloucester students and teachers have access to MIT's Edgerton Center (on MIT's Cambridge campus), which offers a number of hands on learning experiences. Gloucester High School's robotics program is part of this collaboration.

Immediate Opportunities

- There are also some immediate opportunities to expand marine and maritime education programs in Gloucester:
 - Lynn Klotz and Joe Rosa, as part of an effort to attract biotechnology research institutions and companies to Gloucester, have developed a detailed plan for an industry-funded biotechnology education institute providing training at the technician and professional levels.
 - North Shore Community College has proposed the establishment of a Marine Technology Center at the UMass field station at Hodgkin's Cove in partnership with government, business & industry, higher education, public schools and community leaders. The center would:
 - Expand North Shore Community College academic programming (credit and non-credit) in Marine Technology, including Marine Systems, Electrical Machinery, Communication-Navigation, Marine Trades (outboard/inboard motors), and Marine Safety.
 - Partner NSCC faculty and teachers in public schools to develop middle school and high school curriculum in marine science and technical training that will prepare students for local careers.
 - Collaborate with regional community-based GED, ESL, and literacy programs to design and offer short-term workforce training programs.
 - While the plan was submitted specifically in response to solicitations of interest in the field station site, a location in or near Gloucester Harbor may be more desirable because of closer proximity to marine businesses.

Longer-term Opportunities

- There are also some longer-term opportunities for expanding marine educational activities in the harbor :
 - The Schooner Adventure plans to offer educational programming for both elementary and secondary students once restoration of the craft is completed.
 - The UMass School of Marine Sciences is a multi-campus school that includes UMass Lowell. According to discussions with faculty there, some faculty can benefit from waterside field sites to conduct research and education activities. For example, a professor of invertebrate geology expressed an interest in a harbor location to hire vessels to collect field samples and site a field laboratory to analyze samples. Identifying the full range of opportunities for such activities and formulating a strategy to develop and fund facilities that would be useful to a range of researchers would require discussions with senior administrators at UMass. The Dean of the School of Marine Sciences, who would be a key figure in such discussions, is based at UMass Lowell.
 - In the commercial fishing industry, the aging of the commercial fishing workforce and the growing technical and regulatory complexities of the industry has caused some industry representatives to call for the establishment of a commercial fisherman's training program to precede traditional on-the-job training.

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- While boatbuilding is unlikely to be a major business activity, the track record of Phil Bolger and Friends, and the potential applications of its advanced hull designs, provide an opportunity to develop a niche in advanced boat building,
- There are opportunities to develop industries emerging through marine research, including aquaculture and marine renewable energy, in Gloucester Harbor.
- Other industries that have traditionally played a role in the harbor economy or have been suggested as growth prospects, including frozen fish processing, fish processing technology, marine equipment, water transportation, and coastal protection and restoration, do not appear to offer opportunities for growth.

Advanced Boat Building

- Phil Bolger and Friends has established a decades-long reputation for innovative hull design for a variety of craft, both pleasure and commercial.
- The firm's designs offer particular potential to increase fuel efficiency, which will become increasingly important as energy costs continue to rise.
- The Department of the Navy's Ship and Force Architecture Concepts Program has recently shown strong interest in the firm's design of a small-scale patrol craft and is examining a small commercial fishing vessel designed by the firm as a basis for the craft's design.
- Some local fishing industry representatives have expressed skepticism about the adaptability of the design to the operations of commercial fishing vessels, even though its reduced fuel consumption would lead to reduced operational costs. In addition, the design does not conform to current federal regulation, and would require a waiver to test prototype vessels under working conditions.
- Working with the firm to fund, build, and test prototype vessels (both commercial and recreational) could lead to scale-up into commercial production, increasing employment of local skilled tradesmen. Finding a location that would enable visitors to observe the boat building activities would provide an attraction that local tourism representatives cite as sought after by visitors.
- In the short-term, PBF has an understanding with the Gloucester Maritime Heritage Center to use its facility for small-scale prototype development. If initial prototype development demonstrates commercial potential, larger stand-alone facilities would likely be required.

Aquaculture

- The U.S. aquaculture industry has strong growth potential:
 - According to the U.N. Food and Agriculture Organization, aquaculture accounted for 47% of the world's fish food supply in 2006. World aquaculture has grown dramatically in the last 50 years. From production of less than 1 million tons in the early 1950s, production in 2006 was reported to have risen to 51.7 million tons, with a value of \$78.8 billion. Growth rates in North America has been much lower than in most other regions, with average growth of 1.8% per annum between 1995 and 2005.
 - America's aquaculture industry currently meets only 5 to 7% of U.S. demand for seafood. Most of that is catfish. Aquaculture products such as U.S. farmed oysters, clams, mussels, and salmon supply 1.5% of American seafood demand.
 - The U.S. currently imports over 60% of its seafood, resulting in a trade deficit of more than \$7 billion annually (ranking second to oil among natural products being imported).
- Aquaculture in New England is already a significant industry. According to the National Marine Fisheries service, major marine aquaculture species cultivated in New England and their market value in 2007 were oysters, (\$81.5 million); clams, (\$65.8 million); (salmon, \$40.8 million); tilapia (\$34.4 million); striped bass, (\$31.5 million); shrimp, (\$10.0 million); and mussels, (\$4.5 million).

Aquaculture

- The Massachusetts Office of Coastal Zone Management has developed an Aquaculture Strategic Plan for the state. According to the plan:
 - Massachusetts enjoys a competitive advantage for aquaculture in terms of access to fresh and marine waters, excellent port and processing facilities, world-class research institutions, a highly educated workforce, and established markets and distributions links.
 - When sited and managed properly, aquaculture is an environmentally compatible industry that requires consistently high water quality. The success of aquaculture is, in many ways, dependent on enhanced and sustained water quality.
 - Aquaculture offers jobs ranging from the highly technical to the basic and supports numerous spin-off and support industries. The aquaculture industry and the jobs it creates are also sustainable, which means that aquaculture activities, if implemented using good husbandry practices, can be carried on indefinitely. Aquaculture products can also assist in diversifying the fresh fish available to consumers, wholesalers and retail markets.
 - The Commonwealth recognizes the need to support aquaculture in a manner that is compatible with the other existing uses of Massachusetts' waters and uplands. Specifically, diverse needs (such as private property rights, public access, the wild fishery, navigation, and recreation) that aquaculture will compete with must be analyzed and aquaculture must be balanced with other compatible activities.

Aquaculture

- Aquaculture producers in Gloucester could benefit from collaboration with institutions conducting applied aquaculture research in or in close proximity to Gloucester, including the MIT finfish hatchery, Salem State College's Northeastern Massachusetts Aquaculture Center, and the University of New Hampshire's Atlantic Marine Aquaculture Center.
- Gloucester also provides proximity to markets and infrastructure, which are important advantages for the industry.
- Aquaculture can provide supplemental income to the commercial fishing industry. Fishing boats are needed to seed, maintain, and harvest aquaculture stocks. Fishermen could also form cooperatives to operate aquaculture businesses, including processing, packaging, and marketing.

Marine-related Alternative Energy Equipment Production, Generation, and Transmission

- Free Flow Power, which designs, produces, and installs hydrokinetic turbines in tidal environments, is headquartered in Gloucester Harbor just outside of the DPA. While it manufactures turbines elsewhere in Massachusetts under contract with other companies, it has expressed interest in consolidating its manufacturing operations in Gloucester. It would require 100,000 sq. ft. with at least 25 feet of vertical clearance. As it grows, it is also likely to expand its corporate offices. While the manufacturing facility does not require waterfront access, the ability to locate this facility somewhere in Gloucester, in proximity to its management and research functions, is considered strongly desirable by the firm. The recent federal stimulus package, which authorized \$2.3 billion for a 30% tax credit to support new, expanded, or re-equipped domestic manufacturing facilities for advanced energy products, could be a source of funding for this project.
- While the firm is currently focusing on freshwater installations in other areas of the U.S., it is interested in exploring the application of its technology to tidal environments, including along the Massachusetts coast. It would need to conduct feasibility studies to identify suitable locations and would likely require a public funding partner. The successful implementation of such a project could benefit local communities through reduced electricity costs.

Marine-related Alternative Energy Equipment Production, Generation, and Transmission

- In the area of wind energy, the Massachusetts Technology Collaborative, General Electric, and the U.S. Department of Energy have formed an Organizing Group to discuss and create guidelines for an offshore wind collaborative for wind energy development in the waters of the Atlantic off the Northeast coast. The global wind energy market is projected to grow from its current annual size of \$8 billion to \$47 billion in the next 10 years, with a major percentage of this invested in offshore facilities.
- In early 2009, The Massachusetts Renewable Energy Trust commissioned a Port and Support Infrastructure Analysis for Offshore Energy Development. The study will analyze shore and port facilities with a view toward identifying appropriate port facilities, estimating upgrades to make the locations suitable to support offshore energy development and quantifying economic impacts on the port area and surroundings. With its extensive harbor infrastructure, Gloucester may be identified as a suitable site for supporting offshore energy development.
- The recently released draft Massachusetts Ocean Management Plan identifies two provisional sites for commercial-scale wind energy production in coastal waters near Gloucester. One is approximately five miles south of Gloucester and the other is approximately 15 mile north. These areas are considered less technically suitable for wind energy than some sites in southeastern Massachusetts, but could be considered for designation subject to additional research. If these sites are developed for commercial wind energy, Gloucester's full service port would make it a likely base for constructing, operating, and repairing wind energy facilities.

Frozen Fish Processing

- Frozen fish processing is primarily a remnant of the time when processors such as Gorton's obtained most of their fish through the local commercial fishing industry. Currently, the majority of fish processed locally for the frozen fish market are caught in the Pacific and shipped from the west coast.
- While companies such as Gorton's and Good Harbor Fillet state that they are planning to stay in Gloucester, it is unlikely that other firms would locate here unless the harvesting of pollack, tilapia, or other species used in frozen fish production were to increase substantially.
- Both Gorton's and Good Harbor Fillet also report difficulties recruiting a suitable workforce, both professional and production.
- There may be some potential for companies developing niche products used by the frozen fish industry in the production process. A local firm, Proteus Industries developed the NutriLean pre-frying treatment that reduces fat content and increases moisture content of fried food products. It can be applied to chicken, fish, or meat prior to cooking by a spray-on process or as a batter ingredient. The product is used by Good Harbor Fillet. It was developed by a former research scientist at the UMass marine station, who is now a senior executive of the company.

Fish Processing Technology

- While Gloucester's fishing industry spawned the design and manufacture of fish processing equipment in the past, there is little of this activity left in Gloucester today. One company, Pearce Processing Systems, designs and manufactures portion-control cutting, pressing, and conveying equipment. While it is headquartered in Gloucester, its manufacturing operations are based elsewhere.

Marine Equipment Production

- While Gloucester was a location for companies producing equipment for commercial and leisure vessels, very few of these companies remain. One of the few is ITT Flojet, which manufactures marine water pumps primarily for small and medium-sized leisure vessels. Flojet's manager reports that Gloucester has become a difficult location to recruit high-skilled labor for design and engineering work. The plant's sales have declined significantly, and it is planning to move its production facility to Mexico although it will maintain its corporate offices with management and design/engineering functions in Gloucester .

Maritime Transportation

- While there have been recent efforts to develop ferry services in Gloucester (e.g., to Nova Scotia), past efforts have been unsuccessful and future prospects remain uncertain.
 - An effort to establish Gloucester-Shelburne, Nova Scotia international ferry service in the late 1990s and early 2000s ended after several years because of logistical challenges and failure to attract private investment.
 - Daily seasonal ferry service from Boston to Provincetown was launched in 2008 by Boston Harbor Cruises but was discontinued in 2009.
 - The Canadian government is currently planning to create a year-round ferry service from Yarmouth to New England targeting commercial truck traffic. Gloucester is one of four possible sites under consideration, along with Boston, Portland, and Portsmouth. Issues with a Gloucester location include poor highway access, parking concerns, and questions about where a large ferry terminal would be located. Poor proximity to an airport compared to Boston and Portland may also be a disadvantage.
- Commuter ferry service to Boston is unlikely to be initiated because of high subsidy costs, variable weather conditions, and relatively long commuting times. The presence of a competing commuter rail service further reduces the likelihood of Gloucester as a commuter ferry location.

Coastal Protection and Restoration

- Traditional erosion processes along the New England coastline caused by extreme weather conditions are likely to be accelerated by climate change. This will likely require the increased development of engineering and construction services that develop natural and manmade barriers to coastal erosion and flooding.
- The federal government has established a Northeast Region Implementation Team to provide a coordinated partnership among federal, state, and non-governmental agencies to improve coastal estuarine habitats to resist erosion.
- The Army Corps of Engineers, which is chair of the team, indicates that it is not currently looking for harbor sites as staging areas for its dredging and restoration projects.
- In the longer run, as the impacts of climate change become more severe, there is likely to be a greater need for port staging areas for restoration projects, which often use vessels to move earthen materials to protect or restore coastal environments.

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- Gloucester Harbor, with its picturesque views, interesting mix of activities, and proximity to downtown shops and restaurants, can be an attractive location for small entrepreneurial companies. It is likely to be particularly attractive to entrepreneurs who live in or near Gloucester and are looking for a site that appeals not only to themselves, but a staff of knowledge workers.
- Gloucester's quality of life, proximity to the water and relatively low cost can be an important draw for "lifestyle" entrepreneurs.
- While not marine industrial, such businesses can qualify to use some of the space within the Designated Port Area as a supporting use. New opportunities will be created if the supporting use category is increased from the current maximum of 25% to 50% of the total property square footage as recommended in the City's current Harbor Plan that is being reviewed by the state.
- The development of additional amenities such as walkways, a harbor shuttle, and eating places would likely help to attract such companies. Another important issue to address is improving broadband internet service.