Massachusetts Fisheries Recovery Commission
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ECONOMIC IMPACT OF REGULATIONS ON THE MARINE FISHERIES INDUSTRY IN THE STATE OF MASSACHUSETTS

Brett M. Baden, Ph.D.* Marcelo Bianconi, Ph.D.**

June 30, 2006: Marine Fisheries Industry Economic Impact Study for the State of Massachusetts
Ref: Contract on Bid No. 06-41: Marine Fisheries Industry Economic Impact Study

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Any remaining errors and/or shortcomings are our sole responsibility.

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Executive Summary

We study the economic impact of fisheries management on local fishing communities in the State of Massachusetts. We present a description of some recent fisheries management regulation policies, focusing on Amendments 5, 7 and 13. We make extensive econometric analysis of the potential economic effects of Amendments 5, 7 and 13 using data on the gross real sales tax receipts of all cities, towns and localities of the State of Massachusetts. The econometric analysis of gross real sales tax state data shows that Amendment 5 had a negative effect on gross real sales tax receipts for all towns in the fishing industry in the State, Amendment 7 had no statistically significant effects, and Amendment 13 had significant negative effects in the port of Gloucester in the North Shore, among others. In terms of employment effects, the results indicate that Massachusetts' fishing communities have experienced higher rates of unemployment, lost employment in fishing after the passage of Amendment 13, and lost employment in fishing during the 1990s. We supplement the employment effects with additional information using the Geographical Information Systems (GIS). The GIS analysis indicates that fishing employment decreased from 1990 to 2000 in Gloucester, Plymouth, and New Bedford, fishing neighborhoods became more concentrated, and in Gloucester and Plymouth, waterside neighborhoods lost fishing employee residents. Several specific valuations of the economic impact of regulations on fishing localities in terms of gross real sales tax receipts and employment are presented. We use a more abstract economic model to show that reductions in sea space and/or labor input have important economic effects for the behavior of a fishing production unit. The effects work both in terms of possible additional risk taking, and in terms of changes in demands for factor inputs that affect the local economy.

We then include an analysis of travel costs for the port of Gloucester. We find an estimate of the valuation of the consumer surplus for visitors to the port for the years of 2003 and 2004. These results indicate that the cultural value of the working fisheries industry is non-trivial. We analyze results of surveys filled out by participants in the fishing industry, and members of the business community provide some evidence of individuals and businesses perception of the effects of regulations on their activities. Individual participants in the fishing industry perceive a disconnect between federal regulatory activity and the economic environment in which they operate. Surveys of businesses in Gloucester, Plymouth, and New Bedford indicate that changes in the fishing industry are having less and less effect; most of the effects of regulation were felt in the early to mid 1990s. Time trend analysis indicates that there were fewer fish related businesses in Gloucester following the passage of Amendments 5 and 13. Future regulation of the fishing industry should be cognizant of the costs estimated from previous regulatory regimes in this report and should provide a full accounting of the potential consequences of new regulation.

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I. Introduction, History, Context and Institutions

This study focuses on the economic side of fishing industry activity, in particular on the empirical and theoretical effects of regulations imposed on the fishing industry in the last fifteen years or so. We take a fairly general top-to-bottom approach in the sense that we look for measurements of the effects of regulations at a general level of aggregation. The main hypothesis in this study is that the introduction of federal regulations in the fisheries activities of the State of Massachusetts has had an economic impact which may be potentially measured and valued in dollar terms. We have gathered data and information, and have processed and analyzed these data and information using several econometric methods, and other techniques. We believe we provide some measurements that may potentially corroborate the hypothesis that fishing regulations have a negative impact in some fishing localities in the State of Massachusetts.

The coastal towns in the State of Massachusetts have had a long history of fishing economic activity and the fishing industry has been a major component of its coastal landscape.[1] In this study, we present some theory and evidence of the economic effects of federal regulations on the fishing industry in the fishing localities of the State. The scope is broad from the point of view of our use of sales tax data for all cities and towns of the state to determine the potential differentiated effects of regulations in localities where the fishing industry is active versus all others. We then narrow the analysis to some specific localities in the North Shore (Gloucester), South Shore (Plymouth/Marshfield and Boston to a smaller extent) and New Bedford/Fairhaven. We examine employment effects, geographic maps using Geographic Information Systems (GIS) with census tracks, travel costs approaches, and surveys. We also present some theoretical models and simulations of productive units as describing fishing units. The main focus of this study is the economic impact on areas where groundfish is, or was, of great importance. The species in the groundfish category are cod, winter flounder, witch flounder, yellowtail flounder, american plaice, windowpane flounder, haddock, white hake, read and white hake combo, halibut, redfish and pollock. In summary, one of the purposes of this study is to measure the economic impacts of Amendments 5 of 1994, 7 of 1996 and 13 of 2003. The scope of the empirical analysis is based upon sales tax revenues effects, employment, travel costs effects and surveys.

More specifically, we first provide a description of some recent fisheries management regulation policies, focusing on Amendments 5, 7 and 13. Then, we provide some context for our study and some brief comments on the institutional background in the fisheries.

Next, we make some extensive econometric analysis of the potential economic effects of Amendments 5, 7 and 13 using data on the gross real sales tax receipts of all cities, towns and localities of the State of Massachusetts. The analysis starts with a broad sample which includes all cities and towns in the state and narrows to the cities and towns where fishing activity takes place in the state. We then focus of the specific effects in Gloucester, New Bedford/Fairhaven and Plymouth/Marshfield.

[1] See Doeringer, Moss and Terkla (1986) for a comprehensive study.

Next, we look at employment effects. We start with a broad measure of unemployment and comparisons to some fishing localities. We use data from the State of Massachusetts to measure differences in employment levels that can be correlated with the introduction of the regulations of Amendments 5, 7 and 13. The focus here is on Boston, the North Shore, and some areas of the South Shore and Cape Cod.

We supplement the employment effects part of the study with additional information using the Geographical Information Systems (GIS). We start with comparisons by census tracts for 1990 and 2000 and the look at the more disaggregated comparisons using block groups. The focus in this part is on Gloucester, New Bedford and the Plymouth/Marshfield area.

In the following part, we use a more abstract, but simple economic model to give a theoretical flavor of the short and long run effects of economic regulation on the demands for inputs of a fishing production unit. The approach is quantitative since we use simulation techniques to illustrate the effects of regulations under alternative scenarios of risk taking by fishermen.

We then include an analysis of travel costs for the port of Gloucester. We find a significant estimate of the valuation of the consumer surplus for visitors to the port for the years of 2003 and 2004.

Finally, we present results of surveys filled out by participants in the fishing industry and members of the business community in the last few months. Some concluding remarks follow.

I.1. Fisheries Management General Timeline and Description

In this section, we describe the main regulations and managerial instruments applied to the fisheries industry, with special attention to Amendments 5, 7 and 13.

<u>1950 International Commission for the Northwest Atlantic Fisheries treaty</u>

Began regulation of New England Fisheries

- Began through US State Department, with input from the Bureau of Commercial Fisheries; Later the Bureau became the National Marine Fisheries Service (NMFS) under US Department of Commerce
- Effective regulation was on minimum trawl codend (net) mesh size in 1953
- Quotas imposed in the 1960s
- Seasonal closures on Georges Bank in 1970s.

<u>1976 Magnuson Fishery Conservation and Management Act</u>

- established 8 regional fishery management councils, including the New England Fisheries Management Council (NEFMC)

- 1977 Extended territorial fishing waters to 200 miles off shore

Established Quota Management systems for catches

- 1976, 1977 Quotas Imposed

1982 NEFMC Interim Groundfish Plan

- Removed quotas

- Regulation of winter flounder under New England Fisheries Management Council

1986 NEFMC Comprehensive Groundfish Plan

- established biological targets, regulated more species, provided for a technical monitoring group

1996 Sustainable Fisheries Act

All regional fisheries must reduce over-fishing of groundfish and reduce bycatch

The Amendments:

- Amendment 5 – 1994
- Amendment 7 – 1996
- Amendment 13 – 2003

Amendment 5: *Effective May 1, 1994*

Amendment 5 (A5) introduced three multispecies (MS) vessel permits: Limited Access (LA), Hook Gear Only, and Possession Limit Only. In order to qualify for a LA permit, the vessel must demonstrate one of the following: 1) The vessel must have held a Federal MS permit as of 2/21/1991 and said vessel must have landed MS finfish on at least one trip in the year preceding 2/21/1991, or 2) The vessel was unable to fish in the year preceding 2/21/1991 (e.g. being repaired, constructed, or sold) and was issued a Federal MS permit for the following year, or 3) The vessel replaced a vessel that meets either 1 or 2. For vessels obtaining a LA permit they are then categorized further as follows: 1) Individual Days at Sea (DAS), 2) Fleet DAS, 3) Vessels 45ft. or Less, 4) Hook Only LA, 5) Combination, or 6) Gillnet.

DAS Effort Reduction Program: Individual DAS Vessels: DAS allocation is calculated by looking at the vessel's DAS during 1988-1990, eliminating the lowest DAS year and averaging the remaining two years. The vessel may fish its DAS at any time but, must take one 20-day period out of the MS fishery between March 1-May 31, during which the vessel is limited to 500 lbs of regulated species per trip. (In 1994 vessels had to take this 20-day period between May 1-May 31). The DAS allocation is to be reduced by 10% of the baseline DAS (DAS calculated for period between 1988-1990) each year for 5 years, including 1994, so as to reach a 50% reduction in DAS baseline by 1999.

Fleet DAS Vessels: Vessels in this category, after a trip of more than 24 hours, must stay at dock for half the amount of time spent on the last trip. The vessels must take time out

of the MS fisheries in minimum 20-day blocks (i.e. vessel is limited to 500lbs of MS regulated catch per trip in this time period), of which one 20-day block must be taken during March 1-May 31 (during May in 1994)) according to the following schedule: 1994 & 1995, 80 days out; 1996, 128 days out; 1997, 200 days out; 1999, 233 days out. Thus in 1995 vessels have 190 "opportunity days", in 1996, 158 "opportunity days", and by 1999 the vessel will have 88 "opportunity days".

Vessels 45ft. or Less: Are exempted from the effort control program.

Combination Vessels: Vessels used in both Scallop and MS fishing, like Individual DAS vessels, will be subject to the possession limits as described above *and the 10% per year reduction of DAS for the first 5 years of A5.*

Effort Monitoring: Effective September 1, 1994, Individual DAS and Combination vessels must install an electronic vessel tracking system (VTS), while Fleet DAS must use a call-in system until further notice.

Area Closures: *Closed Area II* (Along US/Canada boundary) is closed from February-May in 1995, and from January-June beginning in 1996. *Nantucket Lightship* would be closed until June of 1995.

Regulated Mesh Areas (RMA): Fishing in certain areas (RMA's) requires the use of nets whose mesh size is increased. Certain areas are exempted and vessels using smaller mesh nets are limited to possessing less than 500lbs of catch.

Pair Trawl Ban: Pair Trawling (using two boats to achieve the horizontal spread of the trawl net) is banned for MS fishing.

Reporting: Monthly catch/trip reports are required of all vessels and weekly dealer reports are required for all purchases from federally regulated vessels.

Amendment 7: *Effective July 1, 1996*

Amendment 7 speeds up the schedule for reaching 50% effort reduction of Individual DAS and 88 Fleet DAS, so that these goals are reached by 1997 as opposed to 1999.

Exemptions: A major change implemented by A7 is the inclusion of vessels between 31-45ft, and those previously categorized as LA Hook-Gear and Gillnet vessels, in the DAS effort reduction program. Vessels under 30ft can still be exempted from the effort reduction program but, their possession limit has been reduced to 300lbs of cod, haddock and yellow tail flounder (combined) per trip. (There are several other species included in the regulated MS category).

DAS Reduction: Individual DAS and Combination vessels will have their A5 baseline DAS reduced by 35% (allocation will be prorated in 1996 since regulations were

implemented 2 months into fishing year) and in 1997 the allocation will be 50% of A5 baseline. Fleet DAS vessels are limited to 116 DAS, but restrictions regarding "days out" are relaxed to allow more flexibility in planning trips. In 1997 the Fleet DAS will be reduced by 51 DAS more, so as to reach the 88 DAS desired. Vessels in the Individual DAS and Fleet DAS categories, who agree to use large mesh nets will be allocated 12% DAS more than the vessel would have received if had fished in the regular Individual or Fleet DAS category.

Notification: VTS notification is suspended until further notice but, call-in notification is required.

Area Closures: There are three new seasonally closed areas under A7. One off the coast of Maine and two off of Massachusetts shores. Pre-existing year round closed areas from A5 (Closed Areas 1 & 2, and Nantucket Lightship) remain closed.

Spawning Season Restriction: Vessels under 30ft and Open Access Hand Gear vessels must take 20-days out in March. The 20-days out requirement between March 1-May 31 for all other LA vessels remains in effect

Possession Limits: Open Access (OA) Handgear (new category H permit) vessels are limited to possessing no more than 300lbs, combined weight of cod, haddock, and yellowtail flounder per trip. OA Scallop (new categories J permit) vessels are limited to possessing no more than 300lbs of regulated species per trip, respectively. The current haddock trip possession limit was increased to 1000lbs.

Amendment 13: *Effective May 1, 2004* (unless otherwise noted)

Overview: Amendment 13 (A13) calls for a host of changes which effect permit categories, Days at Sea (DAS), trip and possession limits, gear, protocol for fishing in the US/Canada Management Area, Total Allowable Catch (TAC), Special Access Programs (SAP), electronic dealer reporting, as well as changes in year round closure areas.

Permit Categories: Under A13 DAS permits are no longer issued to fleets, based on fleet averages, but are assigned to each individual vessel based on that vessels fishing history.

Handgear permits (which fell into one category, H) are now listed in separate categories HA and HB for limited access and open access, respectively. Different reduced possession limits were placed on both categories.

DAS Reduction: Category A DAS allow fishing on any regulated species (restricted by general area closures). Category B DAS may be used only to fish approved SAP's subject to the requirements of the SAP's as listed below. Category C DAS are for the time being reserved. DAS baselines are calculated using the vessels maximum DAS used in any one

fishing year between May 1, 1996 and April 30, 2002. The following changes are implemented by A13, broken down by implementation date and category of DAS:

Effective May 1, 2004:
Cat A DAS= %60 of DAS Baseline
Cat B DAS= %40 of DAS Baseline
%20 of which are Regular and,
%20 of which are Reserve.
Effective May 1, 2006
Cat A DAS= %55 of DAS Baseline
Cat B DAS= %45 of DAS Baseline
%22.5 of which are Regular and,
%22.5 of which are Reserve.
Effective May 1, 2009
Cat A DAS= %45 of DAS Baseline
Cat B DAS= %55 of DAS Baseline
%27.5 of which are Regular and,
%27.5 of which are Reserve.

Category C DAS (which are reserved, i.e. cannot be used until further notice) as the difference between A13 DAS baseline and the vessel's baseline calculated as of May 1, 2001 (Amendment 7 DAS allocation).

Beginning May 1, 2006 each DAS reported while fishing in the *Southern New England (SNE)* or *Mid-Atlantic Regulated Mesh Areas (MA RMA)* will be charged as 1.5 DAS to the vessel's DAS allowance.

DAS Carry-overs: DAS may be carried over from year to year in the following manner: For 2003 to 2004, 2003 DAS from all categories will be added to a vessel's Category B Regular DAS. For all subsequent years DAS will be transferred over starting with Cat A, then Cat B regular, and finally Cat B reserve to the respective category of the following year, up to a total of 10 DAS.

DAS Leasing and Transfers**:** A13 calls for a leasing program that allows vessels to lease their Cat A DAS to other vessels of similar size (up to the number of DAS of the receiving vessel's 2001 DAS allowance). No subleasing is allowed and further measures are described for monkfishing DAS.

Permanent transfers of DAS from one vessel to another vessel of comparable size are permitted provided that the transferor permanently relinquishes all federal and state fishing permits, and Category A & B DAS transferred are reduced by %40 and a %90 reduction is imposed on Category C DAS.

Measures Based on US/Canada Resource Sharing Understanding: Additional regulation for fishing areas in George's Bank include gear restrictions, total allowable catch (TAC) limits, Vessel Monitoring Systems, and catch reporting.

Special Access Programs: "A SAP is a narrowly defined fishery that allows fishing for NE multispecies stocks or nonmultispecies stocks that, in the absence of such authorization, would not be allowed. The purpose of this program is to allow increased access to fish stocks that can withstand additional harvesting without jeopardizing conservation objectives of such stocks or other multispecies stocks. Amendment 13 implements two SAPs, the CA II Yellowtail Flounder SAP and the SNE/MA Winter Flounder SAP." (Amendment 13 Small Entity Compliance Guide, p18)

EFH Habitat Closure Areas: A13 designates seven habitat closure areas (areas where certain ground trawling gear cannot be used). Many of the areas overlap or extend already existing closed areas.

Electronic Dealer Reporting: All federally permitted dealers are required to submit electronic reports on all fish bought from vessels. These reports will replace trip-level reports and landing summaries currently submitted via the Interactive Voice Response system for quota-monitored species.[2]

I.2. Context

In this section, we present some discussion of how regulations might, and are perceived to affect a natural resource fishing area, its fisheries and fishing communities.[3] This section also discusses some of the theoretical literature relevant to this issue. However, the focus of this section is to explain in easily understandable terms how fisheries regulation may affect local economies.[4]

The State government may have an important and useful role to play in the management process of fisheries because it has closer connection and access with the fishermen. This connection allows state authorities to catalyze on the folk knowledge of the individuals on the field, see for example the related discussion of Dyer and McGoodwin (1994). The Federal government seems more detached from this exchange of ideas and knowledge, and can be perceived by local fishermen as an extraneous bureaucratic authority. In the Proceedings of a Conference on Fisheries Management in the US: Managing Our Nation's Fisheries II (2005), no research is presented on the economic impact of the management policies on local fishing communities. Also no specific fisherman's voice is heard or documented, see also Sanchirico and Hanna (2004), Newell, Richard, and James

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[2] Note: These summaries are based on the Permit Holder Letters for Amendments 5 and 7, and the Small Entity Compliance Guide for Amendment 13, issued by the Northeast Region National Marine Fisheries Service. The Permit Holder Letters can be obtained by requesting them from the Fisheries Service and the S.E.C.G. for Amendment 13 can be found on-line at: http://www.nero.noaa.gov/amend13/phl/amend13.pdf

[3] Most of this section has been compiled from notes and comments of meetings, interviews and discussions between the authors and members of the fisheries establishment in the State of Massachusetts.

[4] Extensive literature reviews abound. For example see Copes (1986), Crean and Symes, eds, (1996), Falque et al (2002), among others.

Sanchirico (2003) and Crestin (2000). There seems to be a gap between management authorities and the fishermen on the field, this provides a useful role for the State government to close this gap.

The State is also more responsive to the different demands of participants in the fisheries industry. Commercial fishermen, pleasure boat owners, charter boats, etc all have a say in the marine fisheries state related activities. Regulation can easily raise the level of competition among market participants and the State can hear all sides and have better information to impose rules and regulation that minimize the conflicts among competing interests. It is important to recognize the circular effect of the regulatory environment, which is that diversification to charter boats or leisure occurs to some extent due to the regulations, and that increases the competition with the remaining commercial fleet, making it more likely that all compete for scarce fishing areas.

One important issue would be to check the predictive power of economic impact analysis made prior to the implementation of a regulation and the subsequent outcomes that followed. For example, in the Amendment 13 Economic Impact analysis[5], the economic impact was predicted to be small. We use sales tax data and employment data to verify whether or not this was a reliable prediction for fishing towns and communities in the State of Massachusetts. In terms of future predictive content, the current Framework 42 and Emergency Action, and others, predict a negative impact in the towns and communities where the groundfish industry is active. [6] Our analysis sheds light on possible future impacts of such measures in terms of sales tax revenues and employment in the State.

Regulatory activity may have other effects as well. There is the perception that federal regulatory activity sets biomass targets at very high levels, making it hard to achieve in a plausible time horizon. Whenever a target is close to be reached, the evidence seems to point to further restrictions, making "smoothing" hard to achieve: The capacity for individuals to plan their business activities for a plausible time horizon.[7] The federal mandated rules seem to put smaller fleets at higher risk, and to favor the bigger fleets. For example, lowering of days at sea, or area closures tend to decrease the volume and raise prices making it more difficult for smaller market participants to cope with these kinds of fluctuations.[8] Regulatory constraints spanning from Amendments 5, 7 and 13 have

[5] Northeast Multispecies Draft Amendment 13, July 1, 2003.

[6] Some of the predicted impacts are on the negative 30% range for towns like Gloucester and New Bedford. See e.g. Draft Multispecies Framework 42 And Monkfish Framework 3 Measures and Summary of Impacts, February 1, 2006; FRAMEWORK ADJUSTMENT 43 to the Northeast Multispecies (Groundfish) Fishery Management Plan (FMP), Prepared by the New England Fishery Management Council in consultation with National Marine Fisheries Service Atlantic States Marine Fisheries Commission Mid-Atlantic Fishery Management Council, February 23, 2006.

[7] We discuss the "smoothing" argument in section V.2 below.

[8] For a reference of these effects in the Pacific Halibut fishing industry, see Casey et al (1995); Love et al (1995).

contributed to the downsizing of the fleet, and the policy of no new permits being issued have considerably raised the price of existing permits, possibly favoring large capital ventures. The regulations can also lead to discarding of fish that would otherwise have a significant market value and would make volume in the marketplace.

The Days at Sea (DAS) leasing pilot program is an important example of the economic problems that arise from the incentives to circumvent regulations. One main hypothesis is that, leasing may increase the use of latent days, thus decreasing stocks and increasing mortality. However, DAS may help cooperation at the community level, since individuals interact more with each other in order to know about available opportunities, allowing the benefits of more networking and added social capital.[9]

Regulatory constraints have important economic impact on the infrastructure of the fishing industry and on the mix of local, domestic and foreign product on the marketplace. Federal regulations may constrain the domestic fleet to an extent that it cannot handle the domestic demand for the product. This creates a vacuum that can easily be filled by foreign producers. The ultimate effect is that the local coastal economy changes considerably, usually through the process of "gentrification" and the fishing ports could eventually disappear, to be replaced by residential and commercial activity related to tourism.

Safety and risk taking are also important elements to be considered in fisheries management policy. Rules and regulations change the behavior of market participants in ways that counteract the intended objective of the rules and regulation imposed. Moral hazard, adverse selection and other conflicts abound in the process of fisheries management. The possibility that a rule may lead to more risk taking on the part of fishermen, in an activity that is already risky, should be properly evaluated and one should be skeptical in cases the rule has this property. In section V, we examine here a simple production function theoretical model with risk to illustrate some of those effects.

In summary, regulatory activity in the fisheries may have several other important economic and social effects, besides the usual intended effects on fish mortality and effort.

I.3 Perspectives from Fishing Communities

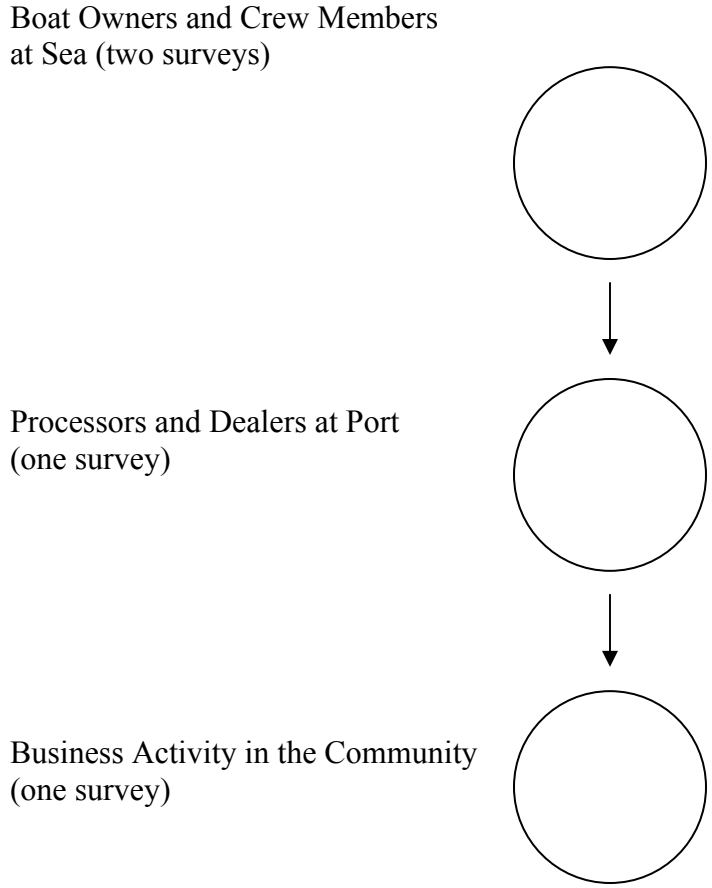
In order to further develop context for the analyses to follow, several informal surveys were distributed to elicit opinions on the state of the fishing industry and the effects of fisheries regulations on local communities. Several types of stakeholders were approached: boat owners & crews, fish processors & dealers, and businesses in fishing communities.

Survey data provides valuable information about how stakeholders in the fishing industry have perceived changes and how they view regulation. Extensive survey data, however,

[9] Social and other forms of networking capital is an important component of Natural Resource communities and regions described in Hall-Arber (2003).

are costly and time-consuming to obtain. The survey results included in this section are from a limited and informal sample, they provide some qualitative information which should be considered in conjunction with the quantitative analyses provided in this report.[10] A more extensive discussion of the surveys and the actual surveys used are available in the Appendix. The surveys were written and designed to capture the stages at which the fishing activity evolves, as shown in Figure 1.1. Boat owners, crew members, Port dealers and processors, and local businesses were approached to provide information. Response rates were low; the most effective collection of surveys from boat owners occurred at a Massachusetts Fisheries Recovery Commission meeting. The primary reason for low response rates was the timing of the study and the shortness of the study period. Business survey response rates were moderate.

Figure 1.1: Surveys and Economic Activity



[10] An important caveat of the surveys presented here is that, given costs and other limitations, they are not rigorous in terms of socio-economical, sociological and anthropological content.

I.3.1 Boat Owners Survey

Surveys were distributed to several boat owners; four were completed (three from Gloucester and one from Provincetown). The results are as follows:

- Fishing has traditionally been an inter-generational profession. This pattern, however, seems to be rare in the current generation
- Regulations such as area closures have changed the behavior of boat owners in a significant manner
    - * boat owners go to other more distant areas to fish
    - * boat owners buy less and cheaper gear and postpone purchases of new equipment
    - * boat owners take on less crew
    - * boat owners fish for alternative species, such as scallops when groundfishing is closed.
- Boat owners find auctions to be useful in providing price information and feel that they are treated well by the auctions
- Boat owners report that most of them have at one time required help at sea or help returning to port; they also report that most boats have proper safety equipment
- Boat owners report that the biggest changes they have experienced in both the last 1 and 5 years are changes in reliance on credit and a change in the role and reliance of family members
- Boat owners perceive regulations to be their most substantial hindrance in making a living.
- Boat owners believe that they have little input into the regulatory process and that enforcement of regulations in unfair and overly harsh.
- Mesh size restrictions were viewed as the best regulatory restrictions

In sum, boat owners have found that they have had to adapt to changes in regulations through changing their operation and trade patterns. The closures issue is an important element in fisheries management policy. There is the perception and real constraint imposed by closures that make it restrictive for fishermen to operate smoothly and to make medium to long term business plans. All respondents indicated some feeling of disenfranchisement regarding the process of regulatory development. All respondents were unanimous in stating that mesh size regulation is the most effective fisheries management tool. The Gloucester respondents were unanimous in pointing to the benefits of the auction as a price stabilizer and reliable dealer that recognizes quality; our estimate is that the Gloucester auction takes 80 to 90% of the volume in the area. The auction indeed reduces transactions costs and spreads information more efficiently.

I.3.2 Processors and Dealers Survey

Although many surveys were distributed, only one survey was completed and returned. This survey provides some insight into the issues and attitudes faced by dealers and processors (detailed results are available in the appendix). Overall the single dealer survey can be used best for anecdotal information. The dealer survey does provide an

overall view that is similar to the boat owners' perception, which is probably prevalent throughout the industry. It is signified in these surveys that they believe the problem is not over-fishing, but poor fishery management.

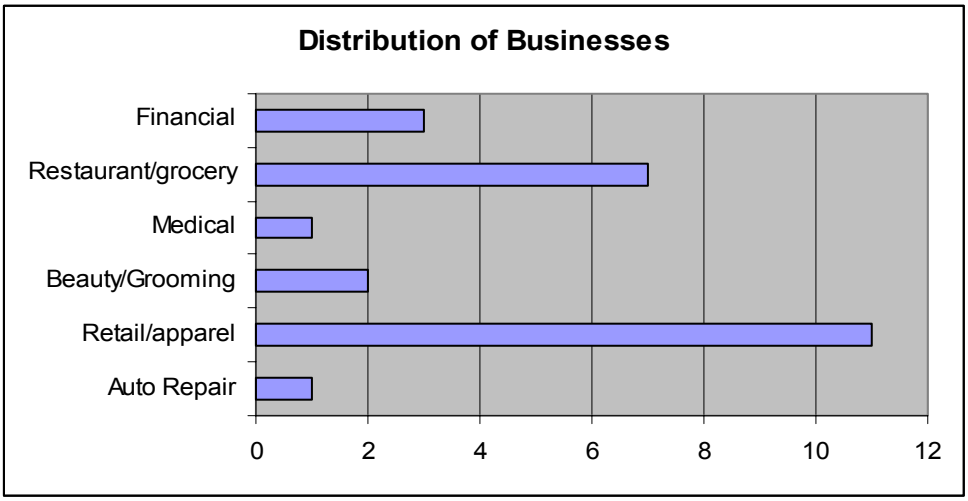
I.3.3 Business Surveys

Surveys were administered to businesses in the vicinity of the ports in Gloucester, New Bedford, and Plymouth. 45 survey responses were collected: 24 in Gloucester, 6 in New Bedford, and 15 in Plymouth. These surveys asked primarily about effects from regulations in the last five years. While these surveys were informal and do not conform to survey criteria for valuation studies, these surveys do provide some useful information about the fishing communities in Massachusetts. These survey results provide useful contextual information for the analyses that follow in subsequent chapters which will focus on these towns in greater depth and detail.

Gloucester: 24 surveys

1. What type of business do you currently operate?:

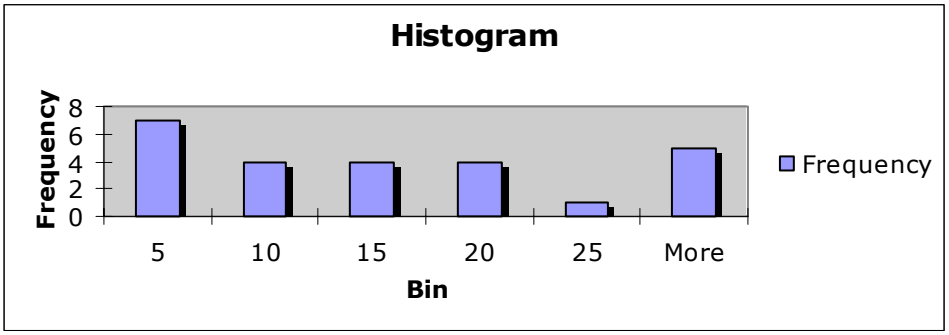
Figure 1.2



Most business surveyed were retail/apparel and restaurant/grocery.

2. How long have you been in business?:

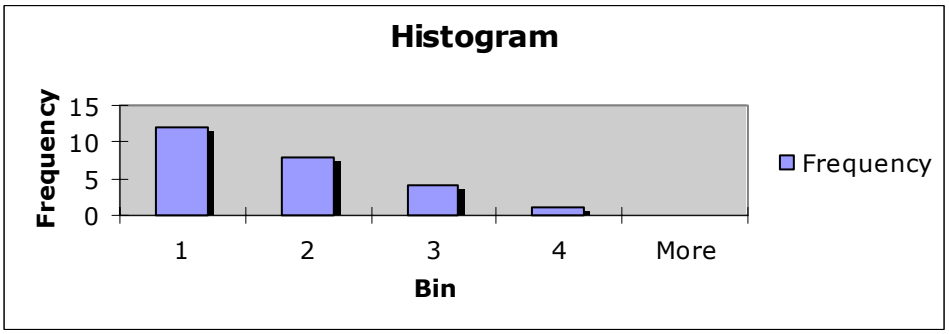
Figure 1.3



The distribution is mostly uniform with the exception of the 25 year range.

3. How many people does your business employ?:

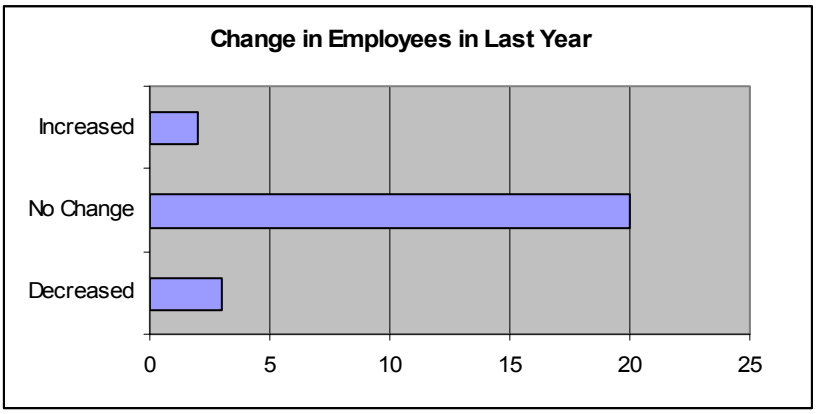
Figure 1.4



Mostly small business.

4. Has the number of employees changed during the ***past one year****?*

Figure 1.5



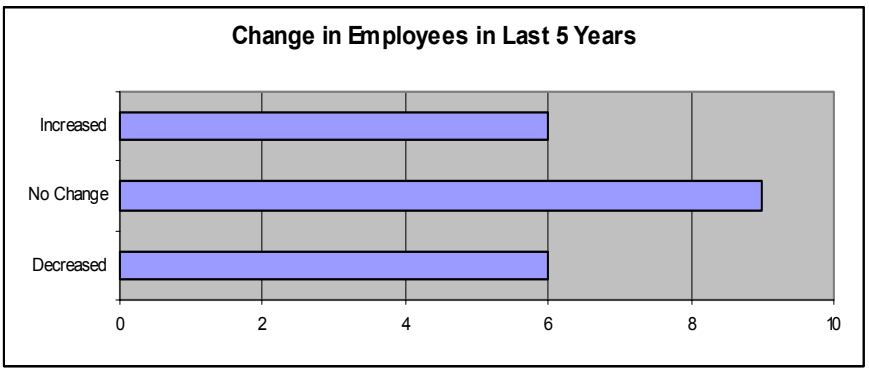
Almost no change in the last year.

4a. Do you feel your answer to 4. is related to the Fishing industry in your community?

Only one answered yes in this case. Most respondents mentioned that changes in the fishing industry had a large effect in the early 1990's and afterwards the effects were marginal. This lends support to the hypothesis that the sequential regulatory constraints have second order effects, however the magnitudes of the second order effects will be subject of further measurements.

*5. Has the number of employees changed during the **past five years?**:*

Figure 1.6



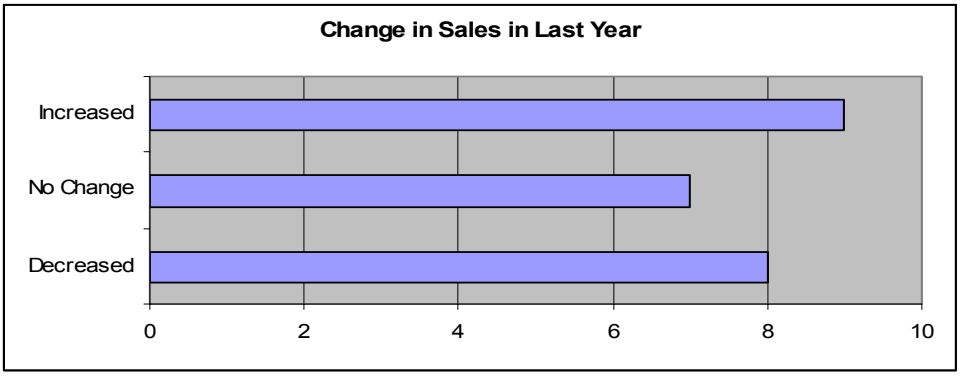
There is more evidence that change has been evenly distributed.

5a. Do you feel your answer to 5. is related to the Fishing industry in your community?

Only two responded yes, see 4a above for reference.

*6. How have your sales changed during the **past one year**?*

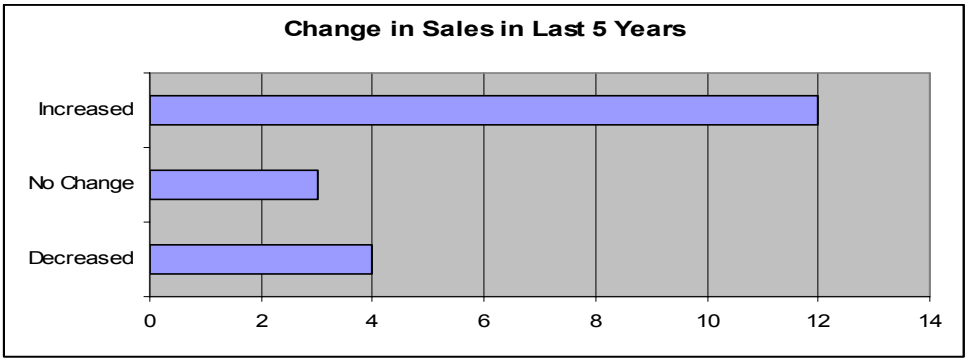
Figure 1.7



Uniformly distributed over the range.

*7. How have your sales changed during the **past five years**?*

Figure 1.8



Majority reported an increase in the past five years.

In sum, the results of the survey of businesses in Gloucester was as expected; changes in the fishing industry are having less and less effect; most of the effects of regulation were felt in the early to mid 1990s. Very little of the fishing industry changes were reflected in business activities and changes in business activity in the last five years.

An additional analysis was performed for Gloucester using data on listed businesses. Since no yearly registry of businesses was available, Yellow Page directory advertisements of businesses in fish related goods and services provision were compiled as an indication of the number of fishery related businesses. The Yellow Page directory was consistent (same company) throughout the period and the categories remained consistent as well. Categories included fish packers, fish nets, fish brokers, retail fish sellers, wholesale fish sellers, fishing supplies, bait, and tackle dealers.

The 14 years of data allow a simple regression to measure if there were any significant trends in the number of fish related businesses from 1993 through 2006. The simple regression in Table 1.1 also controls for the entry of new businesses.

Table 1.1: Listed Business Simple Regression

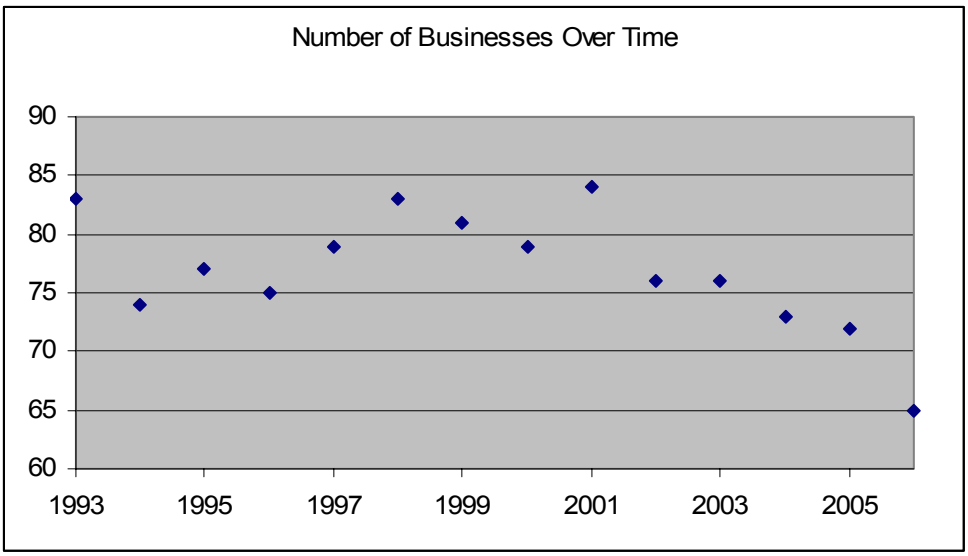
Source	SS	df	MS		
				Number of obs =	14
				F(4, 9) =	4.87
Model	235.960786	4	58.9901965	Prob > F =	0.0228
Residual	108.967785	9	12.1075317	R-squared =	0.6841
				Adj R-squared =	0.5437
Total	344.928571	13	26.532967	Root MSE =	3.4796

num_tot	Coef.	Std. Err.	t	P>|t|	[95% Conf.	Interval]
a5	-9.396644	4.655284	-2.02	0.074	-19.92763	1.13434
a7	3.071812	2.804609	1.10	0.302	-3.272655	9.416279
a13	-7.834228	2.678644	-2.92	0.017	-13.89374	-1.774714
num_new	.3161074	.3122664	1.01	0.338	-.3902884	1.022503
_cons	83	3.479588	23.85	0.000	75.12863	90.87137

The variable a5 indicates a separate trend associated with the period after Amendment 5 was instituted that is separate and below the average trend. The variable a13 indicates a separate trend which is below the average following the passage of Amendment 13. The years following Amendment 7 appear to have no effect on this trend.

These data are displayed in the following chart. The period following implementation of Amendment 5 in 1994 is associated with fewer fish related businesses as is the number of businesses after the passage of Amendment 13 in 2004.

Figure 1.9



These results should not be interpreted for more than they are. This is a regression with only 14 observations and simply measures trends in the number of businesses over time. While other factors could have led to changes in the number of businesses, the different time trends suggest that there may have been an effect of regulations on the number of fish related businesses in Gloucester.

New Bedford**:** 6 surveys

Due to the small number of surveys completed for New Bedford, the results are discussed briefly here. Most business surveyed were retail/apparel and restaurant/grocery that had been in business 2 to 4 years, with 1 business older than 10 years. The majority of businesses reported an increase in business in both the past year and the past five years.

Plymouth**:** 15 surveys

Due to the small number of surveys completed for Plymouth, the results are discussed briefly here. Most business surveyed were retail/apparel and restaurant/grocery that had been in business 5 to 10 years, with 1 business in operation for each of 15 and 20 years, 2 for 30 years, and 1 for longer. Most businesses had an increase in fishing activity in the last year, though several saw no change and a few saw a decline. Similar to the findings

for the last year, the majority reported an increase in the past five years, though this pattern is consistent with the one year results.

In sum, the results of the survey of businesses in Gloucester, Plymouth, and New Bedford yielded expected results. Changes in the fishing industry are having less and less effect; most of the effects of regulation were felt in the early to mid 1990s. Time trend analysis indicates that there were fewer fish related businesses in Gloucester following the passage of Amendments 5 and 13. Very little of the fishing industry changes were reflected in business activities and changes in business activity in the last five years.

These results are consistent with the theory that most businesses responded to changes in regulation from Amendment 5 in the early to mid 1990s. By 2000, most fishing industry related businesses in these port communities had adapted and diversified or were no longer in business. While the survey results indicate little effect, the difficulty of such surveys is that they can only elicit comments from surviving businesses and are unable to assess impact on businesses that are no longer active.

I.4. Institutional Analysis

Part of economic analysis is the prediction of effects based on incentives and institutions. For the fishing industry, this involves discussing what effects regulatory constraints are likely to have upon the current practices and future viability of the industry. While regulation may be necessary to enable sustainable fisheries management, not all regulation will lead to positive outcomes. It is these unintended consequences that institutional analysis must address.

A key area of concern is the effect of regulatory constraints upon the safety of fishers and vessels. The increasingly regulated market has made it very difficult for fishers to generate profits and has caused decreases in fisheries employment, as this study has shown. One unintended consequence of this is that the fishing fleet is growing progressively older and few repairs and updates are being implemented. This is logical from the boat captain's perspective – investments in new equipment are unlikely to be worthwhile if future allowed fishing levels are uncertain. No clear pattern in safety and rescues has been observed.[11] However, casual analyses have difficulty disentangling effects upon safety from other current trends, such as the Coast Guard's recent additional efforts to improve safety of the commercial fleet.

What is apparent are the effects of incentives upon safety. Since fishing days are numbered, fishing boats will utilize all available time. Since labor is expensive and returns to fishing are low and uncertain, more boat captains fish alone. As mentioned above, the commercial fishing fleet is ageing and is not experiencing substantial re-investment. In addition, operation of large boats close to shore in traditional day-boat

[11] Coast Guard rescue data have been requested to provide such an analysis. BMC Robert Breaker (Operations Officer, US Coast Guard, Gloucester) has noticed no clear pattern of safety issues but does see disturbing practices.

territories has forced small boats to look further from shore, thus exposing them to more potentially hazardous conditions.

The operation of large boats in shore, in areas predominantly fished by small boats is indicative of another trend that has been occurring since regulations have been passed – increasing centralization of the industry. Large boats will exploit whatever fishing grounds they can to maximize their use of open fishing days. This leads to smaller boats having a more difficult time fishing in near waters, thus inducing them to travel further for fish. This also leads to lower returns for these boats. Diversification has also become more important under regulation – to allow fishing for different species at different times. This diversification is visible in boats interchanging fishing infrastructure to target different species, thus allowing more efficient use of the boats. However, the capital necessary to fish for different species is expensive, and so is switching. These factors lead to a contraction of small boat operations and the increasing concentration of fishing in the hands of a few firms. Larger organizations have more resources to adapt to the changing regulatory climate and the changes in physical capital that they induce.

A further institutional change that fisheries regulation has spurred has been the movement to re-zone fishing specific port-side land use for residential use. Many areas, such as Gloucester, have become attractive communities and the demand for water-side residences is high. However, there is an irreversibility in transforming fishing industry port land into residences. The conversion of fishing docks to residences is likely to be final. Once ownership is diffused among many residential land-owners, collective action problems make it unlikely that fishing facilities will be rebuilt (when fishing becomes highly profitable) in naturally attractive ports; negotiation of this sort is difficult and is likely to require eminent domain and entail extensive litigation.

Since there are a limited number of fishing ports with close proximity to fishing grounds, deep harbors, and easy access to infrastructure, the replacement of this type of land use with sea-side residences will severely hamper any resurgence in the fishing industry. If port conversion becomes widespread, as fishing becomes more profitable (given growing demand and increasing stocks), Massachusetts will be at a disadvantage in deploying its fishing fleets. More reliance will be placed upon foreign sources of fish protein as a substitute for domestic production. As demand for fish protein grows, local stocks will become increasingly attractive for fishing. Fishing boats from other states or nations who have retained working harbors will then harvest the fisheries once utilized by Massachusetts' fishers. This trend will also assist in the concentration of the fishing industry among a few small, highly capitalized firms.

The next part of this chapter gives a briefly discusses the implications of fisheries regulation upon individual ports.

I.4.1. Boston

While Boston is a large urban cluster with several different economic activities from financial services to tourism, the fishing-related activity is an important component of the

economic activity. Boston is a provider of fishing-related support services to other localities and it is a major point of international access and commerce of fisheries products. The area of the Fish Pier in the Boston harbor has been visibly affected by regulations. What used to be a major landing hub is now much more restricted. Boston still is an important distribution center though.[12] Fewer landings make the area idle and the use of property for different purposes becomes a profitable alternative. There are several factors that affect the use of the Boston harbor for landings. The days-at-sea (DAS) regulations and fuel costs make the use of other ports closer to the fishing grounds more attractive for landings. Fuel cost effects have been magnified in the last several months further affecting the viability of landings at Boston harbor under regulations. The landed species in this port have varied over time, mostly due to regulations. Cod and haddock used to be the main species, now it has diversified to include cod, flounders, pollock, haddock, monkfish, lobster, clams, scallops, ocean catfish, and mussels. [13]

I.4.2. Gloucester

Gloucester is a major port in the North Shore.[14] The landed species in the port are diversified and include cod, dabs, winter flounder, yellowtail, haddock, pollock, hake, halibut, grey sole (all groundfish), plus whiting, squid, shrimp, herring, mackerel, lobster (crab as bycatch), bluefin tuna, swordfish, stripped bass, dogfish, skate, monkfish, bluefish, slime eels, sea cucumbers, clams, and others.[15]

I.4.3. New Bedford

While New Bedford is consistently ranked a top port for the value of its commercial fisheries landings (not per pounds landed), the fishing industry accounts for a relatively small share of the total economic direct activity of the city.[16] Employment in the industry is significant, mainly at the low skill end. The sea scallops have become the main fishing activity and regulations in this species have been less drastic, relative to groundfish. The harbor is well used in its capacity and an overlay clause guarantees the marine

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[12] The Legal Sea Foods quality control plant at the Boston harbor is a good example of the efficient use of the space taking advantage of the closeness to Logan airport and major highways such as Route 95.

[13] See Hall-Arber et al (2000), pages 202-209 for a thorough description of the Boston Harbor locality.

[14] See Hall-Arber et al (2000), pages 235-247 for a thorough description of the Gloucester locality and also Hall-Arber at al (2003).

[15] Several of the observations were made by Michael Costello of the Gloucester Chamber of Commerce, for example, there is a sense in the business community that the fishing industry could make a "come back" eventually, but under current conditions, the likelihood is small. This port has suffered important economic effects from regulations as one may visibly observe the idle capacity in the designated fishing activities areas; and because Gloucester is close to the Boston area, gentrification of the port is a real threat to the viability of economically feasible landings in the port.

[16] According to Jim Mathis at the New Bedford Chamber of Commerce, the number is of the 8-12% order. Mathis pointed to the golf balls industry as a larger component in magnitude.

dependency of the business activities. New Bedford is one case where gentrification does not seem to apply. The landed species in this port are also diversified and include cod, flounders (various), fluke, dabs, winter flounder, yellow tail, haddock, pollock, hake, grey sole, halibut (all ground fish), whiting, squid, shrimp, herring, lobster (crab as bycatch), tuna, swordfish, scup, quahogs, dogfish, skate, monkfish, conch, mussels, tilefish. [17]

I.4.4. Plymouth

Plymouth has one small fish pier where commercial fishing activity takes place. The port is 3rd ranked in lobster landings, a sign of the diversification lead by groundfish regulations. Yet fishing employment in Plymouth is in decline. The town regards fishing as an important component of its economic base and the commercial fishing pier is due for a renovation worth $1.8 million.[18] The current renovation of the fishing facilities (as part of an integrated waterfront redevelopment plan) may provide a model for how to cope with gentrification forces. The town provides parking permits for fishermen to dock and land fish into small trucks that can distribute to other localities. Lobster is the main catch, with some finfish as well; the local catch include cod, flounders, dabs, winter flounder, yellowtail, gray sole, tuna, stripped bass, dogfish, skate, monkfish, bluefish, scallops and seaweeds.[19]

[17] See Hall-Arber et al (2000), pages 108-125 for a thorough description of the New Bedford locality.

[18] Information has been kindly provided by Denis Hanks of the Plymouth Area Chamber of Commerce.

[19] See Hall-Arber et al (2000), pages 217-223 for a thorough description of the Plymouth locality.

II. Data and Econometric Models of the Massachusetts Gross Sales Tax Data

In this section, we use sales tax data to measure whether regulations have an impact on tax revenues. The introduction of a regulation in fishing activity may decrease the demand for goods and services in the fishing related industry and may have a negative chained effect in other business in that location.

We obtained data on sales taxes for the towns and localities of the state of Massachusetts. The observations are raw data from tax fillings for the sales tax by towns and communities. The data show the amount of reported sales from retailers from sales tax returns, or taxpayer registrations listing as part of the address in a particular city or town.[20] Table 2.1 shows the towns and localities coded. For each town we have data for average and total gross receipts per month in nominal US dollars. We obtained a measure of the sales taxes in real US dollars by dividing each observation by the US consumer price index (CPI).

In order to measure the impact of the regulations of the fishing activities on the sales taxes, we constructed three data panels:

(i) Monthly data from May 1993 to April 1995, where Amendment 5 takes effect in May 1, 1994;

(ii) Monthly data from July 1995 to July 1997, where Amendment 7 takes effect in July 1, 1996;

(iii) Monthly data from May 2003 to December 2004, where Amendment 13 takes effect in May 1, 2004.

These data panels reflect both data availability and an approximate one year window before and after the regulation takes effect.

The towns and community groups where fishing activity takes places are the following:

a. Gloucester and North Shore – Essex County: Gloucester (Primary multispecies port); Rockport, Newburyport, Beverly, Salem, Marblehead, Manchester, Swampscott (Secondary multispecies ports/groups);

[20] The following caveats must be considered upon use of this data set: Businesses that operate in more than one location in Massachusetts generally file a single sales tax return covering sales at all of the locations in the state; in the data kept by DOR, these sales would all be attributed to the address listed on the return or registration. Similarly, sales from stores that are part of a chain may be filed together under the address of the corporate headquarters. If this address is out-of-state, then sales from this chain might not appear in any of the local tallies. Furthermore, a business can have its return filed by a third party, such as an accountant, and list the address of this party on its return. In this case, our data may show the sales in the city or town in which the accountant's office is located.

b. Boston and South Shore – Middlesex, Suffolk, Norfolk and Plymouth Counties: Boston (Primary multispecies port); Scituate, Plymouth and Marshfield (Secondary multispecies ports/groups);

c. Cape and Islands – Barnstable, Dukes and Nantucket Counties: Chatam, Harwich (Primary multispecies ports); Provincetown, Sandwich, Barnstable, Wellfleet, Woods Hole, Yarmouth, Orleans, Eastham, Nantucket, Oak Bluffs, Tisbury, Edgartown (Secondary multispecies ports/groups);

d. New Bedford Coast – Bristol County: New Bedford, Fairhaven (Primary multispecies ports); Dartmouth, Westport (Secondary multispecies ports/groups).[21]

Those 29 towns and cities and communities are highlighted in Table 2.1 and represent the group taken as representative of the fishing industry primary and secondary activity in the state. Figure 2.0 shows the state by counties, and cities and towns.

We have two key objectives in a first look at the data: Do real sales tax receipts fall in fishing towns relative to non-fishing towns over time? Do real sales tax receipts fall noticeably around the passage of Amendments 5, 7 and 13? The following charts, Figures 2.1 and on, give a flavor of the data regarding those questions.

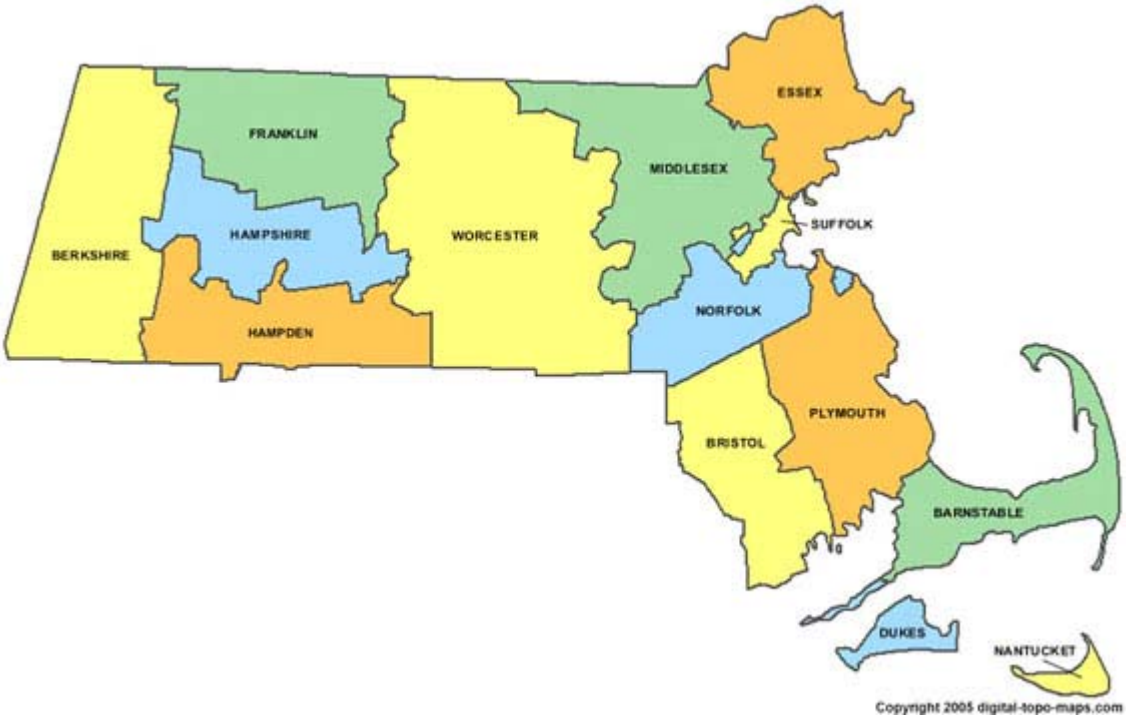
[21] These are classifications based on frameworks for the implementation of Amendment 13.

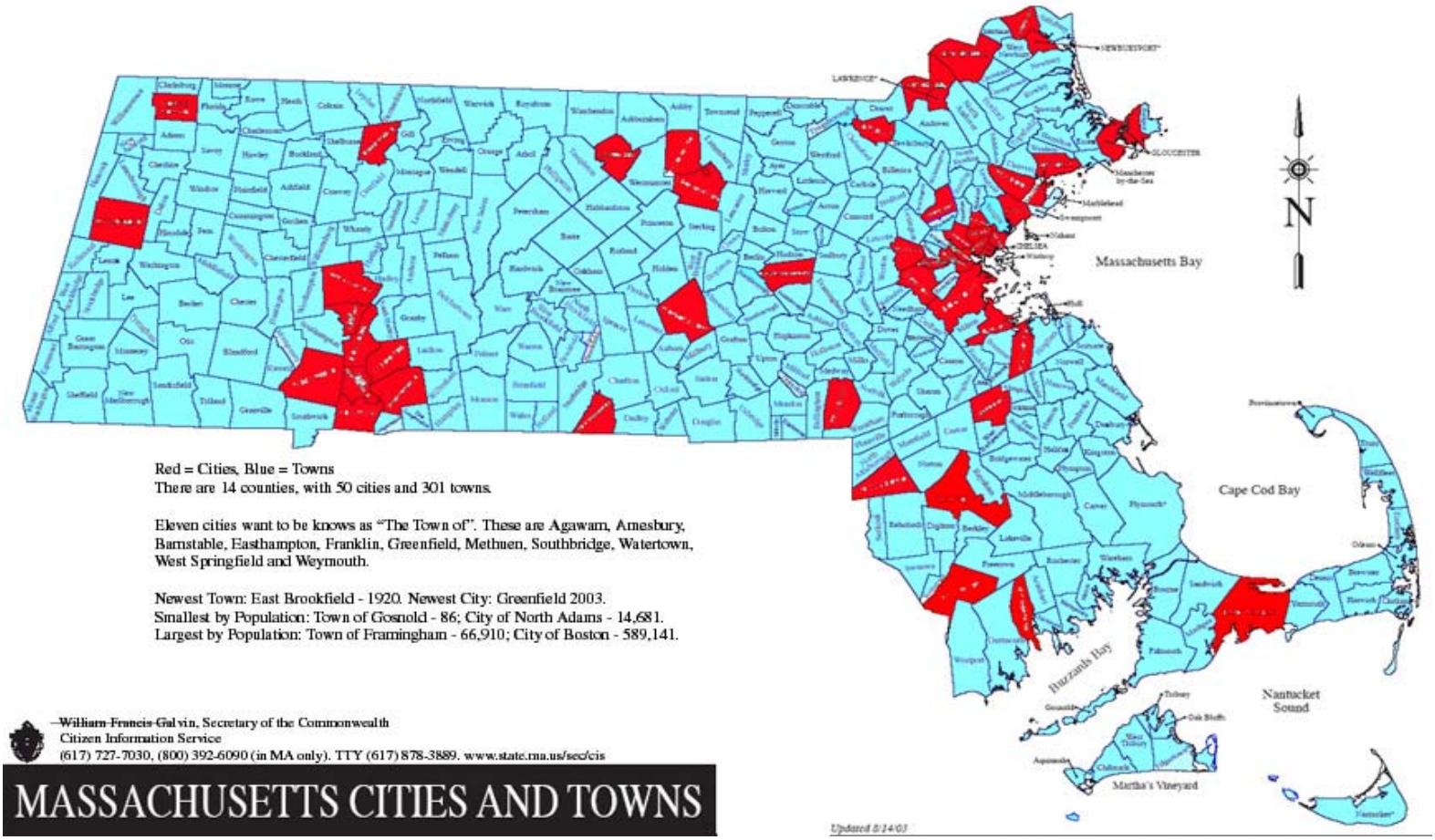
Table 2.1 Towns and Localities of Sales Tax Data in the State of Massachusetts

(000) Unknown
(001) Abington
(002) Acton
(003) Acushnet
(004) Adams
(005) Agawam
(006) Alford
(007) Amesbury
(008) Amherst
(009) Andover
(010) Arlington
(011) Ashburnham
(012) Ashby
(013) Ashfield
(014) Ashland
(015) Athol
(016) Attleboro
(017) Auburn
(018) Avon
(019) Ayer
(020) Barnstable
(021) Barre
(022) Becket
(023) Bedford
(024) Belchertown
(025) Bellingham
(026) Belmont
(027) Berkley
(028) Berlin
(029) Bernardston
(030) Beverly
(031) Billerica
(032) Blackstone
(033) Blandford
(034) Bolton
(035) Boston
(036) Bourne
(037) Boxborough
(038) Boxford
(039) Boylston
(040) Braintree
(041) Brewster
(042) Bridgewater
(043) Brimfield
(044) Brockton
(045) Brookfield
(046) Brookline
(048) Burlington
(049) Cambridge
(050) Canton
(051) Carlisle
(052) Carver
(053) Charlemont
(054) Charlton
(055) Chatham
(056) Chelmsford
(057) Chelsea
(058) Cheshire
(059) Chester
(060) Chesterfield
(061) Chicopee
(062) Chilmark
(063) Clarksburg
(064) Clinton
(065) Cohasset
(066) Colrain
(067) Concord
(068) Conway
(069) Cummington
(070) Dalton
(071) Danvers
(072) Dartmouth
(073) Dedham
(074) Deerfield
(075) Dennis
(076) Dighton
(077) Douglas
(078) Dover
(079) Dracut
(080) Dudley
(081) Dunstable
(082) Duxbury
(083) East Bridgewater
(084) East Brookfield
(085) East Longmeadow
(086) Eastham
(087) Easthampton
(088) Easton
(089) Edgartown
(090) Egremont
(091) Erving
(092) Essex
(093) Everett
(094) Fairhaven
(095) Fall River
(096) Falmouth
(097) Fitchburg
(098) Florida
(099) Foxborough
(100) Framingham
(101) Franklin
(102) Freetown
(103) Gardner
(105) Georgetown
(106) Gill
(107) Gloucester
(108) Goshen
(110) Grafton
(111) Granby
(112) Granville
(113) Great Barrington
(114) Greenfield
(115) Groton
(116) Groveland
(117) Hadley
(118) Halifax
(119) Hamilton
(120) Hampden
(121) Hancock
(122) Hanover
(123) Hanson
(124) Hardwick
(125) Harvard
(126) Harwich
(127) Hatfield
(128) Haverhill
(130) Heath
(131) Hingham
(132) Hinsdale
(133) Holbrook
(134) Holden
(135) Holland
(136) Holliston
(137) Holyoke
(138) Hopedale
(139) Hopkinton
(140) Hubbardston
(141) Hudson
(142) Hull
(143) Huntington
(144) Ipswich
(145) Kingston
(146) Lakeville
(147) Lancaster
(148) Lanesborough
(149) Lawrence
(150) Lee
(151) Leicester
(152) Lenox
(153) Leominster
(154) Leverett
(155) Lexington
(156) Leyden
(157) Lincoln
(158) Littleton
(159) Longmeadow
(160) Lowell
(161) Ludlow
(162) Lunenburg
(163) Lynn
(164) Lynnfield
(165) Malden
(166) Manchester
(167) Mansfield
(168) Marblehead
(169) Marion
(170) Marlborough
(171) Marshfield
(172) Mashpee
(173) Mattapoisett
(174) Maynard
(175) Medfield
(176) Medford
(177) Medway
(178) Melrose
(179) Mendon
(180) Merrimac
(181) Methuen
(182) Middleborough
(183) Middlefield

(184) Middleton
(185) Milford
(186) Millbury
(187) Millis
(188) Millville
(189) Milton
(191) Monson
(192) Montague
(193) Monterey
(194) Montgomery
(196) Nahant
(197) Nantucket
(198) Natick
(199) Needham
(200) New Ashford
(201) New Bedford
(202) New Braintree
(203) New Marlborough
(204) New Salem
(205) Newbury
(206) Newburyport
(207) Newton
(208) Norfolk
(209) North Adams
(210) North Andover
(211) North Attleborough
(212) North Brookfield
(213) North Reading
(214) Northampton
(215) Northborough
(216) Northbridge
(217) Northfield
(218) Norton
(219) Norwell
(220) Norwood
(221) Oak Bluffs
(222) Oakham
(223) Orange
(224) Orleans
(225) Otis
(226) Oxford
(227) Palmer
(228) Paxton
(229) Peabody
(230) Pelham
(231) Pembroke
(232) Pepperell
(233) Peru
(234) Petersham
(235) Phillipston
(236) Pittsfield
(237) Plainfield
(238) Plainville
(239) Plymouth
(240) Plympton
(241) Princeton
(242) Provincetown
(243) Quincy
(244) Randolph
(245) Raynham
(246) Reading
(247) Rehoboth
(248) Revere
(249) Richmond
(250) Rochester
(251) Rockland
(252) Rockport
(253) Rowe
(254) Rowley
(255) Royalston
(256) Russell
(257) Rutland
(258) Salem
(259) Salisbury
(260) Sandisfield
(261) Sandwich
(262) Saugus
(263) Savoy
(264) Scituate
(265) Seekonk
(266) Sharon
(267) Sheffield
(268) Shelburne
(269) Sherborn
(270) Shirley
(271) Shrewsbury
(272) Shutesbury
(273) Somerset
(274) Somerville
(275) South Hadley
(276) Southampton
(277) Southborough
(278) Southbridge
(279) Southwick
(280) Spencer
(281) Springfield
(282) Sterling
(283) Stockbridge
(284) Stoneham
(285) Stoughton
(286) Stow
(287) Sturbridge
(288) Sudbury
(289) Sunderland
(290) Sutton
(291) Swampscott
(292) Swansea
(293) Taunton
(294) Templeton
(295) Tewksbury
(296) Tisbury
(298) Topsfield
(299) Townsend
(300) Truro
(301) Tyngsborough
(303) Upton
(304) Uxbridge
(305) Wakefield
(306) Wales
(307) Walpole
(308) Waltham
(309) Ware
(310) Wareham
(311) Warren
(312) Warwick
(313) Washington
(314) Watertown
(315) Wayland
(316) Webster
(317) Wellesley
(318) Wellfleet
(319) Wendell
(320) Wenham
(321) West Boylston
(322) West Bridgewater
(323) West Brookfield
(324) West Newbury
(325) West Springfield
(326) West Stockbridge
(327) West Tisbury
(328) Westborough
(329) Westfield
(330) Westford
(331) Westhampton
(332) Westminster
(333) Weston
(334) Westport
(335) Westwood
(336) Weymouth
(337) Whately
(338) Whitman
(339) Wilbraham
(340) Williamsburg
(341) Williamstown
(342) Wilmington
(343) Winchendon
(344) Winchester
(345) Windsor
(346) Winthrop
(347) Woburn
(348) Worcester
(349) Worthington
(350) Wrentham
(351) Yarmouth

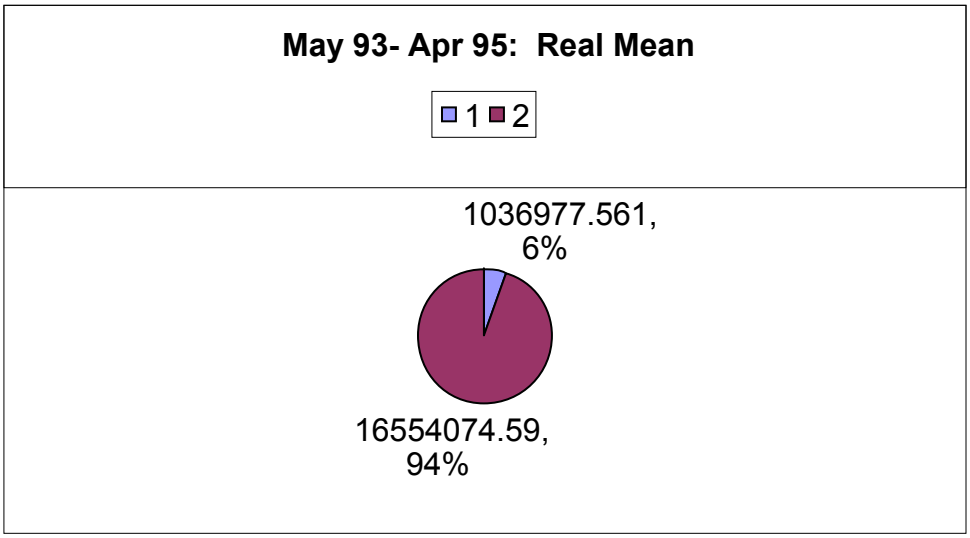
Figure 2.0: Massachusetts State by Counties and Cities and Towns

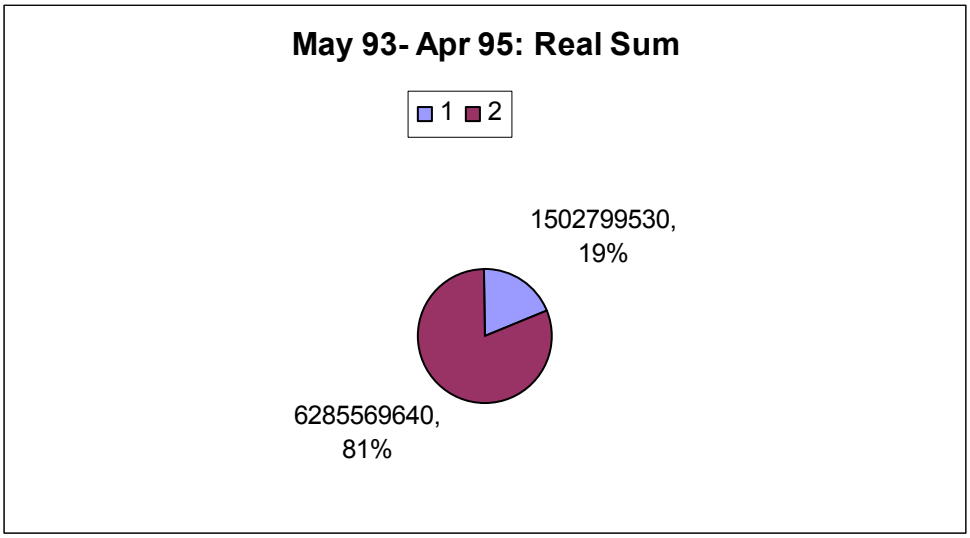




First, for the period May 1993-April 1995, the fishing towns posted 6% of average gross real sales tax receipts, and 19% of total gross real sales tax receipts, relative to all towns in the state, Figure 2.1. For the period May 1993-April 1994, before Amendment 5 was introduced, and for the period May 1994-April 1995, after Amendment 5, the fishing towns posted 6% of average gross real sales tax receipts and 19% of total gross real sales tax receipts as well, without large perceived changes.

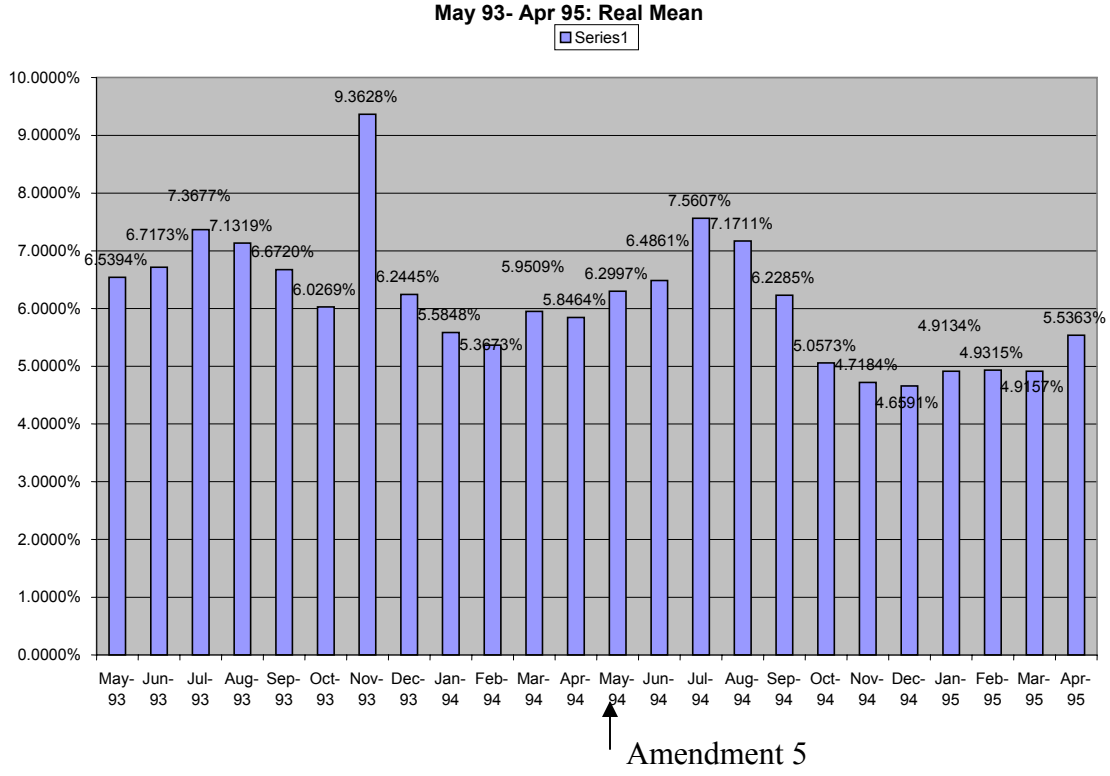
Figure 2.1 Share of Fishing Towns on Total Tax Receipts



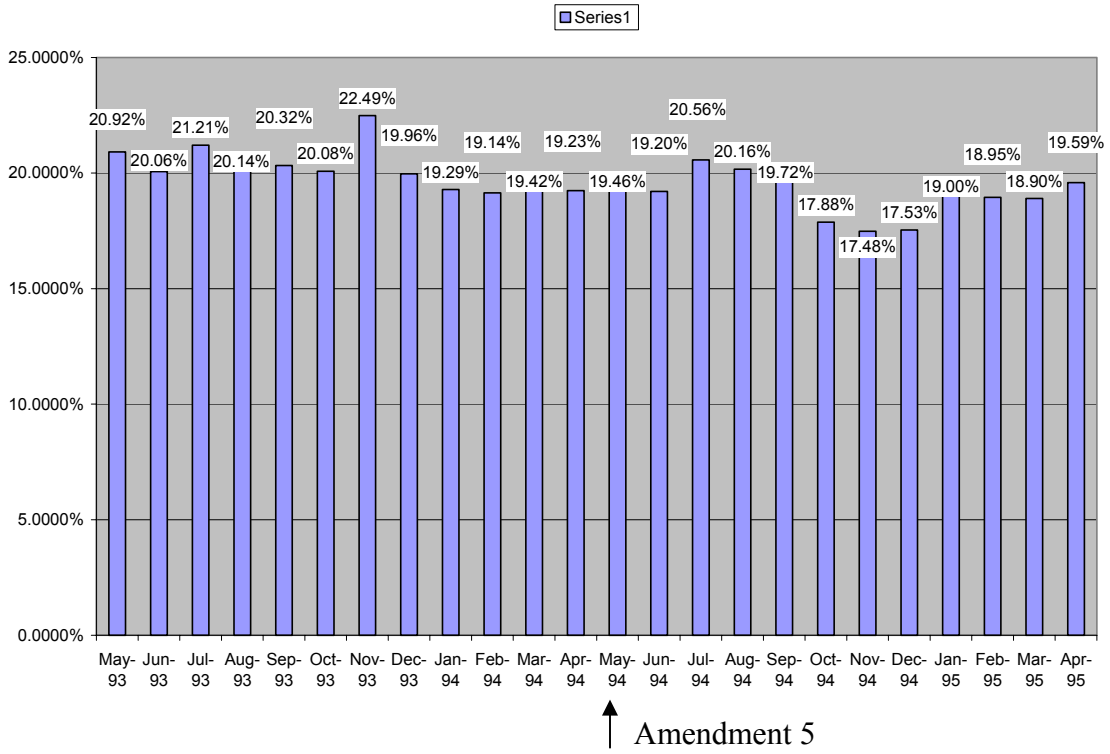


In the following charts, Figure 2.2, the time series monthly shares of the fishing industry towns relative to all towns in the state in this period are presented. The average tax receipts fluctuate with the usual higher seasonal component of summer months. We find a slight downward decline over the period, but the significance of the difference before and after May 1994 is ambiguous for both the average and total gross receipts shares.

Figure 2.2: Evolution of Shares of Tax Receipts in Fishing Towns
May 93- Apr 95: Real Mean

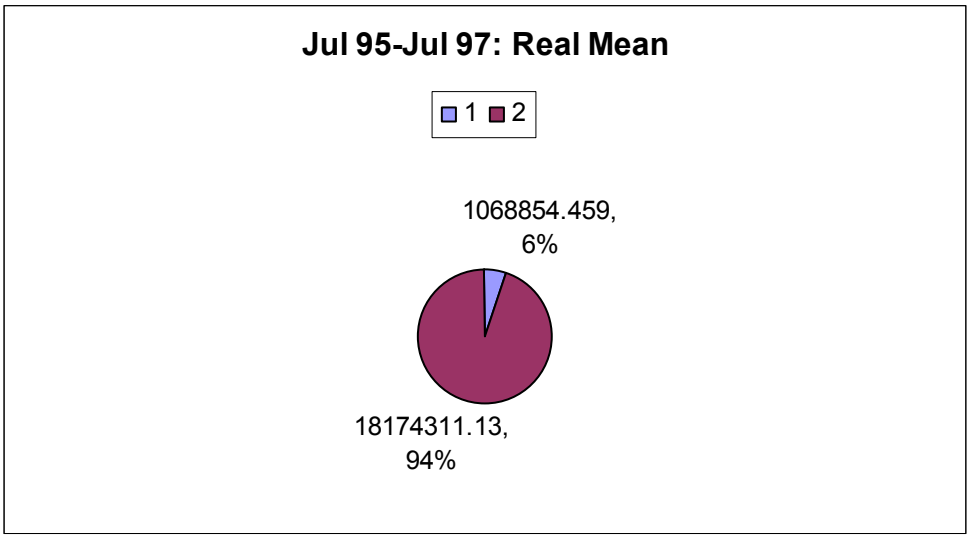


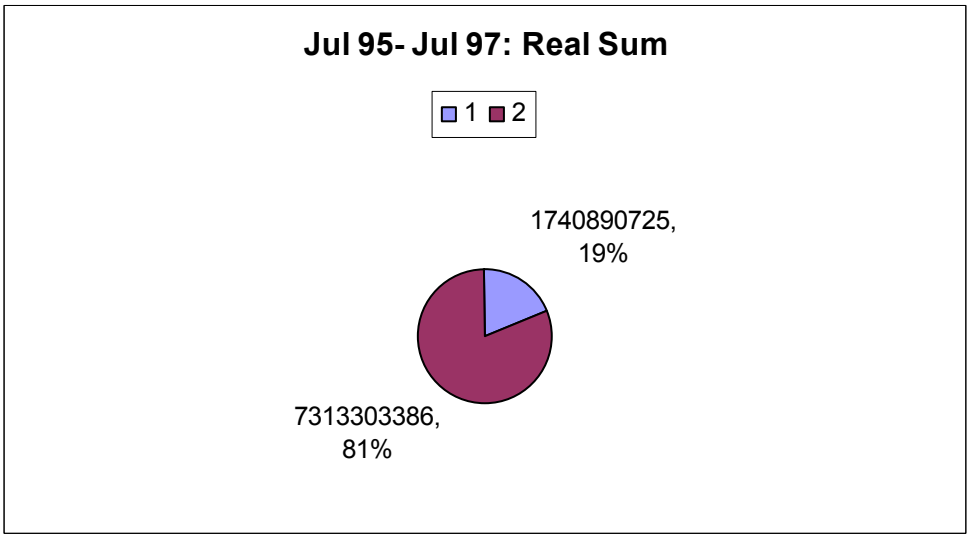
May 93- Apr 95: Real Sum



Second, for the period July 1995-July 1997, Figure 2.3, the fishing towns continue to post 6% of average gross real sales tax receipts of the state, and 19% of total gross real sales tax receipts. For the period July 1995-June 1996, before Amendment 7 was introduced, and for the period July 1996-July 1997, after Amendment 7, the fishing towns posted 6% of average gross sales tax receipts and 19% of total gross sales tax receipts as well.

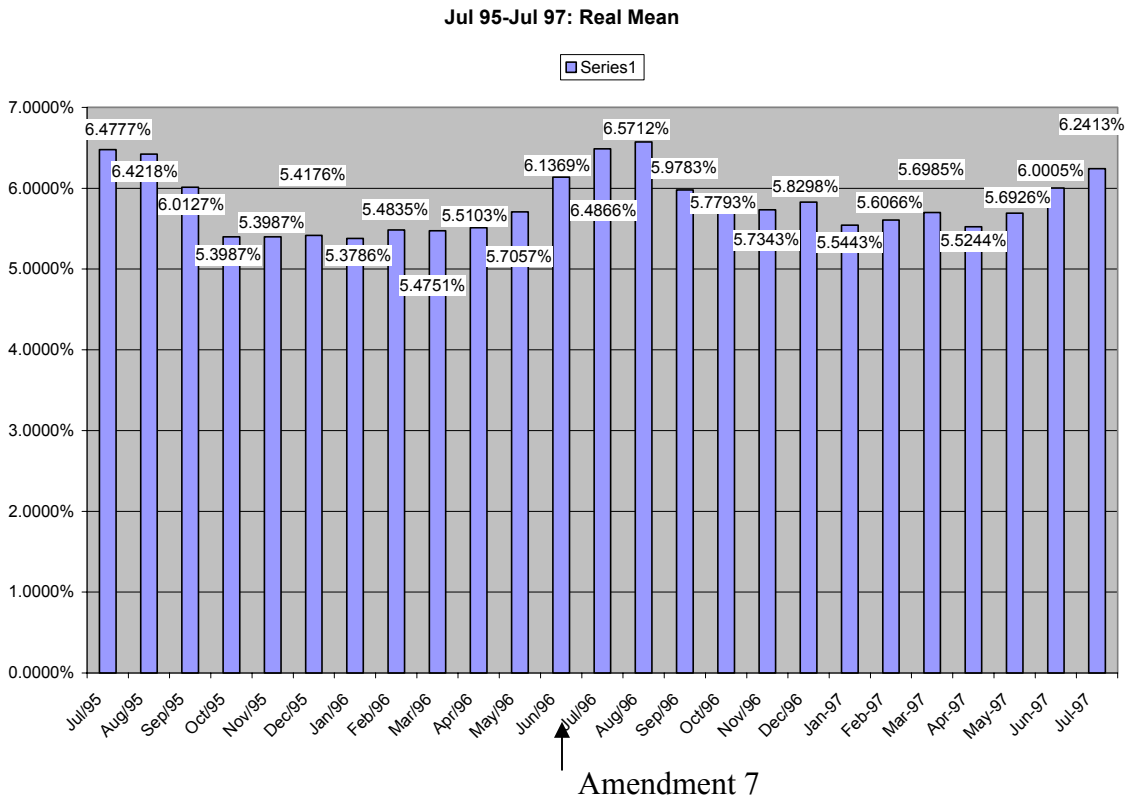
Figure 2.3 Share of Fishing Towns on Total Tax Receipts

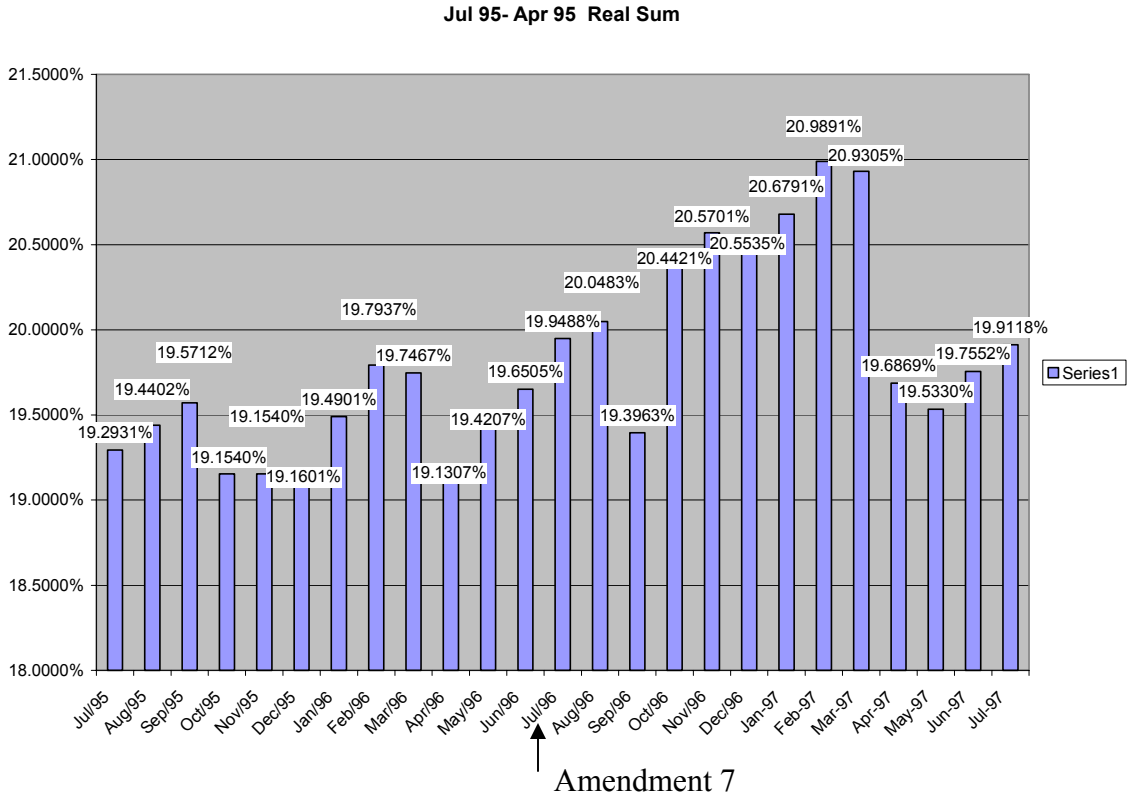




The time series monthly shares of the fishing industry towns in this period show a seasonal pattern for the average sales tax receipts, but a visible upward trend for the total sales tax receipts in this period, Figure 2.4.

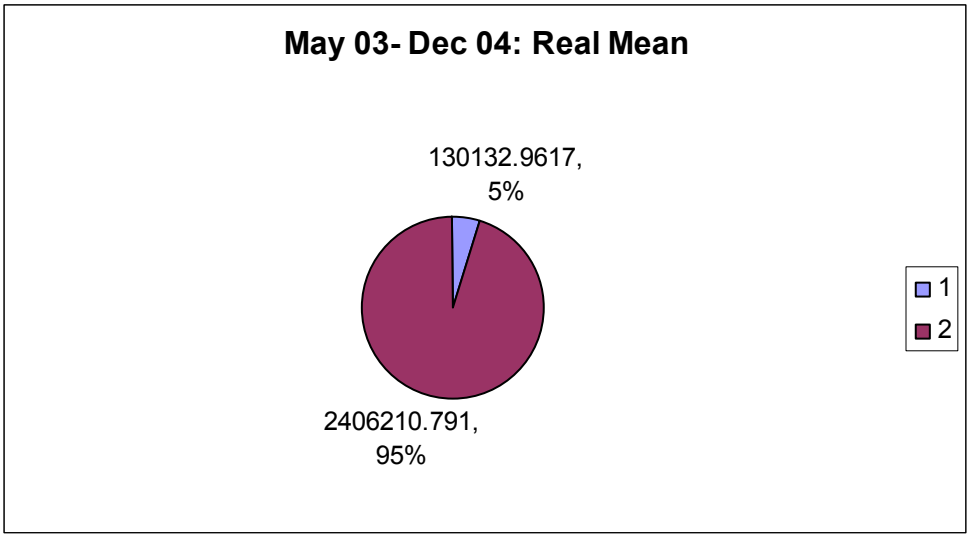
Figure 2.4 Evolution of Shares of Tax Receipts in Fishing Towns

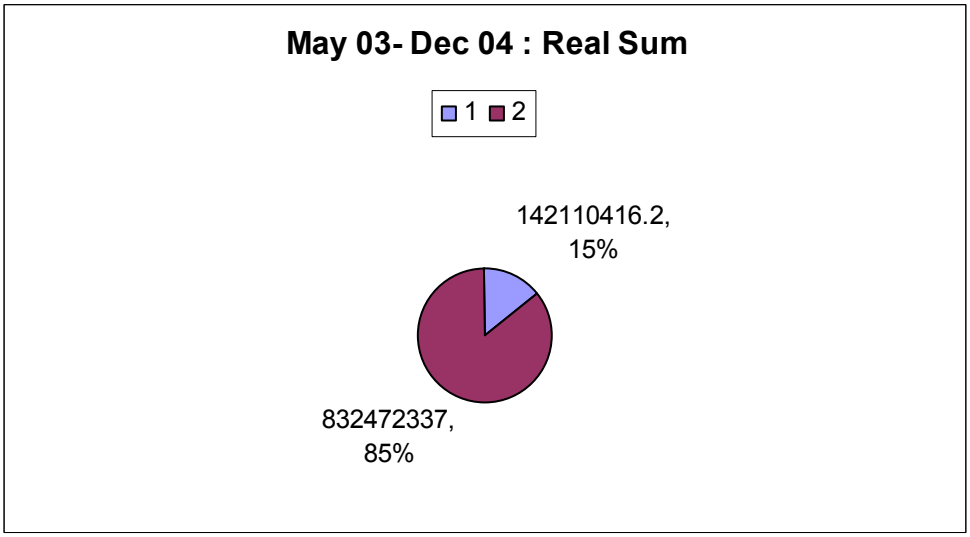




Lastly, for the period May 2003-December 2004, Figure 2.5the fishing towns posted 5% of average gross real sales tax receipts and 15% of total gross real sales tax receipts. This is a visible decline from the levels of 1993-1997, -1% on average and -4% on total gross real sales tax receipts.

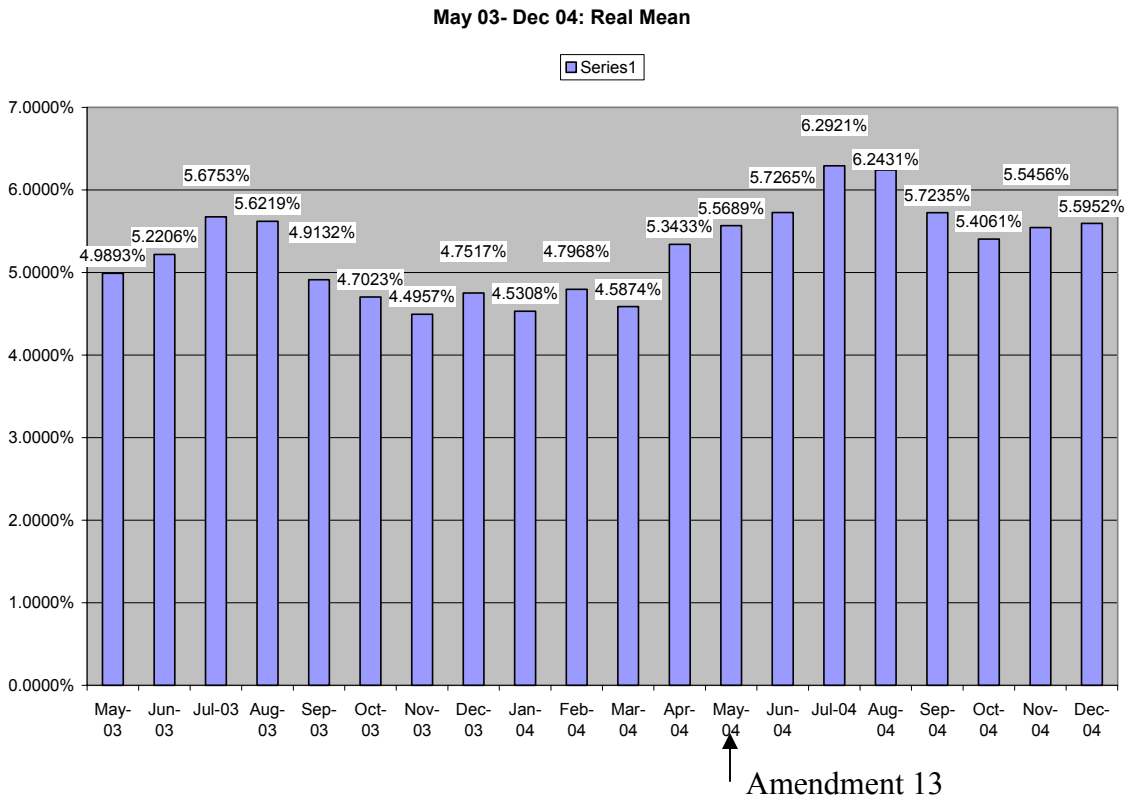
Figure 2.5 Share of Fishing Towns on Total Tax Receipts

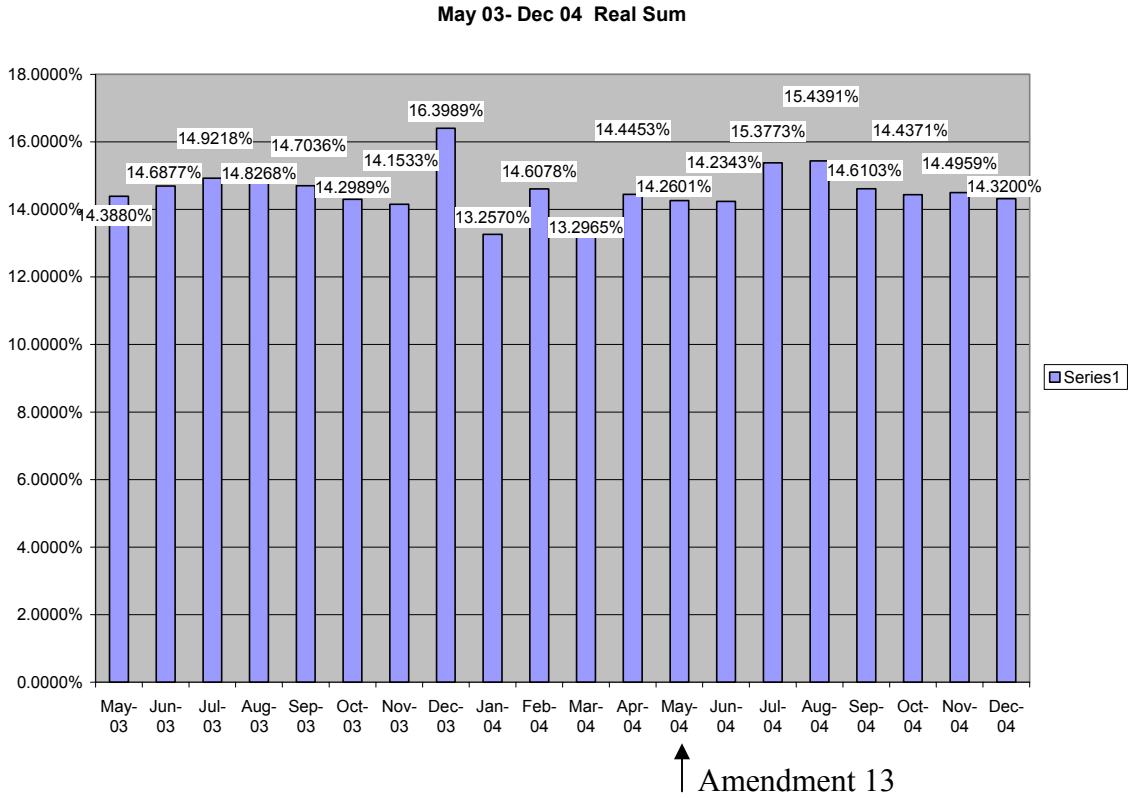




The time series monthly shares of the fishing industry towns in this period show a slight upward trend on averages, but no significant changes for the gross total.

Figure 2.6 Evolution of Shares of Tax Receipts in Fishing Towns





In summary, at the outset of this section we asked whether real sales tax receipts fall in fishing towns relative to non-fishing towns over time. The answer seems affirmative when comparing the 1990's to the 2000's. Do real sales tax receipts fall noticeably around the passage of Amendments 5, 7 and 13? The evidence is not conclusive here. Of course, graphical representations and simple summary statistics alone do not tell us the entire story of regulation impacts. We proceed with a more detailed econometric analysis of the data.

II.1. Econometric Estimations of Gross Real Sales Tax Data

The basic econometric analysis pursued with the sales tax data hinges on separating the towns into two groups:

(i) The 29 localities where fishing activity takes place, as defined by a-d above, that is Gloucester, Rockport, Newburyport, Beverly, Salem, Marblehead, Manchester, Swampscott, Boston, Scituate, Plymouth, Marshfield, Chatam, Harwich, Provincetown, Sandwich, Barnstable, Wellfleet, Woods Hole, Yarmouth, Orleans, Eastham, Nantucket, Oak Bluffs, Tisbury, Edgartown, New Bedford, Fairhaven, Dartmouth, Westport;

(ii) All other towns in the State.

The data lend themselves perfectly to the policy analysis branch of econometrics, specifically the fact that an exogenous government policy intervention, i.e. the Amendments 5, 7 and 13, affects the towns where fishing activities take place, the so-called treatment group. The control group consisting of all other towns is thought not to be affected by the policy intervention. The key issue is that, in addition to regulations, many other factors can affect real sales tax receipts over time. It is essential that we consider statistical analyses that control for other changes over time. In the policy analysis branch of econometrics, the common utilized econometric methodology used is the differences-in-differences method.[22]

The main economic hypothesis is that the introduction of a regulation in fishing activity decreases the demand for goods and services in the fishing related industry and has a chain effect in other business in the location. This chain effect may be captured by potential lower tax receipts of business in the locations most affected by the treatment.

Specifically, if we let y_{it} denote the (logarithm of) gross real sales tax receipts for unit i (say a local restaurant, or a local vehicle shop), in period t (say January of 1995), the econometric model is of the form:

$$y_{it} = a_0 + a_1 d_{1t} + a_2 d_{2i} + a_3 d_{1t} d_{2i}$$

$$+ \ldots \textit{(other factors; fixed effects; controls)} \ldots + \textit{error term} \qquad (2.1)$$

[22] Any textbook in econometric analysis present discussions of policy analysis with data and the differences-in-differences method, see e.g. Greene (2003).

where d_{1t} takes value 0 in the months before the amendment has been implemented (say before May 1994 in the case of Amendment 5) and 1 after the implementation; d_{2i} takes value 0 for all towns not affected by the fishing industry and 1 for all 29 towns with active fishing industry in a-d; and the interaction term $d_{1t}\ d_{2i}$ captures the effect of the policy change, i.e. the amendment, on the towns where the fishing industry is active.

The constant term a_0 measures the

$$average\ [\ y_{it} \mid d_{1t} = d_{2i} = 0\ ] = a_0, \qquad (2.2)$$

that is the average gross real sales tax receipts *before* ($d_{1t}=0$) an amendment has been implemented, for all towns *not affected* ($d_{2i}=0$) by the fishing industry in the State. The coefficient a_1 measures

$$[\ change\ in\ y_{it}\ /\ change\ in\ d_{1t} \mid d_{2i}\ ] = a_1 + a_2\, d_{2i} \qquad (2.3)$$

hence, a_1 measures the change in average gross sales receipts *after* ($d_{1t}=1$) an amendment has been implemented, for all towns *not affected* ($d_{2i}=0$) by the fishing industry in the State. The coefficient a_2 measures

$$[\ change\ in\ y_{it}\ /\ change\ in\ d_{2i} \mid d_{1t}\ ] = a_2 + a_1\, d_{1t} \qquad (2.4)$$

hence, a_2 measures the change in average gross sales receipts *before* ($d_{1t}=0$) an amendment has been implemented, for all towns *affected* ($d_{2i}=1$) relative to the towns not affected by the fishing industry in the State.

The coefficient of interest for this study is a_3 which measures the marginal change in average gross sales receipts *after* ($d_{1t}=1$) an amendment has been implemented, for all towns *affected* ($d_{2i}=1$) by the fishing industry in the State. a_3 represents the so-called differences-in-differences estimator:

$$\{average\ [\ y_{it} \mid d_{1t} = d_{2i} = 1\ ] - average\ [\ y_{it} \mid d_{1t} = 0,\ d_{2i} = 1\ ]\}$$

$$- \{average\ [\ y_{it} \mid d_{1t} = 1,\ d_{2i} = 0\ ] - average\ [\ y_{it} \mid d_{1t} = 0,\ d_{2i} = 0\ ]\}$$

$$= \{a_3 + a_1\} - a_1 = a_3. \qquad (2.5)$$

It measures the difference in real sales tax receipts between the towns that have an active fishing industry versus all others, before and after the policy intervention takes effect.[23] The main results for this study are reflected in the estimates of a_3, the differences-in-differences estimator.

[23] See e.g. Greene (2003).

The main hypothesis to be tested is whether or not a_3 is negative and statistically significant for the fishing towns in the state. When a_3 is negative, it indicates that for the fishing town in question, the sales tax receipts are lower on average relative to all other towns in the State, and this is likely to be due to the introduction of the policy change.[24]

We proceed with the analysis for the three panels using ordinary least squares (OLS) econometric methods. [25]

II.1.1 Amendment 5: May 1993 to April 1995 Period

First, we use this econometric estimation technique with monthly data from May 1993 to April 1995, where Amendment 5 takes effect on May 1, 1994.

Table 2.2 shows the simple differences-indifferences estimator without further factors, fixed effects or controls. The variable *lrmst* represents the (logarithm of) the average gross real sales tax receipts, and *lrtotst* represents the (logarithm of) the total gross real sales tax receipts per month, per town for all towns in the state. In this sample there are 7,973 observations. For the average gross real sales receipts, *lrmst*, there was an approximate (a_1) -17% decline for all towns *not in the fishing industry* between May 1994-April 1995, compared to May 1993-April 1994, that is comparing averages before and after the amendment took effect. For the total gross real sales receipts, *lrtotst*, there was an approximate (a_1) -20% decline for all towns *not in the fishing industry* between May 1994-April 1995 compared to May 1993-April 1994. In the towns where the fishing industry is active, there was an approximate (a_2) -11% decline in average sales tax receipts but an approximate (a_2) 72% increase in the gross sales tax receipts relative to all other towns for the period May 1993 to April 1994, before the amendment was implemented. This indicates that, on average, each unit had lower revenues, but the gross receipts increased, thus indicating a net gain of units in the towns where the fishing industry was active for the period prior to the amendment.

The main estimator of interest is a_3. For the average sales tax receipts, the introduction of the amendment had an approximate (a_3) *-7%* decline for the towns in the fishing industry, and an approximate (a_3) *-6.5%* decline for the gross total receipts; however those later effects are not statistically significant.

[24] This has to be taken with qualification, there could be other potential explanations for the differences captured by the econometric analysis. Without the precise counterfactuals, results must be interpreted narrowly.

[25] See e.g. Greene (2003).

Table 2.2 – Basic Differences-in-Differences Estimator

	(1) lrmst	(2) lrtotst
dfyear	-0.171	-0.200
	(5.82)**	(3.89)**
dtreat	-0.111	0.721
	(2.35)*	(8.09)**
dyeartreat	-0.070	-0.065
	(0.95)	(0.50)
Constant	5.117	10.162
	(256.38)**	(284.18)**
Observations	7973	7973
R-squared	0.01	0.01

Robust t statistics in parentheses
* significant at 5%; ** significant at 1%

The next set of regressions in Tables 2.3-2.6, show the same regression of Table 2.2 with several fixed time effects for seasonal variation and interactions of the time effects with the treatment group of towns in the fishing industry added. Tables 2.3 and 2.6 show that in the predominantly coastal towns of the fishing industry, there is a well-identified summer effect on tax receipts for the average gross real sales tax in the months of July and August, where the particular rows are shaded.

However, we do not find any statistically significant effect of the months in the fishing year calendar on sales tax receipts; in particular no effect of the month of May when the Amendment 5 was introduced.

Table 2.3: Seasonal Effects

	(1)	(2)	(3)	(4)	(5)	(6)
	lrmst	lrmst	lrmst	lrmst	lrmst	lrmst
dfyear	-0.171	-0.171	-0.171	-0.171	-0.171	-0.171
	(5.85)**	(5.85)**	(5.85)**	(5.85)**	(5.85)**	(5.85)**
dtreat	-0.115	-0.121	-0.136	-0.134	-0.122	-0.106
	(2.40)*	(2.53)*	(2.82)**	(2.80)**	(2.55)*	(2.21)*
dyeartreat	-0.070	-0.070	-0.070	-0.070	-0.070	-0.070
	(0.99)	(0.99)	(1.00)	(1.00)	(0.99)	(0.99)
dtreatmay	0.044					
	(0.38)					
dtreatjun		0.123				
		(1.10)				
dtreatjul			0.295			
			(2.74)**			
dtreatoct				-0.065		
				(0.55)		
dtreatsep					0.132	
					(1.22)	
dtreataug						0.282
						(2.68)**
dfeb	-0.015	-0.015	-0.015	-0.015	-0.015	-0.015
	(0.21)	(0.21)	(0.21)	(0.21)	(0.21)	(0.21)
dmar	0.023	0.023	0.023	0.023	0.023	0.023
	(0.32)	(0.32)	(0.32)	(0.32)	(0.32)	(0.32)
dapr	0.163	0.163	0.163	0.163	0.163	0.163
	(2.29)*	(2.29)*	(2.29)*	(2.29)*	(2.29)*	(2.29)*
dmay	0.382	0.386	0.386	0.386	0.386	0.386
	(5.44)**	(5.69)**	(5.69)**	(5.69)**	(5.69)**	(5.69)**
djun	0.423	0.413	0.423	0.423	0.423	0.423
	(6.22)**	(5.85)**	(6.22)**	(6.22)**	(6.22)**	(6.22)**
djul	0.400	0.400	0.375	0.400	0.400	0.400
	(5.95)**	(5.95)**	(5.39)**	(5.95)**	(5.95)**	(5.95)**
daug	0.424	0.424	0.424	0.400	0.424	0.424
	(6.28)**	(6.28)**	(6.28)**	(5.73)**	(6.28)**	(6.28)**
dsep	0.400	0.400	0.400	0.400	0.389	0.400
	(5.89)**	(5.89)**	(5.89)**	(5.89)**	(5.52)**	(5.89)**
doct	0.273	0.273	0.273	0.273	0.273	0.278
	(3.93)**	(3.93)**	(3.93)**	(3.93)**	(3.93)**	(3.87)**
dnov	0.173	0.173	0.173	0.173	0.173	0.173
	(2.49)*	(2.49)*	(2.49)*	(2.49)*	(2.49)*	(2.49)*
ddec	0.256	0.256	0.256	0.256	0.256	0.256
	(3.69)**	(3.69)**	(3.69)**	(3.69)**	(3.69)**	(3.69)**
Constant	4.875	4.875	4.876	4.876	4.875	4.874
	(92.34)**	(92.36)**	(92.39)**	(92.39)**	(92.36)**	(92.32)**
Observations	7973	7973	7973	7973	7973	7973
R-squared	0.02	0.02	0.02	0.02	0.02	0.02

Robust t statistics in parentheses
* significant at 5%; ** significant at 1%

Table 2.4: Seasonal Effects

	(1)	(2)	(3)	(4)	(5)
	lrmst	lrmst	lrmst	lrmst	lrmst
dfyear	-0.171	-0.171	-0.171	-0.171	-0.171
	(5.85)**	(5.85)**	(5.85)**	(5.85)**	(5.85)**
dtreat	-0.100	-0.101	-0.096	-0.097	-0.109
	(2.10)*	(2.12)*	(2.01)*	(2.05)*	(2.28)*
dyeartreat	-0.070	-0.070	-0.070	-0.070	-0.070
	(0.99)	(0.99)	(0.99)	(0.99)	(0.99)
dtreatnov	-0.131				
	(1.01)				
dtreatdec		-0.123			
		(0.97)			
dtreatfeb			-0.185		
			(1.26)		
dtreatapr				-0.026	
				(0.20)	
dtreatmar					-0.168
					(1.13)
dfeb	-0.015	-0.015	0.000	-0.015	-0.015
	(0.21)	(0.21)	(0.00)	(0.21)	(0.21)
dmar	0.023	0.023	0.023	0.037	0.023
	(0.32)	(0.32)	(0.32)	(0.50)	(0.32)
dapr	0.163	0.163	0.163	0.163	0.165
	(2.29)*	(2.29)*	(2.29)*	(2.29)*	(2.24)*
dmay	0.386	0.386	0.386	0.386	0.386
	(5.69)**	(5.69)**	(5.69)**	(5.69)**	(5.69)**
djun	0.423	0.423	0.423	0.423	0.423
	(6.22)**	(6.22)**	(6.22)**	(6.22)**	(6.22)**
djul	0.400	0.400	0.400	0.400	0.400
	(5.95)**	(5.95)**	(5.95)**	(5.95)**	(5.95)**
daug	0.424	0.424	0.424	0.424	0.424
	(6.29)**	(6.29)**	(6.29)**	(6.29)**	(6.28)**
dsep	0.400	0.400	0.400	0.400	0.400
	(5.89)**	(5.89)**	(5.89)**	(5.89)**	(5.89)**
doct	0.273	0.273	0.273	0.273	0.273
	(3.93)**	(3.93)**	(3.93)**	(3.93)**	(3.93)**
dnov	0.184	0.173	0.173	0.173	0.173
	(2.56)*	(2.49)*	(2.49)*	(2.49)*	(2.49)*
ddec	0.256	0.267	0.256	0.256	0.256
	(3.69)**	(3.70)**	(3.69)**	(3.69)**	(3.69)**
Constant	4.873	4.873	4.873	4.873	4.874
	(92.31)**	(92.31)**	(92.30)**	(92.30)**	(92.32)**
Observations	7973	7973	7973	7973	7973
R-squared	0.02	0.02	0.02	0.02	0.02

Robust t statistics in parentheses
* significant at 5%; ** significant at 1%

Table 2.5: Seasonal Effects

	(1)	(2)	(3)	(4)	(5)	(6)
	lrtotst	lrtotst	lrtotst	lrtotst	lrtotst	lrtotst
dfyear	-0.200	-0.200	-0.200	-0.200	-0.200	-0.200
	(3.90)**	(3.90)**	(3.90)**	(3.90)**	(3.90)**	(3.90)**
dtreat	0.718	0.711	0.697	0.698	0.710	0.727
	(7.90)**	(7.82)**	(7.65)**	(7.66)**	(7.81)**	(8.02)**
dyeartreat	-0.065	-0.065	-0.065	-0.065	-0.065	-0.065
	(0.51)	(0.51)	(0.51)	(0.51)	(0.51)	(0.51)
dtreatmay	0.044					
	(0.20)					
dtreatjun		0.123				
		(0.57)				
dtreatjul			0.295			
			(1.40)			
dtreatoct				-0.069		
				(0.30)		
dtreatsep					0.132	
					(0.61)	
dtreataug						0.282
						(1.36)
dfeb	-0.012	-0.012	-0.012	-0.012	-0.012	-0.012
	(0.10)	(0.10)	(0.10)	(0.10)	(0.10)	(0.10)
dmar	0.026	0.026	0.026	0.026	0.026	0.026
	(0.21)	(0.21)	(0.21)	(0.21)	(0.21)	(0.21)
dapr	0.163	0.163	0.163	0.163	0.163	0.163
	(1.35)	(1.35)	(1.35)	(1.35)	(1.35)	(1.35)
dmay	0.385	0.389	0.389	0.389	0.389	0.389
	(3.14)**	(3.29)**	(3.29)**	(3.29)**	(3.29)**	(3.29)**
djun	0.426	0.416	0.426	0.426	0.426	0.426
	(3.60)**	(3.38)**	(3.60)**	(3.60)**	(3.60)**	(3.60)**
djul	0.403	0.403	0.378	0.403	0.403	0.403
	(3.42)**	(3.42)**	(3.10)**	(3.42)**	(3.42)**	(3.42)**
daug	0.427	0.427	0.427	0.403	0.427	0.427
	(3.63)**	(3.63)**	(3.63)**	(3.30)**	(3.63)**	(3.63)**
dsep	0.403	0.403	0.403	0.403	0.392	0.403
	(3.40)**	(3.40)**	(3.40)**	(3.40)**	(3.19)**	(3.40)**
doct	0.279	0.279	0.279	0.279	0.279	0.285
	(2.33)*	(2.33)*	(2.33)*	(2.33)*	(2.33)*	(2.29)*
dnov	0.176	0.176	0.176	0.176	0.176	0.176
	(1.47)	(1.47)	(1.47)	(1.47)	(1.47)	(1.47)
ddec	0.259	0.259	0.259	0.259	0.259	0.259
	(2.16)*	(2.16)*	(2.16)*	(2.16)*	(2.16)*	(2.16)*
Constant	9.918	9.918	9.919	9.919	9.918	9.917
	(110.14)**	(110.14)**	(110.16)**	(110.16)**	(110.14)**	(110.13)**
Observations	7973	7973	7973	7973	7973	7973
R-squared	0.02	0.02	0.02	0.02	0.02	0.02

Robust t statistics in parentheses
* significant at 5%; ** significant at 1%

Table 2.6: Seasonal Effects

	(1)	(2)	(3)	(4)	(5)
	lrtotst	lrtotst	lrtotst	lrtotst	lrtotst
dfyear	-0.200	-0.200	-0.200	-0.200	-0.200
	(3.90)**	(3.90)**	(3.90)**	(3.90)**	(3.90)**
dtreat	0.732	0.731	0.737	0.735	0.723
	(8.08)**	(8.08)**	(8.13)**	(8.12)**	(7.96)**
dyeartreat	-0.065	-0.065	-0.065	-0.065	-0.065
	(0.51)	(0.51)	(0.51)	(0.51)	(0.51)
dtreatnov	-0.131				
	(0.55)				
dtreatdec		-0.123			
		(0.52)			
dtreatfeb			-0.186		
			(0.74)		
dtreatapr				-0.024	
				(0.10)	
dtreatmar					-0.168
					(0.67)
dfeb	-0.012	-0.012	0.003	-0.012	-0.012
	(0.10)	(0.10)	(0.03)	(0.10)	(0.10)
dmar	0.026	0.026	0.026	0.040	0.026
	(0.21)	(0.21)	(0.21)	(0.32)	(0.21)
dapr	0.163	0.163	0.163	0.163	0.165
	(1.35)	(1.35)	(1.35)	(1.35)	(1.31)
dmay	0.389	0.389	0.389	0.389	0.389
	(3.29)**	(3.29)**	(3.29)**	(3.29)**	(3.29)**
djun	0.426	0.426	0.426	0.426	0.426
	(3.60)**	(3.60)**	(3.60)**	(3.60)**	(3.60)**
djul	0.403	0.403	0.403	0.403	0.403
	(3.42)**	(3.42)**	(3.42)**	(3.42)**	(3.42)**
daug	0.427	0.427	0.427	0.427	0.427
	(3.63)**	(3.63)**	(3.63)**	(3.63)**	(3.63)**
dsep	0.403	0.403	0.403	0.403	0.403
	(3.40)**	(3.40)**	(3.40)**	(3.40)**	(3.40)**
doct	0.279	0.279	0.279	0.279	0.279
	(2.33)*	(2.33)*	(2.33)*	(2.33)*	(2.33)*
dnov	0.187	0.176	0.176	0.176	0.176
	(1.51)	(1.47)	(1.47)	(1.47)	(1.47)
ddec	0.259	0.270	0.259	0.259	0.259
	(2.16)*	(2.17)*	(2.16)*	(2.16)*	(2.16)*
Constant	9.916	9.916	9.916	9.916	9.917
	(110.12)**	(110.12)**	(110.11)**	(110.11)**	(110.13)**
Observations	7973	7973	7973	7973	7973
R-squared	0.02	0.02	0.02	0.02	0.02

Robust t statistics in parentheses
* significant at 5%; ** significant at 1%

The next set of regressions, Tables 2.7-2.10, show models with separate difference-in-difference estimators for each town of the fishing industry group. Thus, the differences-in-differences estimator here reflects changes in each town relative to all other towns in the state, including other fishing towns.[26] In Tables 2.7-2.8, we note that the towns of Beverly and Marblehead in the North Shore, Sandwich on the Cape Cod, and Dartmouth on the South Shore received negative impacts on their average and total gross real sales tax receipts when accounting for the introduction of Amendment 5. The order of magnitude of those effects is: For Beverly about 39% decline and for Marblehead about 32% in the North Shore; for Sandwich on the Cape Cod an approximate 52% decline. Tables 2.9-2.10, which include additional time effects, show similar results with the additional captured negative effect on Provincetown on the Cape Cod.

Table 2.7: Separate Town Effects

	lrmst
dtprovince~n	-0.496
	(0.279)
dtbeverly	-0.387
	(0.082)**
dtmarblehead	-0.323
	(0.088)**
dtsandwich	-0.518
	(0.210)*
dtdartmouth	-0.175
	(0.105)
_cons	4.872
	(0.052)**
Observations	7973
R-squared	0.057

Robust standard error statistics in parentheses
* significant at 5%; ** significant at 1%

[26] Regressions in Tables 2.7-2.8 include several time effects, fixed effects and interactions, only results significant up to the 10% confidence level for the differences-in-differences estimators are reported here.

Table 2.8: Separate Town Effects

	lrtotst
dtprovince~n	-0.483
	(0.286)
dtbeverly	-0.392
	(0.100)**
dtmarblehead	-0.319
	(0.082)**
dtsandwich	-0.531
	(0.204)**
dtdartmouth	-0.168
	(0.101)
_cons	9.910
	(0.088)**
Observations	7973
R-squared	0.058

Robust standard error statistics in parentheses
* significant at 5%; ** significant at 1%

Table 2.9: Separate Town Effects

	lrmst
dtprovince~n	-0.496
	(0.237)*
dtbeverly	-0.387
	(0.082)**
dtmarblehead	-0.323
	(0.114)**
dtsandwich	-0.518
	(0.200)**
cons	4.885
	(0.056)**
Observations	7973
R-squared	0.057

Robust standard error statistics in parentheses
* significant at 5%; ** significant at 1%

Table 2.10: Separate Town Effects

	lrtotst
dtprovince~n	-0.483
	(0.245)*
dtbeverly	-0.392
	(0.101)**
dtmarblehead	-0.319
	(0.110)**
dtnantucket	0.164
	(0.092)
dtsandwich	-0.531
	(0.194)**
cons	9.924
	(0.095)**
Observations	7973
R-squared	0.058

Robust standard error statistics in parentheses
* significant at 5%; ** significant at 1%

The next set of regressions, Tables 2.11-2.13, restrict the data to the subsample of 29 towns and cities and localities affected by the fishing industry only, controlling for time fixed effects. This subsample reduces the data to 672 observations. For this subsample, Table 2.11 shows that Amendment 5 has had a significant impact on sales tax receipts, approximately -24% and -26% lower average and total gross real sales tax receipts for all towns in this subsample as shown in the shaded row.[27].

Taking into account the fact presented in the charts above that the share of those fishing communities on the total gross state tax receipts in about 6% for averages and about 19% for total, about 25% loss in tax revenues for the fishing localities could potentially be a significant amount for the State as a whole.

[27] The regression in Table 2.11 (and Tables 2.23 and 2.35) is:

$$y_{it} = a_0 + a_1 d_{1t} + \ldots \text{ (other factors; fixed effects; controls)} \ldots + \text{ error term}$$

where d_{1t} takes value 0 in the months before the amendment has been implemented (say before May 1994 in the case of Amendment 5) and 1 after the implementation; the constant term a_0 measures the *average* $[\, y_{it} \mid d_{1t} = d_{2i} = 0 \,] = a_0$, that is the average gross real sales tax receipts *before* ($d_{1t}=0$) an amendment has been implemented, for all fishing towns in the State. The coefficient a_1 measures $[\text{ change in } y_{it} \;/\; \text{change in } d_{1t} \,] = a_1$ hence, a_1 measures the change in average gross sales receipts *after* ($d_{1t}=1$) an amendment has been implemented, for all towns in the fishing industry in the State.

Table 2.11: Fishing Towns Only – Amendment 5 Effect

	(1)	(2)
	lrmst1	lrtotst1
dfyear	-0.241	-0.265
	(3.78)**	(2.24)*
dfeb	-0.022	-0.022
	(0.12)	(0.07)
dmar	0.032	0.032
	(0.17)	(0.10)
dapr	0.290	0.290
	(1.65)	(0.93)
dmay	0.573	0.573
	(3.44)**	(1.91)
djun	0.676	0.677
	(4.15)**	(2.29)*
djul	0.796	0.797
	(4.97)**	(2.74)**
daug	0.810	0.810
	(5.11)**	(2.81)**
dsep	0.661	0.661
	(4.12)**	(2.25)*
doct	0.367	0.368
	(2.19)*	(1.21)
dnov	0.213	0.213
	(1.21)	(0.69)
ddec	0.302	0.303
	(1.75)	(0.98)
Constant	4.614	10.491
	(34.35)**	(45.13)**
Observations	672	672
R-squared	0.13	0.04

Robust t statistics in parentheses
* significant at 5%; ** significant at 1%

Finally, for the same subsample, we measure differences-in-differences estimates for the ports of Gloucester, New Bedford/Fairhaven and Plymouth/Marshfield as shown in Tables 2.12-2.13. We find that while Gloucester and New Bedford/Fairhaven show an average and total gross real sales tax receipts significantly above the other towns in the fishing industry *before* Amendment 5 takes effect; the differences-in-differences estimator is not statistically significant in this case. Neither the averages and total, nor the treatment effect are statistically significant in the case of Plymouth/Marshfield as well.

Table 2.12: Differences-in-Differences – Fishing Towns Only

	(1)	(2)
	lrmst1	lrmst1
dfyear	-0.241	-0.251
	(4.08)**	(3.64)**
dglouce	1.399	1.333
	(13.12)**	(8.05)**
dnbefh	0.724	0.714
	(6.74)**	(4.69)**
dplyma	-0.053	-0.082
	(1.16)	(1.23)
dgloucefy		0.133
		(0.63)
dnbefhfy		0.021
		(0.10)
dplymafy		0.059
		(0.65)
dfeb	-0.022	-0.022
	(0.12)	(0.12)
dmar	0.032	0.032
	(0.18)	(0.18)
dapr	0.290	0.290
	(1.79)	(1.78)
dmay	0.573	0.573
	(3.75)**	(3.74)**
djun	0.676	0.676
	(4.52)**	(4.51)**
djul	0.796	0.796
	(5.41)**	(5.40)**
daug	0.810	0.810
	(5.49)**	(5.48)**
dsep	0.661	0.661
	(4.41)**	(4.40)**
doct	0.367	0.367
	(2.36)*	(2.36)*
dnov	0.213	0.213
	(1.31)	(1.30)
ddec	0.302	0.302
	(1.87)	(1.86)
Constant	4.516	4.521
	(35.94)**	(35.73)**
Observations	672	672
R-squared	0.26	0.26

Robust t statistics in parentheses
* significant at 5%; ** significant at 1%

Table 2.13: Differences-in-Differences – Fishing Towns Only

	(1)	(2)
	lrtotst1	lrtotst1
dfyear	-0.265	-0.275
	(2.34)*	(2.08)*
dglouce	1.843	1.786
	(15.78)**	(10.26)**
dnbefh	1.218	1.216
	(5.52)**	(3.90)**
dplyma	0.203	0.165
	(1.97)*	(1.13)
dgloucefy		0.113
		(0.49)
dnbefhfy		0.005
		(0.01)
dplymafy		0.074
		(0.36)
dfeb	-0.022	-0.022
	(0.07)	(0.07)
dmar	0.032	0.032
	(0.10)	(0.10)
dapr	0.290	0.290
	(0.98)	(0.98)
dmay	0.573	0.573
	(2.00)*	(2.00)*
djun	0.677	0.677
	(2.40)*	(2.39)*
djul	0.797	0.797
	(2.88)**	(2.87)**
daug	0.810	0.810
	(2.93)**	(2.93)**
dsep	0.661	0.661
	(2.34)*	(2.34)*
doct	0.368	0.368
	(1.27)	(1.26)
dnov	0.213	0.213
	(0.72)	(0.72)
ddec	0.303	0.303
	(1.02)	(1.02)
Constant	10.324	10.329
	(45.97)**	(45.49)**
Observations	672	672
R-squared	0.13	0.13

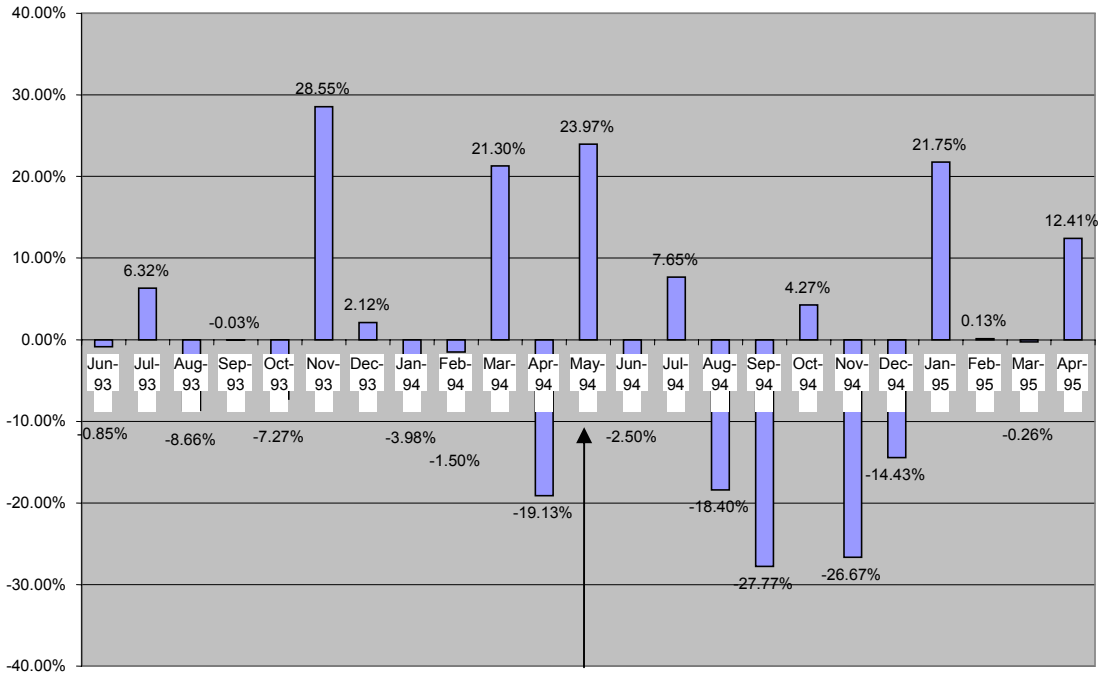
Robust t statistics in parentheses
* significant at 5%; ** significant at 1%

The conclusion for the May 1993 to April 1995 period where Amendment 5 took effect is that, while some of the effects of Amendment 5 are negative, the overall results cannot provide a clear quantitative framework for the hypothesis that Amendment 5 had a large negative impact on the fishing towns in the state, from the perspective of statistical variation in the sales tax receipts of the towns most likely affected by the regulation. The best evidence is from Table 2.11 where the introduction of the amendment is shown to reduce the average sales tax receipts of all fishing towns by about ¼.

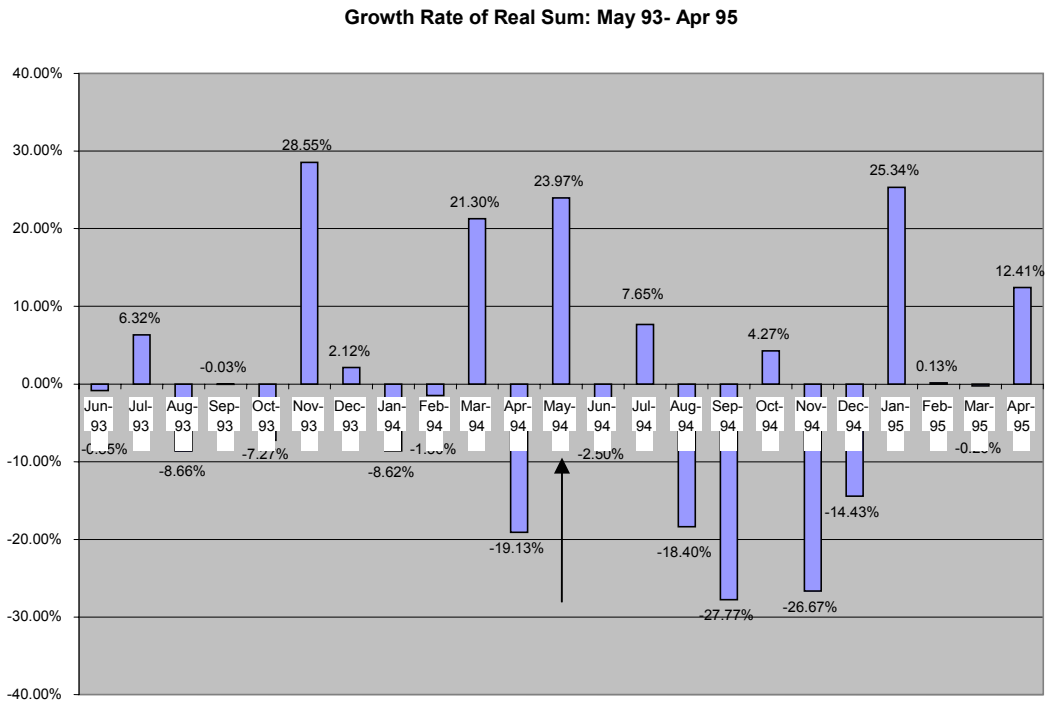
We finally present time series charts of the monthly changes in sales tax receipts for the towns of Gloucester, New Bedford, Fairhaven, Plymouth and Marshfield.

Gloucester: The variation is within the 30% range, it shows large negative monthly changes for the period June 1994, August-September 1994 and November-December 1994, both in averages and total receipts, a potential negative effect of Amendment 5.[28]

Figure 2.7: Gloucester
Growth Rate of Real Mean: May 93- Apr 95

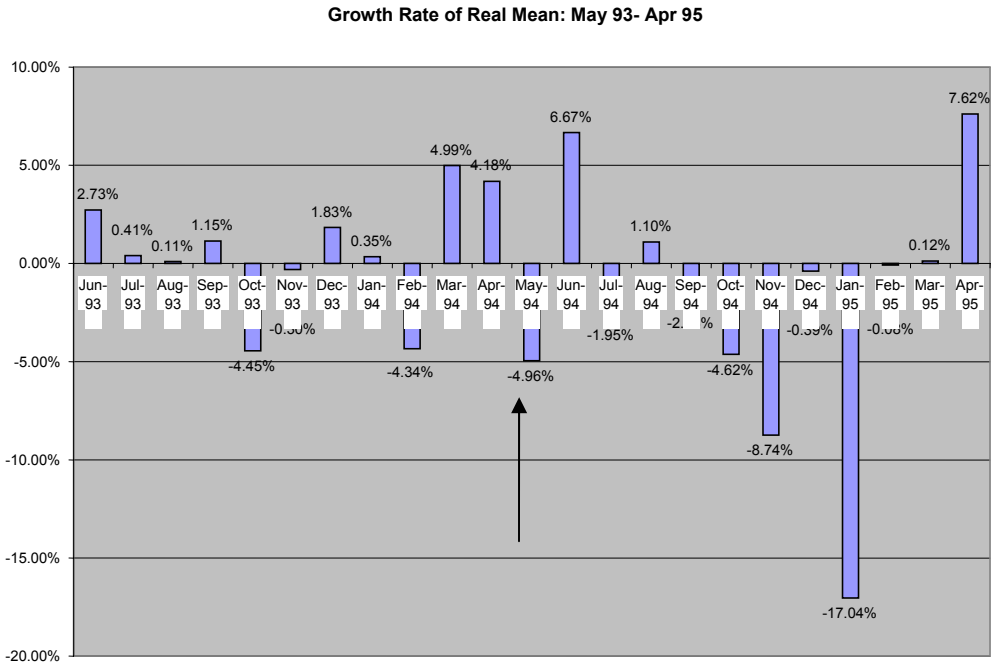


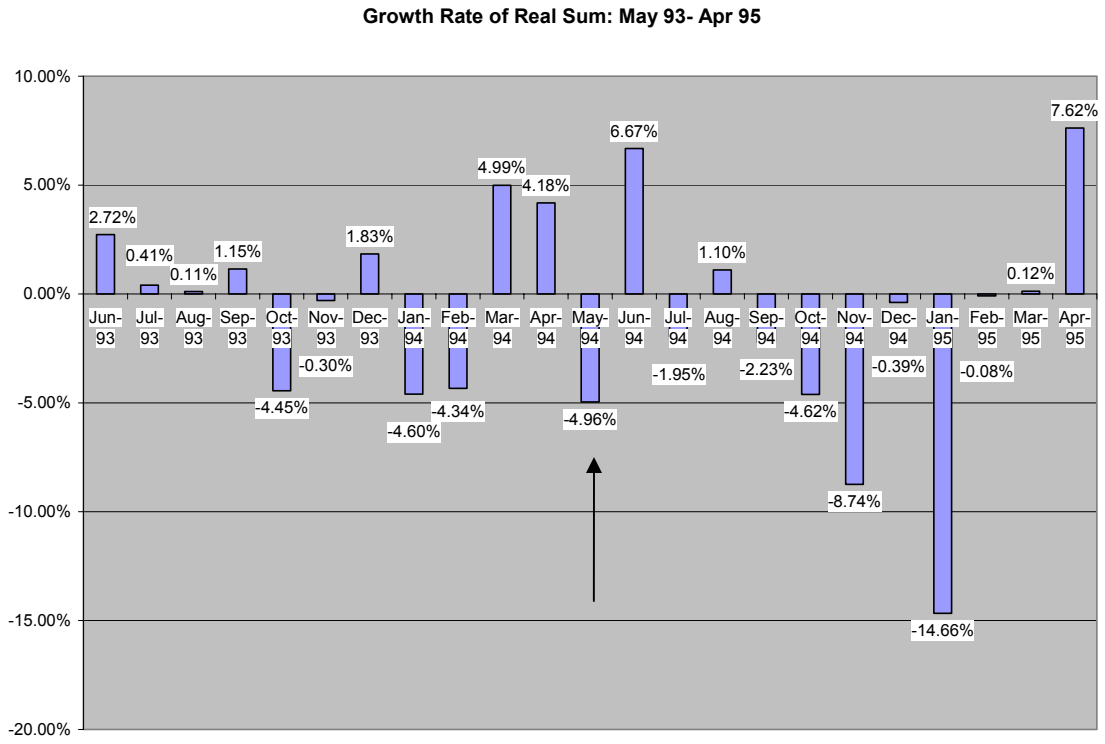
[28] Arrows indicate introduction of Amendment 5 in the month of May 1994.



New Bedford: The variation is within the 10% range, it shows large negative monthly changes for the period July 1994-March 1995, both in averages and total receipts, a potential effect of Amendment 5.

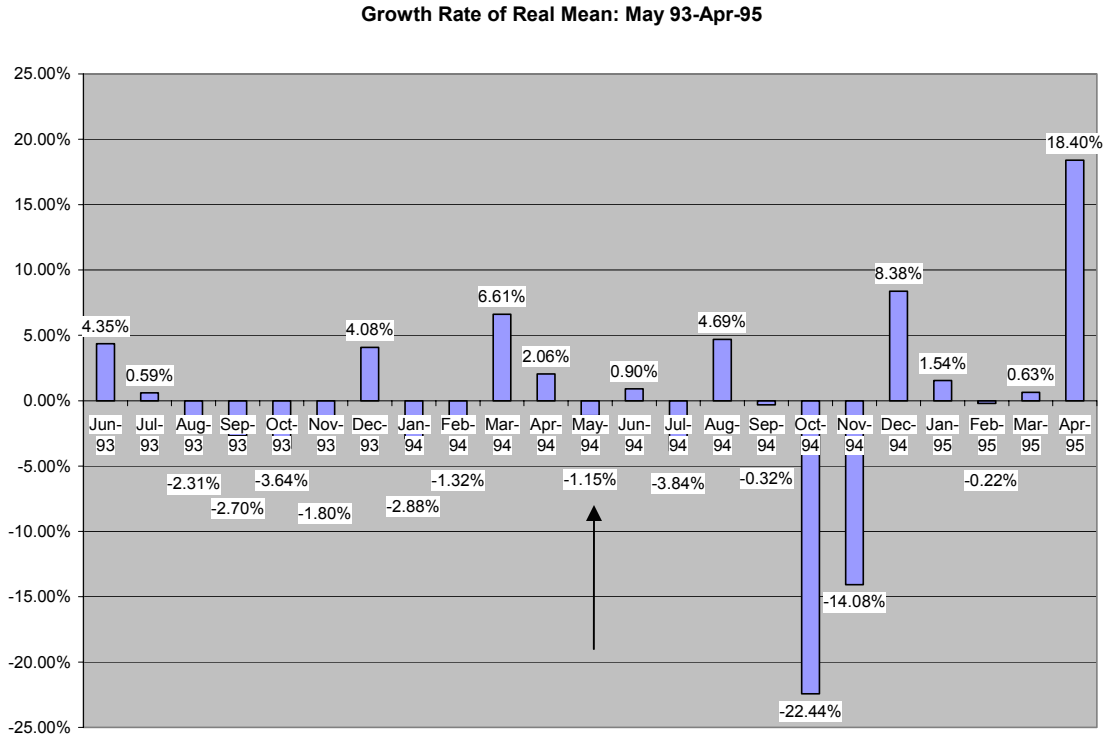
Figure 2.8: New Bedford

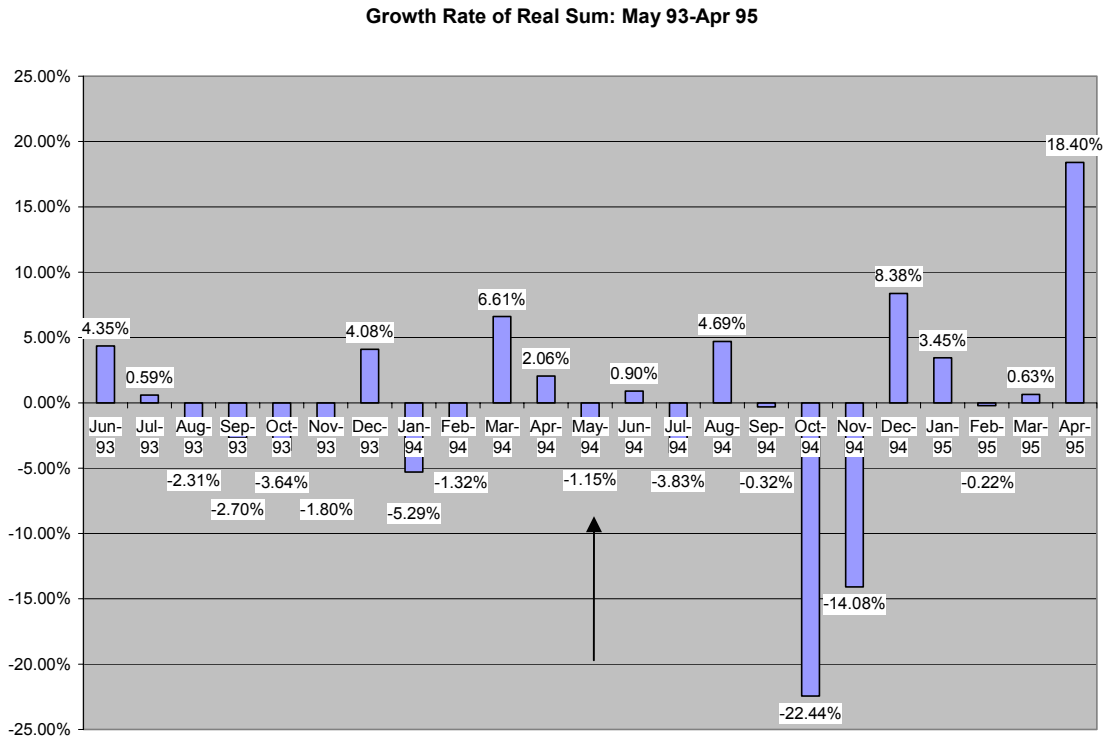




Fairhaven: The variation is mostly within the 10% range, it shows large negative monthly changes for the period October1994-November 1994, both in averages and total receipts. The May 2004 change is negative, but of the 1% order.

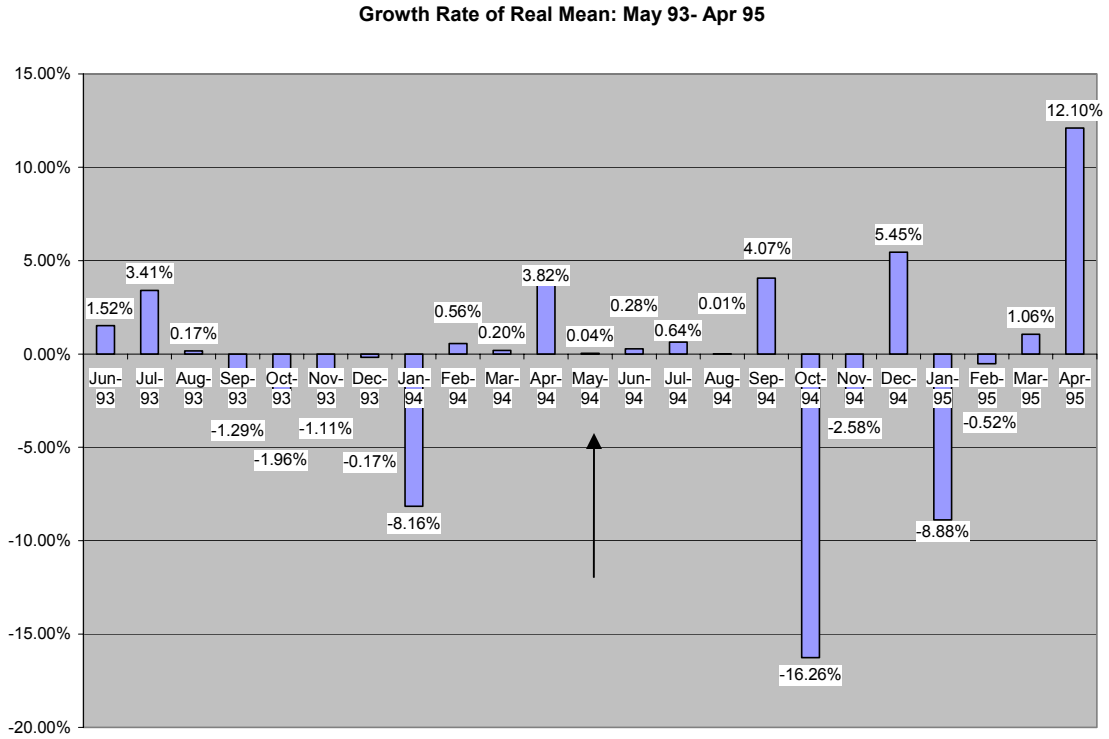
Figure 2.9: Fairhaven

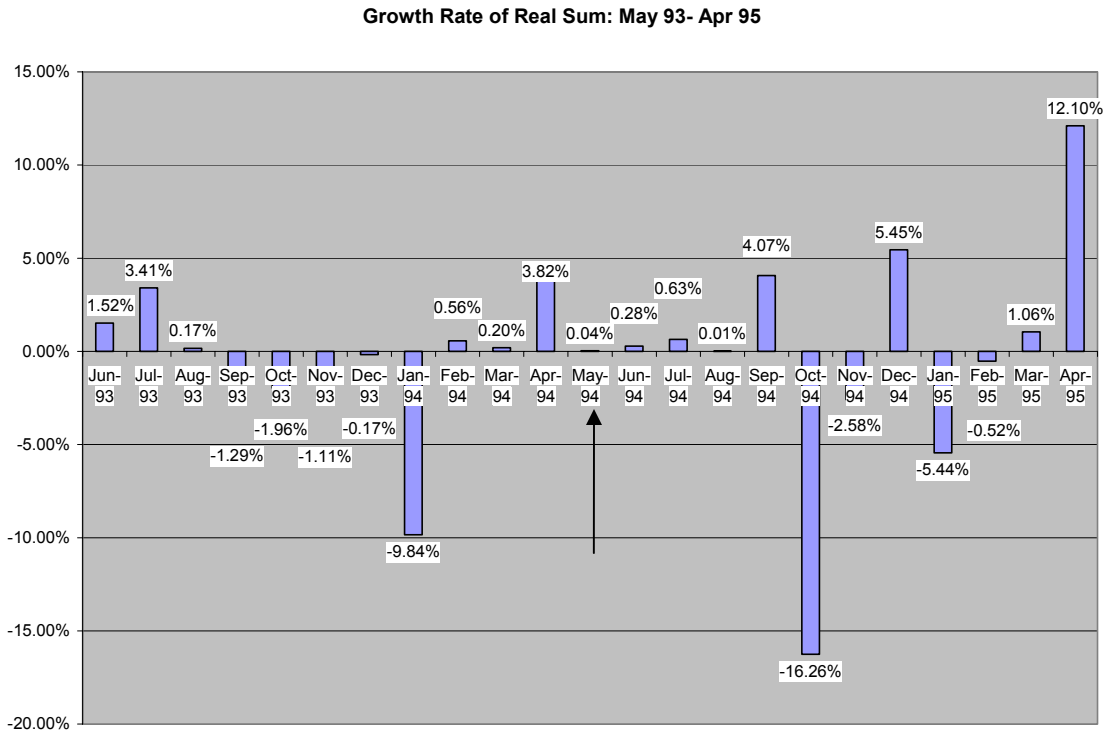




Plymouth: The variation is within the 10% range, it shows large negative monthly changes for the October 1994 month, both in averages and total receipts.

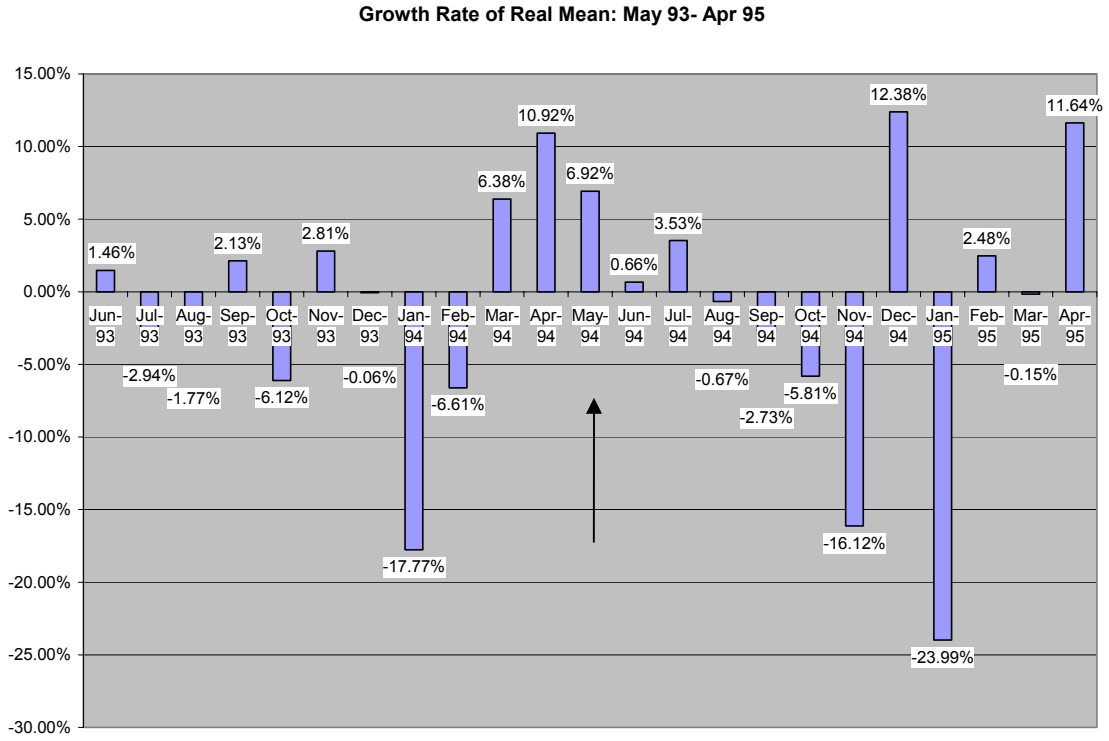
Figure 2.10: Plymouth

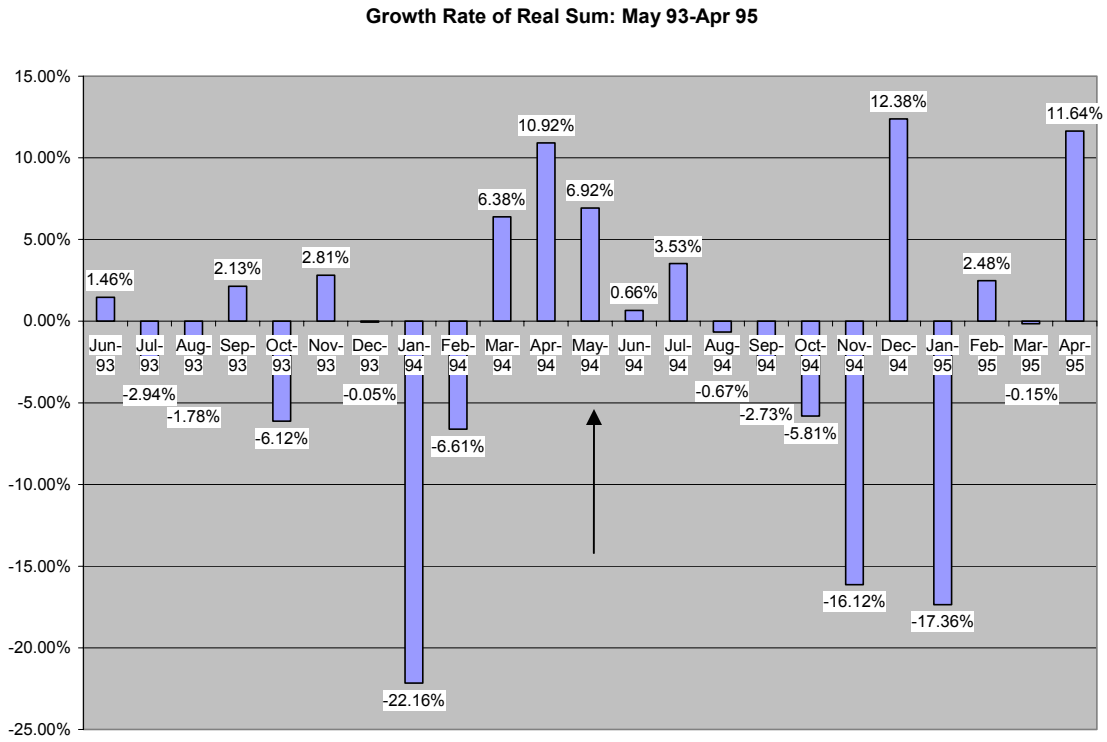




Marshfield: The variation is within the 15% range, it shows increasing negative monthly changes for the period August 1994- November 1994 in averages and total receipts.

Figure 2.11 Marshfield





The time series plots for monthly changes of gross real sales tax receipts give an additional dimension where the regulations of Amendment 5 may have contributed to more variation and more negative changes of tax receipts. It is worth noting that Gloucester has the largest range of variation in monthly changes in this subgroup in this period.

II.1.2. Amendment 7: July 1995 to July 1997 Period

We proceed using the same econometric estimation technique with monthly data from July 1995 to July 1997, where Amendment 7 takes effect on July 1, 1996.

Table 2.14 shows the simple differences-indifferences estimator without further factors, fixed effects or controls. Again, the variable *lrmst* represents the (logarithm of) the average gross sales tax receipts and *lrtotst* represents the (logarithm of) the total gross sales tax receipts pre month per town. This sample has 8,034 observations. For the average gross real sales receipts and the total gross real sales receipts we find no statistically significant effects of Amendment 7.

Table 2.14: Basic Differences-in-Differences Estimator

	(1)	(2)
	lrmst	lrtotst
dfyear	0.007	0.045
	(0.27)	(0.91)
dtreat	-0.096	0.611
	(1.93)	(7.15)**
dyeartreat	0.016	0.003
	(0.22)	(0.03)
Constant	5.185	10.257
	(268.07)**	(292.08)**
Observations	8034	8034
R-squared	0.00	0.01

Robust t statistics in parentheses
* significant at 5%; ** significant at 1%

Tables 2.15-2.18, show the same regression with several fixed time effects for seasonal variation and interactions of the time effects with the treatment group of towns in the fishing industry. The results in Tables 2.15 and 2.16 show a well-identified summer effect on tax receipts for the average gross sales tax in the months of July and August, in the shaded rows.

Table 2.15: Seasonal Effects

	(1)	(2)	(3)	(4)	(5)	(6)
	lrmst	lrmst	lrmst	lrmst	lrmst	lrmst
dfyear	0.008	0.008	0.007	0.007	0.008	0.008
	(0.28)	(0.28)	(0.28)	(0.28)	(0.28)	(0.28)
dtreat	-0.097	-0.104	-0.116	-0.116	-0.105	-0.093
	(1.93)	(2.07)*	(2.26)*	(2.27)*	(2.05)*	(1.83)
dyeartreat	0.016	0.016	0.016	0.016	0.016	0.016
	(0.22)	(0.22)	(0.22)	(0.22)	(0.22)	(0.22)
dtreatmay	0.011					
	(0.09)					
dtreatjun		0.095				
		(0.78)				
dtreatjul			0.241			
			(2.11)*			
dtreatoct				-0.032		
				(0.24)		
dtreatsep					0.109	
					(0.91)	
dtreataug						0.242
						(2.13)*
Dfeb	-0.025	-0.025	-0.025	-0.025	-0.025	-0.025
	(0.38)	(0.38)	(0.38)	(0.38)	(0.38)	(0.38)
dmar	0.014	0.014	0.014	0.014	0.014	0.014
	(0.21)	(0.21)	(0.21)	(0.21)	(0.21)	(0.21)
dapr	0.117	0.117	0.117	0.117	0.117	0.117
	(1.84)	(1.84)	(1.84)	(1.84)	(1.84)	(1.84)
dmay	0.167	0.167	0.167	0.167	0.167	0.167
	(2.56)*	(2.67)**	(2.67)**	(2.67)**	(2.67)**	(2.67)**
djun	0.191	0.183	0.191	0.191	0.191	0.191
	(3.04)**	(2.81)**	(3.04)**	(3.04)**	(3.04)**	(3.04)**
djul	0.158	0.158	0.138	0.158	0.158	0.158
	(2.52)*	(2.52)*	(2.12)*	(2.52)*	(2.52)*	(2.52)*
daug	0.178	0.178	0.178	0.157	0.178	0.178
	(2.82)**	(2.82)**	(2.82)**	(2.41)*	(2.82)**	(2.82)**
dsep	0.147	0.147	0.147	0.147	0.138	0.147
	(2.33)*	(2.33)*	(2.33)*	(2.33)*	(2.11)*	(2.33)*
doct	0.103	0.104	0.104	0.104	0.104	0.106
	(1.64)	(1.64)	(1.64)	(1.64)	(1.64)	(1.62)
dnov	0.068	0.068	0.068	0.068	0.068	0.068
	(1.08)	(1.08)	(1.08)	(1.08)	(1.08)	(1.08)
ddec	0.084	0.084	0.084	0.084	0.084	0.084
	(1.32)	(1.32)	(1.32)	(1.32)	(1.32)	(1.32)
Constant	5.085	5.085	5.086	5.086	5.086	5.085
	(106.51)**	(106.53)**	(106.56)**	(106.56)**	(106.53)**	(106.51)**
Observations	8034	8034	8034	8034	8034	8034
R-squared	0.00	0.00	0.00	0.00	0.00	0.00

Robust t statistics in parentheses
* significant at 5%; ** significant at 1%

Table 2.16: Seasonal Effects

	(1)	(2)	(3)	(4)	(5)
	lrmst	lrmst	lrmst	lrmst	lrmst
dfyear	0.008	0.008	0.008	0.008	0.008
	(0.28)	(0.28)	(0.28)	(0.28)	(0.28)
dtreat	-0.090	-0.091	-0.087	-0.087	-0.092
	(1.76)	(1.77)	(1.75)	(1.75)	(1.83)
dyeartreat	0.016	0.016	0.016	0.016	0.016
	(0.22)	(0.22)	(0.22)	(0.22)	(0.22)
dtreatnov	-0.077				
	(0.55)				
dtreatdec		-0.065			
		(0.47)			
dtreatfeb			-0.105		
			(0.72)		
dtreatapr				-0.050	
				(0.38)	
dtreatmar					-0.108
					(0.74)
dfeb	-0.025	-0.025	-0.016	-0.025	-0.025
	(0.38)	(0.38)	(0.24)	(0.38)	(0.38)
dmar	0.014	0.014	0.014	0.023	0.014
	(0.21)	(0.21)	(0.21)	(0.34)	(0.21)
dapr	0.117	0.117	0.117	0.117	0.121
	(1.84)	(1.84)	(1.84)	(1.84)	(1.84)
dmay	0.167	0.167	0.167	0.167	0.167
	(2.67)**	(2.67)**	(2.67)**	(2.67)**	(2.67)**
djun	0.191	0.191	0.191	0.191	0.191
	(3.04)**	(3.04)**	(3.04)**	(3.04)**	(3.04)**
djul	0.158	0.158	0.158	0.158	0.158
	(2.52)*	(2.52)*	(2.52)*	(2.52)*	(2.52)*
daug	0.178	0.178	0.178	0.178	0.178
	(2.82)**	(2.82)**	(2.82)**	(2.82)**	(2.82)**
dsep	0.147	0.147	0.147	0.147	0.147
	(2.33)*	(2.33)*	(2.33)*	(2.33)*	(2.33)*
doct	0.103	0.103	0.103	0.103	0.103
	(1.63)	(1.63)	(1.63)	(1.63)	(1.64)
dnov	0.075	0.068	0.068	0.068	0.068
	(1.14)	(1.07)	(1.07)	(1.07)	(1.08)
ddec	0.084	0.089	0.084	0.084	0.084
	(1.32)	(1.36)	(1.32)	(1.32)	(1.32)
Constant	5.084	5.084	5.084	5.084	5.084
	(106.50)**	(106.50)**	(106.49)**	(106.49)**	(106.50)**
Observations	8034	8034	8034	8034	8034
R-squared	0.00	0.00	0.00	0.00	0.00

Robust t statistics in parentheses
* significant at 5%; ** significant at 1%

Table 2.17: Seasonal Effects

	(1)	(2)	(3)	(4)	(5)	(6)
	lrtotst	lrtotst	lrtotst	lrtotst	lrtotst	lrtotst
dfyear	0.045	0.045	0.045	0.045	0.045	0.045
	(0.91)	(0.91)	(0.91)	(0.91)	(0.91)	(0.91)
dtreat	0.610	0.603	0.593	0.592	0.604	0.615
	(6.98)**	(6.90)**	(6.78)**	(6.78)**	(6.92)**	(7.07)**
dyeartreat	0.003	0.003	0.003	0.003	0.003	0.003
	(0.03)	(0.03)	(0.03)	(0.03)	(0.03)	(0.03)
dtreatmay	0.004					
	(0.02)					
dtreatjun		0.088				
		(0.42)				
dtreatjul			0.218			
			(1.08)			
dtreatoct				-0.055		
				(0.25)		
dtreatsep					0.086	
					(0.41)	
dtreataug						0.219
						(1.09)
dfeb	-0.025	-0.025	-0.025	-0.025	-0.025	-0.025
	(0.22)	(0.22)	(0.22)	(0.22)	(0.22)	(0.22)
dmar	0.014	0.014	0.014	0.014	0.014	0.014
	(0.12)	(0.12)	(0.12)	(0.12)	(0.12)	(0.12)
dapr	0.117	0.117	0.117	0.117	0.117	0.117
	(1.03)	(1.03)	(1.03)	(1.03)	(1.03)	(1.03)
dmay	0.167	0.167	0.167	0.167	0.167	0.167
	(1.42)	(1.47)	(1.47)	(1.47)	(1.47)	(1.47)
djun	0.191	0.183	0.191	0.191	0.191	0.191
	(1.68)	(1.56)	(1.68)	(1.68)	(1.68)	(1.68)
djul	0.122	0.122	0.104	0.122	0.122	0.122
	(1.07)	(1.07)	(0.88)	(1.07)	(1.07)	(1.07)
daug	0.141	0.141	0.141	0.123	0.141	0.141
	(1.24)	(1.24)	(1.24)	(1.04)	(1.24)	(1.24)
dsep	0.111	0.111	0.111	0.111	0.103	0.111
	(0.97)	(0.97)	(0.97)	(0.97)	(0.88)	(0.97)
doct	0.067	0.067	0.067	0.067	0.067	0.072
	(0.59)	(0.59)	(0.59)	(0.59)	(0.59)	(0.61)
dnov	0.032	0.032	0.032	0.032	0.032	0.032
	(0.28)	(0.28)	(0.28)	(0.28)	(0.28)	(0.28)
ddec	0.048	0.048	0.048	0.048	0.048	0.048
	(0.42)	(0.42)	(0.42)	(0.42)	(0.42)	(0.42)
Constant	10.175	10.175	10.176	10.176	10.175	10.174
	(119.06)**	(119.06)**	(119.08)**	(119.08)**	(119.06)**	(119.05)**
Observations	8034	8034	8034	8034	8034	8034
R-squared	0.01	0.01	0.01	0.01	0.01	0.01

Robust t statistics in parentheses
* significant at 5%; ** significant at 1%

Table 2.18: Seasonal Effects

	(1)	(2)	(3)	(4)	(5)
	lrtotst	lrtotst	lrtotst	lrtotst	lrtotst
dfyear	0.045	0.045	0.045	0.045	0.045
	(0.91)	(0.91)	(0.91)	(0.91)	(0.91)
dtreat	0.619	0.618	0.620	0.620	0.615
	(7.12)**	(7.11)**	(7.13)**	(7.13)**	(7.05)**
dyeartreat	0.003	0.003	0.003	0.003	0.003
	(0.03)	(0.03)	(0.03)	(0.03)	(0.03)
dtreatnov	-0.100				
	(0.44)				
dtreatdec		-0.089			
		(0.39)			
dtreatfeb			-0.112		
			(0.48)		
dtreatapr				-0.057	
				(0.26)	
dtreatmar					-0.115
					(0.49)
dfeb	-0.025	-0.025	-0.016	-0.025	-0.025
	(0.22)	(0.22)	(0.13)	(0.22)	(0.22)
dmar	0.014	0.014	0.014	0.023	0.014
	(0.12)	(0.12)	(0.12)	(0.19)	(0.12)
dapr	0.117	0.117	0.117	0.117	0.122
	(1.03)	(1.03)	(1.03)	(1.03)	(1.03)
dmay	0.167	0.167	0.167	0.167	0.167
	(1.47)	(1.47)	(1.47)	(1.47)	(1.47)
djun	0.191	0.191	0.191	0.191	0.191
	(1.68)	(1.68)	(1.68)	(1.68)	(1.68)
djul	0.122	0.122	0.122	0.122	0.122
	(1.07)	(1.07)	(1.07)	(1.07)	(1.07)
daug	0.141	0.141	0.141	0.141	0.141
	(1.24)	(1.24)	(1.24)	(1.24)	(1.24)
dsep	0.111	0.111	0.111	0.111	0.111
	(0.97)	(0.97)	(0.97)	(0.97)	(0.97)
doct	0.067	0.067	0.067	0.067	0.067
	(0.59)	(0.59)	(0.59)	(0.59)	(0.59)
dnov	0.040	0.032	0.032	0.032	0.032
	(0.34)	(0.28)	(0.28)	(0.28)	(0.28)
ddec	0.048	0.055	0.048	0.048	0.048
	(0.42)	(0.47)	(0.42)	(0.42)	(0.42)
Constant	10.174	10.174	10.174	10.174	10.174
	(119.05)**	(119.05)**	(119.05)**	(119.05)**	(119.05)**
Observation	8034	8034	8034	8034	8034
R-squared	0.01	0.01	0.01	0.01	0.01

Robust t statistics in parentheses
* significant at 5%; ** significant at 1%

The next set of regressions, Tables 2.19-2.22, show models with separate difference-in-difference estimators for each town of the fishing industry group.[29] We find no significant effects of Amendment 7 in each town in this sample ralative to all other towns in the State.

Table 2.19: Separate Town Effects

	lrmst
cons	5.085
	(0.047)**
Observations	8034
R-squared	0.034

Robust standard error statistics in parentheses
* significant at 5%; ** significant at 1%

Table 2.20: Separate Town Effects

	lrtotst
cons	10.174
	(0.084)**
Observations	8034
R-squared	0.033

Robust standard error statistics in parentheses
* significant at 5%; ** significant at 1%

Table 2.21: Separate Town Effects

	lrmst
cons	5.105
	(0.050)**
Observations	8034
R-squared	0.035

Robust standard error statistics in parentheses
* significant at 5%; ** significant at 1%

Table 2.22: Separate Town Effects

	lrtotst
cons	10.180
	(0.090)**
Observations	8034
R-squared	0.034

Robust standard error statistics in parentheses
* significant at 5%; ** significant at 1%

[29] Regressions in Tables 2-19-2.22 includes several time effects, fixed effects and interaction terms, only results significant up to the 10% confidence level for the differences-in-differences estimators are reported.

The next set of regressions, Tables 2-23-2.25, restrict the data to the subsample of towns affected by the fishing industry only, controlling for time fixed effects. This subsample has 672 observations. For this subsample, Table 2.23 shows that Amendment 7 no significant impact on sales tax receipts, for all towns in the sample.

Table 2.23: Fishing Towns Only – Amendment 7 Effect

	(1)	(2)
	lrmst1	lrtotst1
dfyear	0.024	0.048
	(0.35)	(0.43)
dfeb	0.105	-0.047
	(0.59)	(0.16)
dmar	0.141	-0.011
	(0.78)	(0.04)
dapr	0.294	0.141
	(1.75)	(0.49)
dmay	0.395	0.243
	(2.47)*	(0.86)
djun	0.489	0.336
	(3.05)**	(1.19)
djul	0.579	0.377
	(3.74)**	(1.37)
daug	0.599	0.397
	(3.88)**	(1.44)
dsep	0.457	0.254
	(2.88)**	(0.90)
doct	0.295	0.093
	(1.75)	(0.32)
dnov	0.222	0.020
	(1.27)	(0.07)
ddec	0.247	0.045
	(1.42)	(0.15)
Constant	4.770	10.714
	(38.30)**	(47.97)**
Observations	672	672
R-squared	0.04	0.01

Robust t statistics in parentheses
* significant at 5%; ** significant at 1%

Finally, for the same subsample, we measure differences-in-differences estimates for the ports of Gloucester, New Bedford/Fairhaven and Plymouth/Marshfield as shown in Tables 2.24-2.25. We find that while New Bedford/Fairhaven show an average and total gross sales tax receipts significantly above the other towns in the fishing industry for the period before the amendment takes effect, Plymouth/Marshfiled show an average and total gross sales tax receipts significantly below the other towns in the fishing industry for the period before the amendment takes effect. However, the differences-in-differences

effect of Amendment 7 is not statistically significant. Neither the averages and total, nor the treatment effect are statistically significant in the case of Gloucester as well.

Table 2.24: Differences-in-Differences – Fishing Towns Only

	(1)	(2)
	lrmst1	lrmst1
dfyear	0.024	0.025
	(0.37)	(0.33)
dglouce	-0.040	0.011
	(0.15)	(0.03)
dnbefh	0.933	0.915
	(11.77)**	(7.43)**
dplyma	-0.183	-0.183
	(3.50)**	(2.86)**
dgloucefy		-0.102
		(0.18)
dnbefhfy		0.035
		(0.22)
dplymafy		0.002
		(0.02)
dfeb	0.105	0.105
	(0.61)	(0.61)
dmar	0.141	0.141
	(0.82)	(0.81)
dapr	0.294	0.294
	(1.83)	(1.82)
dmay	0.395	0.395
	(2.58)*	(2.57)*
djun	0.489	0.489
	(3.18)**	(3.17)**
djul	0.579	0.579
	(3.86)**	(3.86)**
daug	0.599	0.599
	(4.02)**	(4.01)**
dsep	0.457	0.457
	(2.99)**	(2.99)**
doct	0.295	0.295
	(1.81)	(1.81)
dnov	0.222	0.222
	(1.31)	(1.31)
ddec	0.247	0.247
	(1.47)	(1.46)
Constant	4.718	4.718
	(38.94)**	(38.43)**
Observations	672	672
R-squared	0.12	0.12

Robust t statistics in parentheses
* significant at 5%; ** significant at 1%

Table 2.25: Differences-in-Differences – Fishing Towns Only

	(1)	(2)
	lrtotst1	lrtotst1
dfyear	0.048	0.055
	(0.45)	(0.47)
dglouce	-0.761	-0.599
	(1.36)	(0.81)
dnbefh	1.613	1.589
	(9.74)**	(6.62)**
dplyma	0.229	0.222
	(2.15)*	(1.57)
dgloucefy		-0.323
		(0.29)
dnbefhfy		0.048
		(0.14)
dplymafy		0.013
		(0.06)
dfeb	-0.047	-0.047
	(0.16)	(0.16)
dmar	-0.011	-0.011
	(0.04)	(0.04)
dapr	0.141	0.141
	(0.50)	(0.49)
dmay	0.243	0.243
	(0.88)	(0.87)
djun	0.336	0.336
	(1.22)	(1.21)
djul	0.377	0.377
	(1.39)	(1.39)
daug	0.397	0.397
	(1.47)	(1.47)
dsep	0.254	0.254
	(0.92)	(0.92)
doct	0.093	0.093
	(0.32)	(0.32)
dnov	0.020	0.020
	(0.07)	(0.07)
ddec	0.045	0.045
	(0.15)	(0.15)
Constant	10.609	10.606
	(47.05)**	(46.65)**
Observations	672	672
R-squared	0.11	0.11

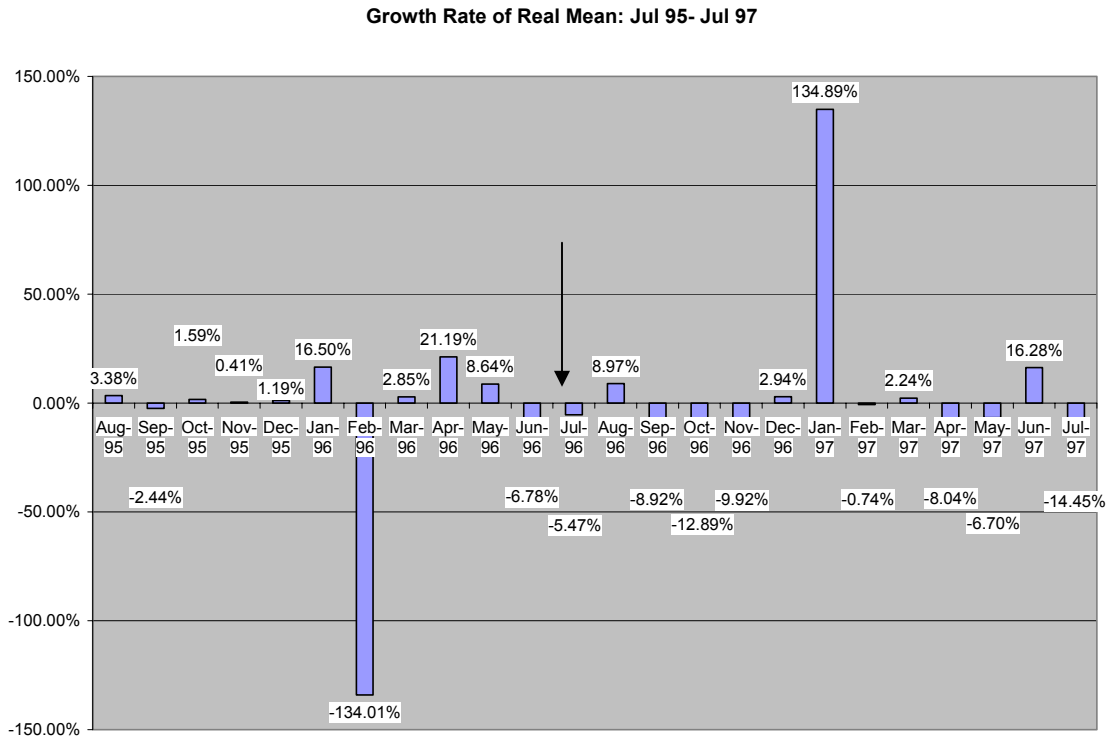
Robust t statistics in parentheses
* significant at 5%; ** significant at 1%

The conclusion for July 1995 to July 1997 period is that the effects of Amendment 7 on average and total gross real sales taxes are not statistically significant. We cannot identify statistically significant effects in this period with the used controls.

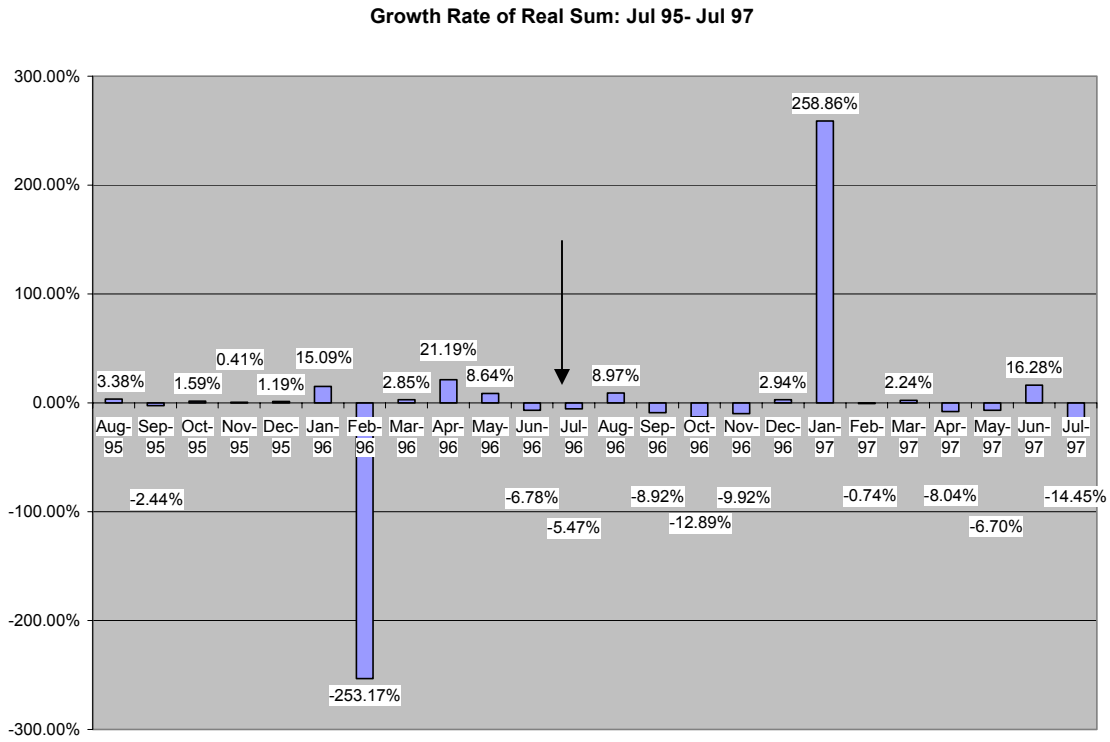
We finally present time series figures of the monthly changes in sales tax receipts for the towns of Gloucester, New Bedford, Fairhaven, Plymouth and Marshfield.

Gloucester: The variation is within the 50% range with some large outliers, it shows a negative monthly change in July 1996 which could be a direct effect of Amendment 7, since July is a summer month subject to positive seasonal component; also from September to November 1996 the change is negative.[30]

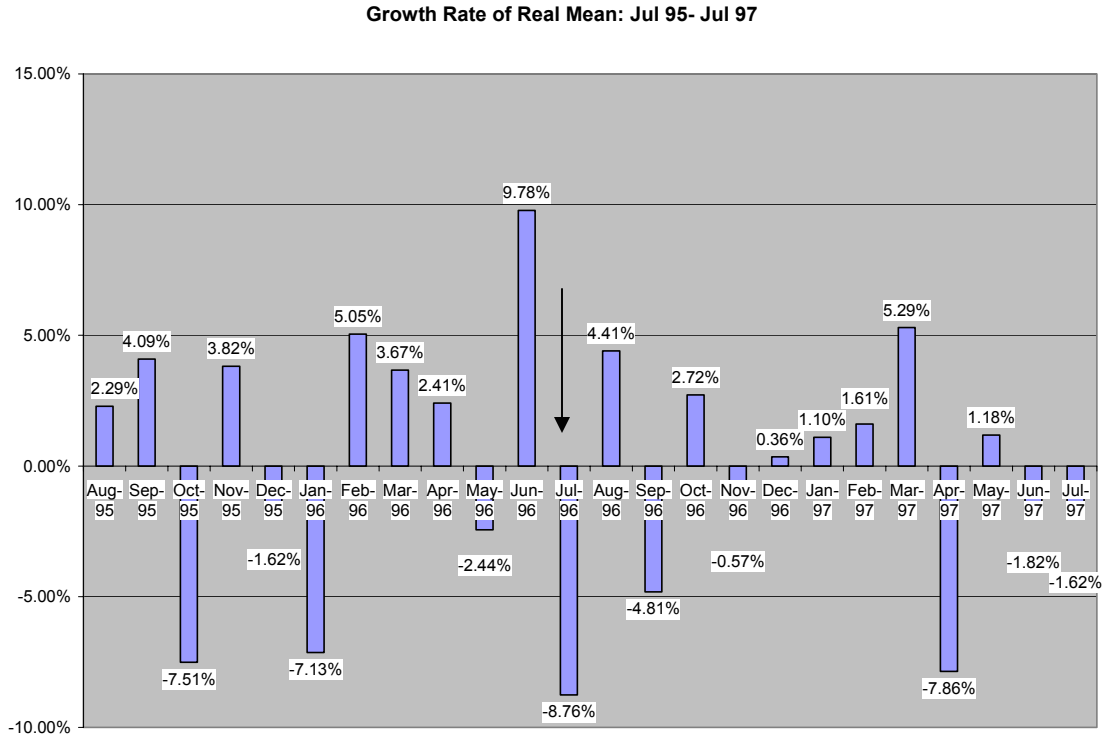
Figure 2.12 Gloucester

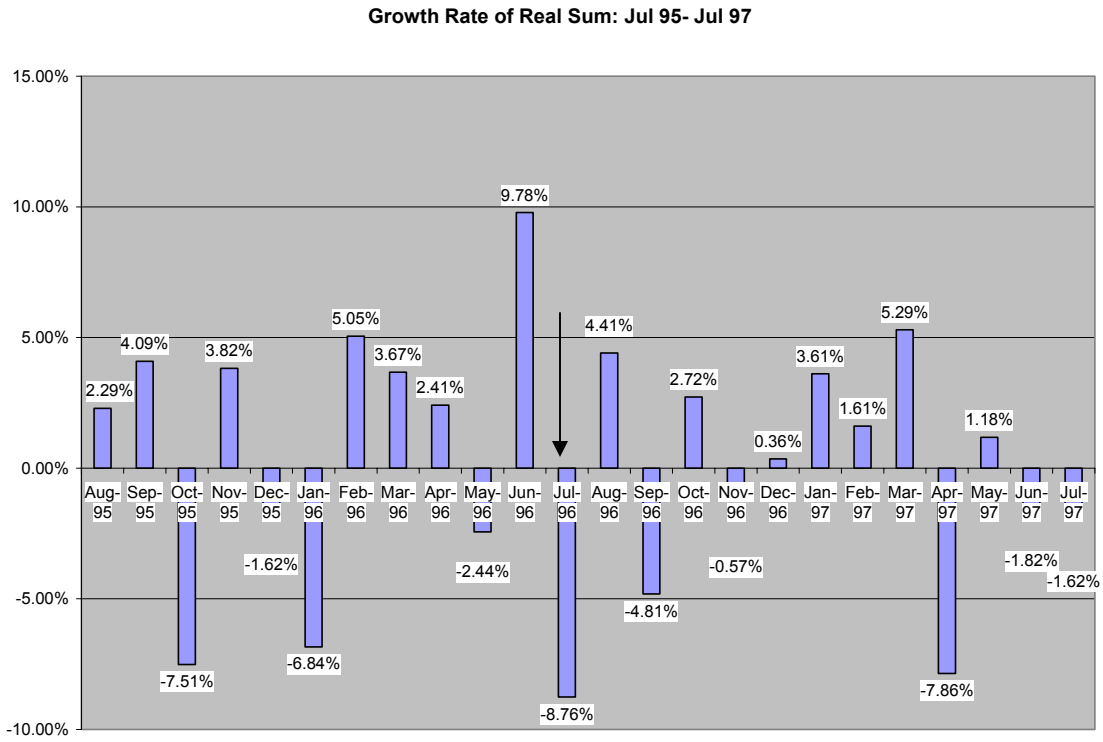


[30] Arrows indicate implementation of the Amendment 7 in July of 1996.



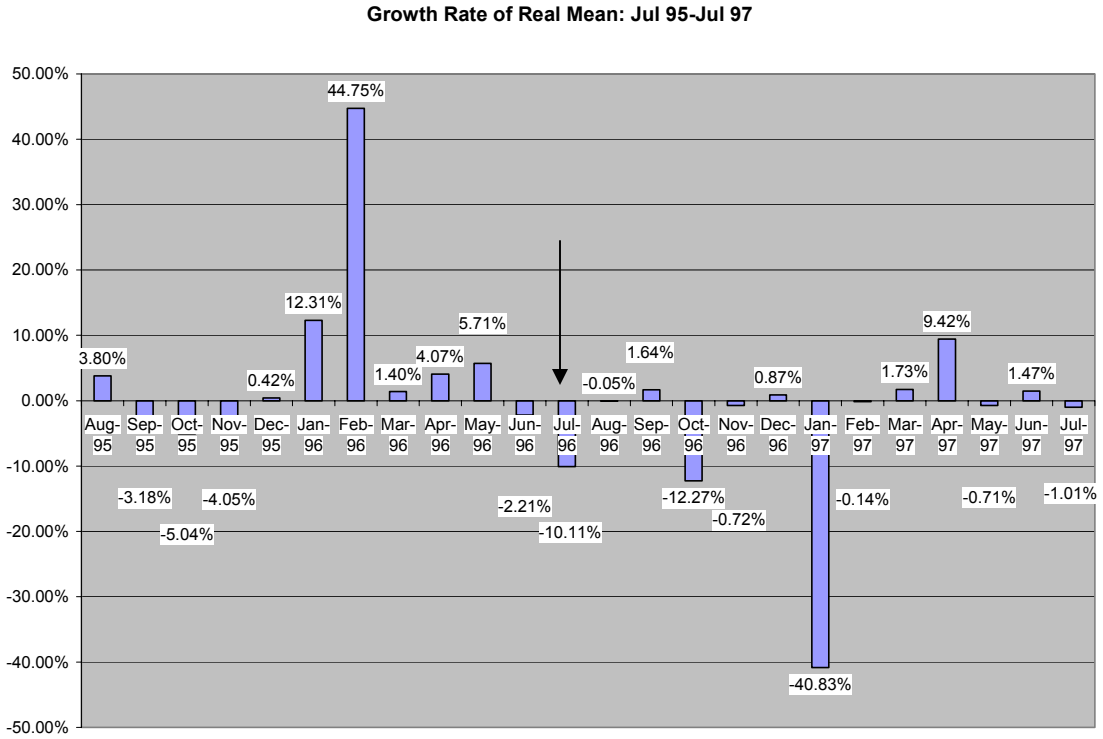
New Bedford: The variation is within the 10% range, data show small variation after July 1996, but the July 1996 effect is -8.7%, a potential negative impact of Amendment 7.
Figure 2.13 New Bedford

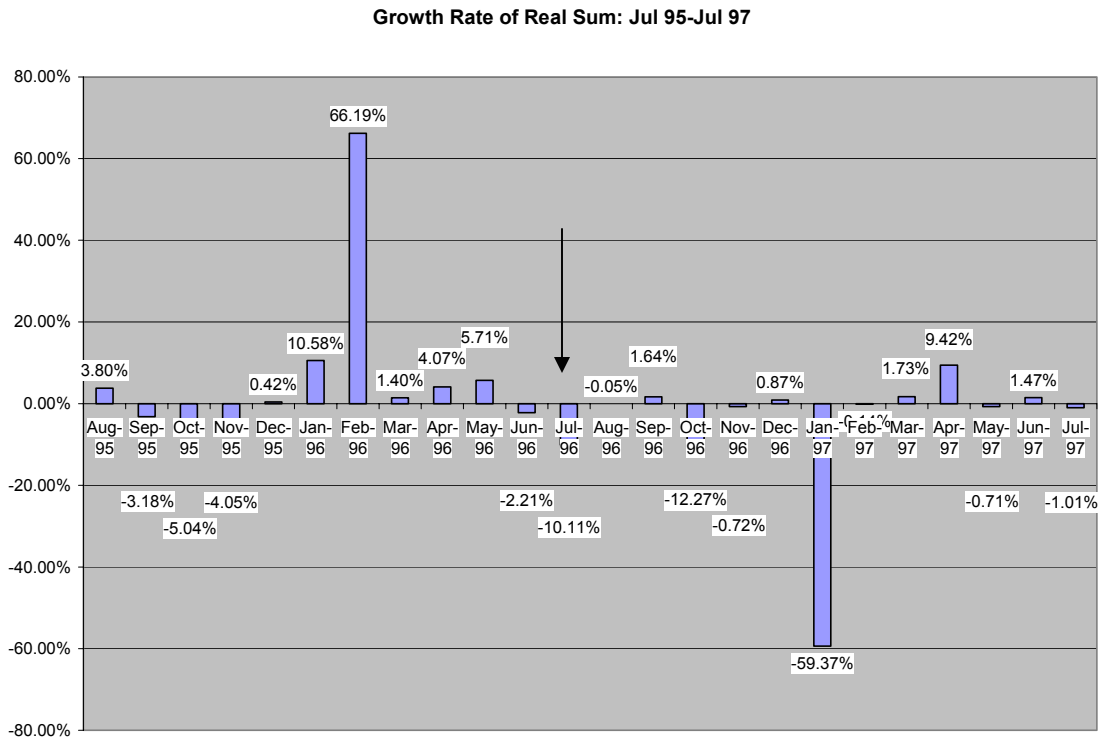




Fairhaven: The variation is mostly within the 20% range with some large outliers, data also show the July 1996 effect as negative.

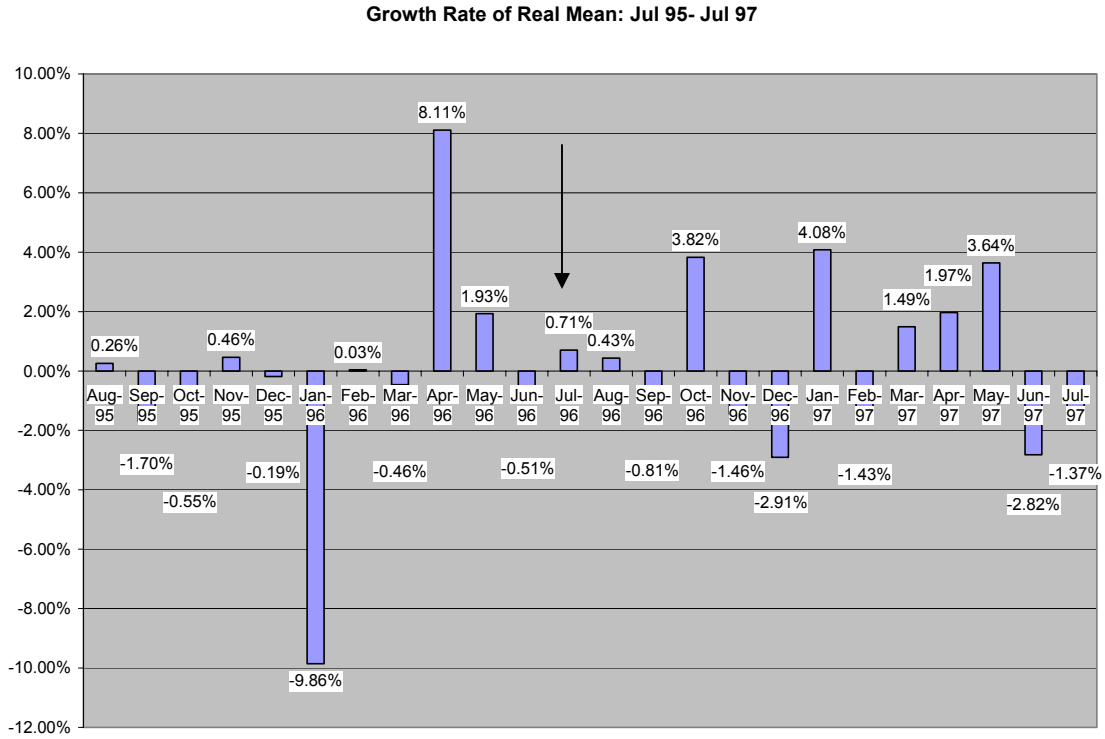
Figure 2.14 Fairhaven

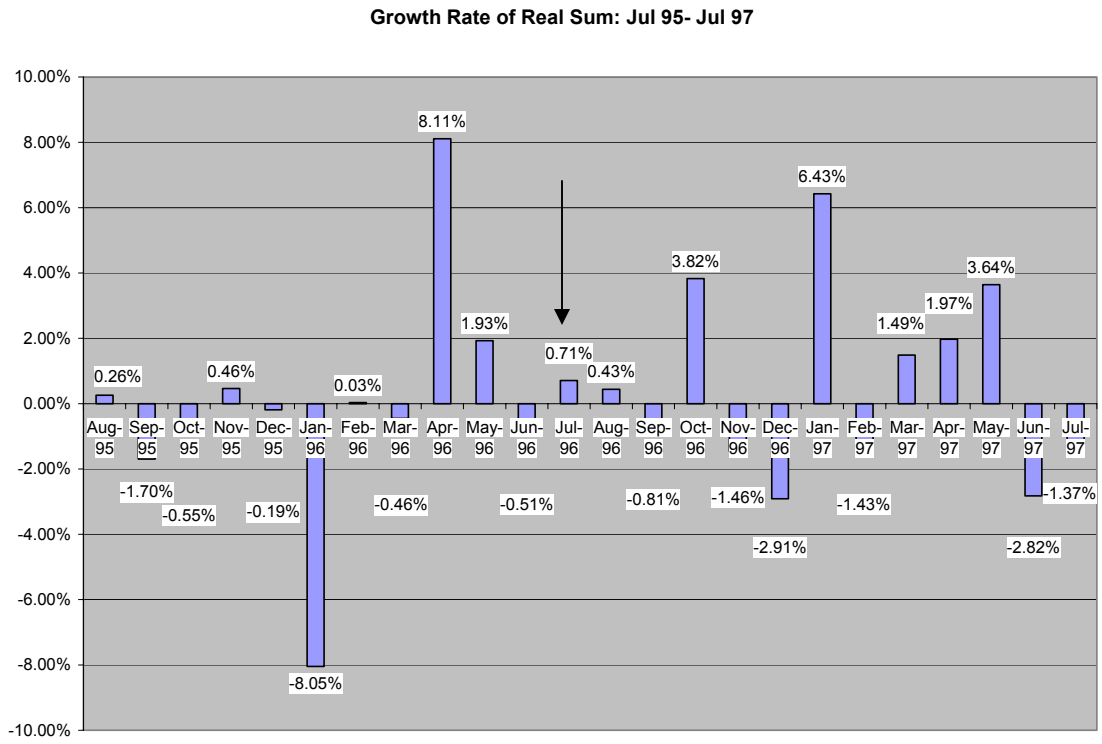




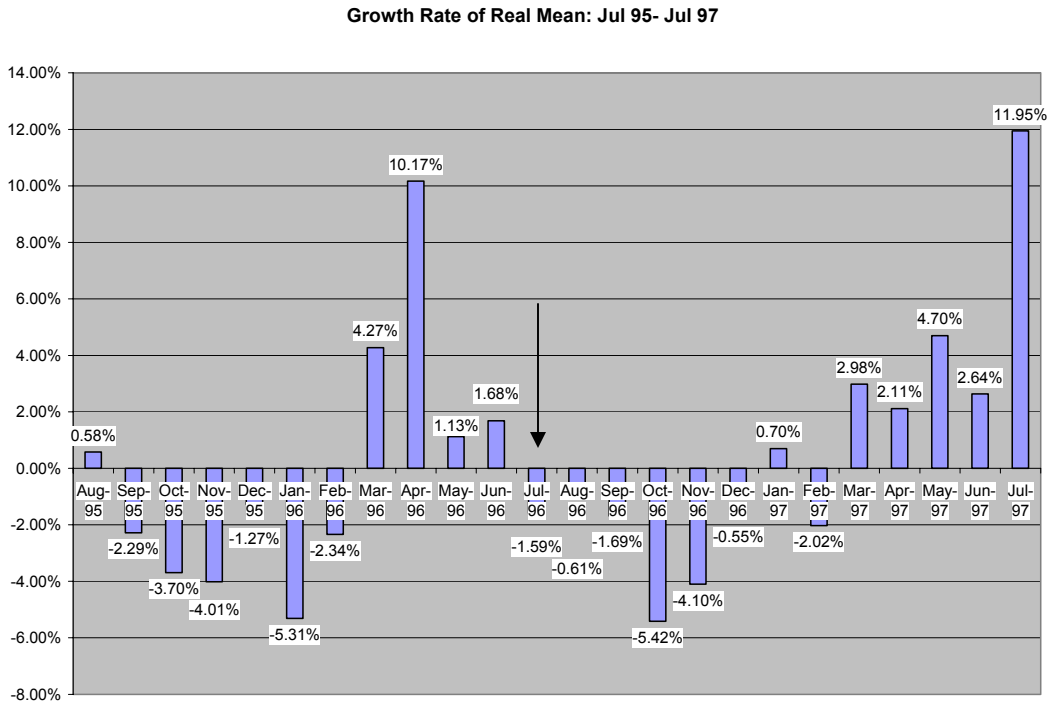
Plymouth: The variation is within the 10% range, and no effects of Amendment 7 are noticed in this case.

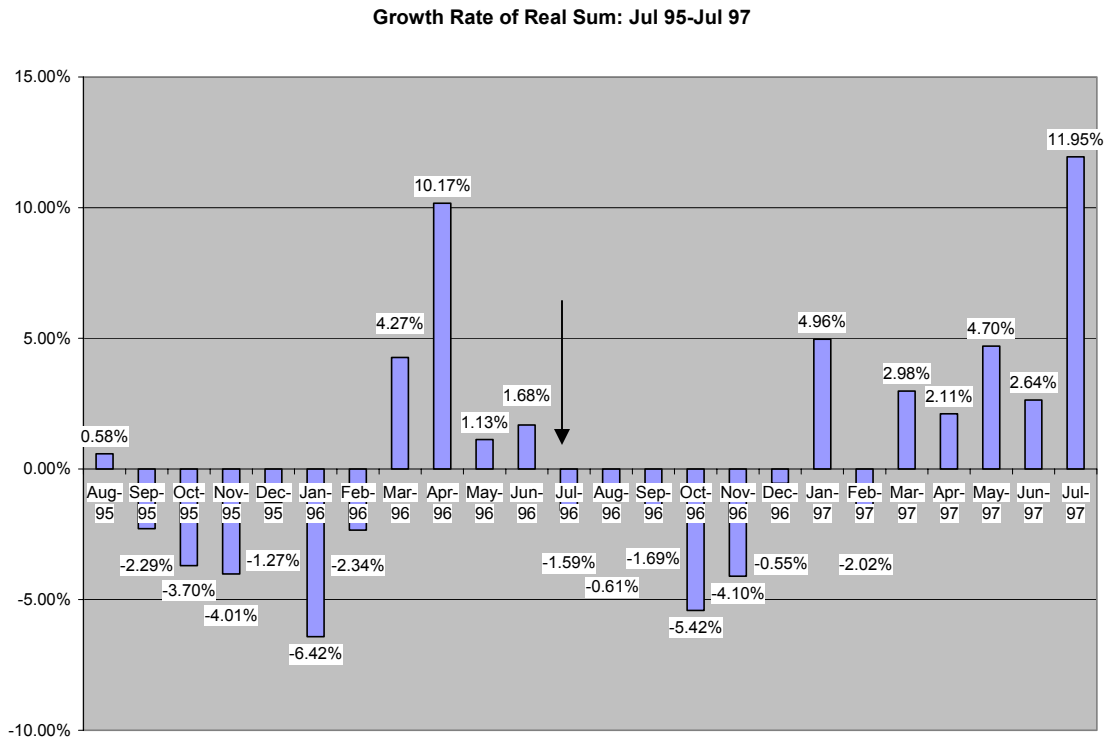
Figure 2.15 Plymouth





Marshfield: The variation is within the 10% range and also no potential effects of Amendment 7 are observed, except for a minor negative July 1996 effect.
Figure 2.16 Marshfield





The monthly change in gross real sales tax data for the towns of Gloucester, New Bedford, Fairhaven, Plymouth and Marshfield do not show a strong persistent negative effect of Amendment 7. Gloucester, New Bedford and Fairhave show a negative change from June 1996 to July 1996, a potential negative short term impact of Amendment 7, introduced in July 1996.

II.1.3. Amendment 13: May 2003 to December 2004 Period

In this sample we have 6,839 observations. In the period before and after when Amendment 13 was introduced (May 1, 2004), Table 2.26 shows for average real gross tax revenues, *lrmst,* there was an approximate (a_1) 11% increase for all towns *not in the fishing industry* between May 2004-December 2005, compared to May 2003-April 2004, that is comparing averages before and after the amendment took effect; and the effect is statistically significant. For the total gross real sales receipts, *lrtotst*, there was an approximate (a_1) 7% increase for all towns *not in the fishing industry* between May 2004-December 2005 compared to May 2003-April 2004. In the towns where the fishing industry is active, there was an approximate (a_2) 17% decline in average sales tax receipts but an approximate (a_2) 71% increase in the gross sales tax receipts relative to all other towns for the period May 2003 to April 2004, before the amendment was implemented. This indicates that, on average, each unit had lower revenues, but the gross

receipts increased, thus indicating a net gain of units in the towns where the fishing industry was active for the period prior to the amendment.

For the estimation of a_3, the average gross real sales tax receipts, the introduction of the amendment had an approximate (a_3) *7%* increase for the towns in the fishing industry, and an approximate (a_3) *-4.5%* decline for the gross total receipts; however those later effects are not statistically significant.

Table 2.26: Basic Differences-in-Differences Estimator

	(1)	(2)
	lrmst	lrtotst
dfyear	0.106	0.066
	(3.61)**	(1.25)
dtreat	-0.168	0.707
	(4.00)**	(8.37)**
dyeartreat	0.067	-0.045
	(1.02)	(0.32)
Constant	5.303	10.336
	(279.69)**	(303.90)**
Observations	6839	6839
R-squared	0.00	0.01

Robust t statistics in parentheses
* significant at 5%; ** significant at 1%

The next set of regressions, Tables 2.27-2.30, show the same regression with several fixed time effects for seasonal variation and interactions of the time effects with the treatment group of towns in the fishing industry. For the 2003-2004 whole period, the results in Tables 2.27 and 2.28 show that, in the predominantly coastal towns of the fishing industry, the summer effect is not identified.

Table 2.27: Seasonal Effects

	(1)	(2)	(3)	(4)	(5)	(6)
	lrmst	lrmst	lrmst	lrmst	lrmst	lrmst
dfyear	0.073	0.073	0.074	0.074	0.073	0.073
	(2.33)*	(2.33)*	(2.35)*	(2.35)*	(2.33)*	(2.32)*
dtreat	-0.165	-0.170	-0.182	-0.183	-0.168	-0.163
	(3.88)**	(3.99)**	(4.27)**	(4.29)**	(3.95)**	(3.84)**
dyeartreat	0.068	0.065	0.060	0.060	0.066	0.069
	(1.05)	(1.01)	(0.92)	(0.92)	(1.02)	(1.06)
dtreatmay	-0.033					
	(0.31)					
dtreatjun		0.032				
		(0.32)				
dtreatjul			0.171			
			(1.86)			
dtreatoct				-0.055		
				(0.53)		
dtreatsep					0.009	
					(0.09)	
dtreataug						0.177
						(1.95)
dfeb	-0.046	-0.046	-0.046	-0.046	-0.046	-0.046
	(0.51)	(0.51)	(0.51)	(0.51)	(0.51)	(0.51)
dmar	0.066	0.066	0.066	0.066	0.066	0.066
	(0.72)	(0.72)	(0.72)	(0.72)	(0.72)	(0.72)
dapr	0.137	0.137	0.137	0.137	0.137	0.137
	(1.55)	(1.55)	(1.55)	(1.55)	(1.55)	(1.55)
dmay	0.154	0.151	0.151	0.151	0.151	0.151
	(1.93)	(1.94)	(1.94)	(1.94)	(1.94)	(1.94)
djun	0.178	0.175	0.178	0.178	0.178	0.178
	(2.29)*	(2.20)*	(2.29)*	(2.29)*	(2.29)*	(2.29)*
djul	0.178	0.178	0.164	0.178	0.178	0.178
	(2.30)*	(2.30)*	(2.07)*	(2.30)*	(2.30)*	(2.30)*
daug	0.166	0.166	0.166	0.152	0.166	0.166
	(2.15)*	(2.15)*	(2.15)*	(1.91)	(2.15)*	(2.15)*
dsep	0.143	0.143	0.143	0.143	0.143	0.143
	(1.85)	(1.85)	(1.85)	(1.85)	(1.79)	(1.85)
doct	0.126	0.126	0.126	0.126	0.126	0.131
	(1.62)	(1.62)	(1.62)	(1.62)	(1.62)	(1.64)
dnov	0.050	0.050	0.050	0.050	0.050	0.050
	(0.64)	(0.64)	(0.64)	(0.64)	(0.64)	(0.64)
ddec	0.106	0.106	0.106	0.106	0.106	0.106
	(1.35)	(1.35)	(1.35)	(1.35)	(1.35)	(1.35)
Constant	5.198	5.199	5.200	5.200	5.199	5.198
	(80.92)**	(80.93)**	(80.95)**	(80.95)**	(80.92)**	(80.92)**
Observations	6839	6839	6839	6839	6839	6839
R-squared	0.01	0.01	0.01	0.01	0.01	0.01

Robust t statistics in parentheses
* significant at 5%; ** significant at 1%

Also, we do not find any statistically significant effect of the months in the fishing year calendar on sales tax receipts, in particular no effect of the month of May when Amendment 13 was introduced.

Table 2.28: Seasonal Effects

	(1)	(2)	(3)	(4)	(5)
	lrmst	lrmst	lrmst	lrmst	lrmst
dfyear	0.073	0.073	0.073	0.074	0.073
	(2.32)*	(2.32)*	(2.33)*	(2.34)*	(2.34)*
dtreat	-0.160	-0.164	-0.165	-0.161	-0.163
	(3.79)**	(3.89)**	(3.87)**	(3.78)**	(3.82)**
dyeartreat	0.070	0.069	0.064	0.060	0.063
	(1.08)	(1.05)	(0.97)	(0.91)	(0.96)
dtreatnov	-0.087				
	(0.77)				
dtreatdec		-0.046			
		(0.40)			
dtreatfeb			-0.032		
			(0.19)		
dtreatapr				-0.062	
				(0.37)	
dtreatmar					-0.085
					(0.50)
dfeb	-0.046	-0.046	-0.043	-0.046	-0.046
	(0.51)	(0.51)	(0.46)	(0.51)	(0.51)
dmar	0.066	0.066	0.066	0.073	0.066
	(0.72)	(0.72)	(0.72)	(0.77)	(0.72)
dapr	0.137	0.137	0.137	0.137	0.142
	(1.55)	(1.55)	(1.55)	(1.55)	(1.56)
dmay	0.151	0.151	0.151	0.151	0.151
	(1.94)	(1.94)	(1.94)	(1.94)	(1.94)
djun	0.178	0.178	0.178	0.178	0.178
	(2.29)*	(2.29)*	(2.29)*	(2.29)*	(2.29)*
djul	0.178	0.178	0.178	0.178	0.178
	(2.30)*	(2.30)*	(2.30)*	(2.30)*	(2.30)*
daug	0.166	0.166	0.166	0.166	0.166
	(2.15)*	(2.15)*	(2.15)*	(2.15)*	(2.15)*
dsep	0.143	0.143	0.143	0.143	0.143
	(1.85)	(1.85)	(1.85)	(1.85)	(1.85)
doct	0.126	0.126	0.126	0.126	0.126
	(1.62)	(1.62)	(1.62)	(1.62)	(1.62)
dnov	0.057	0.050	0.050	0.050	0.050
	(0.71)	(0.64)	(0.64)	(0.64)	(0.64)
ddec	0.106	0.110	0.106	0.106	0.106
	(1.35)	(1.36)	(1.35)	(1.35)	(1.35)
Constant	5.198	5.198	5.198	5.198	5.198
	(80.91)**	(80.92)**	(80.90)**	(80.89)**	(80.91)**
Observations	6839	6839	6839	6839	6839
R-squared	0.01	0.01	0.01	0.01	0.01

Robust t statistics in parentheses
* significant at 5%; ** significant at 1%

Table 2.29: Seasonal Effects

	(1)	(2)	(3)	(4)	(5)	(6)
	lrtotst	lrtotst	lrtotst	lrtotst	lrtotst	lrtotst
dfyear	0.011	0.011	0.011	0.011	0.011	0.011
	(0.19)	(0.19)	(0.20)	(0.20)	(0.19)	(0.19)
dtreat	0.708	0.702	0.691	0.690	0.704	0.710
	(8.19)**	(8.11)**	(7.97)**	(7.96)**	(8.14)**	(8.22)**
dyeartreat	-0.045	-0.047	-0.053	-0.053	-0.046	-0.044
	(0.32)	(0.34)	(0.38)	(0.38)	(0.33)	(0.31)
dtreatmay	-0.013					
	(0.06)					
dtreatjun		0.052				
		(0.24)				
dtreatjul			0.191			
			(0.91)			
dtreatoct				-0.035		
				(0.16)		
dtreatsep					0.029	
					(0.13)	
dtreataug						0.197
						(0.95)
dfeb	-0.046	-0.046	-0.046	-0.046	-0.046	-0.046
	(0.29)	(0.29)	(0.29)	(0.29)	(0.29)	(0.29)
dmar	0.066	0.066	0.066	0.066	0.066	0.066
	(0.41)	(0.41)	(0.41)	(0.41)	(0.41)	(0.41)
dapr	0.145	0.145	0.145	0.145	0.145	0.145
	(0.93)	(0.93)	(0.93)	(0.93)	(0.93)	(0.93)
dmay	0.223	0.222	0.222	0.222	0.222	0.222
	(1.58)	(1.61)	(1.61)	(1.61)	(1.61)	(1.61)
djun	0.249	0.245	0.249	0.249	0.249	0.249
	(1.80)	(1.73)	(1.80)	(1.80)	(1.80)	(1.80)
djul	0.249	0.249	0.234	0.249	0.249	0.249
	(1.81)	(1.81)	(1.66)	(1.81)	(1.81)	(1.81)
daug	0.238	0.238	0.238	0.221	0.238	0.238
	(1.73)	(1.73)	(1.73)	(1.57)	(1.73)	(1.73)
dsep	0.215	0.215	0.215	0.215	0.212	0.215
	(1.56)	(1.56)	(1.56)	(1.56)	(1.50)	(1.56)
doct	0.197	0.197	0.197	0.197	0.197	0.200
	(1.43)	(1.43)	(1.43)	(1.43)	(1.43)	(1.42)
dnov	0.121	0.121	0.121	0.121	0.121	0.121
	(0.87)	(0.87)	(0.87)	(0.87)	(0.87)	(0.87)
ddec	0.181	0.181	0.181	0.181	0.181	0.181
	(1.30)	(1.30)	(1.30)	(1.30)	(1.30)	(1.30)
Constant	10.183	10.183	10.184	10.184	10.183	10.182
	(90.39)**	(90.40)**	(90.41)**	(90.41)**	(90.40)**	(90.39)**
Observations						
	6839	6839	6839	6839	6839	6839
R-squared	0.01	0.01	0.01	0.01	0.01	0.01

Robust t statistics in parentheses
* significant at 5%; ** significant at 1%

Table 2.30: Seasonal Effects

	(1)	(2)	(3)	(4)	(5)
	Lrtotst	lrtotst	lrtotst	lrtotst	lrtotst
dfyear	0.011	0.011	0.012	0.012	0.012
	(0.19)	(0.19)	(0.21)	(0.21)	(0.20)
dtreat	0.712	0.709	0.720	0.724	0.719
	(8.27)**	(8.25)**	(8.32)**	(8.39)**	(8.39)**
dyeartreat	-0.042	-0.044	-0.058	-0.062	-0.055
	(0.30)	(0.31)	(0.41)	(0.44)	(0.40)
Dtreatnov	-0.067				
	(0.29)				
dtreatdec		-0.031			
		(0.13)			
dtreatfeb			-0.153		
			(0.45)		
dtreatapr				-0.169	
				(0.49)	
dtreatmar					-0.206
					(0.59)
dfeb	-0.046	-0.046	-0.033	-0.046	-0.046
	(0.29)	(0.29)	(0.20)	(0.29)	(0.29)
dmar	0.066	0.066	0.066	0.083	0.066
	(0.41)	(0.41)	(0.41)	(0.50)	(0.41)
dapr	0.145	0.145	0.145	0.145	0.159
	(0.93)	(0.93)	(0.93)	(0.93)	(0.98)
dmay	0.222	0.222	0.222	0.222	0.222
	(1.61)	(1.61)	(1.61)	(1.61)	(1.61)
djun	0.249	0.249	0.249	0.249	0.249
	(1.80)	(1.80)	(1.80)	(1.80)	(1.80)
djul	0.249	0.249	0.249	0.249	0.249
	(1.81)	(1.81)	(1.81)	(1.81)	(1.81)
daug	0.238	0.238	0.238	0.238	0.238
	(1.73)	(1.73)	(1.73)	(1.73)	(1.73)
dsep	0.215	0.215	0.215	0.215	0.215
	(1.56)	(1.56)	(1.56)	(1.56)	(1.56)
doct	0.197	0.197	0.197	0.197	0.197
	(1.43)	(1.43)	(1.43)	(1.43)	(1.43)
dnov	0.127	0.121	0.121	0.121	0.121
	(0.89)	(0.87)	(0.87)	(0.87)	(0.87)
ddec	0.181	0.184	0.181	0.181	0.181
	(1.30)	(1.29)	(1.30)	(1.30)	(1.30)
Constant	10.182	10.182	10.182	10.181	10.182
	(90.39)**	(90.39)**	(90.37)**	(90.36)**	(90.38)**
Observations	6839	6839	6839	6839	6839
R-squared	0.01	0.01	0.01	0.01	0.01

Robust t statistics in parentheses
* significant at 5%; ** significant at 1%

The next set of regressions, Tables 2.31-2.35, show models with separate difference-in-difference estimators for each town of the fishing industry group, relative to *all* other towns in the State.[31] In Tables 2.31-2.32, we note that the following statistically significant results for the effects of Amendment 13:

(i) For the city of Boston a 19% **decline** on average sales tax receipts and an 18% decline on total sales tax receipts;

(ii) For the town of Fairhaven a 55% **increase** on average sales tax receipts and a 161% increase on total sales tax receipts;

(iii) For the town of Gloucester, a 74% **decline** on average sales tax receipts and a 301% decline on total sales tax receipts;

(iv) For the town of Eastham, an 80% **increase** on average sales tax receipts and a 135% increase on total sales tax receipts;

(v) For the town of Edgardtown, a 61% **decline** on average sales tax receipts and an 161% decline on total sales tax receipts;

(vi) For the town of Harwich, a 21% **decline** on average sales tax receipts and an 121% decline on total sales tax receipts;

(vii) For the town of Sandwich, an 84% **increase** on average sales tax receipts and an 92% increase on total sales tax receipts.

Tables 2.33-2.34 confirm the results above, and the variation of the sales tax explained ranges from 3% to 5.2%.The results in Tables 2.31-2.32 are intriguing because, for the important port of Gloucester on the North Shore, the effect is negative, statistically significant and the largest in magnitude. It is also negative and statistically significant for Boston, Edgardtown on Martha's Vineyard and Harwich on the Cape Cod.

Since Gloucester has been an active port in the groundfish species, the results indicate that Amendment 13 may have had an important negative impact of economic activity in that city, as measured by sales tax receipts, both on average and in total. In addition, fishing localities represent 5% of the average and 15% of the total gross sales tax receipts in the state as seen in the charts for this period above. While some localities present declines and others present increases in tax receipts, those that present declines are at a loss relative to the whole state and within the fishing active localities.

[31] Regressions in Tables 2.31-2.35 includes several time effects, fixed effects and interactions; only results significant up to the 10% confidence level for the differences-in-differences estimators are reported.

Table 2.31: Separate Town Effects

	lrmst
dtboston	-0.199
	(0.062)**
dtfairhaven	0.554
	(0.143)**
dtgloucester	-0.736
	(0.162)**
dtmarshfield	0.100
	(0.057)
dteastham	0.804
	(0.172)**
dtedgardtown	-0.658
	(0.223)**
dtharwich	-0.207
	(0.079)**
dtsandwich	0.843
	(0.272)**
cons	5.197
	(0.063)**
Observations	6839
R-squared	0.031

Robust standard error statistics in parentheses
* significant at 5%; ** significant at 1%

Table 2.32: Separate Town Effects

	Lrtotst
dtboston	-0.178
	(0.065)**
dtfairhaven	1.607
	(0.307)**
dtgloucester	-3.015
	(0.517)**
dtmarshfield	0.111
	(0.059)
dteastham	1.347
	(0.249)**
dtedgardtown	-1.820
	(0.375)**
dtharwich	-1.209
	(0.177)**
dtwestport	0.132
	(0.061)*
dtsandwich	0.916
	(0.272)**
dtoakb	0.304
	(0.177)
cons	10.177
	(0.111)**
Observations	6839
R-squared	0.051

Robust standard error statistics in parentheses
* significant at 5%; ** significant at 1%

Table 2.33: Separate Town Effects

	lrmst
dtboston	-0.199
	(0.065)**
dtfairhaven	0.554
	(0.149)**
dtgloucester	-0.736
	(0.162)**
dtmarshfield	0.100
	(0.056)
dteastham	0.804
	(0.172)**
dtedgardtown	-0.658
	(0.204)**
dtharwich	-0.207
	(0.080)**
dtsandwich	0.843
	(0.288)**
cons	5.208
	(0.068)**
Observations	6839
R-squared	0.032

Robust standard error statistics in parentheses
* significant at 5%; ** significant at 1%

Table 2.34: Separate Town Effects

	Lrtotst
dtboston	-0.178
	(0.069)**
dtfairhaven	1.607
	(0.331)**
dtgloucester	-3.015
	(0.494)**
dtmarshfield	0.111
	(0.062)
dteastham	1.347
	(0.267)**
dtedgardtown	-1.820
	(0.345)**
dtharwich	-1.209
	(0.155)**
dtwestport	0.170
	(0.068)*
dtnantucket	0.202
	(0.092)*
dtsandwich	0.916
	(0.290)**
dtoakb	0.304
	(0.136)*
cons	10.184
	(0.120)**
Observations 6839; R-squared 0.052	

Robust standard error statistics in parentheses
* significant at 5%; ** significant at 1%

The next set of regressions, Tables 2.35-2.37, restrict the data to the subsample of towns affected by the fishing industry only, controlling for time fixed effects. For this subsample with 560 observations, Table 2.35 shows that Amendment 13 has had no statistically significant impact on sales tax receipts for all towns in the sample, and the explained variation of the sales tax receipts is between 1% to 14%.

Table 2.35: Fishing Towns Only – Amendment 13 Effect

	(1)	(2)
	lrmst1	lrtotst1
dfyear	0.107	-0.096
	(1.75)	(0.71)
dfeb	0.056	-0.089
	(0.27)	(0.22)
dmar	0.123	-0.021
	(0.59)	(0.05)
dapr	0.216	0.094
	(1.06)	(0.23)
dmay	0.269	0.328
	(1.59)	(0.98)
djun	0.349	0.409
	(2.11)*	(1.23)
djul	0.464	0.523
	(2.87)**	(1.60)
daug	0.457	0.517
	(2.84)**	(1.59)
dsep	0.296	0.356
	(1.79)	(1.07)
doct	0.226	0.285
	(1.34)	(0.85)
dnov	0.124	0.183
	(0.71)	(0.54)
ddec	0.213	0.273
	(1.22)	(0.80)
Constant	4.902	10.803
	(34.80)**	(40.49)**
Observations	560	560
R-squared	0.05	0.01

Robust t statistics in parentheses
* significant at 5%; ** significant at 1%

For the same subsample, we measure differences-in-differences estimates for the ports of Gloucester, New Bedford/Fairhaven and Plymouth/Marshfield as shown in Tables 2-36-2.37. In Table 2.36 and 2.37, we find again a negative impact for Gloucester, a 78% decline in average gross real sales tax receipts relative to all towns in the fishing industry and a 304% decline in total gross real sales tax receipts relative to all towns in the fishing industry, results consistent with the findings of regressions in Tables 2-31, 2-34. The New Bedford/Fairhaven area shows a 25% increase in average gross real sales tax

receipts relative to all towns in the fishing industry and an 81% increase in total gross real sales tax receipts relative to all towns in the fishing industry. The results for Plymouth and Marshfield are not statistically significant. The variation of the sales tax receipts explained is between 11% and 15%.

Table 2.36: Differences-in-Differences – Fishing Towns Only

	(1)	(2)
	lrmst1	lrmst1
dfyear	0.109	0.118
	(1.84)	(1.71)
dglouce	0.224	0.537
	(1.80)	(4.25)**
dnbefh	0.725	0.625
	(11.40)**	(6.88)**
dplyma	0.083	0.077
	(2.00)*	(1.35)
dgloucefy		-0.782
		(4.48)**
dnbefhfy		0.250
		(2.24)*
dplymafy		0.015
		(0.19)
dfeb	0.056	0.056
	(0.28)	(0.28)
dmar	0.123	0.123
	(0.62)	(0.62)
dapr	0.216	0.215
	(1.10)	(1.09)
dmay	0.268	0.268
	(1.64)	(1.65)
djun	0.348	0.348
	(2.17)*	(2.18)*
djul	0.463	0.463
	(2.94)**	(2.96)**
daug	0.456	0.456
	(2.91)**	(2.94)**
dsep	0.295	0.295
	(1.84)	(1.85)
doct	0.225	0.225
	(1.38)	(1.39)
dnov	0.123	0.123
	(0.73)	(0.74)
ddec	0.213	0.213
	(1.25)	(1.26)
Constant	4.837	4.833
	(35.07)**	(34.93)**
Observations	560	560
R-squared	0.13	0.14

Robust t statistics in parentheses
* significant at 5%; ** significant at 1%

Table 2.37: Differences-in-Differences – Fishing Towns Only

	(1)	(2)
	lrtotst1	lrtotst1
dfyear	-0.093	-0.048
	(0.71)	(0.33)
dglouce	-0.983	0.232
	(2.19)*	(0.47)
dnbefh	1.549	1.224
	(9.66)**	(5.32)**
dplyma	0.462	0.434
	(4.16)**	(2.99)**
dgloucefy		-3.036
		(5.86)**
dnbefhfy		0.814
		(3.14)**
dplymafy		0.071
		(0.32)
dfeb	-0.089	-0.089
	(0.23)	(0.23)
dmar	-0.021	-0.021
	(0.05)	(0.05)
dapr	0.093	0.088
	(0.24)	(0.22)
dmay	0.327	0.327
	(0.97)	(1.01)
djun	0.407	0.407
	(1.22)	(1.27)
djul	0.522	0.522
	(1.59)	(1.65)
daug	0.515	0.515
	(1.57)	(1.64)
dsep	0.354	0.354
	(1.06)	(1.10)
doct	0.284	0.284
	(0.84)	(0.88)
dnov	0.182	0.182
	(0.53)	(0.55)
ddec	0.271	0.272
	(0.79)	(0.82)
Constant	10.695	10.677
	(39.10)**	(40.02)**
Observations	560	560
R-squared	0.11	0.15

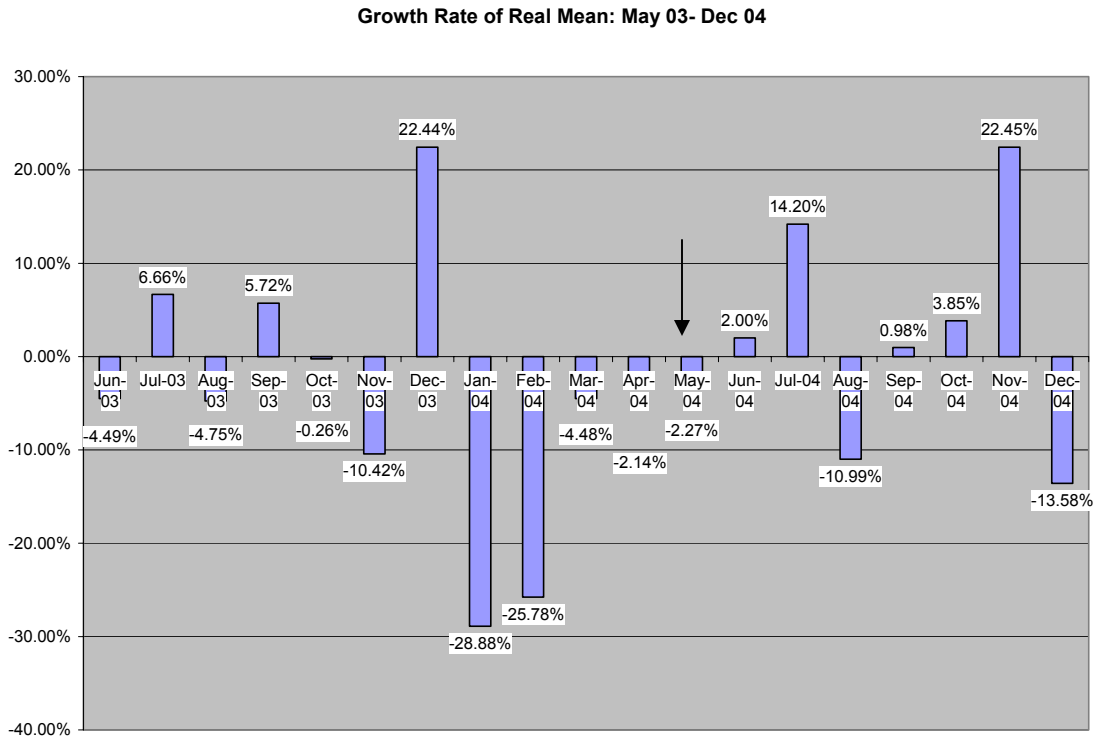
Robust t statistics in parentheses
* significant at 5%; ** significant at 1%

The main conclusion for the period of Amendment 13, May 2003-December 2004, is that we find a statistically significant decline in sales tax receipts in the port city of Gloucester in the North Shore relative to all other towns in the state, and relative to all towns in the fishing industry. There is some significant and credible evidence that Amendment 13 has had negative impact in the port of Gloucester, when measured by monthly sales tax receipts.

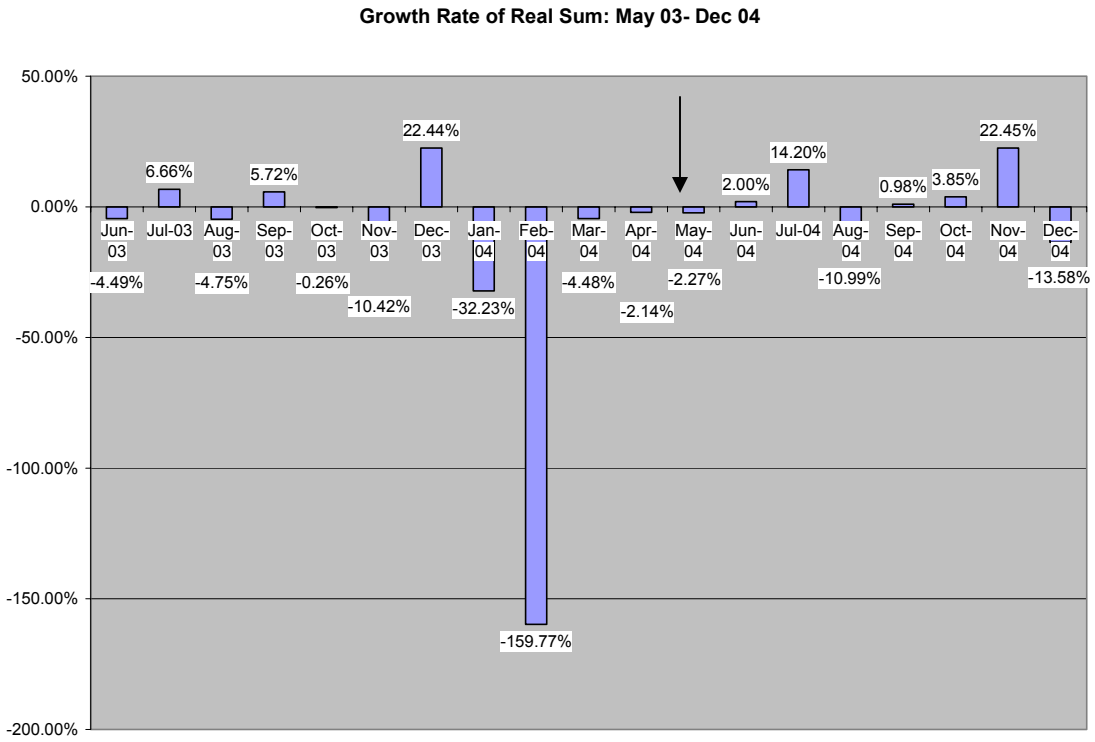
We finally present the time series figures of the monthly changes in sales tax receipts for the towns of Gloucester, New Bedford, Fairhaven, Plymouth and Marshfield in this period.[32]

Gloucester: The variation is within the 30% range. The data show small variation of monthly changes for the period June 2004-December 2004, both in averages and total receipts. However, the May 2004 effect is negative, and so in August 2004, indicating the potential negative effect of Amendment 13.

Figure 2.17 Gloucester

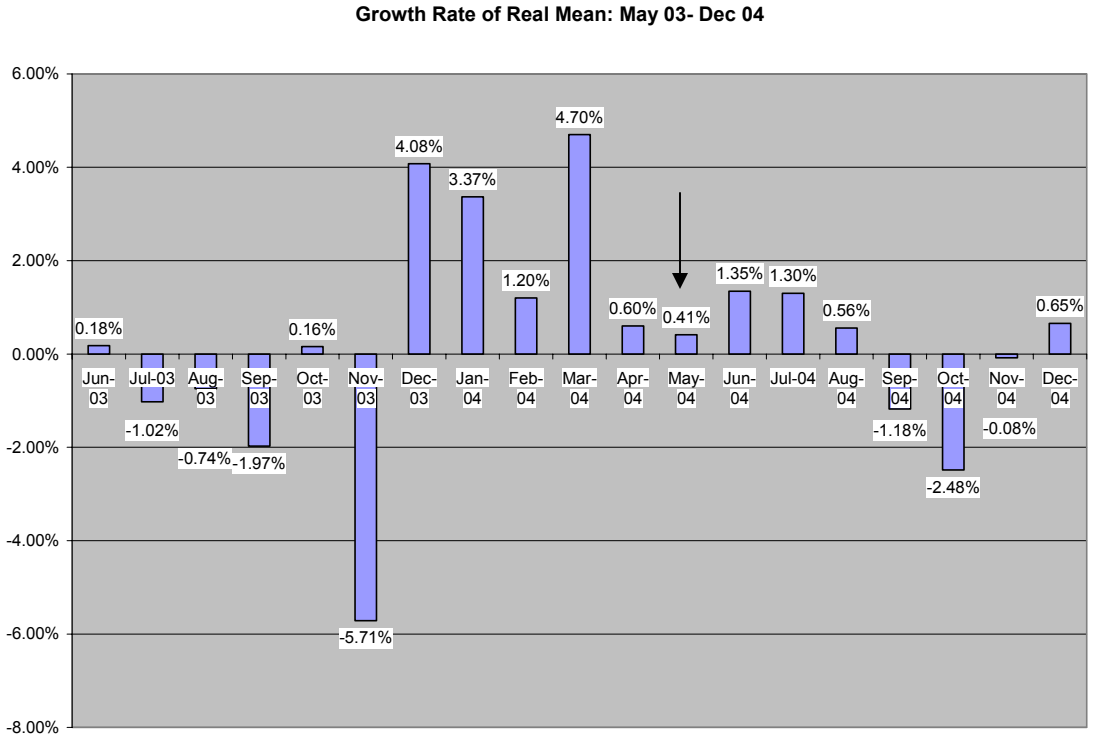


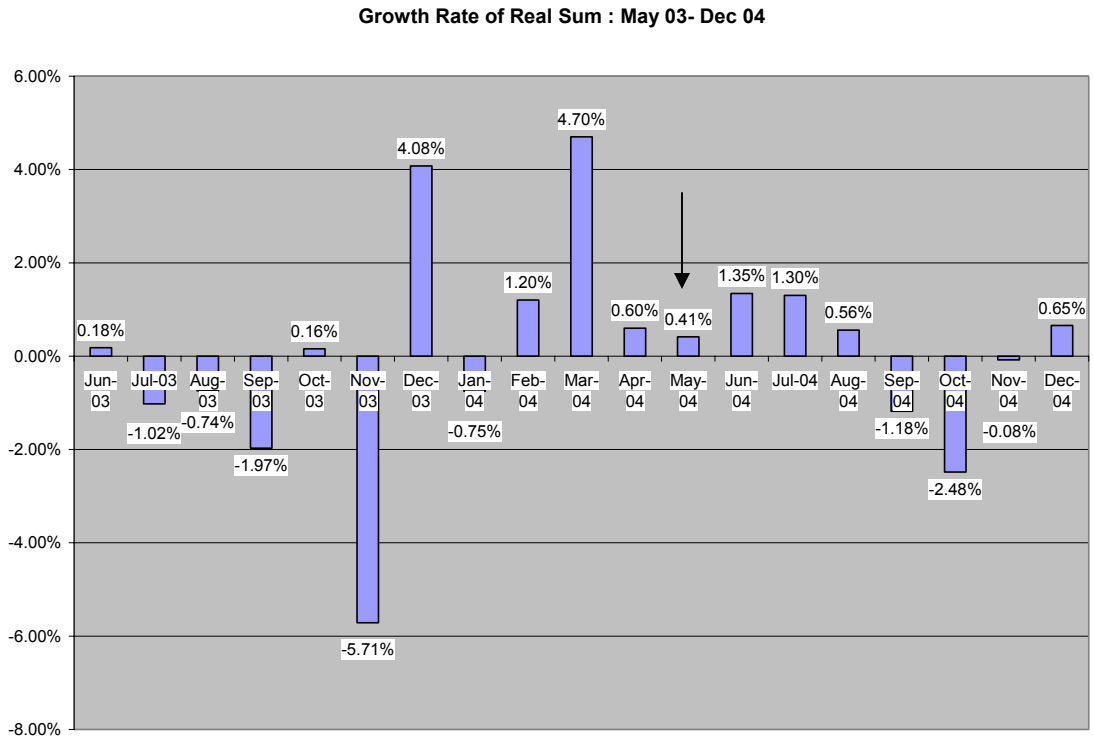
[32] Arrows indicate when Amendment 13 was introduced.



New Bedford: The variation is mostly within the 4% range. The data show small variation of monthly changes for the period June 2004-December 2004, both in averages and total receipts.

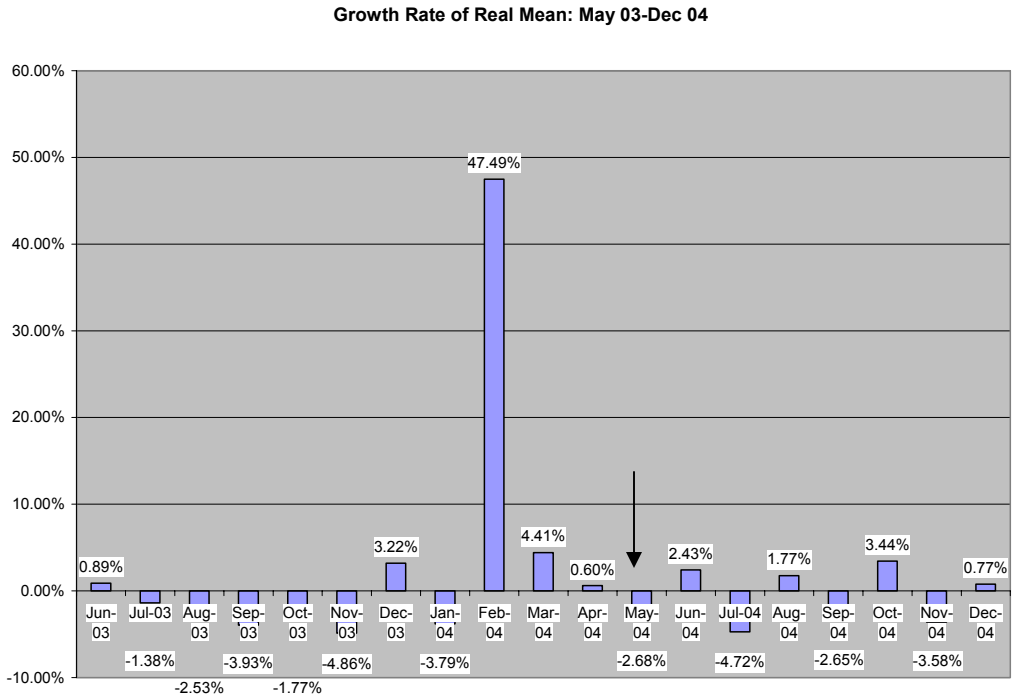
Figure 2.18 New Bedford

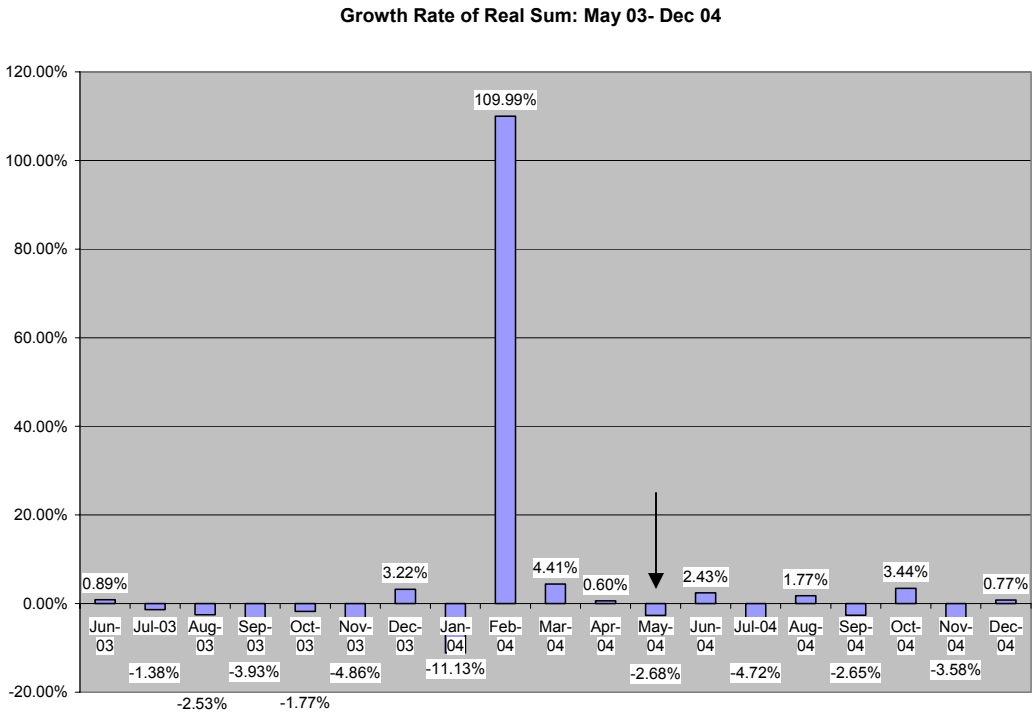




Fairhaven: The variation is within the 10% range, except for an outlier in February 2004. The data show small variation of monthly changes for the period June 2004-December 2004, both in averages and total receipts. May and July 2004 have negative changes, a potential negative effect of Amendment 13.

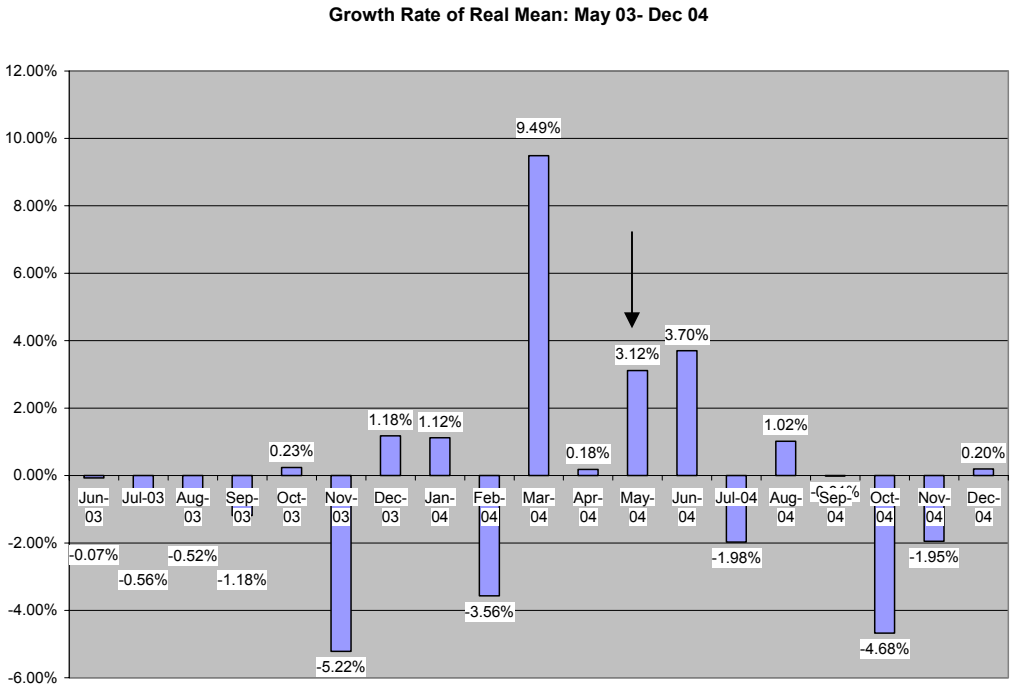
Figure 2.19 Fairhaven

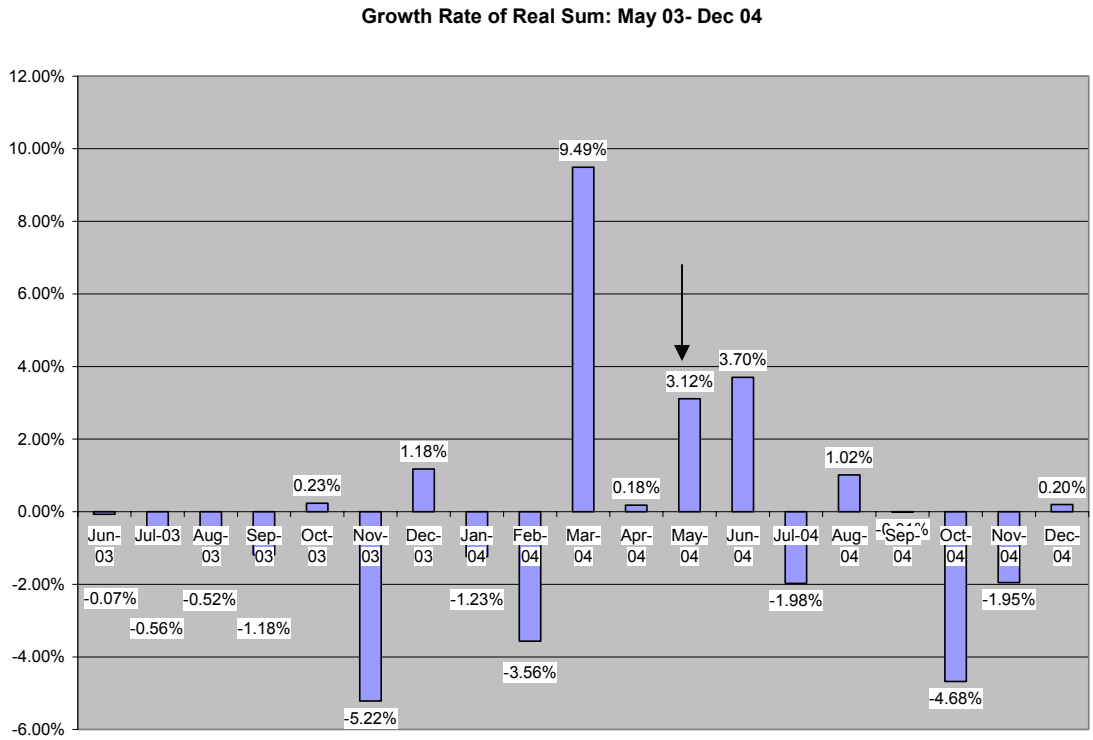




Plymouth: The variation is mostly within the 4% range. The data show small variation of monthly changes for the period June 2004-December 2004, both in averages and total receipts.

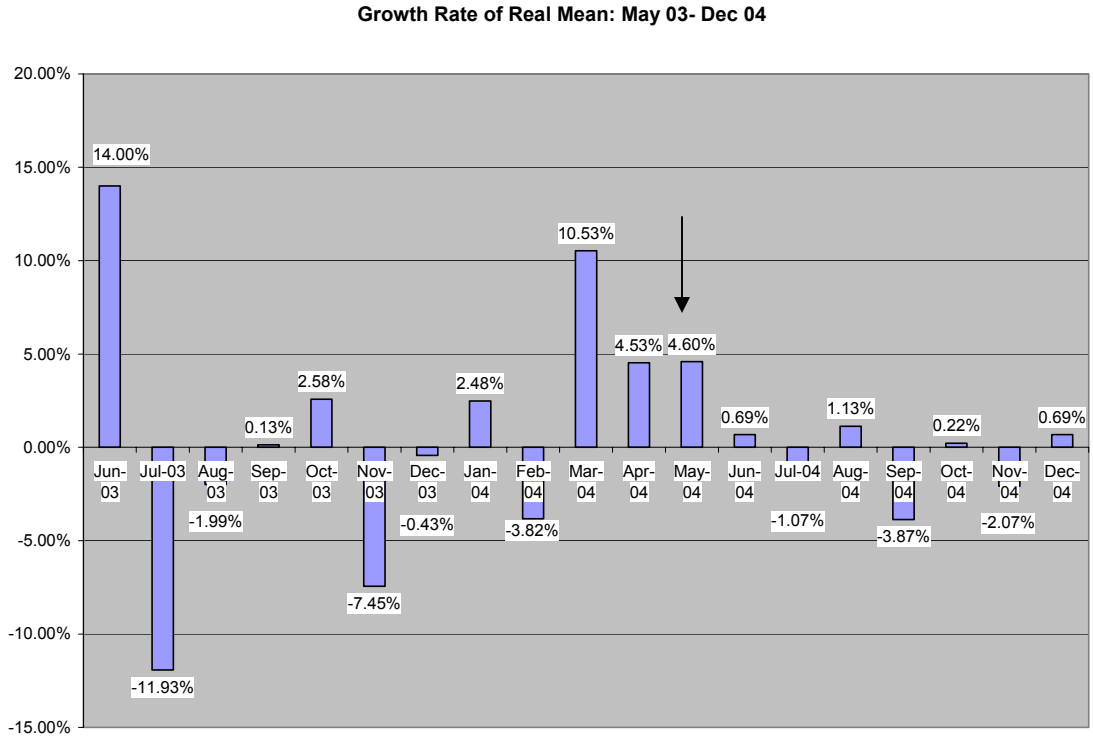
Figure 2.20 Plymouth

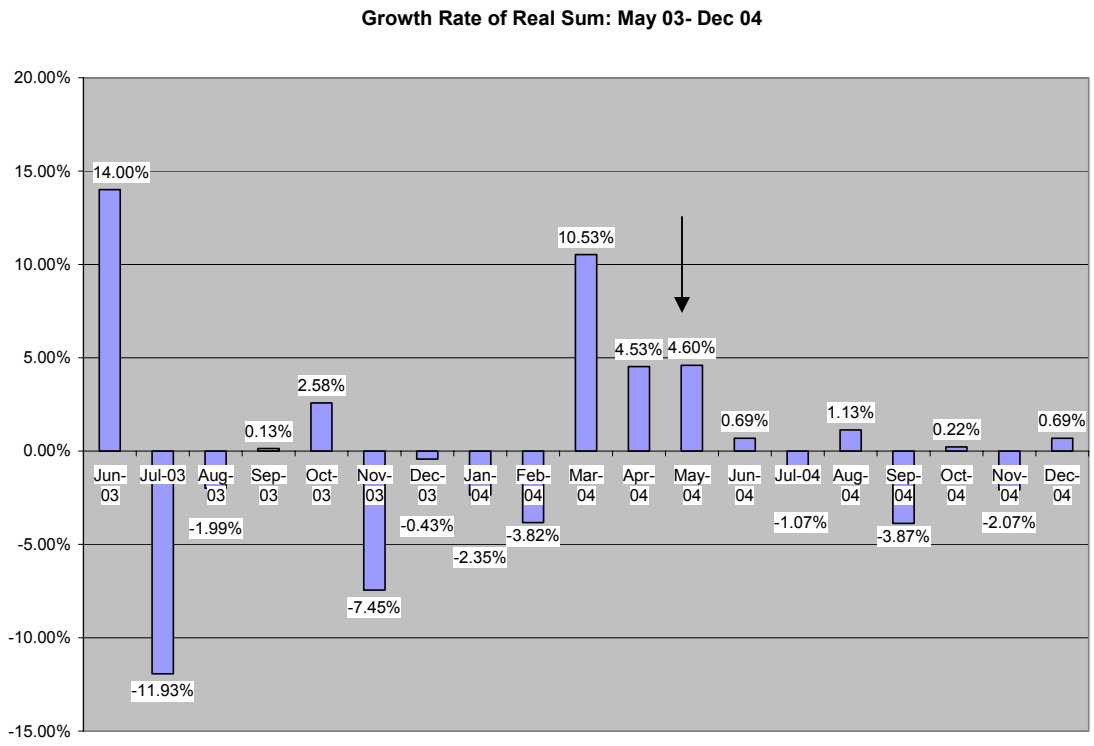




Marshfield: The variation is within the 10% range. The data show small variation of monthly changes for the period June 2004-December 2004, both in averages and total receipts.

Figure 2.21 Marshfield





The conclusion for the time series monthly changes is that we do not find strong evidence of significant persistent monthly change due to the introduction of Amendment 13. However, it is worth noting, in the light of the results in Tables 2.31-2.37, that the port of Gloucester in the North Shore has the largest monthly variation, in the 30%, in the change in sales tax receipts, and was negatively impacted in the month of the introduction of the amendment, May 2004. The other ports and towns in this sample have variation of 10% at most and as low as 4%. This indicates that Gloucester may have been more sensitive to the regulations as opposed to the two other ports.

II.1.4. Summary of Results

The econometric analysis of gross real sales tax state data shows that:

- Amendment 5 had a negative effect for all towns in the fishing industry as shown in Table 2.11
- Amendment 7 had no identified statistically significant effects
- Amendment 13 shows large negative effects in Gloucester in the North Shore relative to all other towns in the State, and relative to the other fishing towns in the State; Harwich on the Cape Cod and Edgartown on Martha's Vineyard also received negative impacts, as seen in Tables 2.31-2.37.

III. Employment Effects

This chapter concerns the historical effect on employment that the imposition of Amendments 5, 7, and 13 have had. When increasingly stringent regulations are imposed, the market contracts and there is less employment available in the affected industry. This chapter begins with an assessment of overall unemployment rates over time in the primary fishing ports. Next, the effects of Amendment 13 are investigated using detailed city and county specific fishing industry employment data in terms of absolute and relative changes in employment. A similar analysis is then performed to capture the effects of Amendments 5 and 7, though with less precise data. A concluding section reviews the findings of this chapter.

III.1. Unemployment

The primary fishing ports in Massachusetts have experienced higher rates of unemployment than the U.S. and Massachusetts. Table 3.1 presents data on unemployment rates for the US, the state of Massachusetts and the Massachusetts towns of Gloucester, Plymouth and New Bedford. The second two columns provide the yearly unemployment rates for both the United States and Massachusetts. The columns indicated in gray show the yearly unemployment rates for the primary fishing ports considered in this report: Gloucester, New Bedford, and Plymouth. Following the unemployment rates by fishing port are the differences between those rates and the rates for the US and Massachusetts, respectively.

Table 3.1: Unemployment Rates (%)

Unemployment Rates											
Year	US	MA	Gloucester	Difference From US	Difference From MA	New Bedford	Difference From US	Difference From MA	Plymouth	Difference From US	Difference From MA
2005	5.1	4.8	5.9	0.8	1.1	8.1	3.0	3.3	4.9	-0.2	0.1
2004	5.5	5.2	6.2	0.7	1.0	8.4	2.9	3.2	5.1	-0.4	-0.1
2003	6.0	5.8	6.9	0.9	1.1	9.5	3.5	3.7	5.6	-0.4	-0.2
2002	5.8	5.3	6.3	0.5	1.0	8.4	2.6	3.1	4.9	-0.9	-0.4
2001	4.7	3.7	4.9	0.2	1.2	6.7	2.0	3.0	3.4	-1.3	-0.3
2000	4.0	2.7	3.7	-0.3	1.0	5.5	1.5	2.8	2.9	-1.1	0.2
1999	4.2	3.3	4.5	0.3	1.2	7.8	3.6	4.5	3.4	-0.8	0.1
1998	4.5	3.4	5.4	0.9	2.0	8.5	4.0	5.1	4.0	-0.5	0.6
1997	5.0	4.1	5.8	0.9	1.7	9.5	4.6	5.4	5.0	0.0	0.9
1996	5.4	4.6	6.5	1.1	1.9	11.1	5.7	6.5	5.7	0.3	1.1
1995	5.6	5.5	8.5	2.9	3.0	12.2	6.6	6.7	6.2	0.6	0.7
1994	6.1	6.2	9.9	3.8	3.7	13.0	6.9	6.8	6.9	0.8	0.7
1993	6.9	7.3	12.2	5.4	4.9	13.5	6.7	6.2	8.5	1.7	1.2
1992	7.5	8.8	14.7	7.2	5.9	15.3	7.8	6.5	9.7	2.2	0.9
1991	6.9	8.8	13.4	6.6	4.6	16.1	9.3	7.3	9.4	2.6	0.6
1990	5.6	6.3	10.8	5.3	4.5	12.5	7.0	6.2	7.3	1.8	1.0

Source: Bureau of Labor Statistics, Massachusetts Economic Development Agency.

The towns of Gloucester and New Bedford have unemployment rates consistently higher than the rates for all of Massachusetts rates as well as the US as a whole. For Gloucester, the differences range from 5.9% in 1992 to 1.0% in the early 2000s. For New Bedford, the differences range from 7.3% in 1991 to about 3.7% in early 2000s. For Plymouth, the ranges are smaller, 1.2% in 1993 to a slight lower average in the early 2000s. The data are compatible with the economic recession of the early 1990s and the recovery of the late 1990s. Of the three communities, New Bedford presents higher unemployment rates.

We present more disaggregated data (specific to the fishing industry) below to better understand the effects of regulations of the fishing industry in these communities.

III.2. Effects of Regulation upon Fishing Employment

The purpose of this section is to address the specific effects of regulation in the fishing industry upon employment. First, a discussion of the methodology is presented to familiarize the reader with how to interpret the results. Next, an analysis utilizing both simple and difference-in-difference analysis shows that Amendment 13:

- decreased the amount of fishing employment in several Massachusetts towns
- decreased the share of employment in fishing relative to manufacturing in several other towns.

This is followed by an analysis of changes in fishing employment in the 1990s that suggests that Amendments 5 and 7 had similar effects.

III. 2.1 Background

Research Questions
The research question addressed in this section concerns trends in employment during periods of regulatory regime change. The primary question is:

1) To what extent did employment in the fisheries industry change over time?

This question can be answered in a straightforward manner by looking at the data and performing a basic time series regression analysis. The interpretation of these findings will then depend on whether or not the effects of Amendment 13 have a statistically significant impact on fisheries employment. Results that are statistically significant can then be used to estimate losses in wages that otherwise have accrued to employees of the fishing industry.

However, it is important to note that some changes may be evident but not statistically significant (statistical significance relies on conventionally accepted statistical confidence levels, ie. 90%, 95%, etc.). For changes that are apparent in the data but not statistically significant, the question of the impact of regulation upon fisheries employment is still important. One methodologically rigorous way to answer this question is to employ a difference in differences procedure to assess the change in fisheries employment relative to some other industry. Decreases in fishing employment may not be substantial enough to be statistically significant, yet these differences may still exist and influence the share

of employment that is comprised of fishing. The difference-in-difference estimator captures this relative change.

This approach allows us to answer the question:

2) Relative to other industries, how much did fisheries employment change over time?

Difference-in-difference comparisons analyze differences in two ways: rates of change over time and differences in rates of change between sectors. Difference in difference estimation is widely used in economics to estimate results that appear intractable to find. The results of this approach allow a high degree of specification when answering detailed questions.

Simply put, the difference in difference estimate looks at the difference between the percentage employment in some other industry and the percentage employment in the fisheries industry. Manufacturing was chosen, since manufacturing has been steadily declining in Massachusetts. A statistically significant, positive link between the imposition of regulation and the difference in difference estimator would mean that the gap between percentage employment in manufacturing and percentage employment in fisheries increased after the imposition of regulation; the relative share of fishing employment fell compared to manufacturing employment (despite continual declines in manufacturing employment).

These two methodologies allow for an assessment of both statistically significant and statistically insignificant changes. The next section discusses the data used to assess the effects of Amendment 13.

III.2.2 Amendment 13 and Employment

This section utilizes data from the Massachusetts Department of Workforce Development. The data from the Massachusetts Department of Workforce Development (Series ES-202) are compiled by the state of Massachusetts from reports by employers subject to unemployment compensation laws. These data provide monthly employment figures from January 2001 to September 2005. The data presented in this section are specific to fishing only. These data are used to address the effects of Amendment 13. This analysis includes only those towns and counties that had fishing separated out as a unique category for the entire period. There are 4 areas studied: Boston and Cape Ann (Gloucester and Rockport), Plymouth (County), Cape Cod (Barnstable County), and the New Bedford region (Fairhaven, New Bedford, and Westport).

Regression analysis is used to determine the effects of Amendment 13 on employment in several Massachusetts towns and counties. Results are presented for all towns considered together (a fixed effects, cross-sectional panel), then separately (individual time series). These regressions control for seasonal and linear time-trend effects and specifically test for any employment effects associated with the implementation of the Amendment 13 regulations. These regressions also include a lagged dependent variable

where appropriate, as indicated by the presence of serial autocorrelation. Regression specifications were selected to minimize the Arellano-Bond (1991)[33] test statistic for the dynamic panel model and to minimize the test statistics of the Durbin (1970)[34] test for serial correlation. Further regressions are run using a difference-in-difference model to assess changes in the relative share of fishing employment due to Amendment 13. These regressions are presented below.

- *Results: All Towns and Counties*

The ideal methodology to assess the effects of Amendment 13 on fishing towns vs. non-fishing towns would be to look at the percentage employment in fishing for all towns and compare the effects of the Amendment. The data required to do this, however, are unavailable; there is no information on the percentage employment in fisheries for towns or counties that do not have information provided in that category.

Instead, this section presents results for all of the cities and counties with fisheries industry specific employment data, considered as a whole. Regression 3.2.1a is a fixed effects, cross-sectional panel model. The dependent variable is percentage employment in fisheries.

Regression 3.2.1a: All Places % Fishing

```
Regression with robust standard errors                 Number of obs =     455
                                                       F( 14,   441) = 1207.28
                                                       Prob > F      =  0.0000
                                                       R-squared     =  0.9767
                                                       Root MSE      =  .29415

------------------------------------------------------------------------------
             |               Robust
        pctf |      Coef.   Std. Err.      t    P>|t|     [95% Conf. Interval]
-------------+----------------------------------------------------------------
   pctf_lag1 |   .4204863   .0833628     5.04   0.000     .2566486    .5843241
        qtr2 |   .0670156   .0443749     1.51   0.132    -.0201971    .1542282
        qtr3 |   .0801494    .040558     1.98   0.049     .0004384    .1598604
        qtr4 |   .1690242   .0443273     3.81   0.000     .0819053    .2561432
           t |    .001725   .0017235     1.00   0.317    -.0016622    .0051122
         a13 |  -.0817846   .0546813    -1.50   0.135    -.1892529    .0256838
      boston |  -.0963192   .0532932    -1.81   0.071    -.2010594    .0084211
          BC |  -.0538152    .051707    -1.04   0.299     -.155438    .0478075
          FH |   1.605183   .2527948     6.35   0.000     1.108351    2.102015
          GL |    1.07981   .1737805     6.21   0.000     .7382692    1.421351
          NB |    1.61928   .2428367     6.67   0.000     1.142019    2.096541
          PC |  -.1154694   .0652346    -1.77   0.077    -.2436789      .01274
          RP |   1.008272   .1703155     5.92   0.000     .6735414    1.343003
          WP |   .8788293   .1482549     5.93   0.000     .5874553    1.170203
------------------------------------------------------------------------------
```

[33] Arellano, Manuel and Stephen Bond (1991) "Some Tests of Specification for Panel Data: Monte Carlo Evidence and an Application to Employment Equations," *Review of Economics and Statistics*, vol. 58, No. 2, pp. 277-297.

[34] Durbin, J (1970) "Testing for serial correlation in least squares regression when some of the regressors are lagged dependent variables," *Econometrica*, vol. 38, pp. 410-421.

This regression includes a lagged dependent variable to reduce the effects of serial auto-correlation, quarterly dummies (qtr2, etc), a linear time trend variable (t), and town/county fixed effects (Boston, BC, etc.). The effects of Amendment 13 (a13, indicated in gray), are -.08% which represents a decrease of 6% across all towns and counties in fisheries employment. However, this effect is not statistically significant at the 90% or 95% confidence levels and should be treated with caution.

The difference in difference estimator also shows an effect associated with the imposition of Amendment 13, as shown in Regression 3.2.1b.

Regression 3.2.1b: All Places %Manufacturing - %Fishing

```
Regression with robust standard errors                 Number of obs =     454
                                                       F( 15,   439) = 6702.37
                                                       Prob > F      =  0.0000
                                                       R-squared     =  0.9935
                                                       Root MSE      =  1.1487

------------------------------------------------------------------------------
             |               Robust
       diff_ |      Coef.   Std. Err.      t    P>|t|     [95% Conf. Interval]
-------------+----------------------------------------------------------------
      diff_1 |   .5746526   .1400694     4.10   0.000     .2993628    .8499425
      diff_2 |  -.1427101   .0511507    -2.79   0.006    -.2432408   -.0421794
        qtr2 |  -.6443001   .1732501    -3.72   0.000    -.9848028   -.3037975
        qtr3 |  -.7616543   .2600682    -2.93   0.004    -1.272788    -.250521
        qtr4 |  -.5726569   .2297334    -2.49   0.013    -1.024171    -.121143
           t |  -.0293859   .0143821    -2.04   0.042    -.0576522   -.0011197
         a13 |    .408303   .2877125     1.42   0.157    -.1571621    .9737681
      boston |   2.957284   1.013263     2.92   0.004     .9658337    4.948734
          BC |   3.071578   1.039828     2.95   0.003     1.027918    5.115238
          FH |   8.748645   2.816808     3.11   0.002     3.212541    14.28475
          GL |   16.99719    5.55469     3.06   0.002     6.080098    27.91428
          NB |   13.50254   4.368039     3.09   0.002     4.917672    22.08741
          PC |   6.463784   2.162224     2.99   0.003     2.214187    10.71338
          RP |   2.953175   1.036853     2.85   0.005     .9153619    4.990988
          WP |   3.368106   1.137766     2.96   0.003     1.131961     5.60425
------------------------------------------------------------------------------
```

The a13 variable (highlighted in gray) indicates that the relative share of employment in fisheries relative to manufacturing increased during this period. Here too, however, the results are not statistically significantly different from zero and should be regarded cautiously.

The results of considering all towns together show some indication of a decline in the fisheries industry associated with the imposition of Amendment 13. However, these results lack statistical significance. One reason for this weakness is that the a13 variable provides the average effect of the intertemporal variation within the towns and counties (considered separately). Some of these towns may not have been individually affected by Amendment 13.

The next section provides estimates for the percentage employment and difference in difference models for each city or county separately.[35]

- *Results: Boston and Cape Ann*

The results for % Fishing in Boston are presented below in Regression 3.2.2a:

Regression 3.2.2a: Boston % Fishing

```
Regression with robust standard errors                 Number of obs =      56
                                                       F(  6,    49) =   25.67
                                                       Prob > F      =  0.0000
                                                       R-squared     =  0.6630
                                                       Root MSE      =  .00197

------------------------------------------------------------------------------
             |               Robust
       pctfB |      Coef.   Std. Err.      t    P>|t|     [95% Conf. Interval]
-------------+----------------------------------------------------------------
     pctfB_1 |     .76078   .0906867     8.39   0.000     .5785384    .9430217
        qtr2 |  -.0006047   .0007789    -0.78   0.441    -.0021699    .0009604
        qtr3 |   -.000578   .0009751    -0.59   0.556    -.0025374    .0013815
        qtr4 |  -.0002039   .0006871    -0.30   0.768    -.0015847    .0011769
           t |   3.43e-06   .0000208     0.16   0.870    -.0000384    .0000453
         a13 |  -.0009358   .0008094    -1.16   0.253    -.0025624    .0006907
       _cons |   .0021562   .0012233     1.76   0.084    -.0003021    .0046145
------------------------------------------------------------------------------
```

Fishing employment fell in Boston, but not in a statistically significant sense.

However, a decline in the relative share of employment in fishing in Boston does coincide with the implementation of Amendment 13 regulations, as indicated in Regression 3.2.2b:

Regression 3.2.2b: Boston %Manufacturing - %Fishing

```
Regression with robust standard errors                 Number of obs =      56
                                                       F(  6,    49) = 1064.97
                                                       Prob > F      =  0.0000
                                                       R-squared     =  0.9930
                                                       Root MSE      =  .02604

------------------------------------------------------------------------------
             |               Robust
      diff_B |      Coef.   Std. Err.      t    P>|t|     [95% Conf. Interval]
-------------+----------------------------------------------------------------
     diffB_1 |   .7945303   .0686334    11.58   0.000     .6566062    .9324543
        qtr2 |  -.0156774   .0103656    -1.51   0.137    -.0365078    .0051531
        qtr3 |   .0022391    .010335     0.22   0.829    -.0185299     .023008
        qtr4 |  -.0164696   .0099512    -1.66   0.104    -.0364672    .0035281
           t |  -.0044608   .0016349    -2.73   0.009    -.0077462   -.0011754
         a13 |   .0449555   .0197362     2.28   0.027     .0052941    .0846169
       _cons |   .7286995   .2506177     2.91   0.005     .2250644    1.232335
------------------------------------------------------------------------------
```

The difference in difference analysis for Boston shows how a non-statistically significant decrease in fisheries employment still has an important impact. For Boston, the

[35] Estimation of the separate city and county regressions as a Seemingly Unrelated Regression system of equations provided no significant efficiency gains.

percentage employment in manufacturing fell from 3.5% in 2001 to 2.7% in 2005. Yet the percentage employment in fisheries work fell at an even faster rate after the imposition of Amendment 13, as indicated by the results above.

The results for Gloucester (Regression 3.2.3a) show a statistically significant decline in fisheries employment for the period of Amendment 13:

Regression 3.2.3a: Gloucester % Fishing

```
Regression with robust standard errors                 Number of obs =      57
                                                       F(  5,    51) =   10.09
                                                       Prob > F      =  0.0000
                                                       R-squared     =  0.4870
                                                       Root MSE      =  .20369

------------------------------------------------------------------------------
             |               Robust
      pctfGL |      Coef.   Std. Err.      t    P>|t|     [95% Conf. Interval]
-------------+----------------------------------------------------------------
        qtr2 |  -.2157478   .0954511    -2.26   0.028    -.4073738   -.0241218
        qtr3 |     -.0346   .0597442    -0.58   0.565    -.1545414    .0853414
        qtr4 |   .1704469   .0661806     2.58   0.013     .0375838      .30331
           t |   .0116001   .0030042     3.86   0.000      .005569    .0176312
         a13 |  -.3336981   .1068932    -3.12   0.003    -.5482952   -.1191011
       _cons |   1.847392   .1008418    18.32   0.000     1.644944    2.049841
------------------------------------------------------------------------------
```

These results show that the percentage employment in fishing in Gloucester fell 0.33%, which is a 16% decrease in fishing employment levels (Average percentage fishing employment was 2.05%; 0.33 is 16% of 2.05). For the period studied, this amounts to a layoff of 32 employees for 39 weeks in 2004 and 39 weeks in 2005 during the study period. Average wages per week were $879 in 2004 and $953 in 2005.[36] This amounts to $ 71,448 lost wages per worker, and an aggregate loss of $ 2,286,336. Table 3.2 summarizes these calculations for Gloucester.

Table 3.2: Fishing Employment Changes in Gloucester

Town	Change in % Employment in Fishing	% Change in Fishing Employment Levels	Number of Jobs Lost	Wages Lost per Worker	Total Wage Revenue Lost
Gloucester	- 0.34%	- 16.0 %	32	$ 71,448	$ 2,286,336

The difference in difference results for Gloucester (Regression 3.2.3b) do not indicate a statistically significant decrease in the share of fisheries employment relative to manufacturing employment associated with Amendment 13. This may be due to the very small decrease in percentage employment in manufacturing employment over the study period (decline of 5%) relative to the results for Boston (decline of 22%).

[36] All dollar figures are expressed in April 2006 constant dollars. Average wage data are provided with employment data by the Massachusetts Department of Workforce Development.

Regression 3.2.3b: Gloucester %Manufacturing - %Fishing

```
Regression with robust standard errors                 Number of obs =      56
                                                       F(  6,    49) =   73.87
                                                       Prob > F      =  0.0000
                                                       R-squared     =  0.9034
                                                       Root MSE      =  .72778

------------------------------------------------------------------------------
             |               Robust
     diff_GL |      Coef.   Std. Err.      t    P>|t|     [95% Conf. Interval]
-------------+----------------------------------------------------------------
    diffGL_1 |    .821762   .0774532    10.61   0.000     .6661139    .9774101
        qtr2 |  -1.593567   .3348431    -4.76   0.000     -2.26646   -.9206751
        qtr3 |  -.9373232   .4051015    -2.31   0.025    -1.751405   -.1232412
        qtr4 |  -.3170561   .3257915    -0.97   0.335    -.9717586    .3376463
           t |  -.0035634   .0125412    -0.28   0.778     -.028766    .0216391
         a13 |   .3639424   .4125939     0.88   0.382    -.4651961    1.193081
       _cons |   5.532008   2.476649     2.23   0.030     .5549962    10.50902
------------------------------------------------------------------------------
```

Regression 3.2.4a indicates a decrease of 0.26% employment in fisheries in Rockport associated with Amendment 13. This decrease represents a 13% decrease in total fisheries employment.

Regression 3.2.4a: Rockport % Fishing

```
Regression with robust standard errors                 Number of obs =      57
                                                       F(  5,    51) =   25.86
                                                       Prob > F      =  0.0000
                                                       R-squared     =  0.6461
                                                       Root MSE      =  .36267

------------------------------------------------------------------------------
             |               Robust
      pctfRP |      Coef.   Std. Err.      t    P>|t|     [95% Conf. Interval]
-------------+----------------------------------------------------------------
        qtr2 |   -.809443   .1607451    -5.04   0.000    -1.132152   -.4867337
        qtr3 |  -.6506105    .161118    -4.04   0.000    -.9740684   -.3271527
        qtr4 |   .2753294   .1686449     1.63   0.109    -.0632393    .6138982
           t |   .0034188   .0045049     0.76   0.451     -.005625    .0124627
         a13 |  -.2559688   .1678485    -1.52   0.133    -.5929386     .081001
       _cons |   2.197503   .1669278    13.16   0.000     1.862381    2.532624
------------------------------------------------------------------------------
```

These results, however, are not statistically significant.

Regression 3.2.4b shows the results of the difference in difference estimation for Rockport. The period following Amendment 13 does not indicate a statistically significant decline in the share of fisheries employment relative to manufacturing.

Regression 3.2.4b: Rockport %Manufacturing - %Fishing

```
Regression with robust standard errors                 Number of obs =      56
                                                       F(  6,    49) =   35.55
                                                       Prob > F      =  0.0000
                                                       R-squared     =  0.8182
                                                       Root MSE      =  .45216

------------------------------------------------------------------------------
             |               Robust
     diff_RP |      Coef.   Std. Err.      t    P>|t|     [95% Conf. Interval]
-------------+----------------------------------------------------------------
    diffRP_1 |   .7759133   .1009706     7.68   0.000     .5730052    .9788213
        qtr2 |  -.6786383    .240514    -2.82   0.007    -1.161969   -.1953073
        qtr3 |  -.5757476   .1992679    -2.89   0.006    -.9761915   -.1753037
        qtr4 |  -.7367625   .1974918    -3.73   0.000    -1.133637   -.3398878
           t |   .0069145   .0058223     1.19   0.241    -.0047858    .0186148
         a13 |   .1624593   .2367103     0.69   0.496    -.3132278    .6381464
       _cons |   .9420086   .3348403     2.81   0.007     .2691219    1.614895
------------------------------------------------------------------------------
```

- *Results: Cape Cod*

Exclusive (fishing specific) data for several Cape Cod towns are unavailable. To assess the effects of fisheries regulation for the Cape Cod region, the total amount of (exclusive) fishing employment for all of Barnstable County is analyzed. Regression 3.2.5a indicates no statistically significant direct effect on employment associated with the passage of Amendment 13.

Regression 3.2.5a: Barnstable County % Fishing

```
Regression with robust standard errors                 Number of obs =      56
                                                       F(  6,    49) =   15.42
                                                       Prob > F      =  0.0000
                                                       R-squared     =  0.6840
                                                       Root MSE      =  .00929

------------------------------------------------------------------------------
             |               Robust
      pctfBC |      Coef.   Std. Err.      t    P>|t|     [95% Conf. Interval]
-------------+----------------------------------------------------------------
    pctfBC_1 |   .3250908   .1065449     3.05   0.004     .1109808    .5392008
        qtr2 |   .0166916   .0037413     4.46   0.000     .0091732    .0242099
        qtr3 |   .0235195   .0035358     6.65   0.000     .0164141    .0306249
        qtr4 |   .0211679   .0038871     5.45   0.000     .0133564    .0289794
           t |  -.0001816   .0001358    -1.34   0.187    -.0004545    .0000913
         a13 |   .0036443   .0045151     0.81   0.423    -.0054291    .0127177
       _cons |   .0408571   .0099711     4.10   0.000     .0208194    .0608948
------------------------------------------------------------------------------
```

Regression 3.2.5b indicates that the difference between the share of fisheries and manufacturing employment has increased, but not at a statistically significant level.

Regression 3.2.5b: Barnstable County %Manufacturing - %Fishing

```
Regression with robust standard errors                 Number of obs =      56
                                                       F(  6,    49) =  419.64
                                                       Prob > F      =  0.0000
                                                       R-squared     =  0.9780
                                                       Root MSE      =   .0816

------------------------------------------------------------------------------
             |               Robust
     diff_BC |      Coef.   Std. Err.      t    P>|t|     [95% Conf. Interval]
-------------+----------------------------------------------------------------
    diffBC_1 |    .837439   .0658617    12.72   0.000     .7050849    .9697932
        qtr2 |  -.1888387   .0297494    -6.35   0.000    -.2486224   -.1290549
        qtr3 |  -.0795056   .0495342    -1.61   0.115    -.1790482     .020037
        qtr4 |   .0630207   .0352893     1.79   0.080    -.0078958    .1339373
           t |  -.0051215   .0024485    -2.09   0.042     -.010042   -.0002009
         a13 |   .0477714    .045946     1.04   0.304    -.0445606    .1401034
       _cons |   .6945896   .2924715     2.37   0.022     .1068461    1.282333
------------------------------------------------------------------------------
```

Taken together, the results do not show a substantial influence of Amendment 13 upon fisheries employment for Barnstable County.

- *Results: Plymouth County*

Exclusive fishing data are unavailable for the municipalities of Plymouth and Marshfield, but such data are available for Plymouth County. The implementation of Amendment 13 coincides with both a substantial decrease in fishing employment and a decrease in the share of fishing relative to manufacturing.

The regression results from Regression 3.2.6a show the effect of Amendment 13 regulations on fishing employment in Plymouth County. The timing of Amendment 13 is highly significant.

Regression 3.2.6a: Plymouth County %Fishing

```
Regression with robust standard errors                 Number of obs =      55
                                                       F(  7,    47) =   20.79
                                                       Prob > F      =  0.0000
                                                       R-squared     =  0.7991
                                                       Root MSE      =  .00266

------------------------------------------------------------------------------
             |               Robust
      pctfPC |      Coef.   Std. Err.      t    P>|t|     [95% Conf. Interval]
-------------+----------------------------------------------------------------
    pctfPC_1 |   .4778169   .1198128     3.99   0.000     .2367846    .7188492
    pctfPC_2 |   .1932644   .1286625     1.50   0.140    -.0655712    .4520999
        qtr2 |   .0043763   .0014261     3.07   0.004     .0015074    .0072453
        qtr3 |   .0036768    .001213     3.03   0.004     .0012366    .0061169
        qtr4 |   .0028255   .0013851     2.04   0.047      .000039     .005612
           t |   .0001539   .0000484     3.18   0.003     .0000566    .0002513
         a13 |  -.0042596   .0015026    -2.83   0.007    -.0072823   -.0012368
       _cons |  -.0009775   .0019736    -0.50   0.623    -.0049479    .0029929
------------------------------------------------------------------------------
```

Table 3.3 shows the lost employment and wage estimates.

Table 3.3 Fishing Employment Changes in Plymouth County

County	Change in % Employment in Fishing	% Change in Fishing Employment Levels	Number of Jobs Lost	Wages Lost per Worker	Total Wage Revenue Lost
Plymouth County	- 0.004%	- 28.6 %	6	$ 58,851	$ 353,106

The difference in difference estimator (Regression 3.2.6b) does not indicate a statistically significant decrease in the relative share of employment in fisheries relative to manufacturing.

Regression 3.2.6b: Plymouth County %Manufacturing - %Fishing

```
Regression with robust standard errors                 Number of obs =      56
                                                       F(  6,    49) =  353.00
                                                       Prob > F      =  0.0000
                                                       R-squared     =  0.9637
                                                       Root MSE      =  .12408

------------------------------------------------------------------------------
             |               Robust
     diff_PC |      Coef.   Std. Err.      t    P>|t|     [95% Conf. Interval]
-------------+----------------------------------------------------------------
    diffPC_1 |    .805747   .0701139    11.49   0.000     .6648478    .9466461
        qtr2 |  -.2245758   .0621541    -3.61   0.001    -.3494792   -.0996725
        qtr3 |  -.1560215   .0907387    -1.72   0.092    -.3383678    .0263248
        qtr4 |  -.0811653   .0702724    -1.16   0.254     -.222383    .0600524
           t |  -.0055712   .0039944    -1.39   0.169    -.0135983    .0024559
         a13 |   .0774788   .1001482     0.77   0.443    -.1237765    .2787342
       _cons |   2.031294   .7916691     2.57   0.013     .4403754    3.622213
------------------------------------------------------------------------------
```

- *Results: New Bedford Area*

This section provides the results of fishing regressions for Fairhaven, New Bedford, and Westport.

Regression 3.2.7a: Fairhaven %Fishing

```
Regression with robust standard errors                 Number of obs =      56
                                                       F(  6,    49) =   12.14
                                                       Prob > F      =  0.0000
                                                       R-squared     =  0.5765
                                                       Root MSE      =  .34889

------------------------------------------------------------------------------
             |               Robust
      pctfFH |      Coef.   Std. Err.      t    P>|t|     [95% Conf. Interval]
-------------+----------------------------------------------------------------
    pctfFH_1 |  -.1364672   .1247292    -1.09   0.279      -.38712    .1141855
        qtr2 |   1.012236   .1431545     7.07   0.000     .7245564    1.299916
        qtr3 |   .8959443   .1781806     5.03   0.000      .537877    1.254012
        qtr4 |   .4732682   .1540333     3.07   0.003     .1637267    .7828097
           t |   .0041742   .0048543     0.86   0.394    -.0055808    .0139292
         a13 |   .0702211   .1909397     0.37   0.715    -.3134866    .4539288
       _cons |   2.540868   .3484191     7.29   0.000     1.840693    3.241042
------------------------------------------------------------------------------
```

Regression 3.2.7b: Fairhaven %Manufacturing - %Fishing

```
Regression with robust standard errors                 Number of obs =      56
                                                       F(  6,    49) =   66.04
                                                       Prob > F      =  0.0000
                                                       R-squared     =  0.8618
                                                       Root MSE      =  1.1879

------------------------------------------------------------------------------
             |               Robust
     diff_FH |      Coef.   Std. Err.      t    P>|t|     [95% Conf. Interval]
-------------+----------------------------------------------------------------
    diffFH_1 |   .5618228   .1819314     3.09   0.003      .196218    .9274277
        qtr2 |  -.0098569     .43872    -0.02   0.982    -.8914978    .8717839
        qtr3 |  -.1275381   .5578513    -0.23   0.820    -1.248582     .993506
        qtr4 |   .3589172    .530379     0.68   0.502    -.7069194    1.424754
           t |  -.0113483   .0199423    -0.57   0.572    -.0514238    .0287272
         a13 |   -2.14924   1.260754    -1.70   0.095    -4.682819    .3843393
       _cons |   6.699502   2.790863     2.40   0.020     1.091054    12.30795
```

Neither Regression 3.2.7a or 3.2.7b reveal statistically significant results concerning the passage of Amendment 13 and a decrease in percentage employment in fishing or a decrease in the relative share of fisheries employment.

The results for New Bedford are much different. Regression 3.2.8a indicates that there was a statistically significant decrease in fisheries employment that corresponds with the implementation of Amendment 13:

Regression 3.2.8a: New Bedford %Fishing

```
Regression with robust standard errors                 Number of obs =      56
                                                       F(  6,    49) =   21.97
                                                       Prob > F      =  0.0000
                                                       R-squared     =  0.6089
                                                       Root MSE      =  .25912

------------------------------------------------------------------------------
             |               Robust
      pctfNB |      Coef.   Std. Err.      t    P>|t|     [95% Conf. Interval]
-------------+----------------------------------------------------------------
    pctfNB_1 |   .1796623   .1405425     1.28   0.207    -.1027686    .4620931
        qtr2 |    .412374   .1294099     3.19   0.003     .1523151    .6724328
        qtr3 |   .3716062   .1166649     3.19   0.003     .1371594     .606053
        qtr4 |   .4570343   .1219105     3.75   0.000     .2120459    .7020227
           t |   .0152875   .0040154     3.81   0.000     .0072183    .0233567
         a13 |  -.2243452   .1137599    -1.97   0.054    -.4529543    .0042638
       _cons |   1.747051    .299221     5.84   0.000     1.145744    2.348358
------------------------------------------------------------------------------
```

This decrease amounts to a 0.22 decrease in percentage fisheries employment, which is an over-all decline of 7.5%. Table 3.4 displays the calculated effects.

Table 3.4 Fishing Employment Changes in New Bedford

County	Change in % Employment in Fishing	% Change in Fishing Employment Levels	Number of Jobs Lost	Wages Lost per Worker	Total Wage Revenue Lost
New Bedford	- 0.22%	- 7.5 %	69	$ 102,297	$ 7,058,493

Regression 3.2.8b: New Bedford %Manufacturing - %Fishing

```
Regression with robust standard errors                 Number of obs =      56
                                                       F(  6,    49) =  100.48
                                                       Prob > F      =  0.0000
                                                       R-squared     =  0.8459
                                                       Root MSE      =  .82598

------------------------------------------------------------------------------
             |               Robust
     diff_NB |      Coef.   Std. Err.      t    P>|t|     [95% Conf. Interval]
-------------+----------------------------------------------------------------
    diffNB_1 |   .8102661   .0690704    11.73   0.000     .6714638    .9490683
        qtr2 |  -.9827944   .4134447    -2.38   0.021    -1.813643   -.1519463
        qtr3 |  -.8449193   .4575356    -1.85   0.071    -1.764372    .0745329
        qtr4 |  -.7629715   .4587783    -1.66   0.103    -1.684921    .1589779
           t |  -.0052374    .011566    -0.45   0.653    -.0284801    .0180053
         a13 |    .259074   .3860363     0.67   0.505     -.516695    1.034843
       _cons |   4.744393   1.851263     2.56   0.014      1.02414    8.464646
------------------------------------------------------------------------------
```

Regression 3.2.8b does not indicate a statistically significant change in the relative share of fishing employment (to manufacturing) associated with Amendment 13.

The results for Westport (Regression 3.2.9a) indicate that the percentage employment in fisheries fell 0.14%, or 12.1% overall after Amendment 13 was passed.

Regression 3.2.9a: Westport %Fishing

```
Regression with robust standard errors                 Number of obs =      56
                                                       F(  6,    49) =   49.57
                                                       Prob > F      =  0.0000
                                                       R-squared     =  0.7400
                                                       Root MSE      =  .21093

------------------------------------------------------------------------------
             |               Robust
      pctfWP |      Coef.   Std. Err.      t    P>|t|     [95% Conf. Interval]
-------------+----------------------------------------------------------------
    pctfWP_1 |   .4338808   .1140125     3.81   0.000     .2047641    .6629974
        qtr2 |   .0565791   .0941256     0.60   0.551    -.1325734    .2457317
        qtr3 |    .129947   .0904153     1.44   0.157    -.0517493    .3116433
        qtr4 |   .1342256   .0862733     1.56   0.126    -.0391471    .3075982
           t |  -.0078699   .0042961    -1.83   0.073    -.0165033    .0007635
         a13 |  -.1377447   .1141996    -1.21   0.234    -.3672374    .0917481
       _cons |   1.147227   .3100528     3.70   0.001     .5241523    1.770301
------------------------------------------------------------------------------
```

This result is not statistically significant.

The share of fisheries employment in Westport (relative to manufacturing) does significantly fall after Amendment 13 is implemented, however, as indicated in Regression 3.2.9b:

Regression 3.2.9b: Westport %Manufacturing - %Fishing

```
Regression with robust standard errors                 Number of obs =      56
                                                       F(  6,    49) =   39.49
                                                       Prob > F      =  0.0000
                                                       R-squared     =  0.8698
                                                       Root MSE      =  .29816

------------------------------------------------------------------------------
             |               Robust
     diff_WP |      Coef.   Std. Err.      t    P>|t|     [95% Conf. Interval]
-------------+----------------------------------------------------------------
    diffWP_1 |   .4927644   .1047118     4.71   0.000     .2823381    .7031906
        qtr2 |  -.4807443   .1186322    -4.05   0.000    -.7191446    -.242344
        qtr3 |  -.5296778   .1269372    -4.17   0.000    -.7847677   -.2745878
        qtr4 |  -.5624399   .1432728    -3.93   0.000    -.8503575   -.2745224
           t |  -.0251751   .0076931    -3.27   0.002    -.0406349   -.0097153
         a13 |   .3645817   .1780013     2.05   0.046     .0068748    .7222887
       _cons |   2.905633   .5812416     5.00   0.000     1.737585    4.073682
------------------------------------------------------------------------------
```

This decrease in the relative share of fisheries employment occurs despite a decrease in manufacturing employment of 36% over the study period.

III.2.3 Amendments 5 and 7 and Employment

Table 3.6 shows percentage of employment for fisheries and manufacturing, in 1990 and 2000 for Gloucester, New Bedford, and Plymouth. This table also displays the percentage change in employment from 1990 to 2000. Fisheries and manufacturing employment both declined in each municipality over this period.

Table 3.6: Changes in Employment 1990 to 2000

	% Employment in Fisheries, 1990	% Employment in Fisheries, 2000	90 to 00 % Change Fisheries Employment	% Employment in Manufacturing, 1990	% Employment in Manufacturing, 2000	90 to 00 % Change Manufact. Employment
Gloucester	3.19	2.49	-21.86	18.67	16.69	-10.57
New Bedford	2.53	0.99	-60.72	22.59	20.74	- 8.18
Plymouth	2.10	0.13	-93.73	9.97	7.60	-23.78

Table 3.7 displays the average difference in difference for the 3 cities, which is the amount that fisheries employment changed relative to employment manufacturing. In Gloucester, where employment in both fisheries and manufacturing declined, employment in the fisheries industry declined 11.28 %. In New Bedford, the fisheries industry declined at a greater rate relative to manufacturing than in Gloucester, at a rate of 52.54%. Plymouth had the largest decline in the fisheries industry relative to manufacturing, at almost 70% more of a decline.

Table 3.7: Difference in Difference Results, 1990 to 2000

	Change in Fisheries Employment Relative to Manufacturing Employment
Gloucester	-11.28 %
New Bedford	-52.54 %
Plymouth	- 69.95 %
Average	**- 44.59 %**

Average employment in the fisheries industry declined more than manufacturing employment over the same period of time. If employment in the fisheries industry had declined at the same rate, then the average decrease in this rate would have been zero. This suggests that something was occurring in the 1990s that particularly affected the fisheries industry, and was not common to other productive businesses, such as

manufacturing. Amendments 5 and 7 occurred in this period and are likely responsible for some part of the decline in fisheries employment.

These findings, however, are not as strong as the above findings for Amendment 13. That analysis was able to rely on 53 continuous months of data, whereas the 1990 to 2000 analysis looks solely at 2 bracketing years (too few observations to use regression analysis with). Furthermore, the employment data available for analyzing Amendment 13 was concentrated on fishing employment only, while the 1990 to 2000 analysis had to use more aggregated data. For these reasons, the 1990 to 2000 analysis should be regarded as suggestive only.

III.2.4. Summary of Results and Importance to the Study

Table 3.8 summarizes the results of this chapter. The results for unemployment show higher rates for Gloucester and New Bedford relative to both the US and Massachusetts. The results for Amendment 13 show statistically significant and insignificant results for losses in percentage employment in fishing and the share of employment in fishing. These results show a preponderance of effects due to Amendment 13. The results for Amendments 5 and 7 also show employment and share losses (though these results are not as methodologically strong as for Amendment 13).

Table 3.8 Results Summary

Town	**US Comparison**
Gloucester	Higher than US average
New Bedford	Higher than US average
Plymouth	Lower than US average

Town/County	**Employment Loss**	**Statistically Significant**	**Wages Lost**	**Statistically Significant Share Loss**
Boston	Yes	No	--	Yes
Gloucester	Yes	Yes	$ 2,286,336	No
Rockport	Yes	No	--	No
Barnstable County	No	No	--	No
Plymouth County	Yes	Yes	$ 353,106	No
Fairhaven	No	No	--	No
New Bedford	Yes	Yes	$ 7,058,493	No
Westport	Yes	No	--	Yes

Town	**Employment Loss**
Gloucester	Yes
New Bedford	Yes
Plymouth	Yes

The towns of Gloucester and New Bedford have had higher unemployment rates than the rest of Massachusetts and the nation as a whole. Plymouth experienced higher unemployment rates in the 1990s but this trend appears to have reversed itself. These

results do not directly show the impact of fishing but indicate that these towns are particularly susceptible to economic distress.

The analysis of fishing employment specifically indicates a loss of fishing jobs in Gloucester, Rockport, and Plymouth County coincident with the implementation of Amendment 13. This lost wage revenue constitutes almost $9.7 million, or roughly $6.5 million per year.[37]

If this loss value is multiplied by a "multiplier effect" wherein the indirect effects of money entering a community are disseminated and spur further investment and consumption, the estimated impact will be greater. A conservative multiplier of 1.7 would result in an estimated loss of $16.5 million dollars ($11 million annually) in community impact across the three towns for who the effects are estimated.[38]

Taken as a whole, the indications are that Amendment 13 affected all 8 of the study areas except Fairhaven (though Barnstable County experienced negligible effects). Boston and Westport lost share in fisheries employment relative to manufacturing. Boston, Rockport, and Westport all experienced some decrease in fisheries employment, though these effects were not significant at the 95% confidence level.

The analysis of aggregated fishing employment data (including agriculture and hunting) for the decennial census of 1990 and 2000 show that employment in these areas decreased in Gloucester, New Bedford, and Plymouth. Difference in difference estimation also indicated that, relative to the share of employment in manufacturing, the share of employment in fishing decreased.

These decreases in fishing employment show that there have been quantifiable losses to the Massachusetts economy. Other losses are harder to quantify due to either a lack of data (data not available earlier in time or in specific towns) or the inability of data to address specific issues. One such issue involves part time fishing. Many former full-time fishers have resorted to fishing part-time. Other former part-time fishers, who may not have appeared as employed in fishing in the official statistics have either had to diversify their activities further or stop fishing entirely. Due to data limitations, the estimated fishing employment effects should be seen as a minimum bound on lost value in employment due to fishing employment foregone.

Should future regulations curtail employment further, some ports (such as Gloucester and Plymouth) could see groundfish fishing cease altogether. As tables 3.2 and 3.3 indicate,

---

[37] The wage estimates for New Bedford may be biased upwards. New Bedford includes the scallop industry which is a high value industry, and as such may offer higher wages than the groundfish industry. However, no groundfish specific wage data are available. In addition, no estimates of lost wages are made for towns that have apparent (though not statistically significant) job losses – this omission would tend to bias the value of foregone wages downward.

[38] This multiplier is the lowest multiplier value suggested in Hughes, David (2003) "Policy Uses of Economic Multiplier and Impact Analysis," *Choices*, an online magazine of the American Agricultural Economics Association, vol. 18, no. 2.

relatively modest job losses account for large portions of employment in these fisheries and result in substantial wage losses.

In sum, the results of this chapter indicate that Massachusetts' fishing communities have:
- experienced higher rates of unemployment,
- lost employment in fishing after the passage of Amendment 13, and
- lost employment in fishing during the 1990s.

Methodological Note:

The decennial US Census is the most scrupulously collected and scholastically verified data collected. These data have limitations; they are collected only at 10 year intervals and give no specific information regarding individuals. However, census data are very useful for allowing trends to be quantified, especially regarding demographics in a specific location.

There is a limitation in precisely answering fisheries employment questions from Census data. This limitation involves the fact that fisheries employment is combined with employment in agriculture, forestry, fishing, and hunting in the 2000 census and agriculture, forestry and fishing in the 1990 census. There are potential aggregation errors that this could cause – changes in fishing employment could be attributed to changes in other employment, such as forestry. The potential for such errors, however, is mitigated by focusing on coastal municipalities that are unlikely to have substantial employment in agriculture, forestry, or hunting. The use of multiple samples of cities from those most oriented toward a coastal economy to coastal cities in general can help provide a test of robustness for this procedure.

IV. Geographic Information Systems Analysis (Maps)

The objective of this chapter is to show changes in the concentration and spatial patterns of employment in the fisheries industry from before and after Amendments 5 and 7 were introduced. This chapter uses Geographic Information Systems (GIS) to visually display fishing employment data from the 1990 and 2000 censuses. By comparing before (1990) and after (2000) maps changes in employee residential concentrations and patterns become evident. These changes are important because they affect land use priorities and decisions.

GIS maps enable one to spatially visualize changes in demographics over time. These maps are of towns, and show data in census tracts. This series of maps shows how the composition and neighborhoods of the port cities of Gloucester, New Bedford, and Plymouth have changed during the 1990s. These maps track the residence of employees in the fisheries industry. As neighborhoods with large portions of fishery employed people depopulate, the culture of the fishery changes and the ability of the industry to find local, skilled workers is hindered.

One crucial aspect of the decrease in fishing employment in port areas is the movement toward residential land use and away from fisheries infrastructure. As fishing employment in port-side neighborhoods decreases, more political pressure is brought to bear for conversion of land to purely residential uses. Such a move is likely to be asymmetric – once land has been shifted from fisheries uses to residences, such a pattern is unlikely to be reversed. The consequence of this movement is that future fisheries activity will be significantly curtailed (or eliminated altogether) in port towns that enjoy natural advantages (deep ports, easy access to open waters) in Massachusetts.

Gloucester, Plymouth, and New Bedford all show decreases in the population of fishery employed residents from 1990 to 2000. Gloucester shows a shift toward the waterfront for the remaining employees. Plymouth shows the most substantial decrease in fisheries employment. New Bedford shows an increase in fishery employed residents, due to the increase in scallop fishing activity over the 1990s.

V.I. Gloucester Maps:

Gloucester is a designated port for fisheries use, and currently has a small commercial boat fleet. The town has experienced important changes in the last 15 to 20 years with a considerable change in the labor force. Currently, most of the commercial fisheries in the town rely on contract labor coming from out of town. The perception is that for the fishing industry to adapt to the uncertain regulatory environment, the fleet has to be small and able to shift gears to different species rapidly. Some of the traditional fishing operations in the town have changed and now rely on imported fish (Gorton's is one example).

Maps are presented in 1990 and 2000 for two levels of aggregation: census tracts and census block groups. Census tracts are a unit of analysis designated by the census bureau which contains an average of 4,000 inhabitants when delineated. Tracts are useful for

assessing broad spatial patterns. Census block groups are smaller than tracts and are generally sub-divisions of tracts. Block groups are the smallest unit of analysis for which the census obtains sample data. Block groups are helpful in analyzing spatial patterns on a smaller, disaggregated scale.

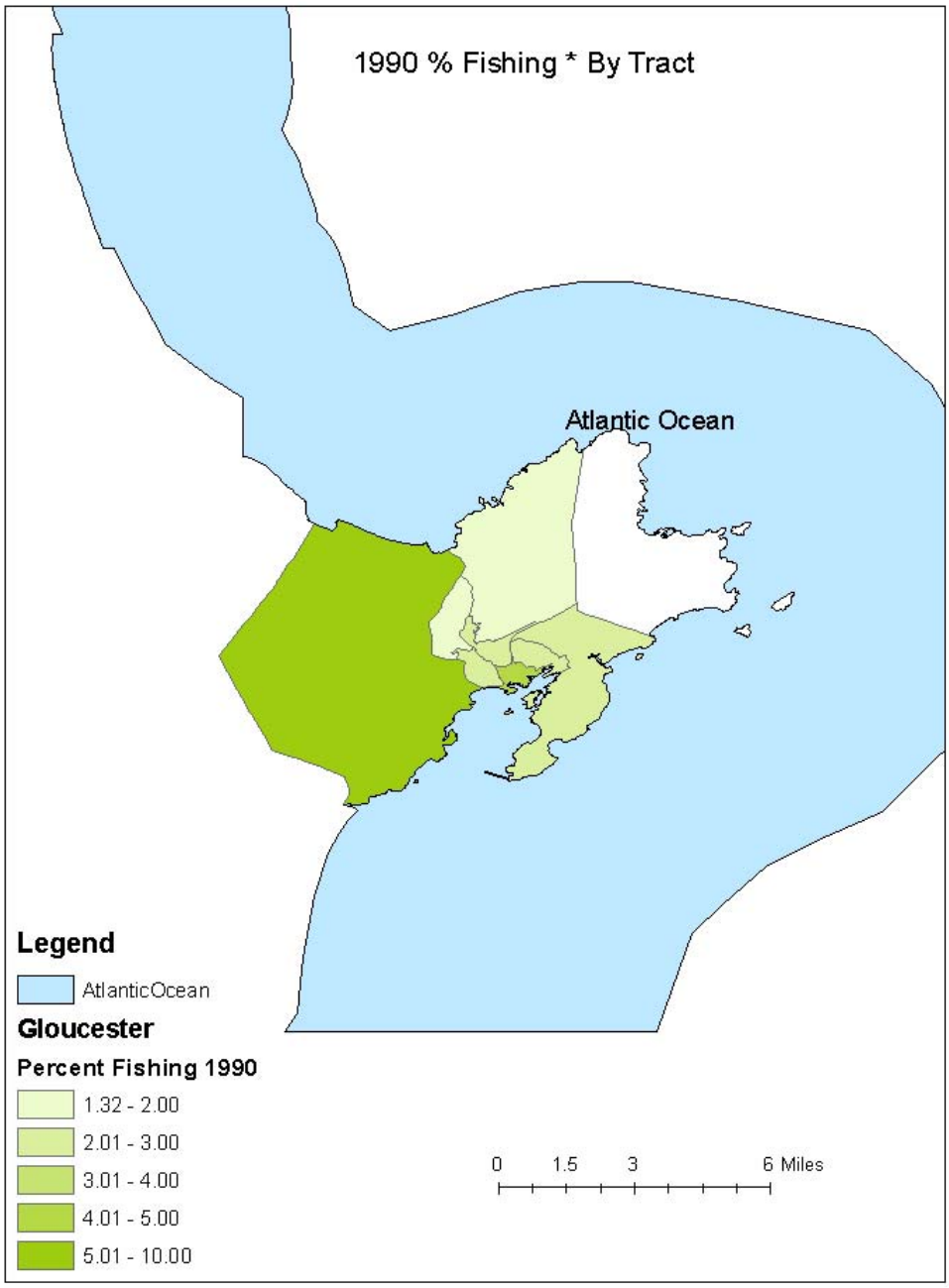


Figure 4.1: * Fishing category includes employment in agriculture, fishing, and hunting

The tract maps show how fishing employment has transformed from a relatively diffuse pattern throughout Gloucester to a more concentrated pattern at the portside. The composition of neighborhoods has changed. In 1990, the highest percentage of fishers lived west of downtown. In 2000, the least percentage of fishermen live in that area. The highest percentage has moved into the downtown area, near the port.

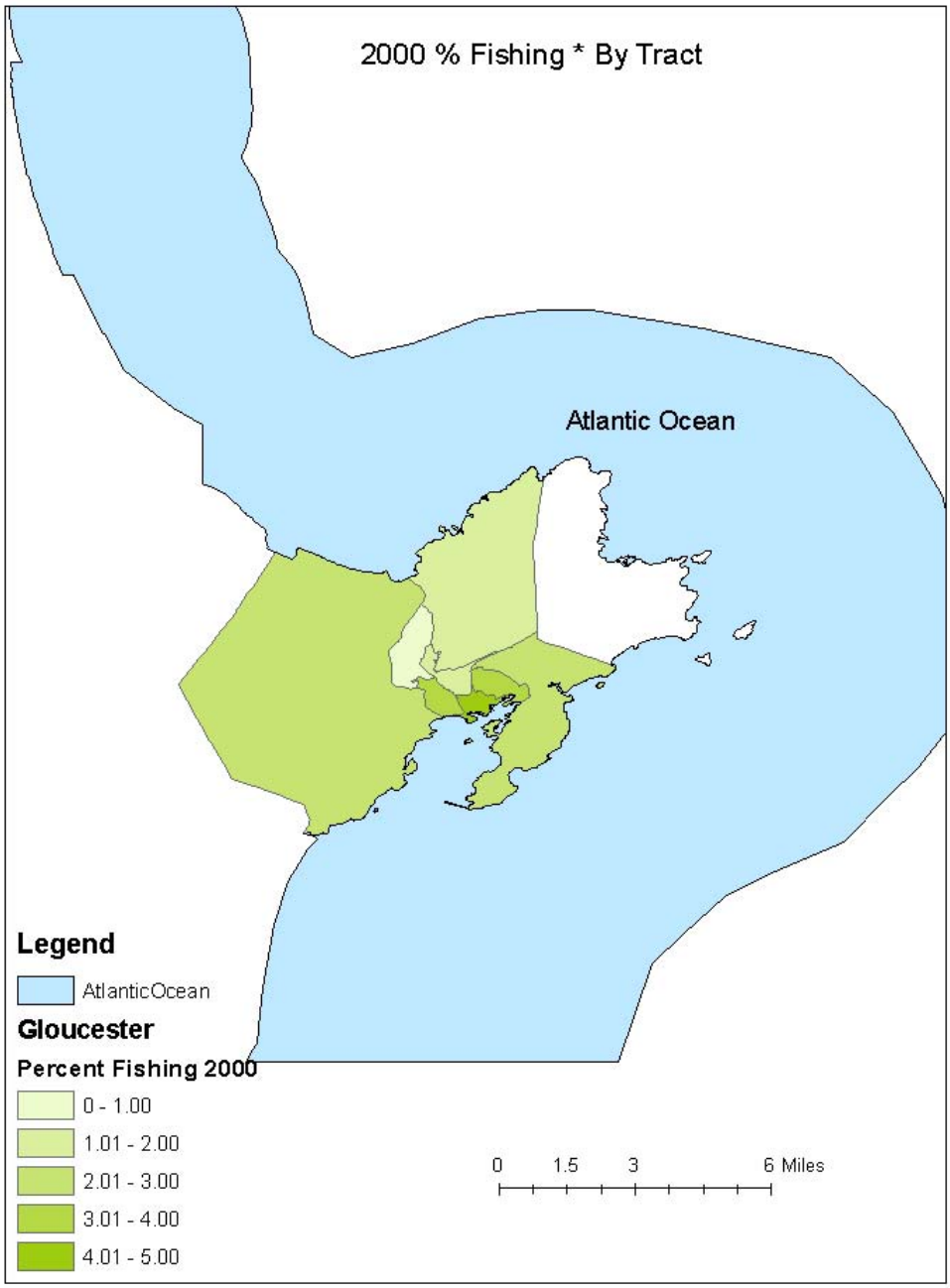


Figure 4.2: * Fishing category includes employment in agriculture, fishing, and hunting

The tract maps also demonstrate how both the percentage of residents employed in fishing has fallen as well as (the highest percentage in 1990 was 9.8% and 4.38% in 2000). Similarly, the tracts with the lowest percentage of residents employed in fishing

fell from 1.32 % to .86%. These trends demonstrate the decrease in fishing employment in Gloucester during the 1990s.

The block group maps allow a more detailed examination of the trends in fisheries employment residence. In 1990, there were many block groups with 3% to 4% and 4% to 7% employment in fishing. These were widely spread throughout Gloucester, and integrated into the community at large (most areas had at least some fishing employment.

The 2000 block group map shows a significant change. In 2000, there were far fewer block groups with fishing employment percentages higher than 3%. In addition, the primary fishing resident neighborhoods have become concentrated on the north-east side of the port. This transition is evidence of the gentrification of the region, where non-fishing residences are competing with traditional fishing neighborhoods for use of land. In addition, fishing residences became more concentrated – there are block groups with higher percentages of fishing employed residents in 2000 than in 1990. This indicates that workers in the fishing industry have become less integrated with the rest of the community.

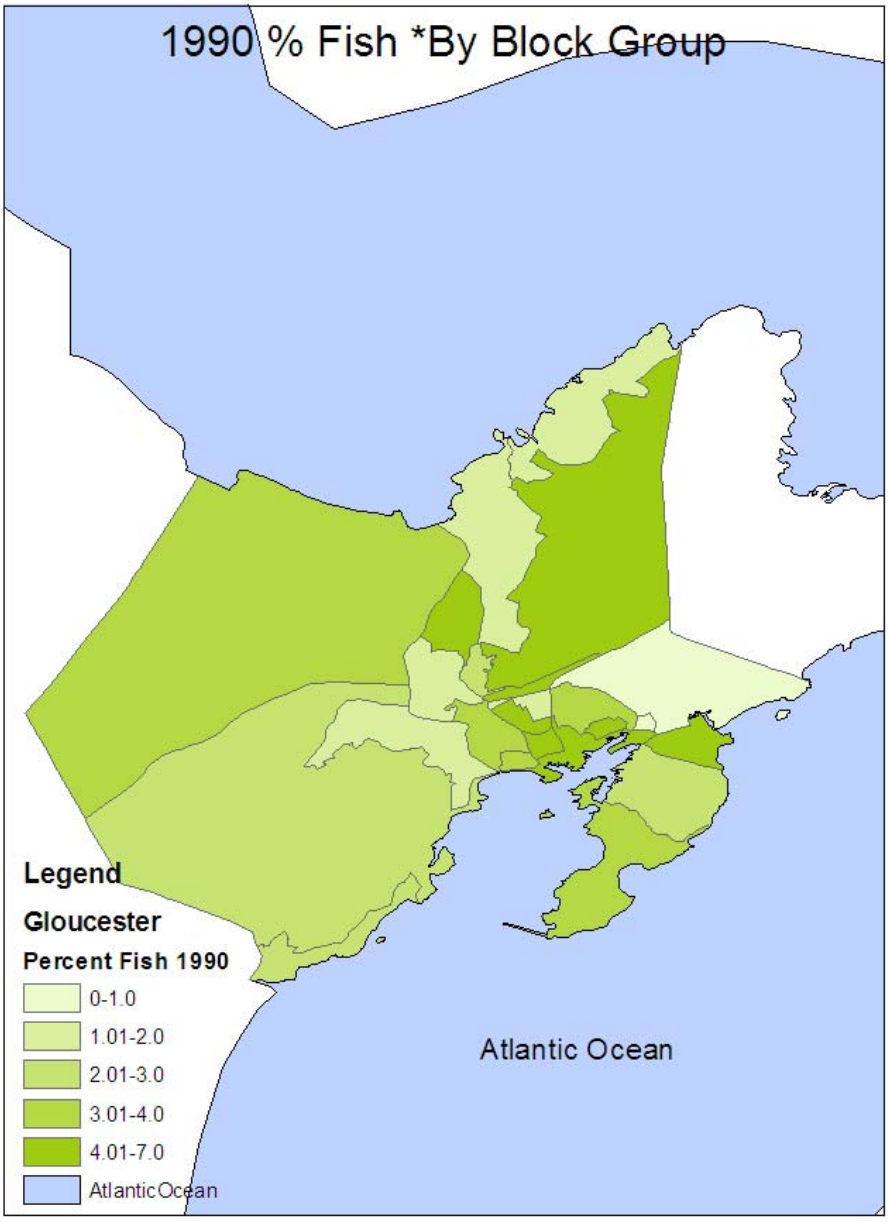


Figure 4.3: * Fishing category includes employment in agriculture, fishing, and hunting

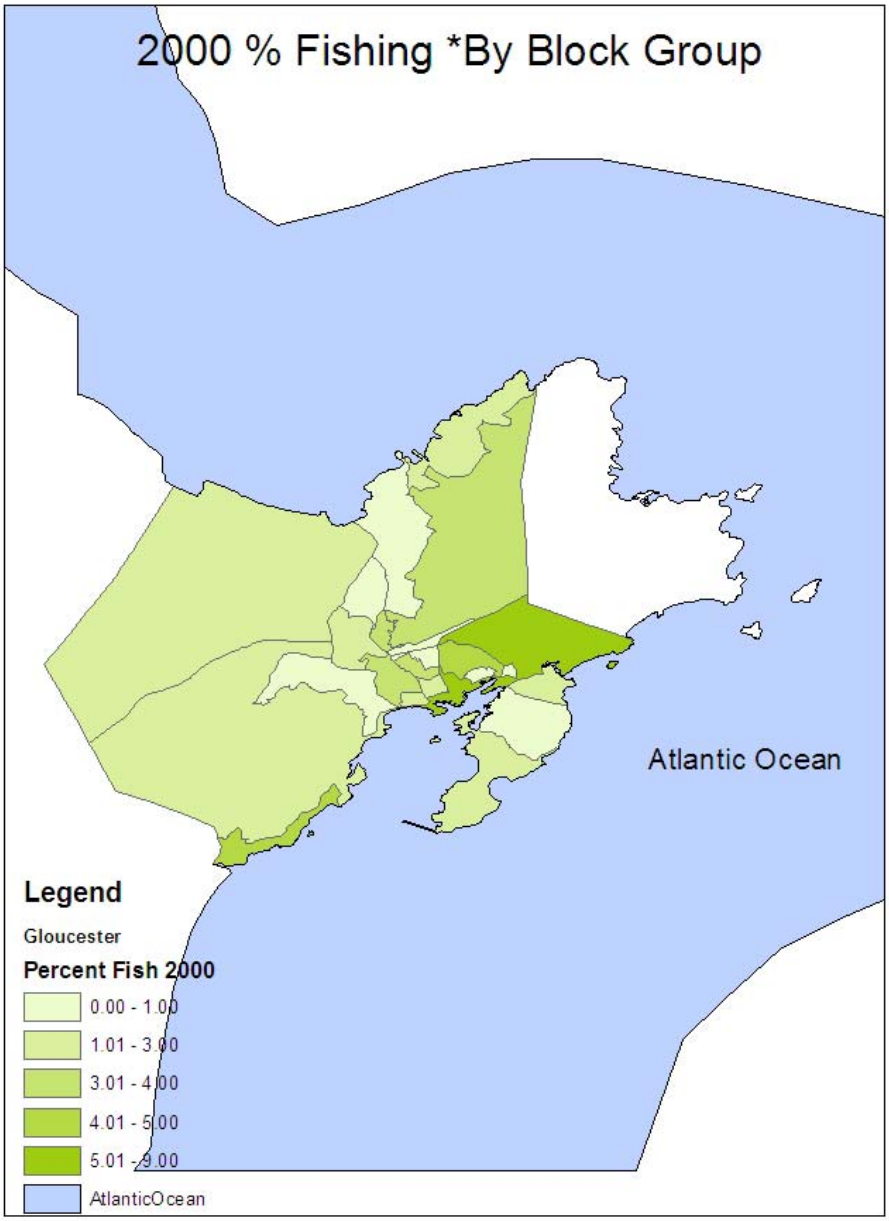


Figure 4.4: * Fishing category includes employment in agriculture, fishing, and hunting

V.2. Plymouth Maps

The tract maps from Plymouth appear to reveal little since the unit of aggregation is large (these maps do not include other Plymouth Harbor related fishing towns since these towns did not have more than one tract each). However, comparing the legend between the two maps indicates that employment in fishing has fallen. Between 1990 and 2000 both census tracts lost employment in fishing. The most dense residence of fishery employees fell from 0.5% to 1.0% to under 0.35 %, a substantial decrease. The least dense census tract with a percentage of fishery employees in residence of .44% in 1990 became completely emptied of all fishery employee residents by 2000, indicating substantial changes in the neighborhoods surrounding the port.

The block group maps for the Plymouth Harbor towns reveal more information. Analysis at the census tract level allows inclusion of Duxbury, Kingston, and Marshfield as well Plymouth. In 1990, there is fishing employment in Kingston, Marshfield, and Plymouth. In Plymouth, the concentration of fishing employment is diffuse, with some fishing neighborhoods abutting the waterfront. The highest percentage of employment in fishing is 3% to 4%. The 2000 map presents a stark contrast. There is no longer employment in fishing in Marshfield or Kingston, and the fishing neighborhoods in Plymouth have contracted to a single block group. The highest concentration, in this single block group, is between 2% and 3% in 2000. The concentration of employment in fishing away from the waterside is indicative of residential gentrification patterns in Plymouth.

For the block group maps it is important to reiterate the caution about the aggregated fishing data from the decennial census. As noted, this category is composed of agriculture, fishing, and hunting employment. In the case of Gloucester, it is highly likely that the predominant amount of employment in this category is in fishing. In Kingston and Marshfield, however, it is possible that some of the employment in "fishing" in 1990 includes agricultural employment.

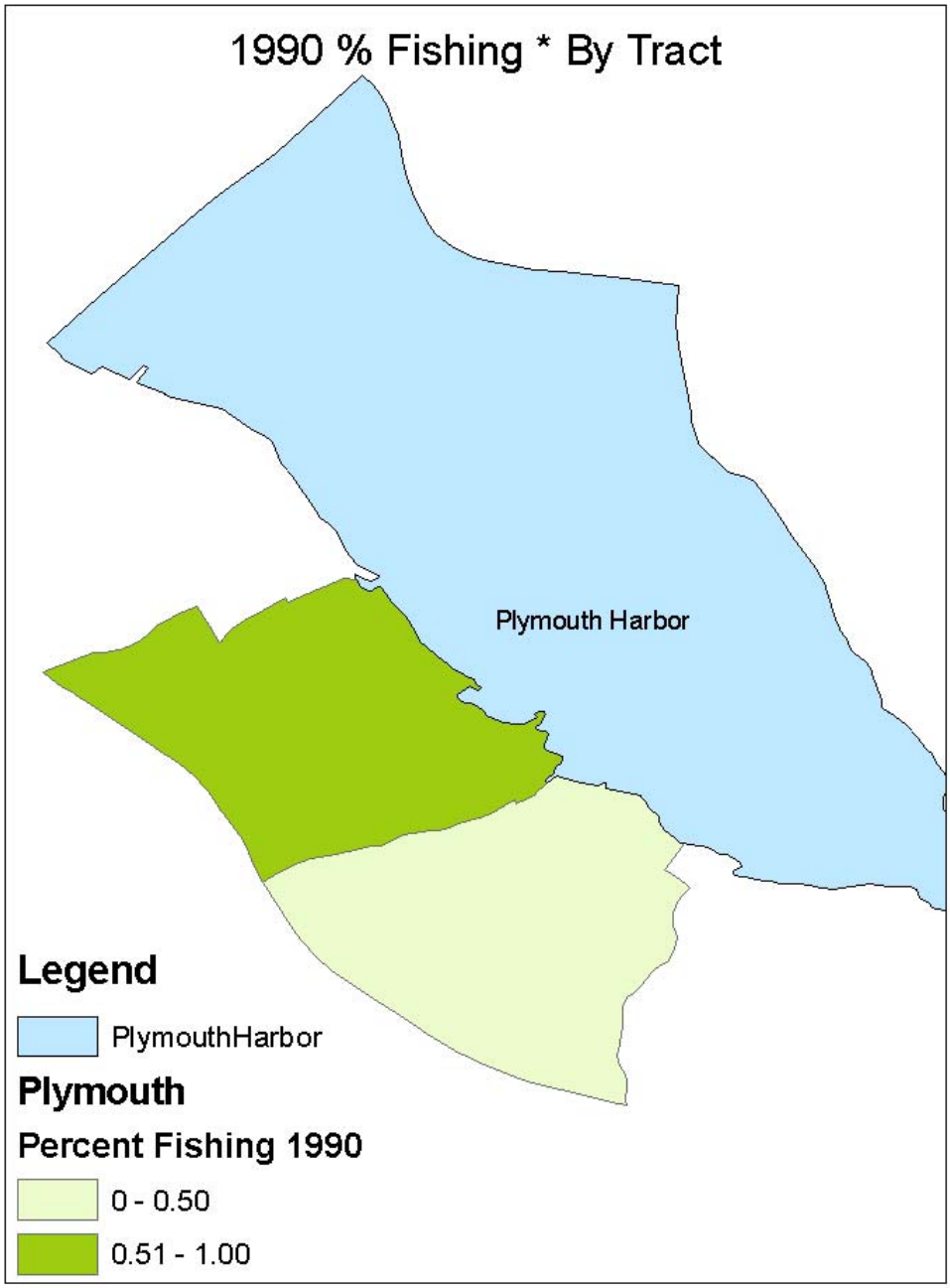


Figure 4.5: * Fishing category includes employment in agriculture, fishing, and hunting

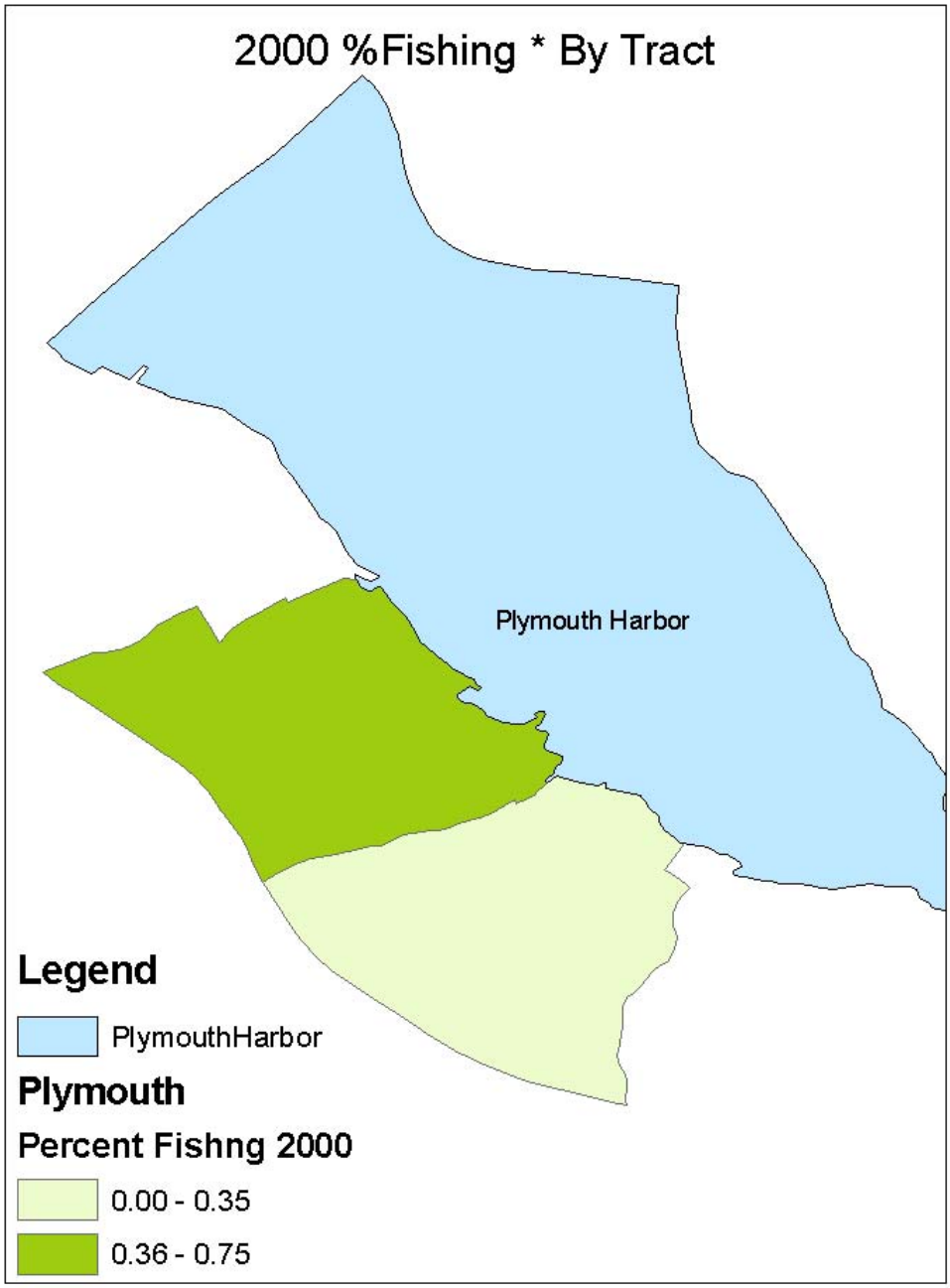


Figure 4.6: * Fishing category includes employment in agriculture, fishing, and hunting

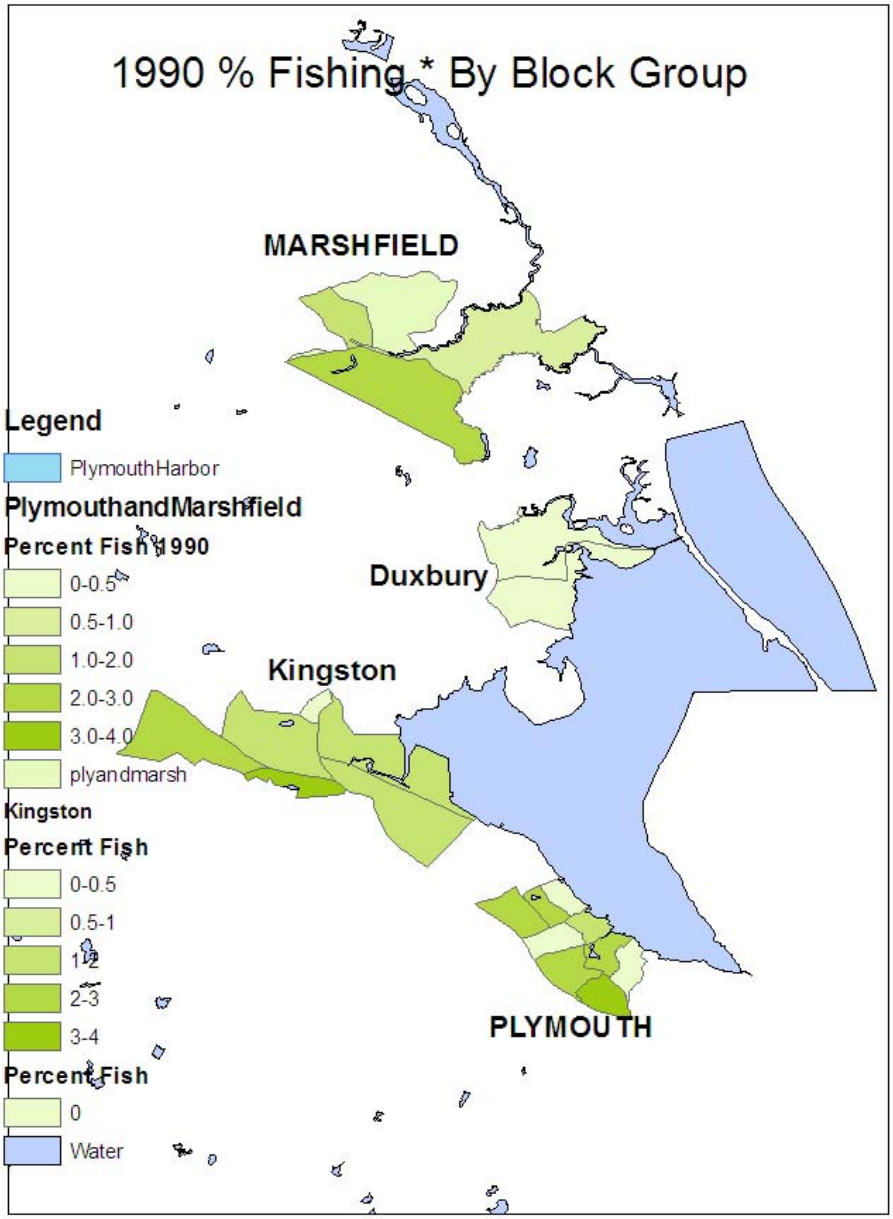


Figure 4.7: * Fishing category includes employment in agriculture, fishing, and hunting

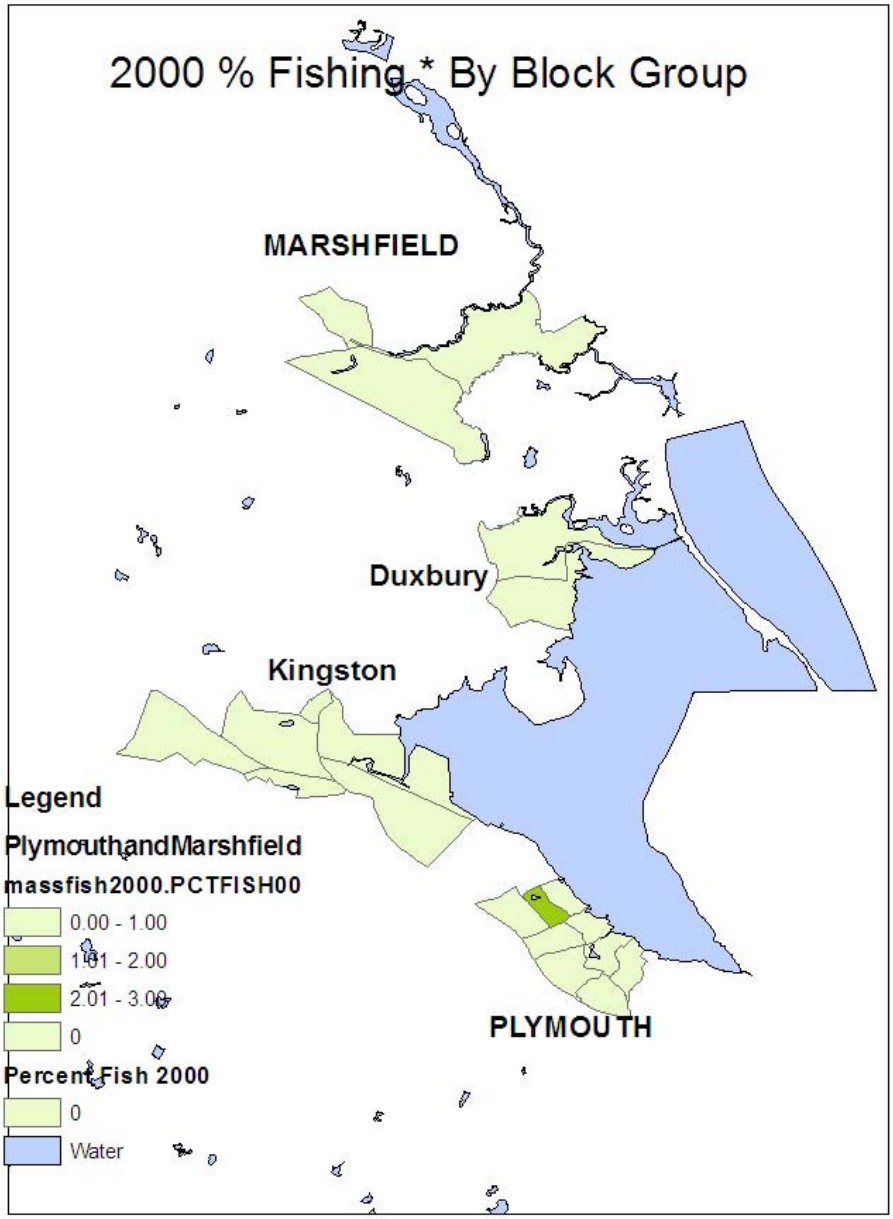


Figure 4.8: * Fishing category includes employment in agriculture, fishing, and hunting

V.3. New Bedford Maps:

New Bedford has substantial scallop fishing activity which comprises up to 90% of the local industry. Recently, the New Bedford economy has been experiencing difficulties with the fluctuations in fishing activities and its rippling effect on insurance business and other sectors. The tract maps show the increasing concentration of residents in the scallop business living close to the port. Unlike Gloucester and Plymouth, there does not appear to be a substantial decrease in fishing employment.

The block group map shows a similar pattern. This level of analysis, however, indicates that the fishing employment neighborhoods are becoming more concentrated and less dispersed throughout the greater community. This may be due to the transition to hiring recent immigrants in the fishing industry, since many immigrant communities tend to be more segregated and densely populated than non-immigrant communities. The block group maps also indicate that the concentration of fishing employment has decreased in New Bedford as well. The highest percentage of fishing employment was 8% to 12% in 1990 and 5% to 7% in 2000.

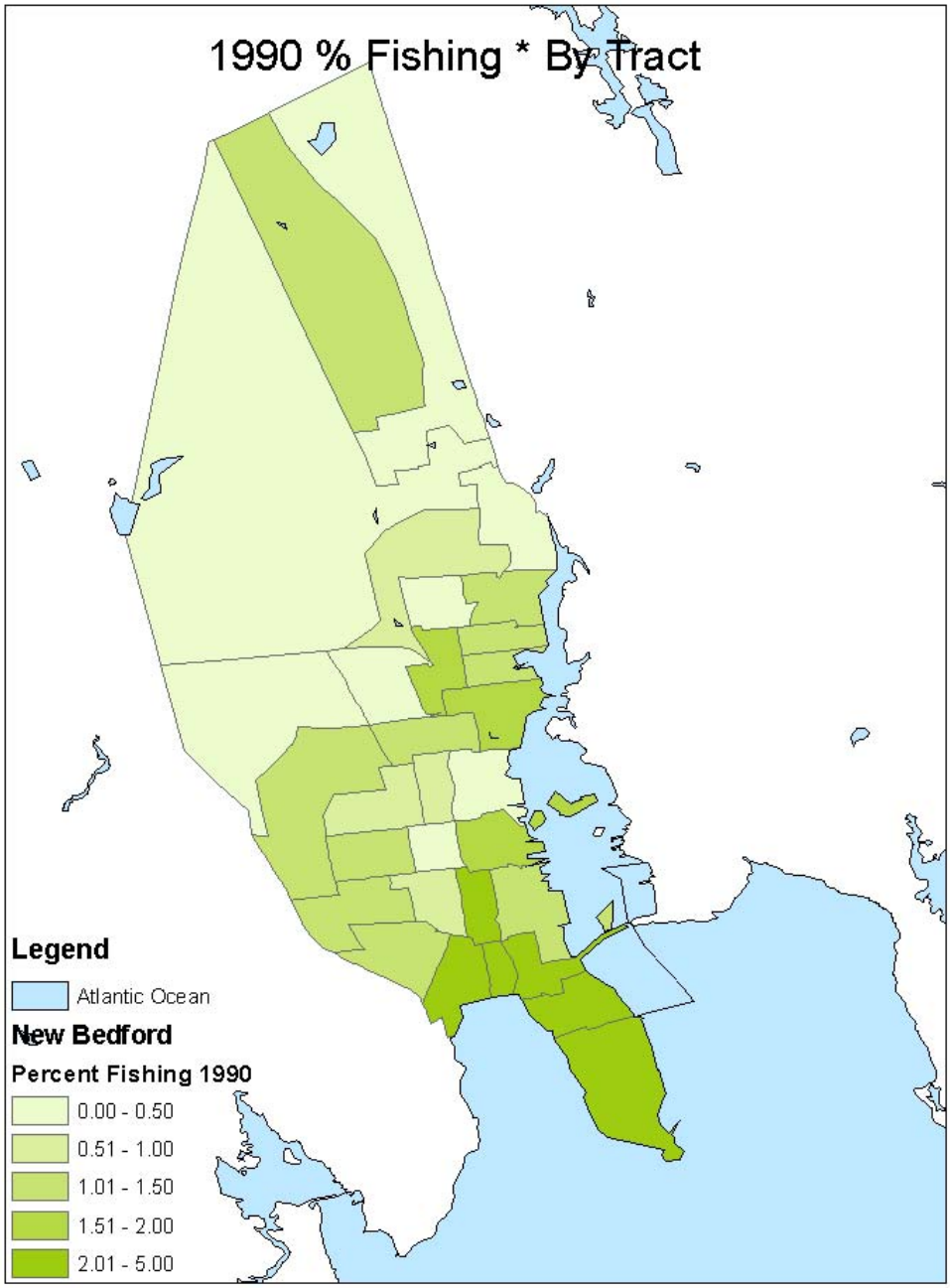


Figure 4.9: * Fishing category includes employment in agriculture, fishing, and hunting

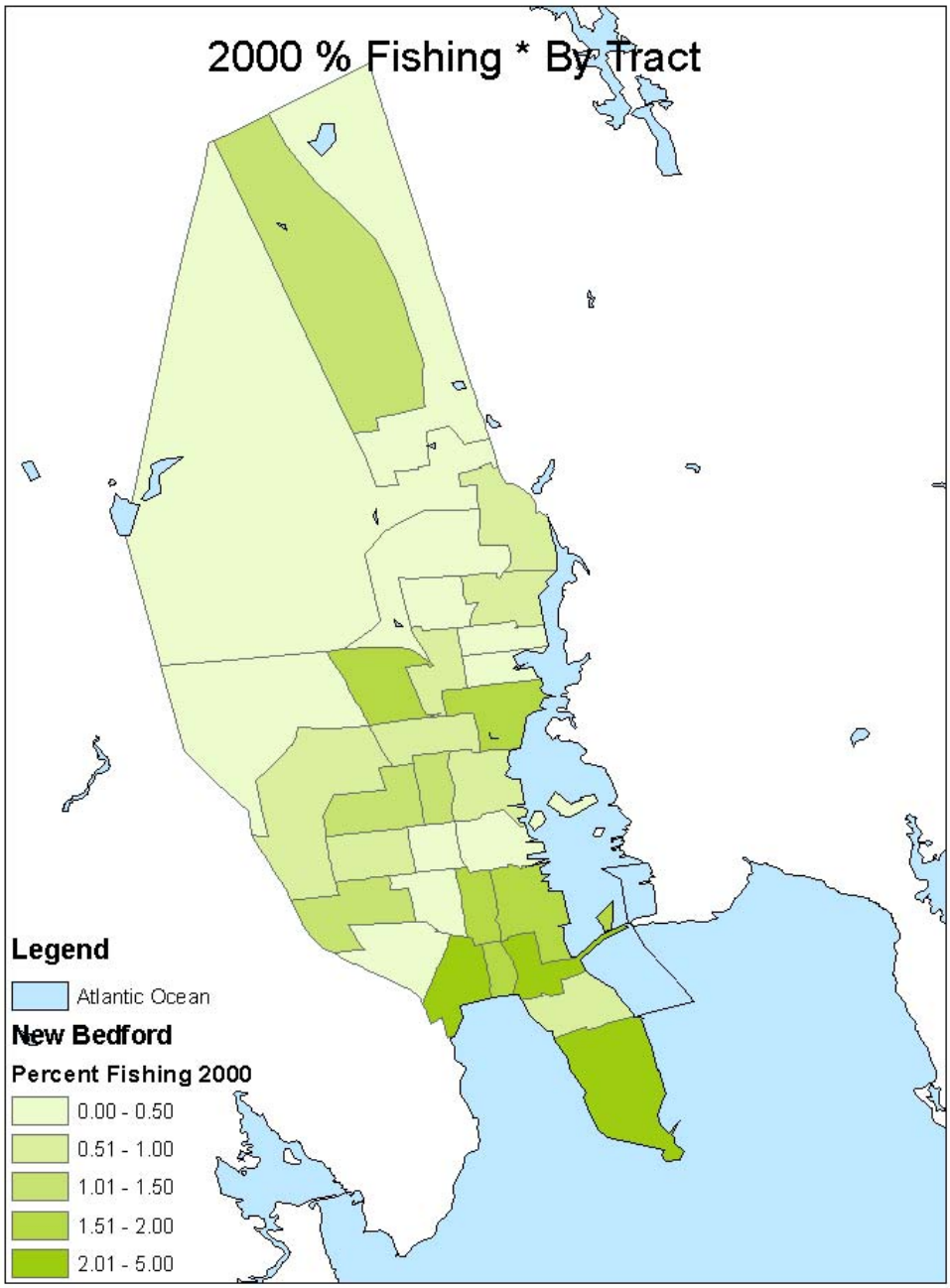


Figure 4.10: * Fishing category includes employment in agriculture, fishing, and hunting

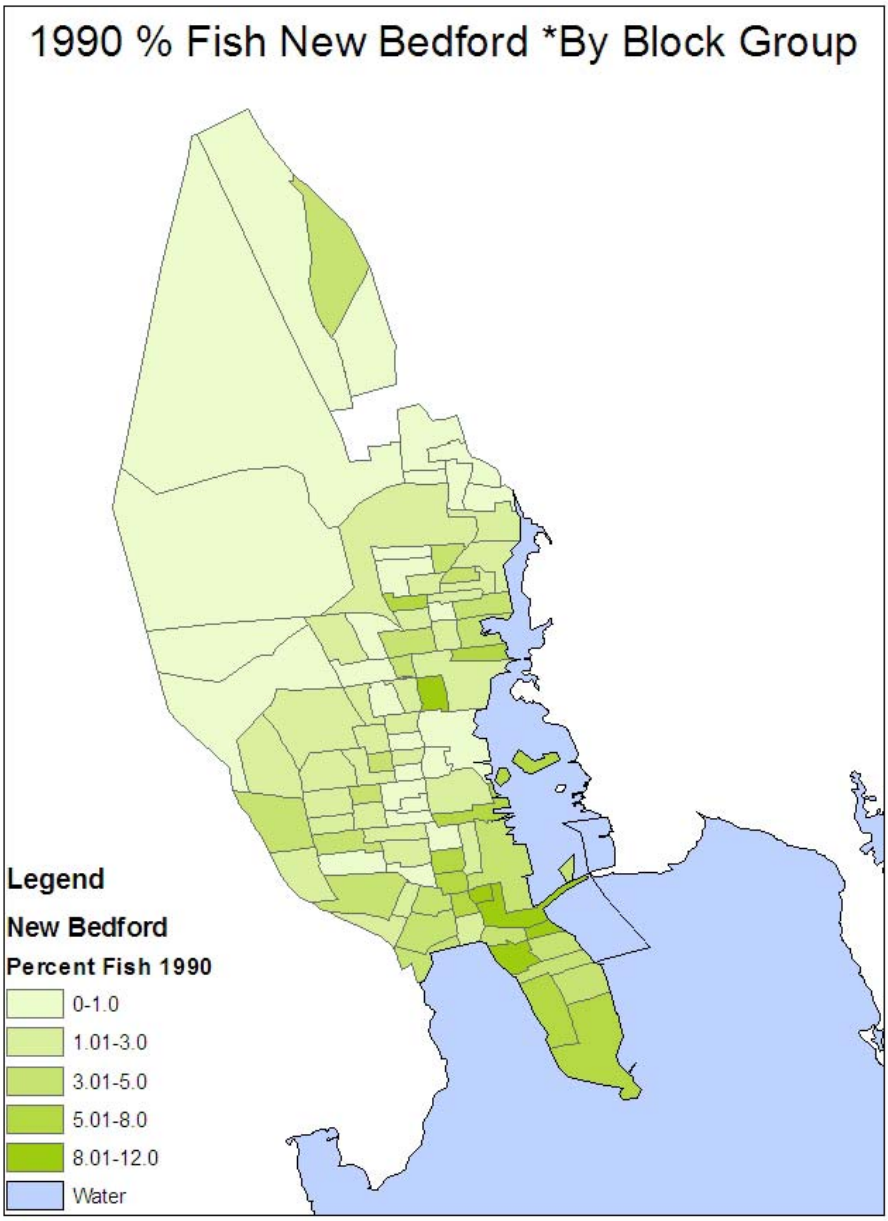


Figure 4.11: * Fishing category includes employment in agriculture, fishing, and hunting

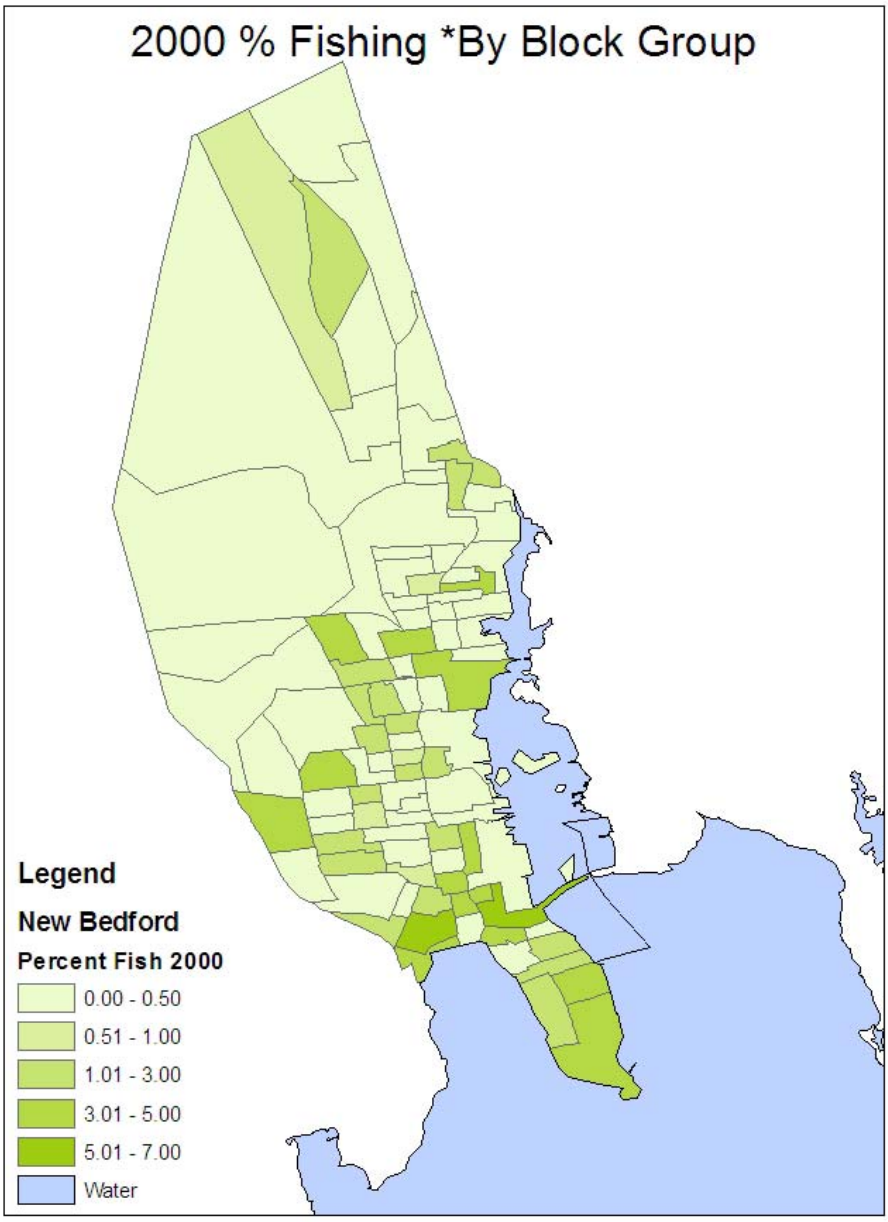


Figure 4.12: * Fishing category includes employment in agriculture, fishing, and hunting

In sum, the GIS analysis indicates that:

- fishing employment decreased from 1990 to 2000 in Gloucester, Plymouth, and New Bedford
- fishing neighborhoods became more concentrated
- In Gloucester and Plymouth, waterside neighborhoods lost fishing employee residents

The loss in fishing employment is addressed in Chapter III of this report. Substantial decreases in fishing employment were found for all three cities.

The concentration of fishing employment in narrowly confined neighborhoods indicates a pattern toward residential disintegration. This may indicate that fishers are becoming less comfortable in their communities at large or that high home rental and ownership costs are driving fishers out of those communities. Fishers may also be no longer able to afford their former neighborhoods due to the decline in the fishing industry. This movement toward displacement raises the same social equity concerns that are discussed when gentrification displaces poor or minority residents in urban areas.

The concentration of fishing employment in tightly defined neighborhoods in Gloucester and Plymouth is also consistent with a displacement from waterfront properties as residential land uses compete with fishing related activities. The observed pattern of residential change demonstrates how this is occurring.

V. Economic Models of Fisheries Activities

V.1. The Production Function for a Fishing Unit

The neoclassical theory of the firm emphasizes the technology of production. In the fisheries industry, we can consider a fishing unit as a production technology which under the unrealistic conditions of certainty (no risk), has a typical production function:

$$y = f(x_1, x_2, x_3, \ldots x_n) \qquad (5.1)$$

where y is the output produced, in this case the fish landed at port, using the inputs $(x_1, x_2, x_3, \ldots x_n)$ according to the function f that represents the state of technology. The inputs for a fishing unit are capital, labor, sea space to operate, etc. Usually, the function f is assumed to exhibit diminishing marginal physical products, and constant returns to scale overall. Prices of inputs are taken as given and denoted $(r_1, r_2, r_3, \ldots, r_n)$. For simplicity, assuming that $n=2$, i.e. there two inputs, the total cost of producing is linear $r_1 x_1 + r_2 x_2$, and given an exogenous level of output, y_o, the unit solves the minimization problem, $Min\ (r_1 x_1 + r_2 x_2)$ by choice of inputs (x_1, x_2) subject to the production technology $y_o = f(x_1, x_2)$. Considering alternative levels of output y, the solutions generate a total cost curve $c(y)$ from which we can deduce an average cost curve, $c(y)/y$ and a marginal cost curve, $dc(y)/dy = c'(y)$ where a prime denotes the rate of change. Under competitive markets, fishing units maximize profits or income, $py - c(y)$, by choice of output y where p is the market price of fish, taken as given by the unit. An equilibrium output is then determined by the usual marginal cost pricing formula, $p^* = c'(y^*)$.

However, a more realistic view should include elements of risk and effort. Suppose the fishing unit has a technology denoted by

$$y^s = A(s) f(x_1, x_2, x_3, \ldots x_n ; s) \qquad (5.2)$$

where the variable s indicates the state of nature in which the fishing unit operates at the particular date, say March 20, 2006. The variable A denotes the ratio of the fishing output to the total input function and represents the state of technology used in the activity. In this case, one of the inputs is taken to be effort. We let p^s denote the state contingent price of the fish produced when sold at the landed port, i.e. the spot price. The inputs are contracted at the beginning of the period, before the fishing activity takes place, at the sure cost $(r_1, r_2, r_3, \ldots r_n)$ for the respective input $(x_1, x_2, x_3, \ldots x_n)$. In each state of nature s, the net income of the fishing unit is given by

$$^s = p^s y^s - {}_{i=1}^{n} r_i x_i \qquad (5.3)$$

where $p^s \ y^s$ is the unit's revenue and ${}_{i=1}^{n} r_i x_i$ is the total deterministic linear cost of inputs. Ownership of the fishing unit indicates a claim to its proceeds given by the list of possible profits in each state of nature $= ({}^1, {}^2, \ldots, {}^S)$.[39]

The typical economic decision of the fishing unit consists of choosing the level of inputs that maximize expected net income, or

$$Max\ [p^s y^s - {}_{i=1}^{n} r_i x_i]$$

[39] Economic models of this type may be found in Bianconi (2003).

$$\{x_i\}_{i=1}^{n} \qquad (5.4)$$

subject to $\quad y^s = A(s)\, f(x_1, x_2, x_3, \ldots x_n ; s)$

given prices $\{r_i , p^s\}$ and the probability distribution of the states of nature s. The optimality conditions for this problem are

$$\partial[p^s A(s) f_i(\ldots;s)] = r_i , \qquad \text{for each input } i=1,\ldots n \qquad (5.5)$$

where $f_i(\ldots;s) = \partial f(x_i,\ldots ; s)/ x_i > 0$ is the marginal physical product of input i. The set of optimality conditions can be solved for the input demands as a function of prices $\{r_i, p^s\}$ and the probability distribution of s. This solution equalizes the marginal benefits and marginal costs of the productive activity, and gives us the basis for a cost-benefit analysis of the use of inputs given the technology.

Here we examine one example of the workings of this economic model, and the potential effect of regulation on fishing activity. Suppose the function f is given by

$$f(x_1, x_2, x_3, \ldots x_n ; s) = k^a\, l^b\, sea^c\, [e\, g(s)]^d \qquad (5.6)$$

where the inputs are specifically denoted k for physical capital, l for labor, sea for sea space, and e for effort, where effort is a function of the state of nature through the function g. If the state of nature is good, say good weather, then g is lower so that effective effort is lower. If the state of nature is bad, say bad weather, then g is higher so that effective effort is higher. This captures the overall effect of alternative states of nature on the effective effort per unit of labor. The powers a,b,c,d are less than one and $a+b+c+d<1$ so that diminishing marginal products and decreasing returns to scale are preserved.[40] The conditions (5.5) yield the set of relationships

$$\partial[p^s A(s) \{e\, g(s)\}^d]\, a\, k^{a-1}\, l^b\, sea^c = r_k \qquad (5.7a)$$

$$\partial[p^s A(s) \{e\, g(s)\}^d]\, k^a\, b\, l^{b-1}\, sea^c = r_l , \qquad (5.7b)$$

$$\partial[p^s A(s) \{e\, g(s)\}^d]\, k^a\, l^b\, c\, sea^{c-1} = r_{sea} , \qquad (5.7c)$$

$$\partial[p^s A(s)\, d\, \{e\, g(s)\}^{d-1} g(s)]\, k^a\, l^b\, sea^c = r_e , \qquad (5.7d)$$

which can be solved for the demands for capital, labor, sea space and effort given the prices and probability distribution of the states of nature. The effects of prices and risk on input demands can be then analyzed.

(i) An increase in the price of one of the inputs relative to the other inputs reduces the demand for that input and raises the demand of the other inputs according to the substitutability parameters a,b,c,d;

(ii) An increase in the expected price of the landed fish raises the use of all inputs;

(iii) A change in the state of nature, say an increase in risk due to bad weather, would bring a reduction in the use of capital, labor, and sea space, and could imply higher effort,

[40] The sum of the coefficients to be less than unit implying decreasing returns to scale is assumed for analytical purposes, under the rationale that other factors are held constant.

though the effort/labor ratio increases. Expected profits and output are reduced in this case.

It is also important to recall that production choices may be subject to time constraints of short run versus long run nature. In the short run, certain inputs may vary, such as labor and effort, while others may be fixed such as physical capital and sea space due to regulations.[41] In the case of fisheries, it is plausible that a change in regulation or prices has a smaller short run effect than the overall total cumulated long run effect. We may understand this proposition with the analysis of specific regulations.

Suppose that a federal regulation fixes sea space at *sea=sea**. The choice set for a fishing unit is reduced to demands for capital, labor and effort only. Table 5.1 illustrates the economic trade offs involved in the solution for demands for the remaining variable inputs. The rows under the base set refer to the profit maximizing equilibrium, without any regulation. Columns refer to the levels of risk in the fishing activity, starting with a scenario of no risk (probability of good state of the world equals 1), to moderate risk (probability of good state of the world equals 0.85), and maximum risk (probability of good state of the world equals ½). Additional risk at the base set without any restrictions on choices of inputs, leads to higher levels of effort per unit of labor, but very little variation in the capital/labor ratio, profit/output and profit/labor ratios. The expected output per worker is stable over the moderate level of risk, but declines as we move to the maximum level of risk.

Next, we introduce a 30% reduction in sea space for fishing activity from the levels of no risk activity and no restrictions. Table 5.2 presents the percentage changes from the base set in Table 5.1. In the short run, the level of physical capital is fixed and the fishing unit can only adjust effort and labor. Relative to the base set, in the case of no risk, capital per worker increases by about 20%, effort per worker and profit per output decrease, -33% and -44% respectively, profit per worker decreases by 8% and output per worker increases by 65%. As more risk is taken to the moderate level, capital increases by much less, effort is reduced by much less, expected profit does not change and profit per worker increases, while output per worker increases much less. Taking maximum risk raises capital usage per worker by 26%, reduces effort by only 3%, reduces profit and increase output dramatically. Thus, the expected output per worker is higher across the board relative to the base set because of the higher capital/labor ratio. However, the raise in the capital/labor ratio indicates the presence of some idle capacity relative to the base set in the short run, there is too much capital for the amount of labor used. The key result is that, in the short run, for units taking low levels of risk, it is profitable to take additional moderate risk in face of the regulation in the short run, but for units already taking moderate levels of risk, taking more risk is not profitable in the short run. From the no risk to the moderate risk columns there is a gain in expected profits with the increased effort, but from moderate to maximum risk the additional effort does not translate into higher profits since physical capital remains fixed in the short run. From the perspective of expected output per worker, the maximum risk leads to the highest expected output per worker where the capital/labor ratio is the highest.

[41] In the microeconomics branch of economics, this is the so-called Le Chantelier principle.

The next rows show the long run adjustment where physical capital can be adjusted. Since capital is variable in the long run, the capital/labor ratio returns to capacity use consistent with the base set. But this implies physical capital is reduced and more effort per unit of labor is taken when compared to the short run effect. The effects of risk taking are qualitative similar to the short run, but different in magnitude. It would be more profitable to operate at moderate levels of risk as opposed to maximum or no risk. In this case, the capital/labor ratio is stable and from the perspective of expected output per worker, the moderate risk leads to the highest expected output per worker.[42] However, as Table 5.2 shows the expected output per worker in the long run is below the base set across all levels of risk, given the reduced stock of physical capital.

We then introduce a regulation that imposes a 30% reduction in sea space and a 30% reduction in labor units from the levels of no risk activity and no restrictions. The labor unit reduction captures the effect of days at sea (DAS) regulations, common in the fishing industry. Now, the only variable margin in the short run is effort. In the long run, both effort and capital are variable. In the short run, the labor restriction makes the capital/labor ratio very large relative to the base set (an increase of about 168%), indicating large idle capacity in the fishing unit, across all levels of risk. The effort per worker increases relative to the base set, and expected profits are zero in the short run. Taking additional moderate risk, implies much more effort in the short run and expected profits become moderately positive, i.e. profits fall by less relative to the base set. But, maximum risk with very high levels of effort does not pay off in terms of expected profits, which become negative. The expected output per worker is higher relative to the base set, but does not vary much since the only margin in variable effort.

The long run adjustment leads to a large reduction in the physical capital relative to the short run, but relative to the base set the capital/labor ratio will be higher. Thus, the capital/labor ratio does not completely adjust to the capital/labor ratio of the base set, because labor is restricted by the regulation and some idle capacity will remain underused in the long run, relative to the base set. Moderate levels of risk give the maximum level of expected profits, a 50% increase relative to the base set; and high efforts at high levels of risk give the lowest levels of expected profits, a 50% reduction relative to the base set. The expected output per worker is decreasing in the level of risk in this case since labor input is fixed in the short and long run.

The conclusion is that a reduction in sea space and/or labor input has important economic effects for the behavior of a fishing production unit, and these effects can change the demand for factor inputs, thus affecting the local economy. In particular, it introduces idle capacity and low usage of inputs that have an adverse effect on the local economy. Moreover, the introduction of regulation can lead production units to choose to take more risk, in order to compensate for loss in revenues. This can be potentially hazardous for an activity that is already risky.

[42] Note that prices of output (price of fish) are taken as given and held constant; if prices are higher due to the restriction, then the fishing unit may be more prone to take additional risk.

Finally, there are two important issues to raise here. First, the analysis presented is for one period only. The introduction of more periods raises the important consideration that policy interventions should be smoothed over time, as opposed to large interventions in one period only.[43] Large emergency interventions make the business planning horizon for the fishing units shorter and riskier. Interventions should be smoothed over longer periods of time making the environment for productive fishing units stable. In this way, business and investment plans can be made for a longer horizon and with more accuracy of the projected results. The smoothing of policy interventions provides gains in welfare of all in the productive activity, those gains should not be ignored. Second, on a related issue, the potential expectation of future regulation may lead to current over-fishing and excess risk taking even if prices are low, the so-called "race to fish." The smoothing of policy intervention and management can reduce the adverse effects of negative expectations.

V.2. Other Economic Models

A fisherman may be modeled as a rational individual willing to supply labor, effort, and demand consumption subject to resources constraints. Supposing the individual takes prices as given the felicity function would be of the form $u(c, l, e)$ where consumption provides positive felicity and labor and effort impose costs. The analysis in this case would give us the individual's willingness to supply labor and effort and the individual demand for consumption goods, given prices. We do not pursue this avenue here.

The Natural Resource Community as a Network is also a potentially useful economic model to analyze in the fisheries industry, see Hall-Arber (2000). This class of economic models focuses on each individual fishing unit as a node on an interrelated network of flows of goods, services, exchange of ideas, transmission of human, cultural and social capita and knowledge and exchange of physical capital. This is a potentially useful approach for examining the impact of regulation on the industry.

There is a vast literature on fisheries production since Gordon (1954), including Conrad and Clark (1987) and more recently Wilen and Homans (1998), Grafton, Squires and Fox (2000) and Costello et al (2005) among others. Some of this literature emphasizes the dynamic aspects of biomass evolution and other stocks and flows of activities to better understand the impact of regulation, focusing on the external effects across space and time.

Other models of fisheries and economic activity may be found in Homans and Wilen (2005), and a good description of fisheries economic activity is provided in Hall-Arber (2003), Georgianna (2000) and Doeringer, Moss and Terkla (1986).

[43] This is the same argument encountered in the tax smoothing policies discussed in the public finance literature where large changes in tax policies should be avoided in order to provide a stable environment for market participants to make credible and useful business plans, e.g. Barro (1979)

Table 5.1: Model Simulations

	Probability of Good State: 1 (No Risk)	Probability of Good State: 0.85 (Moderate Risk)	Probability of Good State: 0.5 (Maximum Risk)
Base Set			
Capital/Labor	3.12	3.12	3.12
Effort/Labor	0.03	0.15	0.53
Expected Profit/Output	0.09	0.09	0.08
Expected Profit/Labor	0.12	0.12	0.10
Expected Output/Labor	1.33	1.33	1.25
30% Reduction of Sea Space: Short Run with Physical Capital Fixed			
Capital/Labor	3.75	3.23	3.94
Effort/Labor	0.02	0.14	0.51
Expected Profit/Output	0.05	0.09	0.02
Expected Profit/Labor	0.11	0.13	0.05
Expected Output/Labor	2.20	1.44	2.5
30% Reduction of Sea Space: Long Run with Physical Capital Variable			
Capital/Labor	3.12	3.12	3.12
Effort/Labor	0.03	0.15	0.52
Expected Profit/Output	0.08	0.10	0.04
Expected Profit/Labor	0.06	0.12	0.02
Expected Output/Labor	0.75	1.20	0.50
30% Reduction of Sea Space and 30% Reduction of Work Activity: Short Run with Physical Capital Fixed			
Capital/Labor	8.36	8.36	8.36
Effort/Labor	0.04	0.22	0.68
Expected Profit/Output	0.00	0.03	-0.06
Expected Profit/Labor	0.00	0.05	-0.10
Expected Output/Labor	1.72	1.67	1.67
30% Reduction of Sea Space and 30% Reduction of Work Activity: Long Run with Physical Capital Variable			
Capital/Labor	3.45	3.56	3.21
Effort/Labor	0.04	0.19	0.54
Expected Profit/Output	0.10	0.13	0.04
Expected Profit/Labor	0.15	0.18	0.05
Expected Output/Labor	1.50	1.38	1.25

Table 5.2: Model Simulations – Percent Changes from Base Set

	Probability of Good State: 1 (No Risk)	Probability of Good State: 0.85 (Moderate Risk)	Probability of Good State: 0.5 (Maximum Risk)
	All % Changes From Base Set		
30% Reduction of Sea Space: Short Run with Physical Capital Fixed			
Capital/Labor	20.19%	3.53%	26.28%
Effort/Labor	-33.33%	-6.67%	-3.77%
Expected Profit/Output	-44.44%	0.00%	-75.00%
Expected Profit/Labor	-8.33%	8.33%	-50.00%
Expected Output/Labor	65.41%	8.27%	100.00%
30% Reduction of Sea Space: Long Run with Physical Capital Variable			
Capital/Labor	0.00%	0.00%	0.00%
Effort/Labor	0.00%	0.00%	-1.89%
Expected Profit/Output	-11.11%	11.11%	-50.00%
Expected Profit/Labor	-50.00%	0.00%	-80.00%
Expected Output/Labor	-43.61%	-9.77%	-60.00%
30% Reduction of Sea Space and 30% Reduction of Work Activity: Short Run with Physical Capital Fixed			
Capital/Labor	167.95%	167.95%	167.95%
Effort/Labor	33.33%	46.67%	28.30%
Expected Profit/Output	-100.00%	-66.67%	-175.00%
Expected Profit/Labor	-100.00%	-58.33%	-200.00%
Expected Output/Labor	29.32%	25.56%	33.60%
30% Reduction of Sea Space and 30% Reduction of Work Activity: Long Run with Physical Capital Variable			
Capital/Labor	10.58%	14.10%	2.88%
Effort/Labor	33.33%	26.67%	1.89%
Expected Profit/Output	11.11%	44.44%	-50.00%
Expected Profit/Labor	25.00%	50.00%	-50.00%
Expected Output/Labor	12.78%	3.76%	0.00%

VI. Travel Costs: Cultural Value of the Gloucester Fishery

VI.1 Background

The objective of this chapter is to provide a measure of the cultural value of the continuation of Gloucester as a working seaport. There are apprehensions that further regulation of the groundfish industry could cause a cessation of operation in some ports; Chapter 3 discusses this possibility in the context of fisheries employment. By measuring this cultural value we can then think about what cultural costs a cessation of fishing activity in Gloucester would have. Once we have an understanding of the magnitude of these results we can then think about the effects fishing cessation would have in other seaports in addition to Gloucester.

There is substantial anecdotal evidence that the fishing industry in Gloucester has cultural values that benefit visitors. Gloucester proclaims itself as "America's Oldest Seaport" on its welcome sign. The blockbuster movie *The Perfect Storm* was set in Gloucester. Each year many tourists come to Gloucester to see the workings of an operating seaport.

Non-market valuation techniques can be used to estimate this cultural value. The travel cost method is used in this section with visitation data from the Gloucester Maritime Heritage Center to provide an estimate of the cultural value of the fishing port of Gloucester.[44]

Ideal data for travel cost methodology include detailed surveys about the reason for visitation and activities pursued during the visit, the point of origin, other visits made in the same trip, and wages given up to make the trip. In the case of visitation to the Gloucester Maritime Heritage Center, no such detailed information are available. What is available is the home location of all visitors to the Dive Exhibit, located in the basement of the Heritage Center. The next section discusses the data and several of the assumptions necessary to estimate travel costs from this data.

VI.2 Methodology and Data

The zonal method of travel cost analysis estimates a demand function for travel to a particular site. First, various zones at different distances from the visited site are defined. Numbers of visitors per zone are then used in conjunction with the population within that zone to get a visitation rate per 100,000 people (thus making the visitation rates for all zones comparable). These visitation rates are interpreted as the quantity of visits. The distances for each zone, in conjunction with the mechanical and time cost of travel from each zone to the destination, along with the cost of visiting the site (in this case a time cost) are used to compute the different prices corresponding to the number of visits. In this way a demand curve is generated. The value of the site is interpreted as its consumer surplus, or the integral of the area under the demand curve.

[44] A recommended resource to help readers understand the travel cost method is available at www.ecosystemvaluation.org .

The log books for visitation to the Dive Museum at the Gloucester Maritime Heritage Center were compiled for 2003 and 2004. The Dive Museum is a small exhibit with equipment and historical information on display for visitors. The Dive Museum does not charge an admission fee. The Dive Exhibit kept consistent log books while the Heritage Center itself did not.

Harriet Webster, the Heritage Center's Executive Director, said that the visitors who went to the Dive museum were about ¼ of the visitors who came to the Maritime Heritage Center.[45] As such, multiples of the values derived from the Dive Exhibit visitations will be considered. In addition, each family enters one home location in the visitor log book.

The visitation records from the dive museum record the date and city of origin for all visitors. These data have the advantage of being meticulously kept and recorded, 5 days a week, year round for 2 consecutive years.

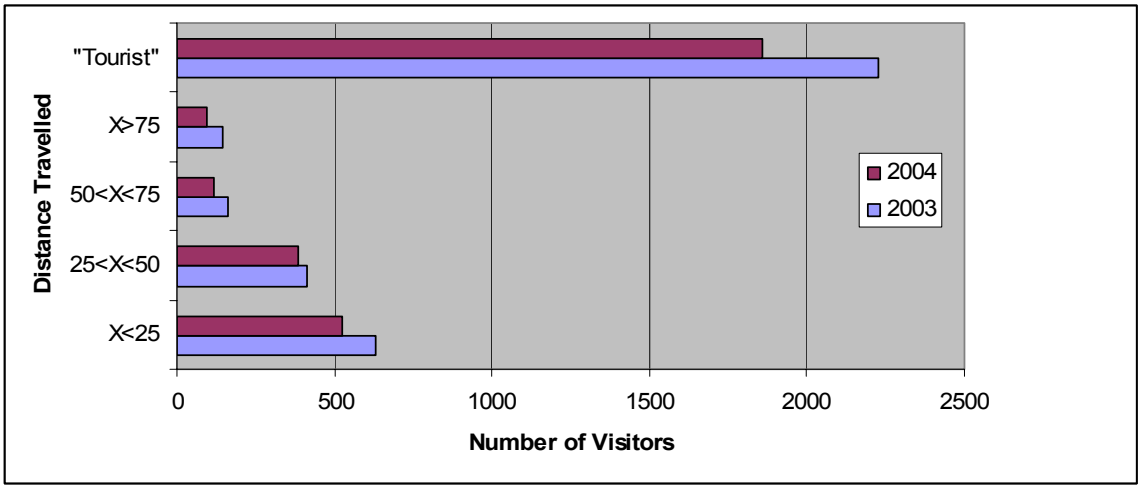
Instead of defining travel "zones," this analysis uses actual municipalities. This generates substantially more visitation rates than reliance on a small number of zones. The number of visits per 100,000 population is computed using the number of visits from the municipality and that municipality's census 2000 population. Travel distances and travel times to Gloucester were estimated from Mapquest for each municipality.

The predominant amount of visitors were considered "tourist" – defined as non-Massachusetts visitors to the museum. Many of these visitors were from other countries. These visitors were assumed to be visitors to Boston who took a day trip to Gloucester to visit the museum. As such, their travel costs are assessed from Boston. All visitors from Massachusetts were assumed to be visiting the maritime as their primary tourism destination. All visitors were assumed to be traveling by automobile.

The data are consistent with expectations. For Massachusetts visitors, the largest numbers were those that lived closer to the museum. The numbers of visitors from Gloucester itself were 330 and 222 for 2003 and 2004 respectively. For all categories the visitation numbers declined from 2003 to 2004. Figure 6.1 displays the distances traveled by year. The largest amount of visitors were from out of Massachusetts, and so designated "tourist," signifying that these were out of state (and international) tourists to Boston who made a separate day trip to Gloucester. The numbers of visitors decreased as the distance traveled increased; in all cases the number for visitors traveling less than 25 miles was greater than the number traveling from 25 to 50 miles and so on.

[45] Interview with Harriet Webster, Gloucester Maritime Heritage Center Executive Director, 4/7/2006.

Figure 6.1: Visitation by Year and Distance



To make the visitation rates comparable, following the zonal method of travel cost analysis, year 2000 county populations are used for Massachusetts residents. Tourist populations were obtained from estimates of the number of tourists to Boston per year.[46]

According to AAA estimates, the average cost of driving a mile was 56.6 cents in 2003 and 53.6 cents in 2004.[47] The per capita wage for Massachusetts residents[48] was adjusted for inflation (all dollar amounts are in April, 2006 constant dollars).[49] Wages for "tourists" were assumed equivalent to the US per capita wage for that year (most non-Massachusetts visitors were from the United States). A federal tax rate of 25% and a Massachusetts state tax of 5.3% were applied to all Massachusetts residents. A federal tax rate of 25% and an average state tax of 4% were applied to all "tourists."

The estimated value of travel time is computed as 1/3 * Annual Disposable Income / Hours Worked per year.[50] Assuming 2,000 hours worked per year, this becomes:

$$Value\ of\ time = \frac{1}{3}\left(\frac{Annual\ Disposable\ Income}{2{,}000}\right)$$

This analysis assumes 2 hours spent at the Maritime Heritage Center and in Gloucester. The value of travel time is assumed to be equivalent to the value of recreational time.

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[46] Greater Boston Convention and Visitors Bureau tourism statistics.

[47] American Automobile Association, *Your Driving Costs 2006, Your Driving Costs 2005, Your Driving Costs 2004* . All figures are in April 2006 constant dollars.

[48] Bureau of Economic Analysis, Regional Economic Accounts.

[49] Bureau of Labor Statistics CPI Series CUUR0000SA0.

[50] Fuguitt, Dana, and Shanton Wilcox, *Cost Benefit Analysis for Public Sector Decision Makers* (Westport, CT, Quorum Books, 1999).

Total travel costs to visit the Maritime Heritage Center are the sum of the time costs and the costs per mile traveled.

VI.3 Results

The analysis uses simple regressions of the visitation rates per 100,000 population regressed on total visitation costs and total visitation costs squared. The demand functions are displayed in Figure 6.2, and the regressions they are estimated from may be found in Table 6.1.

Figure 6.2: Demand for Visitation

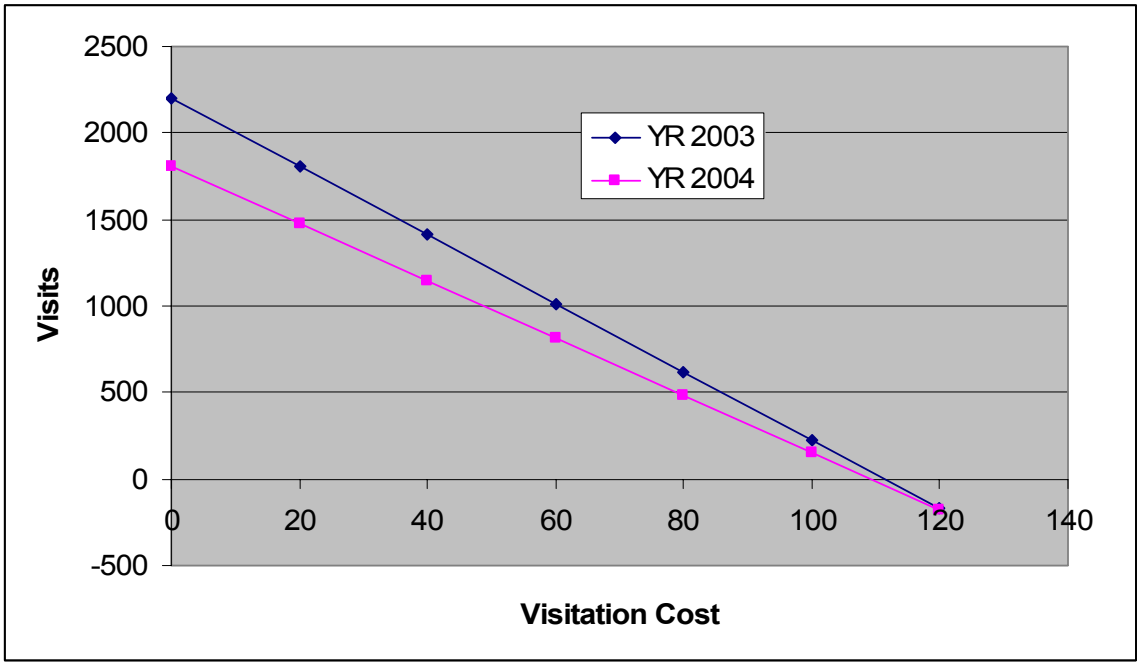

Table 6.1: Regression Results

2003 Results

```
      Source |       SS       df       MS              Number of obs =     179
-------------+------------------------------           F(  1,   177) =    3.68
       Model |  57.8076498     1  57.8076498           Prob > F      =  0.0568
    Residual |  2782.62057   177  15.7210202           R-squared     =  0.0204
-------------+------------------------------           Adj R-squared =  0.0148
       Total |  2840.42822   178  15.9574619           Root MSE      =   3.965

------------------------------------------------------------------------------
   vp100thou |      Coef.   Std. Err.      t    P>|t|     [95% Conf. Interval]
-------------+----------------------------------------------------------------
  total_cost |  -.0128009   .0066756    -1.92   0.057    -.0259749     .000373
       _cons |   2.363238   .6522381     3.62   0.000     1.076074    3.650402
------------------------------------------------------------------------------
```

2004 Results

```
      Source |       SS       df       MS              Number of obs =     165
-------------+------------------------------           F(  1,   163) =    3.30
       Model |  33.2681539     1  33.2681539           Prob > F      =  0.0710
    Residual |  1641.39036   163  10.0698795           R-squared     =  0.0199
-------------+------------------------------           Adj R-squared =  0.0139
       Total |  1674.65852   164  10.2113324           Root MSE      =  3.1733

------------------------------------------------------------------------------
   vp100thou |      Coef.   Std. Err.      t    P>|t|     [95% Conf. Interval]
-------------+----------------------------------------------------------------
  total_cost |   -.011019   .0060623    -1.82   0.071    -.0229898    .0009518
       _cons |   1.960931   .5397761     3.63   0.000     .8950762    3.026786
------------------------------------------------------------------------------
```

The consumer surplus is measured as the value under these demand curves. These amounts are $123,543 and $98,373, respectively for 2003 and 2004. The average value for these two years is $110,598. These values are the consumer surplus for all of the visitors who signed the log-book when visiting the museum.

Since each visitor who signs the guestbook is generally 1 representative from a visiting family, a measure of the consumer surplus for all family members can be obtained by multiplying the individual consumer surplus by the average Massachusetts family size from the 2000 census (3.11). This produces a total consumer surplus of $343,960 (averaged across 2003 and 2004). This amount is the total consumer surplus for all family members who visit the Gloucester Maritime Heritage Center Dive Exhibit.

To extrapolate from the visitation to the dive exhibit to the to the total number of Maritime Heritage Center visitors from the population that visits the Dive exhibit, these estimates should be multiplied by 4, (as suggested by Museum Director Webster)[51],

[51] This estimation provides a conservative estimate of the number of visitors to the Maritime Heritage Center (10,000 to 15,000 visitors per year). No good data exist, but when the state of Massachusetts estimated visitation rates for development and funding purposes, the state estimated visitation at 25,000 per year. (Interview with Harriet Webster, Gloucester Maritime Heritage Center Executive Director, 4/7/2006)

which produces a total valuation of almost $1.4 million (averaged across 2003 and 2004). These estimates are displayed in Table 6.2.

Table 6.2: Consumer Surplus

	Consumer Surplus	Consumer Surplus for Average Family (x3.11)	Consumer Surplus for all Visiting Families (x4)
2003	$123,543	$384,219	$1,536,875
2004	$ 98,373	$305,940	$1,223,760
AVERAGE	$110,598	$343,960	$1,375,839

VI.4 Discussion

This study has limitations which must be kept in mind when considering these results. The explanatory power of the econometric models is relatively low; alternative models would likely produce more substantial estimates.[52] In addition, several important assumptions are made in the process of applying the travel cost methodology.

The most important assumption is that the values of time and distances traveled for visitors to the site are representative of the greater population; this assumption makes the calculation of visits per 100,000 people possible. However, the process by which the data were obtained is liable to selection bias – what is known is only the population who visited the dive exhibit – not if this population was a representative sample of where they visited from. If visitors value the cultural heritage of the fishing industry more than non-visitors, then the estimates of travel cost consumer surplus are likely to be biased upwards. While this assumption is a potentially serious limitation to the estimates produced here, the use of two years of data allow for more robust estimation than reliance on a single year of data (roughly comparable estimates across the two years indicate that the sample may be representative).

Other assumptions have also been made. All non-Massachusetts visitors were classified as "tourists." However, several visitors came from other New England states and traveled distances greater than the relatively short distance from Boston to Gloucester. This assumption would bias the total consumer surplus estimates downward. Another assumption is that travel time produces costs (though this travel time is discounted to 1/3 of the wage rate). However, in some cases vacation travel time to a destination may provide positive utility. This assumption would lead to a slight upward bias in the total consumer surplus. Another assumption of this study is that the logbook records contain all visitation records (that each family who visited was represented). To the extent that the entries in the log-book under-represent the true visitation rates, the total consumer surplus estimates would be biased downward.

[52] Alternative specifications were experimented with. Inclusion of various indicator variables, semi-log, and log-log model specifications substantially increase the explanatory power. However, to preserve the ease of interpretation of the results, the simple untransformed linear regression is presented.

Table 6.3 reviews the various sources of potential bias and the directions of bias. The assumption is listed, followed by the direction of bias and a judgment of the potential magnitude of the bias.

Table 6.3 Assumptions and Potential Biases

Assumption	**Direction**	**Likely Magnitude**
Correct Model	?	Small
Representative Sample	Upward	Large
Full Sample Obtained[53]	Downward	Large
All Out of state visitors as "tourists"	Downward	Moderate
Travel time not recreational	Upward	Small

All of these various assumptions suggest some caution should be used when considering the cultural value attached to the Maritime Heritage Center. As such, some value in the range of estimates presented in Table 6.2 should be used.

This derived valuation is for visiting the Maritime Heritage Center in Gloucester. This is not specifically the cultural value of an operating fishing port. However, the Heritage Center prides itself on being part of a working fishing port, and advertises itself as such.[54] Some substantial part of the derived value attaches to the continuation of the fishing industry in Gloucester. If active fishing operations were to cease in Gloucester some part of this value would be lost. As an estimate, one might consider the loss of 1/3 to 1/2 of the averaged total consumer surplus ($1.375 million) reported in Table 6.2, equivalent to $460,000 to $690,000 per year. If this loss were permanent due to changes in land use decisions (as discussed in Chapter 4), these estimates would have to be considered in terms of a lifetime valuation.[55]

In addition, this estimation is for the port of Gloucester only. Similar computations for other fishing ports in Massachusetts were not possible for this study. If this valuation attaches to Gloucester specifically, some multiple of this value should attach to other fishing communities, such as Boston, Plymouth, Cape Cod, and New Bedford.

The potential loss of cultural value of a working fisheries industry in Massachusetts is non-trivial. The cultural value of the fisheries industry provides some amount of consumer surplus in the magnitude of $500,000 per year for the residents of Massachusetts. The loss of such cultural value should be considered as an additional cost for regulations that may cause fishing operations to cease in different fishing ports. If such changes result in permanent cessation of activities, the annual consumer surplus values should summed to reflect a permanent loss of such values.

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[53] See footnote 52.

[54] See http://www.gloucestermaritimecenter.org/

[55] A net present lifetime valuation can be computed by summing the discounted income stream over some time period. For 30 years at a 10% discount rate, this amounts to a lifetime value between $4.8 million and $7.2 million.

VII. Concluding Remarks

We have provided some measurements that corroborate the hypothesis that fishing regulations have a negative impact in some fishing localities in the State of Massachusetts. Several specific valuations of the economic impact of regulations on fishing localities in terms of gross real sales tax receipts and employment are presented.

First we reviewed the recent history of regulation and discussed likely potential effects of regulations upon the local economies. Next we presented results of informal surveys filled out by participants in the fishing industry and members of the business community in the last few months. Results of surveys filled out by participants in the fishing industry, and members of the business community provided some evidence of individuals and businesses perception of the effects of regulations on their activities. Individual participants in the fishing industry perceive a disconnect between federal regulatory activity and the economic environment in which they operate. Surveys of businesses in Gloucester, Plymouth, and New Bedford indicate that changes in the fishing industry are having less and less effect; most of the effects of regulation were felt in the early to mid 1990s. Time trend analysis indicated that there were fewer fish related businesses in Gloucester following the passage of Amendments 5 and 13. We concluded this section with a discussion of the likely institutional impacts of regulation in Massachusetts fishing towns.

Using data on the gross real sales tax receipts of all cities, towns and localities of the State of Massachusetts we showed that Amendment 5 had a negative effect on gross real sales tax receipts for all towns in the fishing industry in the State, Amendment 7 had no statistically significant effects, and Amendment 13 had significant negative effects in the port of Gloucester in the North Shore relative to all other towns in the State, and relative to the other fishing towns in the State; Harwich on the Cape Cod and Edgartown on Martha's Vineyard also received negative statistically significant impacts from Amendment 13. These results indicate that the regulations in Amendments 5 and 13 caused tax revenues to be lower than they otherwise would have been. Since tax revenues are a function of gross receipts, we can extrapolate a negative effect on gross business receipts for fishing towns following the imposition of these regulations.

We then looked at employment effects. We started with a broad measure of unemployment and comparisons to some fishing localities. We used data from the State of Massachusetts to measure differences in employment levels that can be correlated with the introduction of the regulations of Amendments 5, 7 and 13. In terms of employment effects, the results indicated that Massachusetts' fishing communities have experienced higher rates of unemployment, lost employment in fishing after the passage of Amendment 13, and lost employment in fishing during the 1990s. Lost wages following the imposition of Amendment 13 are $6.5 million per year.

We supplemented the employment effects with additional information using the Geographical Information Systems (GIS). We started with comparisons by census tracts for 1990 and 2000 and the look at the more disaggregated comparisons using block

groups. The GIS analysis indicated that fishing employment decreased from 1990 to 2000 in Gloucester, Plymouth, and New Bedford, fishing neighborhoods became more concentrated, and in Gloucester and Plymouth, waterside neighborhoods lost fishing employee residents.

We used an abstract economic model to show that reductions in sea space and/or labor input have important economic effects for the behavior of a fishing production unit, both in the short and long run. The approach was quantitative since we used simulation techniques to illustrate the effects of regulations under alternative scenarios of risk taking by fishermen. The effects illustrate the possible additional risk taking by fishermen when faced with regulations, and the short and long term trade offs faced by fishermen in terms of equipment usage and effort. We find that regulations may induce more risk taking by fishermen, and may lead to low usage of capacity both in the short run and the long run in this industry.

We then included an analysis of travel costs for the port of Gloucester. We find a significant estimate of the valuation of the consumer surplus for visitors to the port for the years of 2003 and 2004. We discuss how this estimate can be used to provide a measure of the cultural value of continued fisheries operations in Massachusetts. If regulation induced a cessation of fishing operations in currently operating fishing ports, the loss in cultural value would be between $120,000 to $500,000 per year.

In sum, we found substantial costs associated with the past imposition of fisheries regulations. While some regulation is surely necessary to provide for the sustainability and growth of the fisheries stock, future regulation should be carefully scrutinized to accurately forecast potential costs. Federal estimates based on input-output models are likely to under-estimate the true effects on a state economy, which are many and varied. Analyses such as this one provide a clearer picture of the relevant costs of past regulations by examining micro-level data within the state.

One important conclusion of our study is that fisheries management should take into account these economic effects and consequences. The science that drives fisheries regulations is perceived as disconnected from market participant's economic activity and their potential impact on the economy. A more balanced approach is needed to make fisheries management consistent with sustainable economic activity in localities where the fishing industry is active.

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APPENDIX

A.I. Surveys

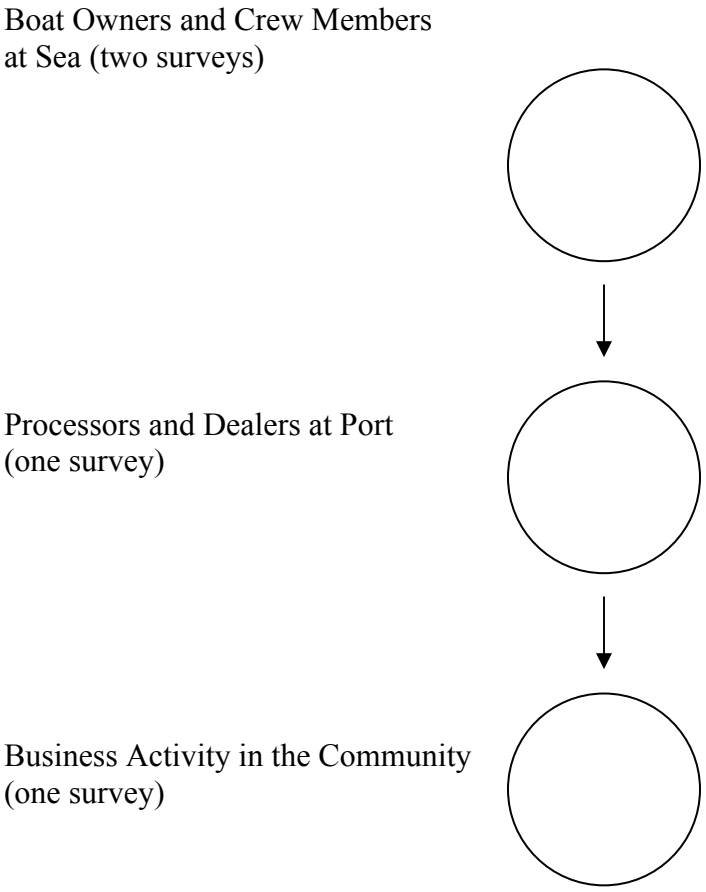
Section **I.3** gives a summary of the survey results; this appendix provides *all* the information and analysis of the surveys, including some of the information presented in section **I.3**.

A.I. Survey Results

Survey data provides valuable information about how stakeholders in the fishing industry have perceived changes and how they view regulation. Extensive survey data, however, are costly and time-consuming to obtain. The survey results included in this section are from a limited and informal sample, they provide some qualitative information which should be considered in conjunction with the quantitative analyses provided in this report.[56] The actual surveys are available in the Appendix. The surveys were written and designed to capture the stages at which the fishing activity evolves, as shown in Figure AI.1. Boat owners, crew members, Port dealers and processors, and local businesses were approached to provide information. Response rates were low; the most effective collection of surveys from boat owners occurred at a Massachusetts Fisheries Recovery Commission meeting. The primary reason for low response rates was the timing of the study and the shortness of the study period. Business survey response rates were moderate.

[56] An important caveat of the surveys presented here is that, given costs and other limitations, they are not rigorous in terms of socio-economical, sociological and anthropological content.

Figure AI.1: Surveys and Economic Activity



Results: Boat Owners Survey

Surveys were distributed to several boat owners; four were completed (three from Gloucester and one from Provincetown). The results are as follows:

• Fishing has traditionally been an inter-generational profession. This pattern, however, seems to be rare in the current generation
• Regulations such as area closures have changed the behavior of boat owners in a significant manner
    * boat owners go to other more distant areas to fish
    * boat owners buy less and cheaper gear and postpone purchases of new equipment
    * boat owners take on less crew
    * boat owners fish for alternative species, such as scallops when groundfishing is closed.

- Boat owners find auctions to be useful in providing price information and feel that they are treated well by the auctions
- Boat owners report that most of them have at one time required help at sea or help returning to port; they also report that most boats have proper safety equipment
- Boat owners report that the biggest changes they have experienced in both the last 1 and 5 years are changes in reliance on credit and a change in the role and reliance of family members
- Boat owners perceive regulations to be their most substantial hindrance in making a living.
- Boat owners believe that they have little input into the regulatory process and that enforcement of regulations in unfair and overly harsh.
- Mesh size restrictions were viewed as the best regulatory restrictions

This certainly changes the character of the local trade and in many cases leads to a change in the flows of interstate trade.

The closures issue is an important element in fisheries management policy. There is the perception and real constraint imposed by closures that make it restrictive for fishermen to operate smoothly and to make medium to long term business plans.

All respondents were unanimous in stating that mesh size regulation is the most effective fisheries management tool. The Gloucester respondents were unanimous in pointing to the benefits of the auction as a price stabilizer and reliable dealer that recognizes quality; our estimate is that the Gloucester auction takes 80 to 90% of the volume in the area. The auction indeed reduces transactions costs and spreads information more efficiently.

A more detailed analysis follows.

- Family History (Questions 3-5)
All the surveys indicate that the boat owners had either a father or grandfather in the commercial fisherman industry. All five surveys indicated that their grandfather had been a commercial fisherman, and four of the five boat owners indicate that their father had been a commercial fisherman as well. Only one of the surveys indicated that a commercial fisherman had a child working as a commercial fisherman.

- Area Closures Impact (Questions 6-9)
Four out of Five surveys signified that closures have shifted where they make purchases, causing them to buy less total, less quality, or cheaper gear such as trawl wire, oil skins, boots, and other fishing gear. These area closures have also forced two out of the five boat owners surveyed to shift where they berth their vessel. (The questions dealing with regulations other then area closures are not readily interpretable, three of the five surveys indicate that there are other regulations that shift where they make their purchases, but one does not provide an answer and the other two name are closures.)

- Change in Fishing Practices 1 and 5 years (Questions 12 and 13)

Boat owners indicated that in response to regulations in the last year they decreased their time at sea changed fishing locations. They also cut back on gear, maintenance, and crew, and postponed purchases of new gear. These answers were consistent in both the last year and the last five years.

Figure AI.2

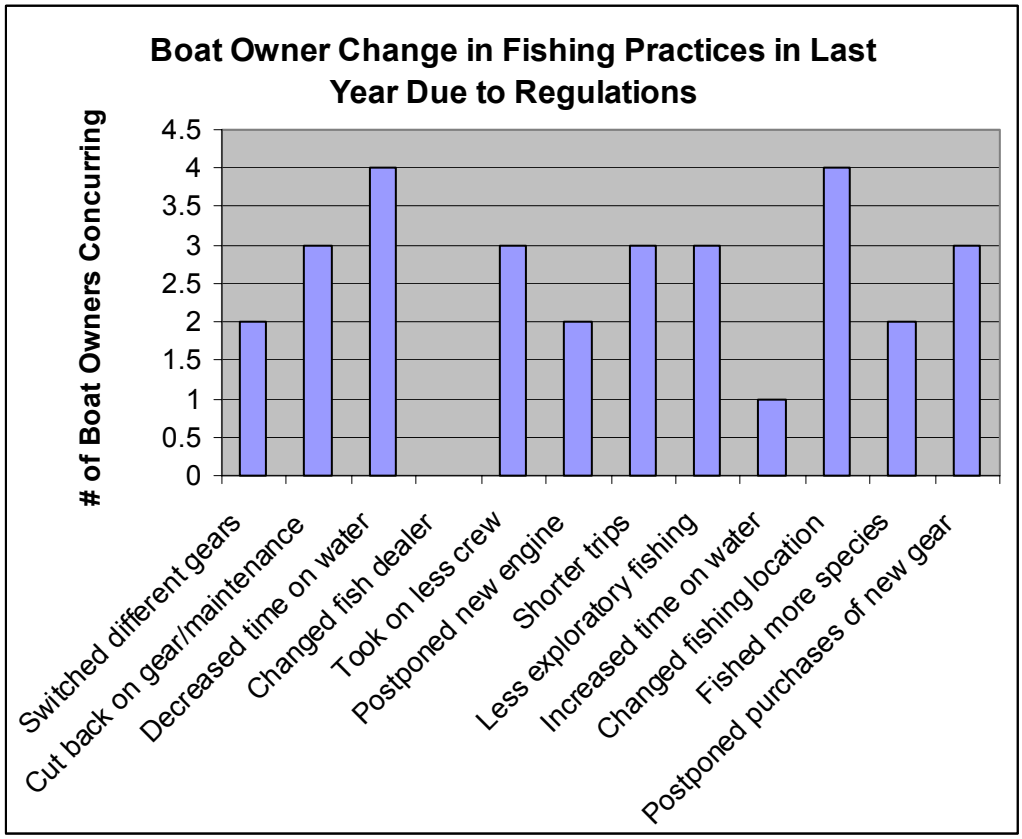
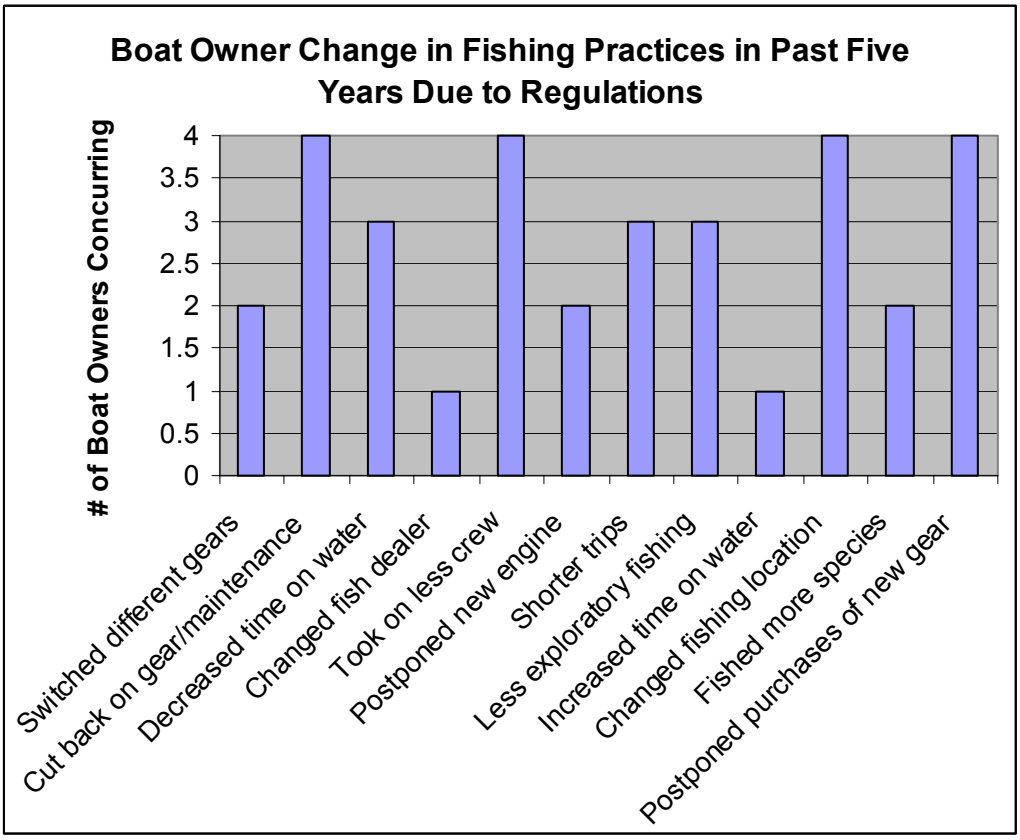


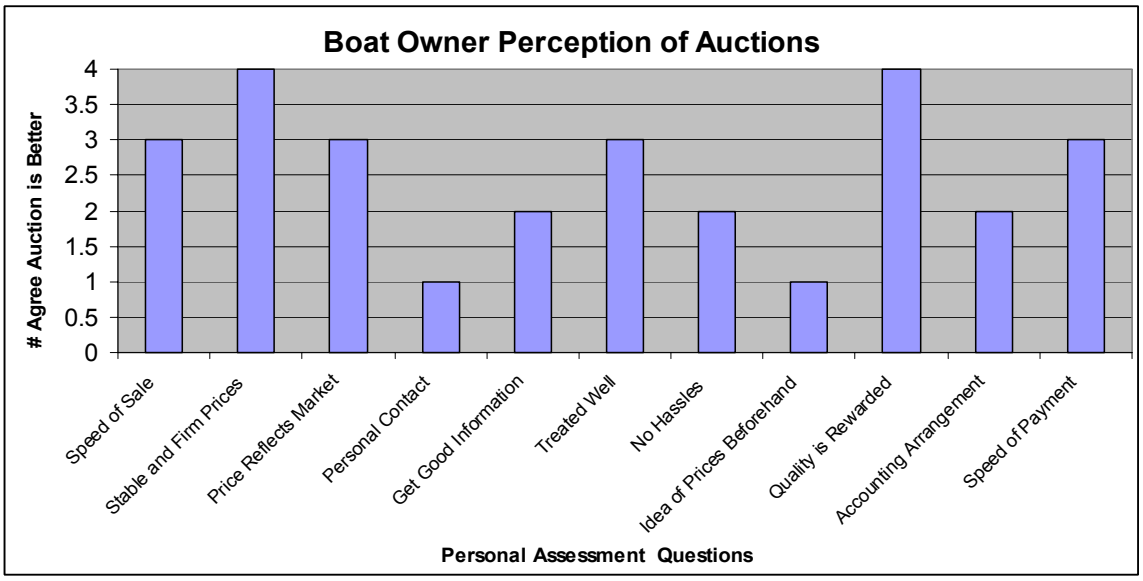
Figure AI.3



- Use of Fish Auctions (Questions 16-20)
Four out of five surveys signified that they decide which fish dealer to sell through by using an Auction (one survey left question 16 unanswered), and believe they have good price information on when to land fish. Two boat owners indicated that they decide when to fish based upon the prices. Four out of five surveys (one survey skipped this question) indicated that they gather information by not using paying services but by going to auctions and word of mouth.

Question 20 asked how auctions compared to non-auction sales of fish based upon 11 characteristics. Four of the five surveys answered this question, with one questionnaire skipping this question entirely. The perceived benefits of auctions have been placed into a chart below that presents the number of surveys that provided a positive auction mark for each question.

Figure AI.4



While the amount of surveys gathered are not enough to determine statistical significance the anecdotal evidence gathered from these five surveys indicates that boat owners rely heavily on the use of auctions to sell fish, gather information on pricing and determine when to fish. They also indicate that auctions reward quality, pay in a timely manner and generally treat them well.

- Help & Safety Equipment (Questions 21-23)

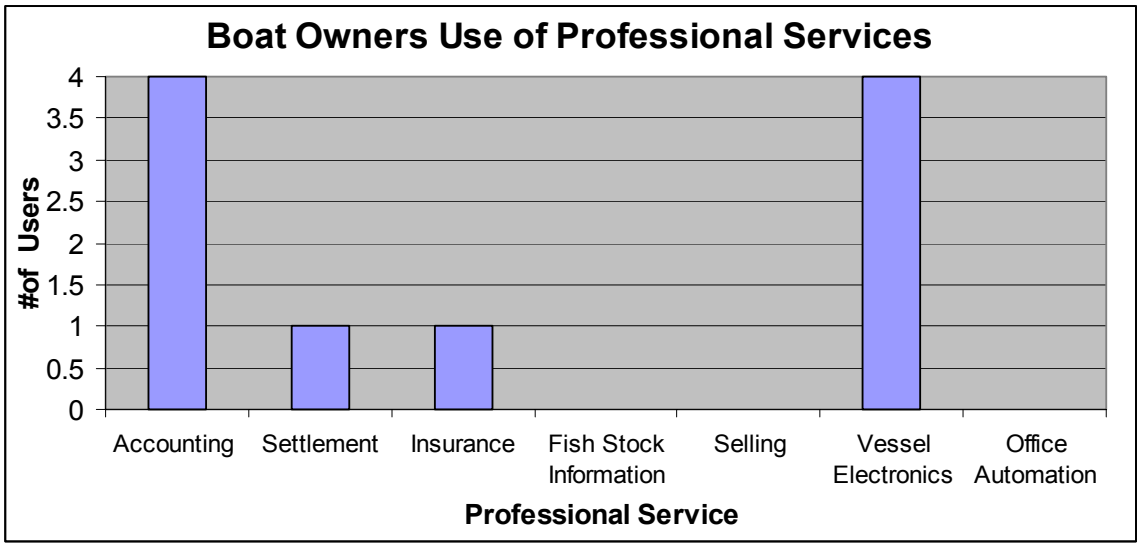
Questions 21 and 22 ask whether the boat owners have required help at sea or returning to port over the last year and the past five years. Three out of five boat owners indicated that they have required help while either at sea or returning to port within the last five years, and two indicated they required help within the past year.

Boat owners when questioned what percentage of fisherman they know "well" have all the required safety equipment in good operating order on board their vessels; indicated results between 90-100%.

- Professional Services (Question 24)

Four out of the five boat owners surveyed provided answers to question 24 which asked what professional services they use (in the family, COOP or organization). The results of these four questions have been provided in the chart below. Boat owners rely primarily on accounting and vessel electronics professional services.

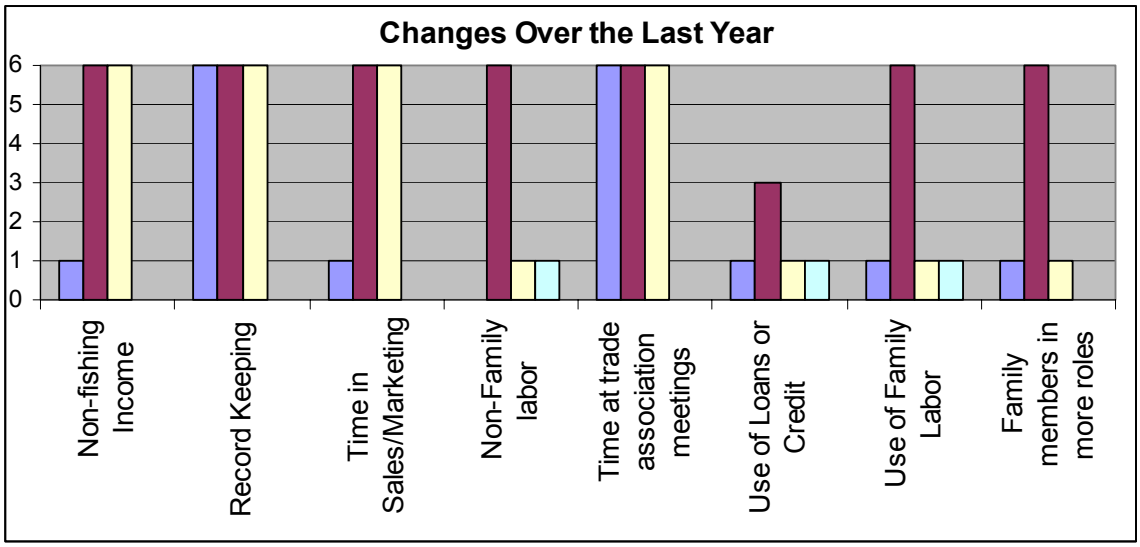
Figure AI.5



- Perceived changes to the industry & effect on making a living (Questions 25-27)
Boat Owners were asked to answer a series of questions that posed potential perceived changes to the industry along with their ability to make a living through fishing. These questions were answered using a scale of 1 to 6, with 1 equal to most changed and 6 equal to least changed.

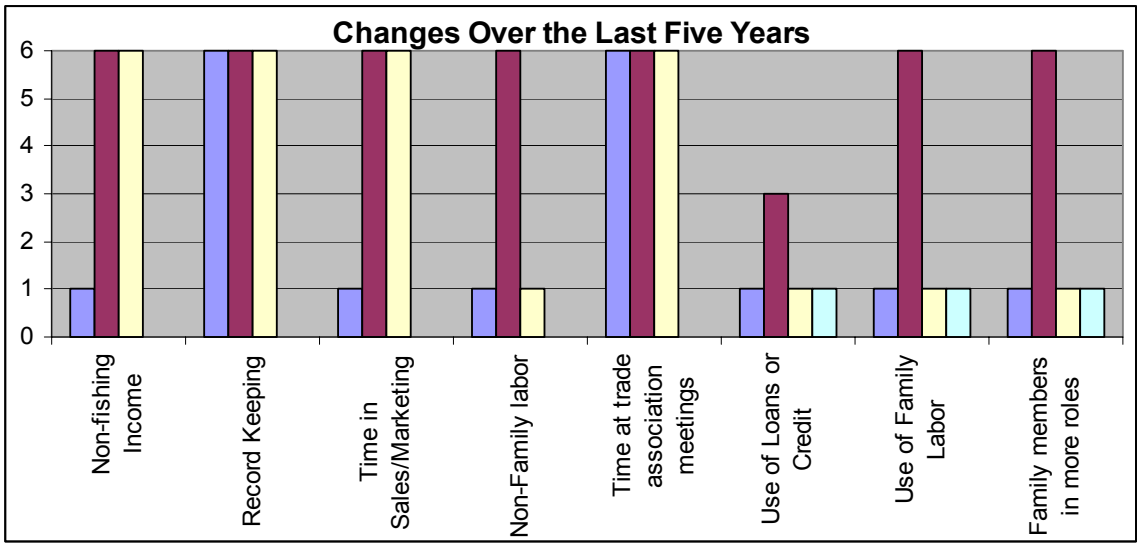
The following charts show the responses to each question. Since there were four respondents there are 3 or 4 columns indicating each response (some surveys included unanswered questions). For changes over the last year, 2 out of 3 boat owners responded that non-fishing income and time spent in sales and marketing changed the least, while 1 respondent indicated that they changes the most. 3 out of 3 respondents reported that record keeping and time at trade association meetings were least affected. The majority of respondents agreed that they were most affected in the last year in use of non-family labor, reliance on loans or credit, a change in the use of family labor, and having family labor work in more roles.

Figure AI.6



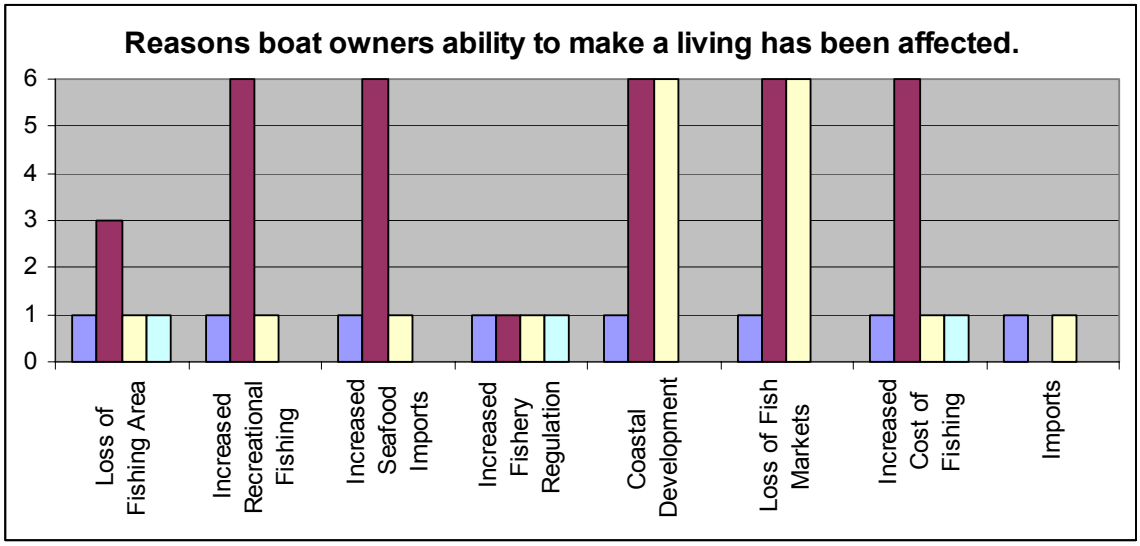
The results of the question concerning changes in the last five years are consistent with the answers in the last year. Furthermore, the same respondents reported similar effects over both periods.

Figure AI.7



Boat owners perceive several reasons for changes in their ability to "make a living." Respondents were unanimous in their assessment that increased regulation makes it harder to be economically viable. A majority also responded that increased seafood imports, loss of fishing areas, increased recreational fishing, and increases in the cost of fishing have contributed to difficulty in making a living.

Figure AI.8



- Services utilized in port (Question 28)
Boat owners were questioned as to five services that they might utilize when in port. These fives services included vessel repair, gear supply, ice company, fuel and groceries. All five boat owners surveyed indicated that they utilize ice companies, fuel and groceries, while four out of five use vessel repair and gear supply.

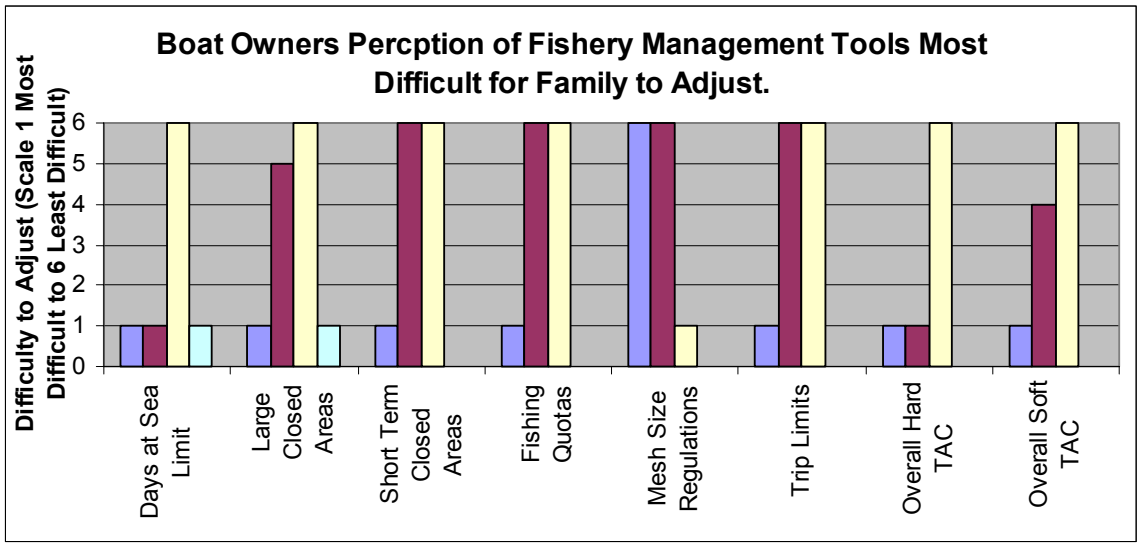
- Opinion of fisheries management, formal council/committee, and enforcement of regulations (Questions 30-39)
Only one out of five boat owners felt their views get expressed in the formal council/committee management process. This perhaps could be due to only one in five boat owners signifying that they felt they understood the council/committee management system. None of the boat owners indicated that the fisheries management process adequately considers the effect that it will have on the fisheries economic activity, for a few reasons. "Government does not make right evaluation when making rules on economic impact"; "They do not listen to us (fishermen)" and "When making the laws, what they (regulators) think of income we will lose is not right". All the boat owners also felt that the fisheries management of fishing stocks also does not take into consideration the effect they have on the fisheries economic activity. One anecdotal explanation for this line of thinking is that "there (are) better ways to manage fishing without closures; we only have 50 days a year to fish, so why do we need closures".

While all the boat owners surveyed signified that they felt fisherman generally want to comply with regulations, just one out of five boat owners indicated that they knew important fisheries management laws like the Magnuson Act.

Four out of five boat owners indicated that they felt there was adequate fisheries enforcement both at sea and port, however that same number signified that they think enforcement treats the fishing industry unfairly. Their anecdotal response for why they felt enforcement was being unfair primarily revolved around a sense of being typecast as a bad apple and treated poorly. With the idea of improving enforcement by "not talk(ing) down to me" and "be less cut and dry, be a little forgiving."

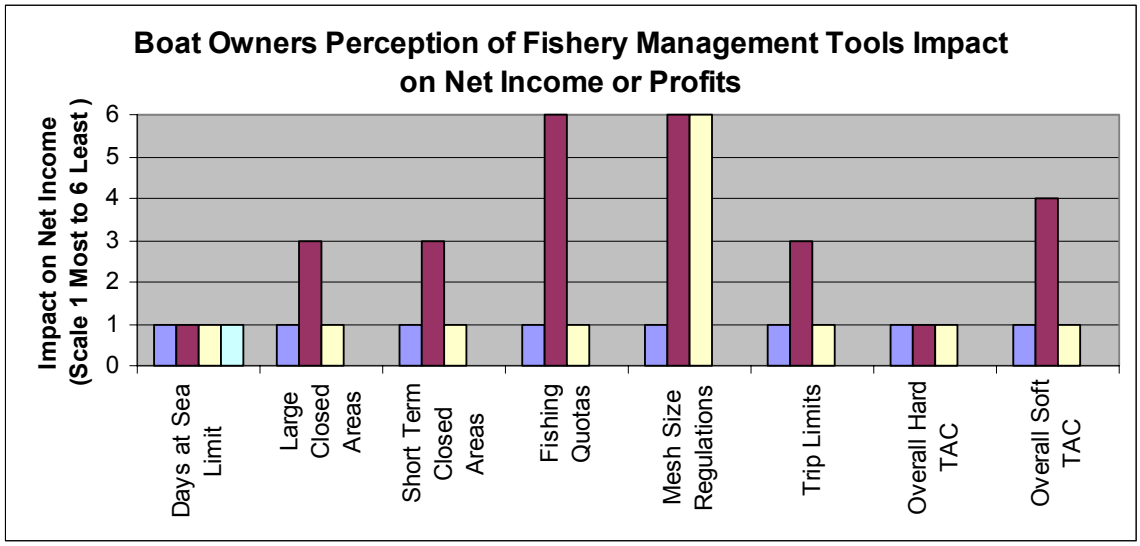
- Boat owner perception of fishery management tools (Questions 40 -42 or 39-41)
When boat owners were questioned as to the effectiveness of fishery management tools in reducing fishing mortality the overall feeling was that only mesh size regulations were having an effect. The boat owners were then asked to provide their perception on how difficult it was for a fishing family to adjust to these same fishery regulations. Days at Sea Limit was determined to be the most difficult management tool with three out of four surveys indicating that this was the most difficult; followed by two out of three surveys indicating that overall hard TAC was the most difficult, and then large closed areas with 2 out of four surveys given it a most difficult ranking.

Figure AI.9



Days at sea limits and overall hard TAC fishery regulations were reported to have the most impact on overall net income, with mesh size regulations being considered to have the least effect on income. Closures, trip limits, and Soft Tac were also seen to have important effects on net income or profits.

Figure AI.10



- Boat Crew Survey

Whether or not fishing activity is becoming more part-time versus full-time activity would be an important issue to be examined here, unfortunately there have been no responses to date for those surveys.

- Processors and Dealers Survey

Although several surveys were distributed, only one survey was completed and returned. This survey provides some insight into the issues and attitudes faced by dealers and processors. Overall the single dealer survey can be used best for anecdotal information. The dealer survey does provide an overall view that is similar to the boat owners' perception, which is probably prevalent throughout the industry. It is signified in these surveys that they believe the problem is not over-fishing, but poor fishery management.

- Access to domestic vs. foreign supply (Questions 1-6a)
According to the single processor/dealer access to domestic or local fish and shellfish has been increasingly difficult over the last five years continuing even through this year, creating a situation where they have had to buy foreign fish supply replacements from Ireland, Canada, Panama and Ecuador. The dealer believes that this mix of domestic versus foreign fish supply has changed by 60-75% over the past five years, and by 60% over the last year.

- Price fluctuation (Questions 7-8b)
The dealer believes that more price fluctuations that have been occurring over the past five years continuing through this year have been due to regulations because "they won't let them fish".

- Affect federal regulatory activity on fisheries has had on business operation (Questions 11-15)
The dealer survey signified that over the past year the way they operate their business has been affected by federal regulatory activity because of "No Product" and that they are "a lot more cautious". These have lead to the dealer planning to make internal changes to their operations in terms of reducing the mix of domestic versus foreign and/or farmed products in the near future. The dealer signified that the federal regulations have affected the way shore-side facilities are operated, and thinks that their business should consider the effects of regulations on shore-side facilities.

The dealer had this to say about fishery management. "Federal regulations need to get a better grip on what they are managing. It is because of poor management, not over fishing that has caused this mess".

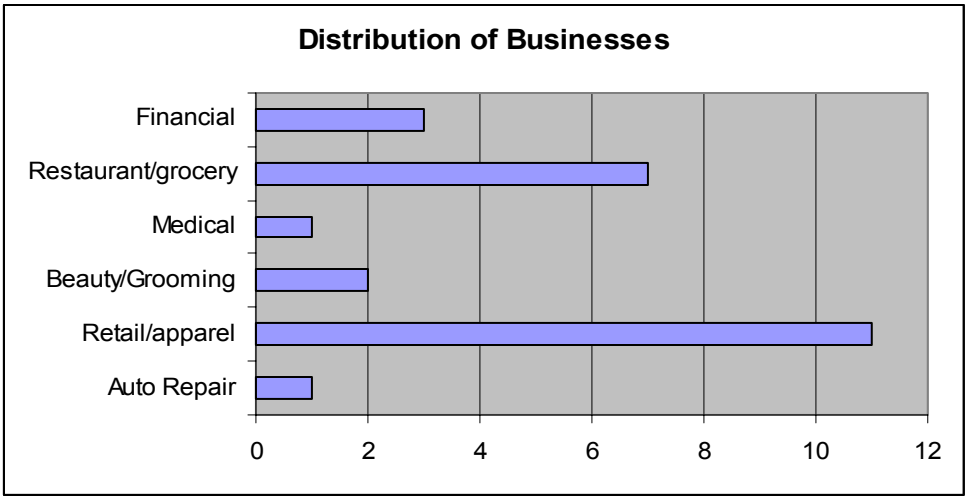
- Business Surveys:

Surveys were administered to businesses in the vicinity of the ports in Gloucester, New Bedford, and Plymouth. These surveys asked primarily about effects from regulations in the last five years.

- **Gloucester:** 24 surveys

1. What type of business do you currently operate:

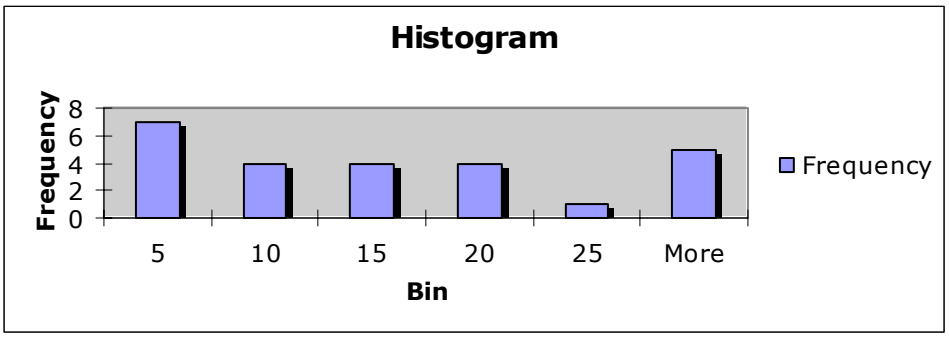
Figure AI.11



Most business surveyed were retail/apparel and restaurant/grocery.

2. How long have you been in business:

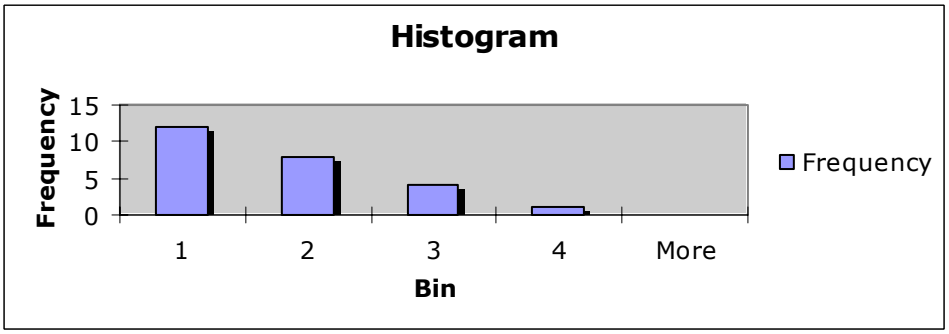
Figure AI.12



The distribution is mostly uniform with the exception of the 25 year range.

3. How many people does your business employ:

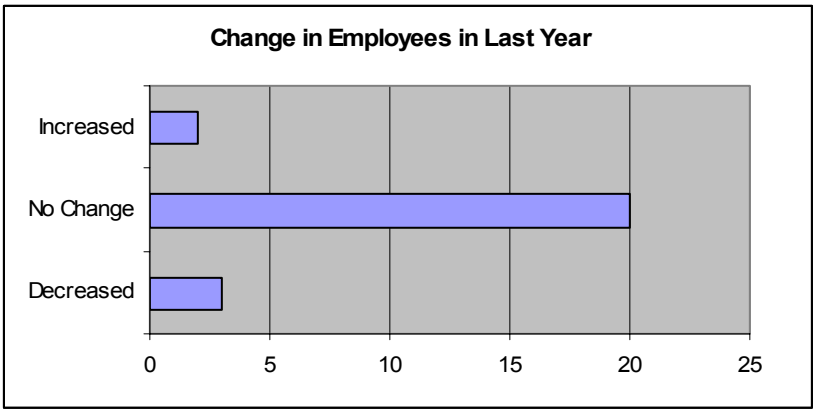
Figure AI.13



Mostly small business.

4. Has the number of employees changed during the **past one year**?

Figure AI.14



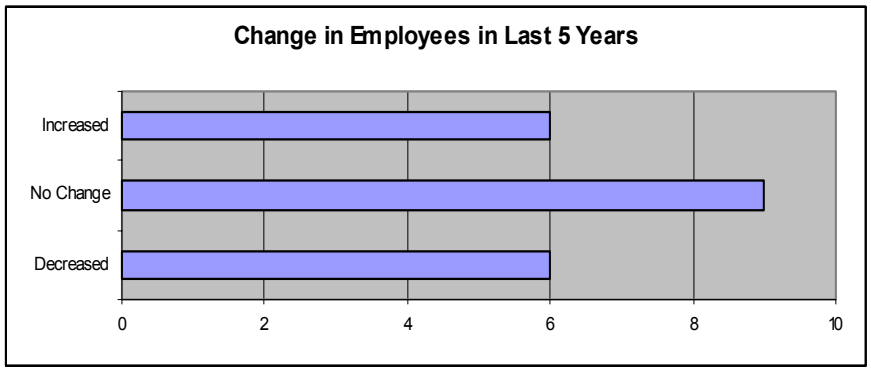
Almost no change in the last year.

4a. Do you feel your answer to 4. is related to the Fishing industry in your community?

Only one answered yes in this case. Most respondents mentioned that changes in the fishing industry had a large effect in the early 1990's and afterwards the effects were marginal. This lends support to the hypothesis that the sequential regulatory constraints have second order effects, however the magnitudes of the second order effects will be subject of further measurements.

5. Has the number of employees changed during the **past five years**:

Figure AI.15



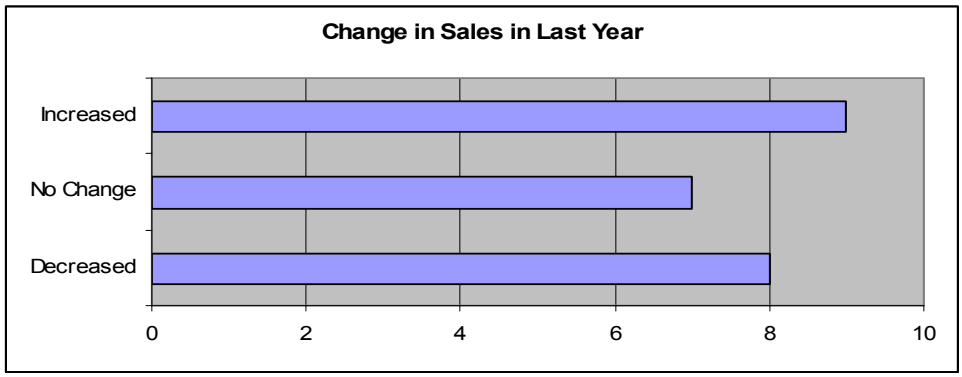
There is more evidence that change has been evenly distributed.

5a. Do you feel your answer to 5. is related to the Fishing industry in your community?

Only two responded yes, see 4a above for reference.

6. How have your sales changed during the **past one year**?

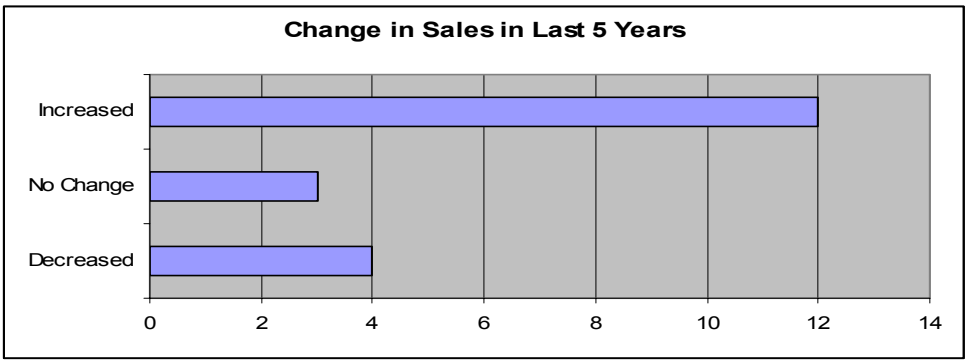
Figure AI.16



Uniformly distributed over the range.

7. How have your sales changed during the **past five years**?

Figure AI.17



Majority reported an increase in the past five years.

In sum, the results of the survey of businesses in Gloucester was as expected; changes in the fishing industry are having less and less effect; most of the effects of regulation were felt in the early to mid 1990s. Very little of the fishing industry changes were reflected in business activities and changes in business activity in the last five years.

An additional analysis was performed for Gloucester using data on listed businesses. Since no yearly registry of businesses was available, Yellow Page directory advertisements of businesses in fish related goods and services provision were compiled as an indication of the number of fishery related businesses. The Yellow Page directory was consistent (same company) throughout the period and the categories remained consistent as well. Categories included fish packers, fish nets, fish brokers, retail fish sellers, wholesale fish sellers, fishing supplies, bait, and tackle dealers.

The 14 years of data allow a simple regression to measure if there were any significant trends in the number of fish related businesses from 1993 through 2006. The simple regression in Table AI.1 also controls for the entry of new businesses.

Table AI.1: Listed Business Simple Regression

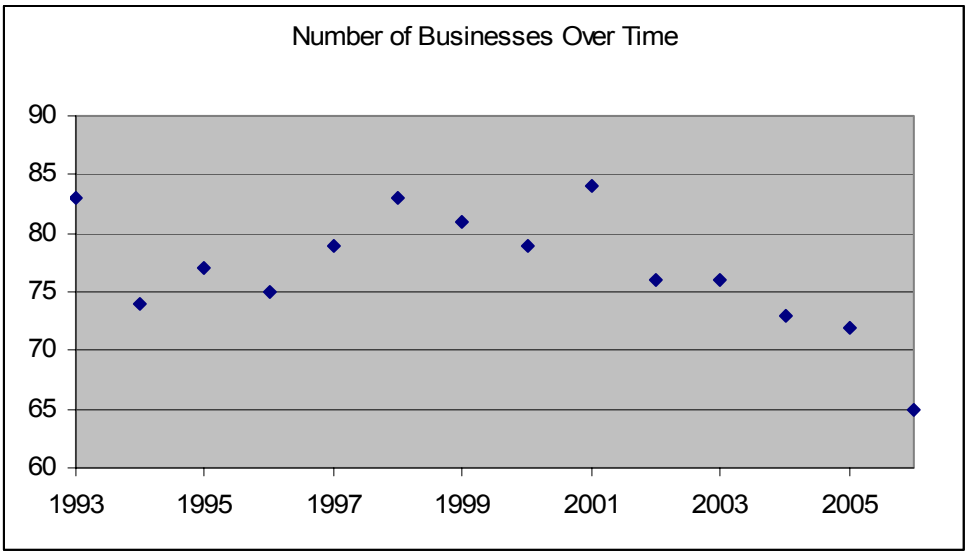
```
      Source |       SS       df       MS              Number of obs =      14
-------------+------------------------------           F(  4,     9) =    4.87
       Model |  235.960786     4  58.9901965           Prob > F      =  0.0228
    Residual |  108.967785     9  12.1075317           R-squared     =  0.6841
-------------+------------------------------           Adj R-squared =  0.5437
       Total |  344.928571    13   26.532967           Root MSE      =  3.4796

------------------------------------------------------------------------------
     num_tot |      Coef.   Std. Err.      t    P>|t|     [95% Conf. Interval]
-------------+----------------------------------------------------------------
          a5 |  -9.396644   4.655284    -2.02   0.074    -19.92763     1.13434
          a7 |   3.071812   2.804609     1.10   0.302    -3.272655    9.416279
         a13 |  -7.834228   2.678644    -2.92   0.017    -13.89374   -1.774714
     num_new |   .3161074   .3122664     1.01   0.338    -.3902884    1.022503
       _cons |         83   3.479588    23.85   0.000     75.12863    90.87137
------------------------------------------------------------------------------
```

The variable a5 indicates a separate trend associated with the period after Amendment 5 was instituted that is separate and below the average trend. The variable a13 indicates a separate trend which is below the average following the passage of Amendment 13. The years following Amendment 7 appear to have no effect on this trend.

These data are displayed in the following chart. The period following implementation of Amendment 5 in 1994 is associated with fewer fish related businesses as is the number of businesses after the passage of Amendment 13 in 2004.

Figure AI.18

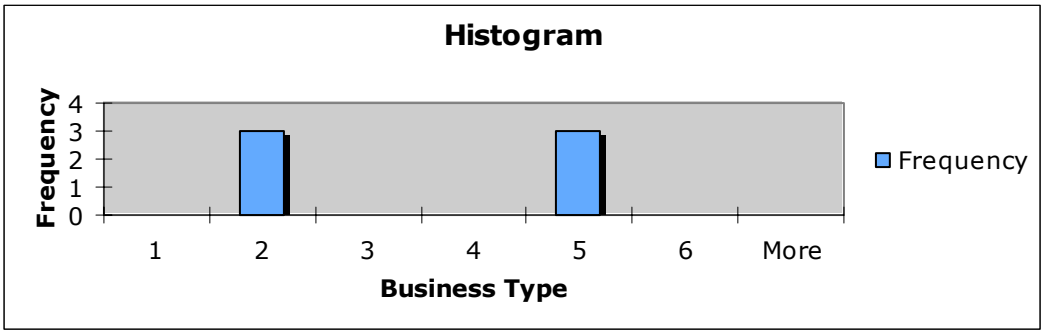


These results should not be interpreted for more than they are. This is a regression with only 14 observations and simply measures trends in the number of businesses over time. While other factors could have led to changes in the number of businesses, the different time trends suggest that there may have been an effect of regulations on the number of fish related businesses in Gloucester.

- **New Bedford:** 6 surveys

1. What type of business do you currently operate:

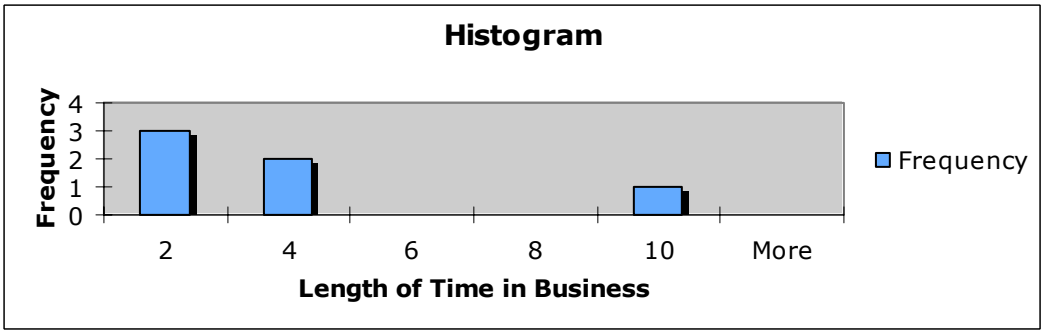
Figure AI.19



Most business surveyed were retail/apparel and restaurant/grocery.

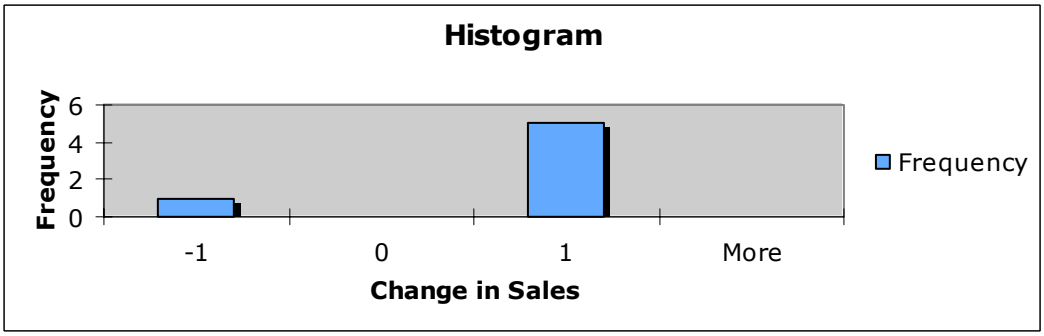
2. How long have you been in business:

Figure AI.20



The distribution is mostly uniform with the exception of the 25 year range.

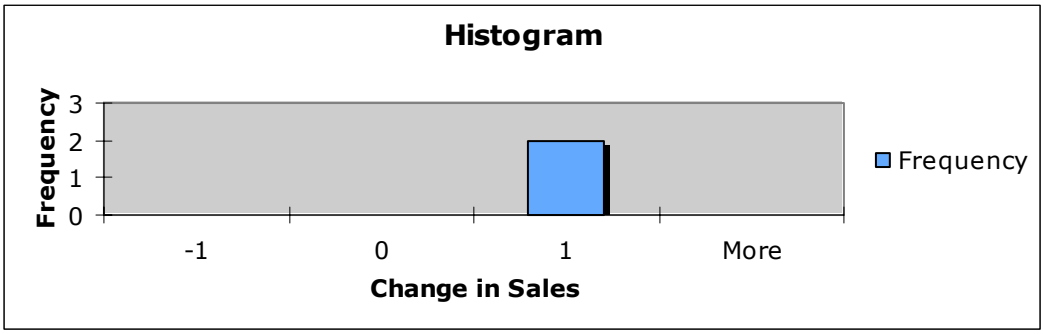
6. How have your sales changed during the **past one year**?
Figure AI.21



Majority reported an increase in the past year.

7. How have your sales changed during the **past five years**?

Figure AI.22

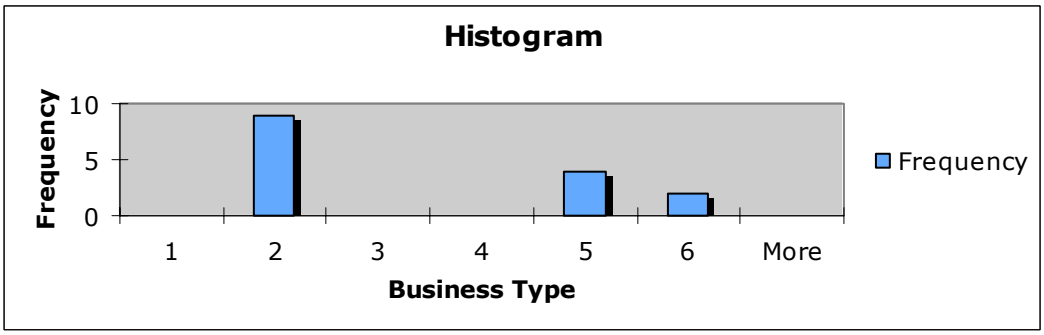


Majority reported an increase in the past five years.

- **Plymouth:** 15 surveys

1. What type of business do you currently operate:

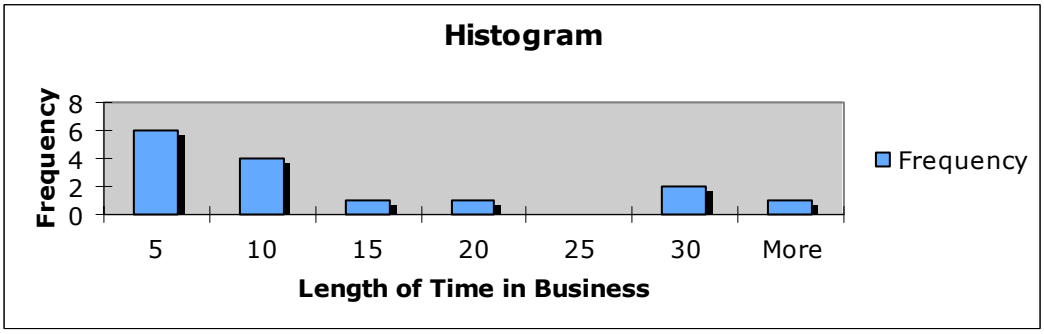
Figure AI.23



Most business surveyed were retail/apparel and restaurant/grocery.

2. How long have you been in business:

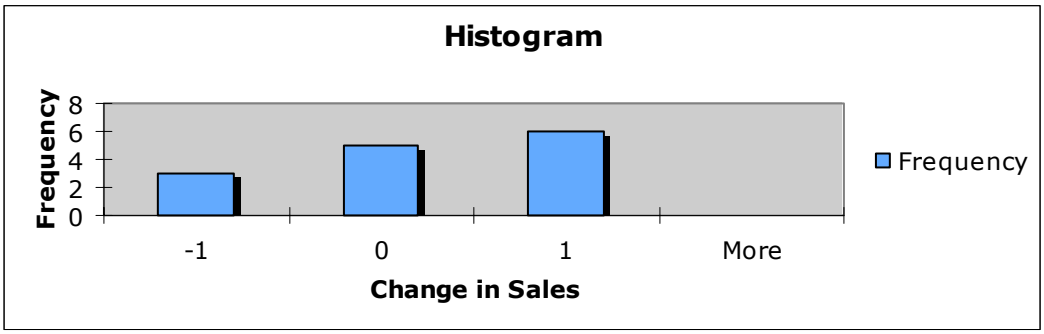
Figure AI.24



The distribution is skewed towards new business in the past 5 years, with the exception of the 25 year range.

6. How have your sales changed during the **past one year**?

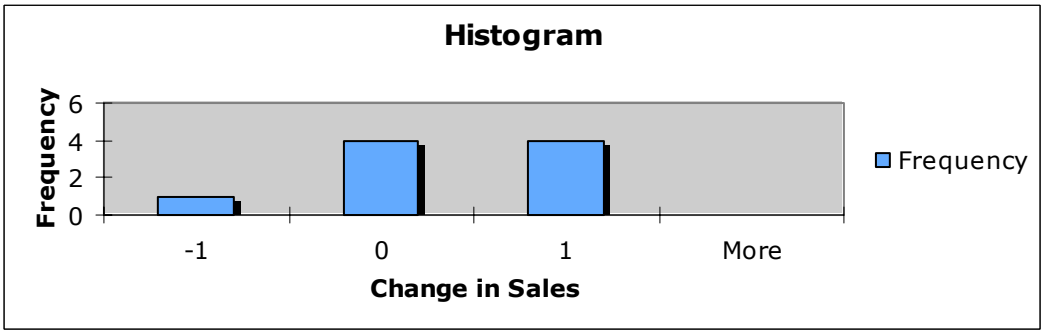
Figure AI.25



Most businesses had an increase in fishing activity in the last year, though several saw no change and a few saw a decline.

7. How have your sales changed during the **past five years**?

Figure AI.26



Majority reported an increase in the past five years, though this pattern is consistent with the one year results.

In sum, the results of the survey of businesses in Gloucester, Plymouth, and New Bedford yielded expected results. Changes in the fishing industry are having less and less effect; most of the effects of regulation were felt in the early to mid 1990s. Time trend analysis indicates that there were fewer fish related businesses in Gloucester following the passage of Amendments 5 and 13. Very little of the fishing industry changes were reflected in business activities and changes in business activity in the last five years.

These results are consistent with the theory that most businesses responded to changes in regulation from Amendment 5 in the early to mid 1990s. By 2000, most fishing industry

related businesses in these port communities had adapted and diversified or were no longer in business. While the survey results indicate little effect, the difficulty of such surveys is that they can only elicit comments from surviving businesses and are unable to assess impact on businesses that are no longer active.

AI.II. Survey Samples:

Business Survey:

Massachusetts Fisheries Recovery Commission
C/O Center for Marine Science and Technology
706 South Rodney French Boulevard
New Bedford, MA. 02744-1221

Economic Impact Study of Fisheries Regulation in the State of Massachusetts

SURVEY: Business Community

---

1. What type of business do you currently operate on your community? (e.g., auto repair, retail apparel, beauty services, grocery, etc)
a. _____

2. How long have you been in business?_____

3. How many people does your business employ?
a. ____ 1 -5
b._____ 6 - 10
c. ____ 11 -15
d._____ More than 16

4. Has the number of employees changed during the **past one year**?
a. _____ Increased
b. _____ Decreased
c. _____ No Change

4a. Do you feel your answer to 4. is related to the Fishing industry in your community?
a. _____Yes
b. _____No
Please, explain_____

5. Has the number of employees changed during the **past five years**?

a. _____ Increased
b. _____ Decreased
c. _____ No Change

5a. Do you feel your answer to 5. is related to the Fishing industry in your community?
a. _____Yes
b. _____No
Please, explain_____

6. How have your sales changed during the **past one year**?
a. _____ Increased by _____ percent
b. _____ Decreased by _____ percent
c. _____ Remained the same

6a. Do you feel your answer to 6. is related to the Fishing industry in your community?
a. _____Yes
b. _____No
Please, explain_____

7. How have your sales changed during the **past five years**?
a. _____ Increased by _____ percent
b. _____ Decreased by _____ percent
c. _____ Remained the same

7a. Do you feel your answer to 7. is related to the Fishing industry in your community?
a. _____Yes
b. _____No
Please, explain_____

8. Do you plan to expand or reduce operations in the near future?
a. _____ Expand
b. _____ Reduce
c. _____ No plans

8a. Do you feel your answer to 8. is related to the Fishing industry in your community?
a. _____Yes
b. _____No
Please, explain_____

9a. Please, rate the **importance** of various factors in influencing your business:
Please Rank: Most important = 1, Least important = 6.
a. Location _____
b. Season _____
c. Fisheries Industry _____
d. Others _____(specify)_____

9b. Which category describes most of your customers?
a._____ Downtown employees
b._____ Tourists
c._____ Local consumers
d._____ Students
e._____ Others (specify): _____

10. In what other ways do you feel the Fishing industry affect your business?_____
_____

_____
_____
_____

Thank you very much for your time and effort!

Business Survey Coded (This is one example of the coded material; codes and other data for all surveys is available upon request):

BUSINESS SURVEY CODEBOOK		
BUSTYPE	Type of Business	
	1	Auto Repair
	2	retail/apparel
	3	Beauty/Grooming
	4	medical
	5	restaurant/grocery
	6	Financial
BUSLNGTH	Length of time in business (in years; less than 1 is coded as 1)	
EMPS	Number of Employees	
	1	1 to 5
	2	6 to 10
	3	11 to 15
	4	more than 16
CHGEMP1	Has Number of Employees Changed in Past Year	
	-1	Decreased
	0	No Change
	1	Increased
CHGEMPF1	Was Change (CHGEMP1) related to Fishing Industry	
	0	No
	1	Yes
CHGEMP5	Has Number of Employees Changed in Past Five Years	
	-1	Decreased
	0	No Change
	1	Increased
CHGEMPF5	Was Change (CHGEMP5) related to Fishing Industry	
	0	No
	1	Yes
CHGSal1	Have Sales Changed in Past Year	

	-1	Decreased
	0	No Change
	1	Increased
PctCHGS1	% Change in Sales in Past Year	
CHGSalF1	Was Change (CHGSal1) related to Fishing Industry	
	0	No
	1	Yes
CHGSal5	Have Sales Changed in Past 5 Years	
	-1	Decreased
	0	No Change
	1	Increased
PctCHGS5	% Change in Sales in Past 5 Years	
CHGSalF5	Was Change (CHGSal5) related to Fishing Industry	
	0	No
	1	Yes
CHGOPS	Do you plan to reduce/expand future operations	
	-1	Reduce
	0	No Plans
	1	Expand
CHGOPSF	Is decision (CHGOPS) related to Fishing Industry	
	0	No
	1	Yes
FACTORS	**Influence of Various Factors on Business (1 - 6 = Most - Least)**	
FACTA	Location	
FACTB	Season	
FACTC	Fishing Industry	
FACTD	Other factors	
CUSTTYP	**Which Category Describes Most Customers**	
TYPA	Downtown Employees	
	0	No
	1	Yes
TYPB	Tourists	
	0	No
	1	Yes
TYPC	Local Consumers	
	0	No
	1	Yes
TYPD	Students	

	0	No
	1	Yes
TYPE	Others	
	0	No
	1	Yes

Boat Owner Surveys:

Massachusetts Fisheries Recovery Commission
C/O Center for Marine Science and Technology
706 South Rodney French Boulevard
New Bedford, MA. 02744-1221

Economic Impact Study of Fisheries Regulation in the State of Massachusetts

SURVEY: Boat Owners

---

1. Which town do you live in? _____.

2. Where does your vessel(s) berth?_____.

3. Was your father a commercial fishermen? a. ___ N b. ___ Y

4. Was your grandfather a commercial fishermen? a. ___ N b. ___ Y

5. Are any of your children in the fisheries business? a. ___ N b. ___ Y

6. Compared to the way you would prefer to operate, have area closures shifted where you make purchases? (Check one) a. ___ N b. ___ Y

6b. If yes, what changes in your purchasing pattern have you made?_____
_____
_____
_____
_____

7a. Have area closures shifted where you berth your vessel? A. ____N b. ____Y

7b. Do you fish _____in-shore, _____off-shore, or _____both?

7c. What is the size of the vessel?_____.

8. Besides area closures, are there any other regulations that have shifted where you make purchases?
(Check one) a. ___ N b. ___ Y

8a. If yes, what are these regulations and what changes have you made?_____

9. Besides area closures, are there any other regulations that have shifted where you berth your vessel?
(Check one) a. ___ N b. ___ Y

10. Are there any other questions you think fishermen want to be asked about their industry's impact on the broader Commonwealth of MA economy?
(Check one) a. ___ N b. ___ Y

10a. If yes, what questions do you recommend?_____

11. Are there any other questions you think fishermen want to be asked about their industry's impact on the economy of the Town or Port?
(Check one) a. ___ N b. ___ Y

11a. If yes, what questions do you recommend?
_____

12. Please list the most significant changes that you have made in your fishing practices in the **last year** because of regulations. **Put a check beside ones that apply to you**:

a. ___ Switched to different gears
b. ___ Cut back on gear/vessel maintenance
c. ___ Decreased time on water
d. ___ Changed fish dealer
e. ___ Took on less crew
f. ___ Postponed new engine
g. ___ Shorter trips
h. _____
i. ___ Spent less time in exploratory fishing
j. ___ Increased time on water
k. ___ Changed fishing location
l. ___ Fished more species
m.___ Postponed purchases of new gear
n. ___ Took longer trips.
o. ___Other _____
p. _____

13. Please list the most significant changes that you have made in your fishing practices in the **last five years** because of regulations. **Put a check beside ones that apply to you**:

a. ___ Switched to different gears
b. ___ Cut back on gear/vessel maintenance
c. ___ Decreased time on water
d. ___ Changed fish dealer
e. ___ Took on less crew
f. ___ Postponed new engine
g. ___ Shorter trips
h. _____
i. ___ Spent less time in exploratory fishing
j. ___ Increased time on water
k. ___ Changed fishing location
l. ___ Fished more species
m.___ Postponed purchases of new gear
n. ___ Took longer trips.
o. ___Other _____
p. _____

14. Please **list** the most significant changes in your household finances that you have seen over the **last year** because of regulations. Some examples are: Cut back on insurance, Cut back on family vacations, Cut back on new clothes, Cut back on savings, Postpone new car, truck, house, etc.

a. _____ d. _____
b. _____ e. _____
c. _____ f. _____

15. Please **list** the most significant changes in your household finances that you have seen over the **last five years** because of regulations. Some examples are: Cut back on insurance, Cut back on family vacations, Cut back on new clothes, Cut back on savings, Postpone new car, truck, house, etc.

a. _____ d. _____
b. _____ e. _____

c. _____ f. _____

16. How do you decide which fish dealer to sell to? (**Check more than 1 if appropriate**)
a. ___ Belong to organization
b. ___ Decide where while at sea
c. ___ Call Market News
d. ___ Call contacts in ports
e. ___ Auction
f. ___ Shop around for best price
g. ___ Tied into buyer through contract/loan
h. ___ Pre-arranged before trip
i. ___ Depends on species
j. ____Other_____

17. Do you think you have good price information about when to land fish?
a. ___ N b. ___ Y

18a. Do you make decisions of when to fish based on prices?
a. ___ N b. ___ Y

18b. Do you observe a lot of price fluctuation over the fishing year?
a. ___ N b. ___ Y

18c. If Yes, do you attribute the price fluctuation to?
a. ____ Regulations
b.____ Quality of Fish
c.____Other_____.

19. How do you gather information on price?
a. ___ Paying service
b.____Other_____

20. How do auctions compare to non-auction sales of your fish?
Check which is better: (A) Auction (NA) Non-auction
a. Speed of sale _____
b. Stable and Firm prices _____
c. Price reflects broad market _____
d. Personal contact _____
e. Get good information _____
f. Treated well _____
g. No hassles _____
h. Good idea of prices beforehand _____
i Quality is rewarded _____
j. Works better with my accounting arrangement _____
k. Speed of payment _____
l. Other_____ _____

21. Have you needed help while at sea or in getting back to port over the **last year**?
a. ___ N b. ___ Y

22. Have you needed help while at sea or in getting back to port over the **last five years**?
a. ___ N b. ___ Y

23.What percentage of the fishermen that you know well have all of the required safety equipment in good operating order on board their vessels? ___ %.

24. Do you get the services of professionals (whether in the family or coop or organization) to handle the following for you? **Please check any of the following for which you use a professional**
a. ___ Accounting/Bookkeeping services
b. ___ Settlement
c. ___ Insurance
f. ___ Vessel electronics
g. ___ Office automation
h. ___ Other_____

d. ___ Fish stock information
e. ___ Selling
i. _____
j. _____

25. How much have the following things changed over the **last year**?
Please Rank: Most changed = 1, Least changed = 6.
a. Dependence on non-fishing income ___
b. Record keeping needs ___
c. Amount of time in sales/marketing ___
d. Use of non-family, hired labor or crew ___
e. Time spent in trade association meetings ___
f. Use of loans and other credit ___
g. Use of family labor ___
h. Need for family members in more roles ___
i. What else?_____ ___
j. _____ ___
k _____ ___

26. How much have the following things changed over the **last five years**?
Please Rank: Most changed = 1, Least changed = 6.
a. Dependence on non-fishing income ___
b. Record keeping needs ___
c. Amount of time in sales/marketing ___
d. Use of non-family, hired labor or crew ___
e. Time spent in trade association meetings ___
f. Use of loans and other credit ___
g. Use of family labor ___
h. Need for family members in more roles ___
i. What else?_____ ___
j. _____ ___
k _____ ___

27. How much have the following affected your ability to make a living fishing?
Please Rank: Most affected = 1, Least affected = 6.
a. Loss of fishing areas ___
b. Increased number of recreational fishers ___
c. Increased seafood imports ___
d. Increased marine fishery regulation ___
e. Coastal development ___
f. Loss of markets for harvested fish ___
g. Increased costs of harvesting fish ___
h. Imports ___
i. ____ Other_____ ___
j. _____ ___

28. What services do you utilize in port?
a.___Vessel Repair
b.___Gear Supply
c.___Ice Company
d.___Fuel
e.___Groceries
f. Other(Specify)_____

29. What do you do when your regular grounds are closed for a period? (**Choose all that apply**)
a. ___ Fish in the closest area to closed area, if there is a reasonable chance of success for the same species
b. ___ Depending on length/size of closure, might move to a different port altogether

c. ___ Try several areas around the closed area
d. ___ Depending on length/size of closure, might switch target species
e. ___ Go to the next area that has a reasonable chance of success for any species I'm allowed to fish
f. ___ Fish in closed area with exempted gear
g. ___Do not fish at all
g. ___ Other _____
_____

30. Do you feel your views get expressed (if not adopted) in the Formal Council/Committee management process?
a. ___ N b. ___ Y

31. Do you feel you understand the Council/Committee management system?
a. ___ N b. ___ Y

32a. Do you think the fisheries management process adequately considers the effect it'll have on the fisheries economic activity?
a. ___ N b. ___ Y

32b. If not, explain_____

33a. Do you think the fisheries management process adequately manage stocks while considering the effect it'll have on the fisheries economic activity?
a. ___ N b. ___ Y

33b. If not, explain_____

34. Do you feel you understand the important laws (like the Magnuson Act) that guide fisheries management? a. ___ N b. ___ Y

35. Is it your feeling that fishermen generally want to comply with regulations?
a. ___ N b. ___ Y

36a. Do you think enforcement treats the fishing industry fairly?
a. ___ N b. ___ Y

36b. If not, how would you improve enforcement?_____

37. Do you feel there is adequate fisheries enforcement at sea in the areas where you fish?
a. ___ N b. ___ Y

38. Do you feel there is adequate fisheries enforcement at the dock where you land your catch?
a. ___ N b. ___ Y

39. Which of the following general tools of fisheries management do you feel are most effective in reducing fishing mortality? **Please Rank: Most effective = 1, Least effective = 6.**
a. ___ Days At Sea (DAS) limits e. ___ Mesh size regulations
b. ___ Large and long closed areas f. ___ Trip Limits
c. ___ Short term closed areas g. ___ Overall Hard TAC
d. ___ Individual Fishing Quotas h. ___ Overall Soft TAC

40. Which of the following general tools of fisheries management do you feel are most difficult for a family to adjust to? **Please Rank**: **Most difficult to adjust to = 1, Easiest = 6**.
a. ___ Days At Sea (DAS) limits e. ___ Mesh size regulations

b. ___ Large and long closed areas f. ___ Trip Limits
c. ___ Short term closed areas g. ___ Overall Hard TAC
d. ___ Individual Fishing Quotas h. ___ Overall Soft TAC

41. Which of the same tools are hardest on net income or profits? **Please Rank: Most impact on net income = 1, Least impact on net income-profits = 6.**
a. ___ Days At Sea (DAS) limits e. ___ Mesh size regulations
b. ___ Large and long closed areas f. ___ Trip Limits
c. ___ Short term closed areas g. ___ Overall Hard TAC
d. ___ Individual Fishing Quotas h. ___ Overall Soft TAC

42. Can you think of a way to "bank" capacity until stocks recover?
a. ___ N b. ___ Y

43a . If yes, how? _____

44. Do you think there is too much active capacity now for stocks to recover without more regulations?
a. ___ N b. ___ Y

45. Do you think there will be too much active capacity for stocks to stay recovered when they do come back?
a. ___ N b. ___ Y

46. Would you advise young people to go into the fishing industry?
a. ___ N b. ___ Y

47a. If yes, what job in the industry? _____
_____

48. What other questions do you think fishermen want to be asked about their vision of the future for themselves, their family's role in fishing, or the industry? _____
_____

49. Please indicate if you agree or disagree with the following list of possible goals for fisheries in this region in the future:
Strongly Agree(SA) Agree(A) Neutral(N) Disagree(D) Strongly Disagree(SD)
a. Max. economic benefits to the Commonwealth of MA___
b. Harvest capacity matched to resources ___
c. Unlimited entry in any fishery ___
d. New entrants limited to numbers exiting ___
e. Secure places for existing fishermen with opportunities not reduced by new entrants ___
f. Maximum benefits to the community ___
g. Maximum possible number of fishermen ___
h. Maximum possible number of fishing jobs the resource can support ___
i. Attract more people to the industry___

50. What other goals do you strongly support?_____
_____
_____
_____
_____

_____

Thank you very much for your time and effort!

Crew Members survey:

Massachusetts Fisheries Recovery Commission
C/O Center for Marine Science and Technology
706 South Rodney French Boulevard
New Bedford, MA. 02744-1221

Economic Impact Study of Fisheries Regulation in the State of Massachusetts

SURVEY: Crew members

---

1. Which town do you live in? _____.

2. Was your father a commercial fishermen? a. ___ N b. ___ Y

3. Was your grandfather a commercial fishermen? a. ___ N b. ___ Y

4. What percent of your household's total annual income comes from all aspects of the fishing industry? _____ %

5a. Which port do you fish out of? _____.

5b. Do you fish _____in-shore, _____off-shore, or _____both?

5c. What is the size of the vessel?_____.

6a. Do you consider this town a fishing community? a. ___ N b. ___ Y

6b. Why or why not? _____
_____

7a. Do you consider this town a community which is dependent on the fishing industry?
a. ___ N b. ___ Y

7b. Why or why not? _____
_____

8. Would you have to move out of your town if fishing became more difficult because of more regulations?
a. ___ N b. ___ Y

9a. Have area closures or other regulations changed where you live?

a. ___ N b. ___ Y

9b.If yes, what regulations?_____
_____

10a. Have area closures or other regulations changed where you spend your income?
a. ___ N b. ___ Y

10b.If yes, what regulations and what have you changed?_____
_____

11. Please **list** the most significant changes in your household finances that you have seen over the **last year** because of regulations. Some examples are: Cut back on life and or health insurance, Cut back on family vacations, Cut back on new clothes, Cut back on savings, Postpone new car, truck, house, etc.
a. _____ d. _____
b. _____ e. _____
c. _____ f. _____

12. Please **list** the most significant changes in your household finances that you have seen over the **last five years** because of regulations. Some examples are: Cut back on life and or health insurance, Cut back on family vacations, Cut back on new clothes, Cut back on savings, Postpone new car, truck, house, etc.
a. _____ d. _____
b. _____ e. _____
c. _____ f. _____

13. How have you been affected by regulations such as Days at Sea?
_____

14. Do you think you will continue working in the fisheries industry in the **next year**? a._____Y
b._____N

15. Do you think you will continue working in the fisheries industry in the **next five years**? a._____Y
b._____N

16. Do you want to own your own boat in the future? a._____Y b._____N

17. What other questions should crew be asked to get at how regulations have affected them?
_____

18. Do you feel you understand the important laws (like the Magnuson Act) that guide the fisheries management process? a. ___ N b. ___ Y

19a. Do you feel the fisheries management system is fair? a. ___ N b. ___ Y

19b.Explain_____
_____

20. Do you feel there is adequate fisheries enforcement at sea in the areas where you fish?
a. ___ N b. ___ Y

21. Do you feel there is adequate fisheries enforcement at the dock where you land your catch? a. ___ N b. ___ Y

22a. Do you feel the fisheries enforcement system is fair? a. ___ N b. ___ Y

22b.Explain_____
_____

23. Which of the following general tools of fisheries management do you feel are most effective in reducing fishing mortality? **Please Rank: Most effective = 1, Least effective = 6.**
a. ___ Days At Sea (DAS) limits e. ___ Mesh size regulations
b. ___ Large and long closed areas f. ___ Trip Limits
c. ___ Short term closed areas g. ___ Overall Hard TAC
d. ___ Individual Fishing Quotas h. ___ Overall Soft TAC

24. Which of the following general tools of fisheries management do you feel are most difficult for a family to adjust to? **Please Rank**: **Most difficult to adjust to = 1, Easiest = 6**.
a. ___ Days At Sea (DAS) limits e. ___ Mesh size regulations
b. ___ Large and long closed areas f. ___ Trip Limits
c. ___ Short term closed areas g. ___ Overall Hard TAC
d. ___ Individual Fishing Quotas h. ___ Overall Soft TAC

25. Which of the same tools are hardest on income? **Please Rank: Most impact on net income =1, Least impact on net income = 6.**
a. ___ Days At Sea (DAS) limits e. ___ Mesh size regulations
b. ___ Large and long closed areas f. ___ Trip Limits
c. ___ Short term closed areas g. ___ Overall Hard TAC
d. ___ Individual Fishing Quotas h. ___ Overall Soft TAC

26. If you could manage fisheries, what would you do differently and why?
_____
_____

29. Would you advise young people to go into the fishing industry? a. ___ N b. ___ Y

30. What do you need to know to be a crew member?
a. ___ Mechanical knowledge
b. ___ Gear and equipment knowledge
c. ___ Computer/technology knowledge
d. ___Other_____.

31. Please indicate if you agree or disagree with the following list of possible goals for fisheries in this region in the future:
Strongly Agree(SA) Agree(A) Neutral(N) Disagree(D) Strongly Disagree(SD)
a. Most economic benefits to the Commonwealth of MA___
b. Harvest capacity matched to resources ___
c. Unlimited entry in any fishery ___
d. New entrants limited to numbers exiting ___
e. Secure places for existing fishermen with opportunities not reduced by new entrants ___
f. Maximum benefits to the community ___
g. Maximum possible number of fishermen ___
h. Maximum possible number of fishing jobs the resource can support ___
i. Attract more people to the industry___

32. What other goals do you strongly support?
_____
_____

33. Which specific groundfish regulations have been the most difficult for you, your family, and/or your business to adapt to?_____

33a. Why?_____

34. What approaches, if any, have you, your family, and your business used to adapt to groundfish regulations in the **last year**? (for example, sought alternative sources of employment, spouse entered the workforce, decreased family spending, eliminated health insurance, took less crew, cut back on gear/vessel maintenance and purchases)

_____

35. What approaches, if any, have you, your family, and your business used to adapt to groundfish regulations in the **last five years**? (for example, sought alternative sources of employment, spouse entered the workforce, decreased family spending, eliminated health insurance, took less crew, cut back on gear/vessel maintenance and purchases)

_____

36. What are some of the changes you have made in your fishing/business practices as a result of groundfish regulations in the **last year?**

_____

37. What are some of the changes you have made in your fishing/business practices as a result of groundfish regulations in the **last five years?**

_____

38. How has the auction system affected the fisheries practices?

_____

39. Your age bracket is:
a. 17-25 b. 26-35 c.36-45 d.46-55 e.56-65 f._____

_____
Thank you very much for your time and effort!

Processors and Dealers survey:

Massachusetts Fisheries Recovery Commission
C/O Vito Calomo
30 Emerson Ave.
Gloucester, MA 01930

To: Processors and Dealers

The Massachusetts Fisheries Recovery Commission is conducting a study of the economic impact of regulations on fishing activities in the State of Massachusetts. A survey is attached and your answers would be very valuable important for the project.

Please, send filled out surveys to the address on top, and many thanks for your attention. We thank you in advance for your time and effort in filling out the survey and returning it to us as soon as possible.

Massachusetts Fisheries Recovery Commission
C/O Vito Calomo
30 Emerson Ave.
Gloucester, MA 01930

Economic Impact Study of Fisheries Regulation in the State of Massachusetts

SURVEY: Processors - Dealers

---

1. Regarding the products you process or deal, has it been increasingly difficult to access domestic or local products in the **past year**? a.____Yes b.____No

2. Regarding the products you process or deal, has it been increasingly difficult to access domestic or local products in the **past five years**? a.____Yes b.____No

3. Regarding the products you process or deal, have you had to buy foreign products to replace domestic product in the **past year**? a.____Yes b.____No

3a. What kinds of products?_____

3b. From which nations?_____

4. Regarding the products you process or deal, have you had to buy foreign products to replace domestic or local product in the **past five years**? a.____Yes b.____No

4a. What kinds of products?_____

4b. From which nations?_____

5. In the **past year**, has the mix of domestic versus foreign and/or farmed products you supply changed significantly? a. ____Yesb. _____No

5a. Can you give a best estimate of the change? _____.

6. In the **past five years**, has the mix of domestic versus foreign and/or farmed products you supply changed significantly? a. ____Yesb. _____No

6a. Can you give a best estimate of the change? _____.

7. In the **past year**, have you experienced more, less or about the same amount of price fluctuation in the domestic product you supply? a.____More b. ____Less c.____Same

7a. Do you believe this is due to regulations? a. ___Yes b.___No

7b. Please, explain why?_____

8. In the **past five years**, have you experienced more, less or about the same amount of price fluctuation in the domestic product you supply? a.____More b. ____Less c.____Same

8a. Do you believe this is due to regulations? a. ___Yes b.___No

8b. Please, explain why?_____

9. Has the availability of foreign product changed your customer base in the **past year**? a.____Yes b. ____No

9a. Please, explain why?_____

10. Has the availability of foreign product changed your customer base in the **past five years**? a.____Yes b. ____No

10a. Please, explain why?_____

11. Has federal regulatory activity on fisheries affected the way you operate your business in the **past year**? a.___Yes b.___No

11a. Please, explain why?_____

12. Has federal regulatory activity on fisheries affected the way you operate your business in the **past five years**? a.___Yes b.___No

12a. Please, explain why?_____

13. Do you plan internal changes in your operations due to possible changes in the mix of domestic versus foreign and/or farmed products in the near future? a.____Yes b.____No

13a. If yes, do you plan to:
a. _____ Expand b. _____ Reduce c. _____ No plans d. _____Other (explain)

14. Do you think regulations have an effect on the way shore-side facilities are operated? a.____Yes b. ____No

14a. Do you think your business should consider the effects of regulations on shore-side facilities? a.____Yes b. ____No

15. In what other ways do you feel federal regulatory activity on fisheries affect your business?_____
_____
_____
_____
_____

Thank you very much for your time and effort!

A2. February 24, 2006: Report of Activities

1. Dates of all meetings, major participants, purpose

i. February 28, 2006: 9:30AM-2:30PM, Division of Marine Fisheries, 30 Emerson Ave Gloucester: Discussion of research agenda with Vito Calomo, visit to Auction in Gloucester, meeting with Larry Ciulla

ii. March 3, 2006: 9:30AM-2:30PM, New England Fishery Management Council, Newburyport, MA, with Vito Calomo and Lori Steele to review previous studies and data.

iii. March 10, 2006: 9:30AM-2:30PM, Division of Marine Fisheries, 30 Emerson Ave Gloucester: Discussion of surveys with Vito Calomo.

iv. March 22, 2006: 9:00AM-1:00PM, Division of Marine Fisheries, 30 Emerson Ave Gloucester: visit the Golucester Chamber of Commerce and discussion of business survey with Michael Costello, Sara Young and Vito Calomo; visit business cites in Gloucester with Vito Calomo

v. March 23, 2006: 12:00-4:00PM, Division of Marine Fisheries, 30 Emerson Ave Gloucester: direct and take research assistants to take surveys to business community in Gloucester; meeting in Gloucester Auction to discuss processors and dealers issues.

vi. March 24, 2006: 3:00PM – Massachusetts State House Senate Reading Room.

2. Progress on Introduction and Overview section: Substantive progress has been made in this part; background information on Amendments 5, 7 and 13 being assembled.

3. Progress on Analyses of Local Economies: Substantive progress in the Gloucester area, fishermen and business have been surveyed; next step will involve same work for Plymouth and New Bedford.

4. Progress on Economic Forecasts: Not ready to report on this part, waiting to obtain data requested from NOOA and MA Department of Revenue.

5. Progress on Institutional Analysis: Substantive progress has been made in this part; literature review has been done and continues.

We submitted a preliminary draft on Thursday, March 30, 2006 of the available research and materials.

A3. February 25 – May 30, 2006: Report of Activities

1. Dates of all meetings, major participants, purpose

i. March 28, 2006: 6:00PM on, Public Hearing at Plymouth Raddison Hotel, Plymouth, MA – Brett Baden and Marcelo Bianconi attended meeting and distribute surveys to fishermen and others; Vito Calomo present.

ii.a. April 7, 2006: 11:00AM-1:30PM, Public Hearing at Weston Public Library, Marcelo Bianconi attended meeting and distribute surveys to fishermen and others; Vito Calomo, chair of meeting.

ii.b. April 7, 2006: 11:00 PM – 12:00 PM, Gloucester Maritime Heritage Center, 23 Harbor Loop, Gloucester: Brett Baden attended meeting with Heritage Center Museum Executive Director Harriet Webster and Dive Exhibit Curator Paul Harling to discuss visitation to the museum and interest in the Gloucester fishing culture. Attended US Coast Guard Commercial Fleet Safety Day.

iii. April 13, 2006: 11:00AM, Marcelo Bianconi, Discussion of research agenda with Vito Calomo, visit to Auction in Gloucester to discuss distribution of Processor-dealres Surveys.

iv. April 25, 2006: 10:00AM-3:00PM, Marcelo Bianconi, Visit auction in Gloucester to check on surveys; attended lunch at Gloucester Rotary Club with Vito Calomo, gave speech about project; coverage at Gloucester Times and interview with reporter.

v. May 1, 2006: 2:00-4:00PM, at Legal Sea Foods at Boston Harbor quality control plant, Legal Seafoods, Inc., 1 Seafood Way, Boston, MA: Marcelo Bianconi and Brett Baden, Meeting with President and CEO Roger Berkowitz, Executive Director of Seafood Operations Bill Holler, and Massachusetts Senator Bruce Tarr, and Vito Calamo to discuss effects of regulation upon restaurant industry, provision of fresh fish, changes in the market for fish.

vi. May 5, 2006: 1:30-5:00PM – Meeting and lunch with Dr. Madeleine Hall-Arber of MIT SeaGrant Program to discuss project, with Vito Calomo and Marcelo Bianconi.

vii. May 15, 2006: 11:00AM-1:00PM: New Bedford Chamber of Commerce, 794 Purchase Street, New Bedford: Meeting with Chamber President Jim Mathes to discuss effects of regulation on fishing activity and employment levels in New Bedford; lunch in New Bedford with Marcelo Bianconi, Brett Baden and research assistant to discuss business surveys and activities.

viii. May 15, 2006: 2:00 PM – 4:00 PM, Brett Baden only, New Bedford Economic Development Council, 1213 Purchase Street, New Bedford: Meeting with Executive Director Robert Luongo to discuss effects of regulation on fishing activity, Economic Development Council loans to fishing boats, and employment levels in New Bedford

viii. May 18, 2006: 11:00AM-1:00PM: Plymouth Chamber of Commerce, 10 Cordage Park Circle, Suite 231, Plymouth: Meeting with Executive Director Denis Hanks to discuss effects of regulation on fishing activity in Plymouth & plans for Plymouth port redevelopment (Marcelo Bianconi and Brett Baden); research assistant in Plymouth distributing business surveys; and lunch in Plymouth with Marcelo Bianconi and Brett Baden to discuss sales tax results and project.

ix. May 30, 2006: 11:00 AM – 11:45 AM, United States Coast Guard Station, 17 Harbor Loop, Gloucester: (Brett Baden only) Meeting with BMC Robert Breaker (Operations Officer) concerning boat safety, rescues, and the impacts of regulation.

2. Progress on Introduction and Overview section: Results reported.

3. Progress on Analyses of Local Economies: Results reported.

4. Progress on Economic Forecasts: Data have been obtained results are reported.

5. Progress on Institutional Analysis: Results reported.

We will be working on revising this preliminary draft, and will seek comments and suggestions from all involved in this process and will seek expert evaluation (refereeing) as outside opinions for revisions.

We plan to submit a final version of the study on June 30, 2006.

A4. June 1, 2006 – June 30, 2006: Report of Activities

1. Dates of all meetings, major participants, purpose

   i. June 22, 2006: 3:30-5:30PM, at Tufts University, Brett Baden and Marcelo Bianconi, meeting with Professor Jay Shimshack, reviewer of the study for discussion of review and comments.

2. Progress on Introduction and Overview section: Results reported.

3. Progress on Analyses of Local Economies: Results reported.

4. Progress on Economic Forecasts: Data have been obtained results are reported.

5. Progress on Institutional Analysis: Results reported.

Final report is submitted on June 30, 2006; other comments and changes may be attached to this document in the future.

We obtained expert evaluation (refereeing) from one contacted scholar, we contacted a second scholar but received a late response and have not received comments; we plan to attach comments if we receive them in the future.

Baden and Bianconi, June 30, 2006