FINAL REPORT

Analyzing 19th-century Fisheries Records to Determine the Historical Abundance and Distribution of Gulf of Maine Cod

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INTRODUCTION: This project expanded on earlier research, funded by the Sloan Foundation’s HMAP Program as part of the Census of Marine Life. In that work, data from codfishing logs and fishermen’s contracts (fishing agreements) of Beverly, Massachusetts, schooners fishing on the Scotian Shelf in the 1850s were extracted, analyzed historically, and modeled statistically to estimate the biomass of cod on those fishing grounds in 1852. Historical records from the Beverly fleet were well suited for analysis using fisheries stock assessment models. The record set was virtually complete, with both a log and fishing agreement corresponding to one vessel during one season. The number of cod landed that year, number of men fishing and days at sea could be calculated from the log. Vessel size (tonnage), length of the season, number of men fishing, and the total weight of the fish at the end of the season (in quintals, or 112 lbs of dressed and dried cod) could be extracted from the fishing agreement. Because Beverly captains frequently “spoke” other vessels fishing near by, and noted vessel names and ports in their logs, the total Scotian Shelf fleet could be reconstructed, and the tonnage of the “spoken vessels” gleaned from collateral documents such as federal license records. Since distinctive fishing patterns and different locations correlated well with vessel tonnage, Beverly vessels were shown to be representative of the Scotian Shelf fleet as a whole. Fishing effort could be standardized for the total fleet and cod biomass estimated (Rosenberg et al. 2005).

At first, we expected to use the same procedure to model cod biomass for the Gulf of Maine (GoM) using logbook data from the inshore fishery. However, we found that incomplete datasets and unexpected variations in the behavior of fishermen 150 years ago presented insurmountable obstacles to using these data in the usual management models.

Gaps existed in archival records for most Customs Districts. Although there are 524 Frenchman’s Bay logs dating from 1861-1865, a comparison with license records shows that excellent coverage exists for only one year, 1861, with 93% of the logs present. In 1865, the year with the worst coverage, only 43% of the logs still exist. Fishing agreements survive for almost all Frenchman’s Bay logs, and a standardized Abstract page at the end of these logbooks also provides vessel tonnage, length of season and the weight of the catch. Fewer agreements exist for other customs districts and, since other printed logbook forms did not contain an Abstract page, vessel tonnage and weight of landings were not recorded. Furthermore, although some GoM captains described fishing among more than a hundred sail, they rarely noted “spoken vessels” in their logs, probably because of differences in customs that existed between the distant water and inshore fisheries. Unlike the Scotian Shelf, reconstructing total fishing effort for the GoM was impossible using logbooks and agreements.

It was also impossible to standardize fishing effort. Fishing patterns did not correlate with vessel tonnage because Frenchman’s Bay fishermen exhibited two different economic strategies that affected how hard they fished. Since the cod bounty was based on vessel tonnage and not on catch, incentive existed to take out the biggest schooner the crew could handle each season. Fishermen on small vessels tended to fish near shore because safe operating range and carrying capacity were limited. Since they earned little federal subsidy, they maximized profit by fishing diligently, an economic strategy considered standard behavior today. Larger schooners could travel further from home, but they didn’t have to. The fishermen aboard earned a greater cash subsidy from the bounty. In a mixed economy “cash crop” fishermen looked to minimize
effort while making a target income from fishing to augment other family revenue from farming or lumbering. Very large Frenchman’s Bay vessels, some over 100 tons, fished inshore grounds alongside very small vessels, some under 10 tons. For instance, the AGENORA, 104 tons out of Surry in Blue Hill Bay, caught 8275 cod – over 40% of its total catch that year – near Duck Island just south of Mount Desert. In fact, the AGENORA fished in the same locations as the 22 ton JAMES MONROE out of Tremont, also in Blue Hill Bay. Some small vessels caught more cod in a season than large vessels did. The 12 ton boat NYMPH with a crew of 3 out of Cranberry Isles, just south of Mount Desert caught 15819 cod in 1862, while the 88.9 ton OLIVE BRANCH with a crew of 9 from Tremont only brought home 4122 cod that year. Vessels that caught less than 20,000 cod averaged 43.25 tons, with a standard deviation of 21.47. Vessels that caught over 20,000 cod, however, averaged just 58.25 tons, with a standard deviation of 25.48. Because fishing effort differed with economic strategy, neither landings nor fishing location correlated with vessel size. Although fishermen’s behavior in the days of sail proved more interesting and varied than previously realized, standardizing fishing effort for the GoM was impossible. (Differences in decision-making and risk-taking among Frenchman’s Bay fishermen became the focus of our National Science Foundation project, which will be completed in early 2008).

PROJECT OBJECTIVES, DATA AND ANALYSIS: This project’s goals were to establish biological reference points and geographical distribution for the mid 19th-century cod population in the GoM, and compare them to modern equivalents. In order to do this, we:

1) evaluated and retrieved historic fisheries data from historic codfishing logs dating from 1852-1866 and contemporary records, primarily found in the National Archives and Records Administration, Waltham MA,
2) created databases pertaining to each separate analysis,
3) derived a biological reference point for Gulf of Maine cod in 1861,
4) mapped landings distribution and size variation, and
5) compared the results with the modern cod population.

Logs from the Maine Customs Districts of Bath, Penobscot-Castine, Frenchman’s Bay, and Machias were digitized, along with corresponding fishing agreements. Information was transcribed into sets of databases scaled to season, trip or day so that landings during each of those time periods could be aggregated. Logs not yet digitized from the Massachusetts Customs Districts of Salem-Beverly and Newburyport were evaluated for landings and fishing location. Summary statistics of the GoM fleet are summarized in Table 1. Although the historical sample is far from complete, it indicates that, between 1852 and 1866, only 3% of vessels fishing in the GoM were from the Massachusetts Customs Districts of Salem-Beverly and Newburyport. The overwhelming preponderance of vessels fishing in the GoM between 1852 and 1866 appear to have come from Maine. Since the Frenchman’s Bay Customs District is the most complete source of data, it became our primary focus, augmented with data from the other regions as necessary and where available.
<table>
<thead>
<tr>
<th>State</th>
<th>Customs District</th>
<th>Year Range</th>
<th>Number of logs</th>
<th>GoM logs</th>
<th>% GoM</th>
<th>GoM logs with fishing agreements (tonnage and weight of cod)</th>
<th>% GoM logs with fishing agreements</th>
</tr>
</thead>
<tbody>
<tr>
<td>ME</td>
<td>Machias</td>
<td>1856-1864</td>
<td>113</td>
<td>103</td>
<td>91.15%</td>
<td>53</td>
<td>51.45%</td>
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<td></td>
<td>Frenchman’s Bay</td>
<td>1861-1865</td>
<td>524</td>
<td>482</td>
<td>91.98%</td>
<td>482</td>
<td>100.00%</td>
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<tr>
<td></td>
<td>Penobscot-Castine</td>
<td>1860-1866</td>
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<td>37</td>
<td>80.43%</td>
<td>20</td>
<td>54.05%</td>
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<tr>
<td></td>
<td>Bath</td>
<td>1852-1857</td>
<td>45</td>
<td>40</td>
<td>88.89%</td>
<td>16</td>
<td>40.00%</td>
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<tr>
<td>MA</td>
<td>Newburyport</td>
<td>1857-1859</td>
<td>233</td>
<td>35</td>
<td>15.02%</td>
<td>6</td>
<td>17.14%</td>
</tr>
<tr>
<td></td>
<td>Salem-Beverly</td>
<td>1857-1862</td>
<td>703</td>
<td>16</td>
<td>2.27%</td>
<td>12</td>
<td>75.00%</td>
</tr>
<tr>
<td>total</td>
<td>1852-1866</td>
<td>1664</td>
<td>713</td>
<td></td>
<td>42.84%</td>
<td>589</td>
<td>82.61%</td>
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</tbody>
</table>

Table 1. Summary log statistics from vessels fishing in the Gulf of Maine, 1852-1866.

Map 1. Gulf of Maine compared to the Region fished by Frenchman’s Bay vessels.
GIS by S. Claesson.
Biological Reference Points for Gulf of Maine Cod in 1861: First we calculated the total catch and average size of GoM cod landed by Frenchman’s Bay vessels in 1861, the year with the best data. Two-hundred-and-twenty vessels, comprising only 15% of Maine’s codfishing fleet, landed 3,281,897 cod weighing 12,134 mt (using a 4.9 multiplier from dressed and dry to round). Most were caught with handlines or tub trawls (similar to long-lines) between Penobscot Bay and Grand Manan within 40 miles of shore by small schooners or boats averaging 45 tons (Map 1). Catch alone shows that this area supported a much more important fishery than has heretofore been acknowledged. Between 1852 and 1866 cod were extraordinarily abundant along this coast. Frenchman’s Bay and Blue Hill Bay alone supported enormous primary production. Except for Grand Manan, this region is almost devoid of cod today. We compare this to the most recent commercial and recreational landings of cod for the entire Gulf of Maine:

- 2003 - 8,100 mt
- 2004 - 5,500 mt
- 2005 - 3,900 mt

The average weight of fish landed is another biological indicator. In 1861 that figure was 8.1 lbs., compared to an average today of 7.6 lbs., a difference of less than 7%.

Frenchman’s Bay regional landings are impressive enough, but we wanted to estimate landings for the entire GoM in 1861. Until the Civil War, the US Treasury Department Commerce and Navigation Reports published aggregated tonnage for the codfishing fleet twice each decade. Total exports of salt cod were also reported. However, the federal government had no authority to regulate or monitor internal commerce before 1887, and most salt cod was shipped to the South and West by 1860. In addition, urbanization, Irish Catholic immigration, recreational hotels that followed railroads up the coast, and ice for refrigeration all combined to substantially increase local and regional markets for fresh cod. For these reasons, salt cod exports figures substantially underestimated removals. Furthermore, although fleets were divided by state, statistics for the GoM and distant water banks were combined. US Fish Commission Reports published the proportion of large vessels to boats by year and by Customs District from 1825 to 1895 (excerpted in O’Leary 1996). Using these percentages, large vessels over 20 tons could be distinguished from boats between 5 and 20 tons for Massachusetts and Maine customs districts. If 1) a comparison of all logs showed that the Frenchman’s Bay fleet was representative of the GoM fleet, and 2) if we could estimate, from the aggregated fleet statistics, the proportion of vessel tonnage that fished in the GoM, we could scale up the Frenchman’s Bay landings accordingly. Table 2 compares:

- average vessel size for vessels fishing in the GoM, with those fishing on the distant banks: the Scotian Shelf, Bay St. Lawrence, Labrador and the Grand Banks (blue box),
- average effort [measured in the average dry weight of cod (in quintals/ton of vessel)] for the GoM and the other Banks (yellow box),
- effort for large and small vessels that fished in the GoM (green box),
- effort for vessels from different Customs Districts that fished in the GoM (red box).
We found that:

- The average tonnage of vessels fishing in the GoM was significantly lower than for vessels on the Grand Banks, and lower, but not significantly lower, for the Scotian Shelf, the Bay St. Lawrence and Labrador (16.78% of the sample vessels fall within the tonnage ranges of both the inshore and distant water fleets). These statistics are supported historically, and can be connected to risk taking strategies of captains and crewmembers. Distant water fishing was risky business, especially on the Grand Banks and the Scotian Shelf. Boats under 20 tons were never taken offshore, and captains of vessels up to 40 tons watched the weather and sought a harbor in adverse conditions. The GoM “cash crop” fishery attracted large schooners that may have been too decrepit to take offshore. The 103 ton Beverly schooner, Mechanic, had sailed to the Grand Banks in 1852, but ended up licensed in Frenchman’s Bay, making short trips out of Surry in the 1860s. In fact, the largest schooner in the entire sample set, the 120-ton ORATOR from Surry, ME, never fished out of sight of the Mount Desert hills.

- The Bay St. Lawrence and the Labrador fishery were essentially shore fisheries prosecuted far from home. Occasionally they attracted small schooners from 35 to 45 tons...
that ran across the Bay of Fundy to Nova Scotia, then skirted the southern shore of Nova Scotia, called the Cape Shore, until they could duck through the Straits of Canso into Bay St. Lawrence. In addition, a few small schooners fished Brown’s Bank at the western edge of the Scotian Shelf. The captains and crews of these few venturesome schooners were risk-takers who fished hard like the large Massachusetts schooners surrounding them. The voyages took longer and were riskier, but attracted profit maximizing fishermen from Maine ports who may have wanted distant water experience before moving south to the big Cape Ann ports. Between 1852 and 1866, the portion of Beverly captains from Maine grew from 5% to 25%.

- Effort measured in average quintals/ton of vessel varies little across the distant water fleets (.95 quintals/ton of vessel, or 106.4lbs). The difference doubles when the GoM fleet is compared (1.85 quintals), although, again, it is not statistically significant (yellow box) ...

- ... however effort for large and small GoM vessels shows statistical difference. The highest effort for all vessels came from the GoM boat fleet, while the lowest came from the GoM vessel fleet. These high and low values bracket the edges of the confidence intervals for the distant water fleets. Chart 1 relates effort to tonnage across all vessel categories. When both tonnage and effort are considered, there is no overlap between the distant water and the GoM fleets.

- Vessels from all six Customs Districts in ME and MA fall within the confidence interval for GoM overall. Note that Salem-Beverly vessels are at the edge of the confidence interval. Their average size is the smallest for any customs district and their effort the highest.

Chart 1. Average Fishing Effort in the Gulf of Maine and on Distant Water Banks.
Although Frenchman’s Bay vessels contribute 4/5 of the data for the GoM, there are no statistical outliers among the other customs districts, so the Frenchman’s Bay fleet accurately represent this sample of the GoM fleet, and can be used as a proxy for fleet effort and landings. Next we had to determine the proportion of total vessel tonnage that fished in the GoM in 1861, using the aggregated fleet statistics. We made several conservative assumptions about the fleet as a whole based on evidence shown in Tables 1 and 2:

- all vessels under 20 tons fished in the GoM. In 1861, 9018.99mt of cod were landed by Massachusetts vessels under 20 tons, and 20493.63 mt were landed by Maine vessels under 20 tons;

- no vessels over 20 tons from Massachusetts fished in the GoM. This is not strictly true, but, since the Massachusetts fleet contributed only 7.15% of the GoM sample set, and their average size was 29.1 tons, we felt this assumption was justified;

- no Massachusetts vessels under 20 tons fished south of Cape Cod. This over-estimate is mitigated by the exclusion of the MA vessels from 20 to 40 tons that fished in the GoM, but which can’t be singled out of the aggregated fleet statistics; and

- no contribution from New Hampshire or Canadian vessels since there were no statistics available for those fleets. This is also untrue, but it adds further insurance that our estimate is conservative;

- that the proportion of the Maine vessel fleet fishing the GoM decreases as the distance of each customs district from the Bay of Fundy grows (Table 1).

Table 3 shows the portion of Maine’s vessel fleet that we assume fished in the GoM in 1861. After testing a range of distributional assumptions and propagating uncertainty throughout, we estimate that 78,600 mt of cod were caught in the Gulf of Maine in 1861 (with a standard deviation of 4,015 mt). Based on modern biological reference points, MSY for cod in the Gulf of Maine today is 16,600 mt, and SSBMSY is 82,830 mt. That is, the target for sustainable stock biomass falls just outside the error bars for estimated cod landings in 1861. We are currently working on a population estimate based on this figure for total removals, and assembling a table of additional landings statistics from the 18th, 19th and early 20th centuries.

**Project Results:**

*Cod landed in the Gulf of Maine in 1861 = 78,600 mt (stdev 4,015 mt)*
*Average weight of cod = 7.6 lbs.*
Table 3. Proportion of tonnage of Maine vessels over 20 tons fishing in the GoM, by Customs District.

<table>
<thead>
<tr>
<th>1861</th>
<th>% tonnage, vessels over 20 tons</th>
<th>tonnage of vessels over 20 tons per customs district</th>
<th>% tonnage fished Gulf of Maine (logs)</th>
<th>low % assumptions</th>
<th>tonnage of vessels fishing in the Gulf of Maine</th>
</tr>
</thead>
<tbody>
<tr>
<td>Passamaquoddy</td>
<td>4%</td>
<td>2953.24</td>
<td>85%</td>
<td>2510.25</td>
<td></td>
</tr>
<tr>
<td>Machias</td>
<td>3%</td>
<td>1785.68</td>
<td>86.48%</td>
<td>1544.33</td>
<td></td>
</tr>
<tr>
<td>Frenchman’s Bay</td>
<td>16%</td>
<td>11126.16</td>
<td>88.36%</td>
<td>9830.85</td>
<td></td>
</tr>
<tr>
<td>Penobscot Bay</td>
<td>29%</td>
<td>20123.24</td>
<td>63.07%</td>
<td>12692.46</td>
<td></td>
</tr>
<tr>
<td>Bangor</td>
<td>2%</td>
<td>1510.96</td>
<td>65%</td>
<td>982.12</td>
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<tr>
<td>Belfast</td>
<td>12.30%</td>
<td>8447.64</td>
<td>65%</td>
<td>5490.97</td>
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<tr>
<td>Waldoboro</td>
<td>9.10%</td>
<td>6249.88</td>
<td>65%</td>
<td>4062.42</td>
<td></td>
</tr>
<tr>
<td>Wiscasset</td>
<td>9.90%</td>
<td>6799.32</td>
<td>65%</td>
<td>4419.56</td>
<td></td>
</tr>
<tr>
<td>Bath</td>
<td>3.90%</td>
<td>2678.52</td>
<td>71.82%</td>
<td>1923.66</td>
<td></td>
</tr>
<tr>
<td>Portland-Falmouth</td>
<td>7.80%</td>
<td>5357.04</td>
<td>10%</td>
<td>535.79</td>
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<tr>
<td>Biddeford</td>
<td>0.60%</td>
<td>412.08</td>
<td>10%</td>
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<tr>
<td>Kennebunk</td>
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<td>1030.2</td>
<td>10%</td>
<td>103.02</td>
<td></td>
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<tr>
<td>York</td>
<td>0.40%</td>
<td>274.72</td>
<td>10%</td>
<td>27.47</td>
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Geographical Distribution of Landings between Blue Hill Bay and Grand Manan, 1861-1865:

*Mapping Fishing Grounds:* In 2004, charts of fishing grounds identified by name in G. B. Goode’s Fisheries and Fishery Industries of the United States, sec. III (1888), and in Walter Rich’s Fishing Grounds of the Gulf of Maine (1929) were geo-referenced. These charts were based on locations and names provided by experienced fishermen in the late 19th- and early 20th-centuries. Goode’s fishing grounds offer the closest physical representation of banks and grounds known to fishermen in the 1850s and 1860s. Spawning grounds in Ted Ames “Atlantic Cod Stock Structure in the Gulf of Maine” (2004) were also geo-referenced. Each chart was aligned by navigational coordinates to overlap a base chart of the Northwest Atlantic coast. The outlines of the fishing banks and grounds were rasterized and centroids plotted that correspond to the names of the grounds (Map 2). Fishing grounds from one source constitute one layer. Additional superimposed layers include LMEs and NAFO zones (Map 3), fishing ground names, names and locations of ports, and contemporary nautical charts with depth contours (Map 4). This GIS dataset provides both historical and modern geographic reference points with which to compare these results. Since the geographical distribution of fishing effort follows the geographical distribution of cod, the distribution of historical landings was taken as a proxy for population distribution. Landings were aggregated by day and by season in terms of three nested geographic scales: region, fishing zone, and fishing ground (or hotspot).
Map 2. Fishing grounds mapped in Goode (1887, dark green), Rich (1929, light green), and spawning grounds mapped in Ames (2002), superimposed on GIS map of the Maine Coast. GIS by S. Claesson.

Map 3. LMEs and NAFO zones superimposed on the North American continental shelf. GIS by S. Claesson.

Map 4. Bathymetric contours, names of fishing grounds, and names of ports. GIS by S. Claesson.
**Fishing Regions:** The Gulf of Maine appears to have been divided into distinct but permeable regions traditionally fished by towns and villages along shore. This is caused in a large part by the prevailing southwesterly winds and the sailing ability of traditional craft. Fishermen chose banks that they could sail to and from easily, for which approach and return would not normally require sailing close hauled. This means they generally went to the east, northeast, south and southeast from homeports, but avoided going west or southwest. Since prevailing winds are a function of climate, generations of fishermen from each coastal village sailed to the same banks and over time accumulated a store of detailed knowledge about local marine habitat and the habits of fish. This knowledge capital synergistically reinforced the geographic restrictions of traditional sailing vessels and made local fishermen experts in the regional conditions of the marine ecosystem.

All but a handful of Frenchman’s Bay vessels concentrated fishing effort between Blue Hill Bay and Grand Manan, in fishing zones 3, 4, 5, 7, 8, 10 and 11 (Map 5). Although there are fewer logs for the other customs districts, Machias vessels appear to have fished in the same region, with a few venturing up the Bay of Fundy into Canadian waters. Penobscot-Castine and Bath vessels appear to have fished between Penobscot Bay and Boon Island. The handful of boats and small schooners out of Newburyport and Salem-Beverly fished primarily from Ipswich Bay to Boon Island.

We think this configuration had an unexpected beneficial effect on GoM fish populations. Tables 1 and 2 show that the size and number of vessels fishing in the GoM decreased going from north to south. From Bath to Cape Ann, vessels averaged just 31 tons, and, in Massachusetts, they made up less than 10% of the fishing fleet. Some of the most heavily fished banks in the Gulf of Maine in modern times are Jeffrey’s Bank, 72.5 km from the nearest land, and Cashes Ledge, 124 km from land. Downeast vessels from Penobscot Bay north that fished

Map 5. Fishing region for Frenchman’s Bay and Machias vessels, containing zones between Blue Hill Bay and Grand Manan. GIS by S. Claesson.
the GoM heavily rarely visited Jeffrey’s Bank and Cashes Ledge. Sailing in that direction was difficult and fishermen likely had little knowledge of those grounds. For fishermen south of the Penobscot who could reach them more easily, Jeffrey’s Bank and Cashes Ledge were at or beyond the outer edge of where the risk-averse would comfortably or safely fish, and risk-takers who wanted to maximize profit entered the distant water fleets that increasingly concentrated around Cape Ann. This means that fishing pressure on Jeffrey’s Bank and Cashes Ledge was low. Technology and human behavior combined to make them defacto marine protected areas, which likely served to replenish stocks fished harder elsewhere in the GoM.

**Fishing Zones:** Deepwater fleets recorded daily latitude and longitude to and from distant water banks and occasionally made observations while fishing. This makes their landings easy to map. However, only 30% of the cod landed in the GoM could be attributed to a particular geographic area. Frenchman’s Bay captains who navigated the GoM by leadline, landmarks and bearings, and time traveled were laconic in their record keeping. Risk-averse skippers likely treated a fishing trip as we treat the drive to work. They didn’t think about it. Many went home for church, some to vote in local elections or to get in their hay, and vessels ducked into nearby ports during bad weather. Most trips were short, routine, and didn’t require diligent record-keeping, since navigation was memorized. Captains occasionally noted the names of individual fishing grounds in daily entries, but local names are often repeated up and down the coast. Rich locates “Duck Island Grounds” near Boon Island off the coast of York ME, but the “Duck Island Grounds” the Frenchman’s Bay fishermen referred to is the one near Mount Desert. There are three “Long Island Grounds,” and four “Middle Grounds.” We had to distinguish the grounds actually mapped in GIS from the grounds the Frenchman’s Bay fishermen actually described. Moreover, grounds were frequently identified by landmarks alone and not by name.

W.B. Leavenworth, who sailed those waters on traditional gaff-rigged sailing craft, developed a method of mapping vessel positions from log entries based on sailing knowledge and dead reckoning. The result was a set of fishing zones that corresponded to the context of the logs, homeport and vessel sailing ability (Map 5). Thus the zones reflect local fishing patterns. Figure 1 maps landings by fishing zone from 1861 to 1864. Catch and effort shifted geographically throughout this region over the four years, a fact that is difficult to interpret. No historical or cultural reason explains the shift nor does current scientific knowledge of cod migration suggest an answer. It is possible that geographic fluctuations in migratory prey species such as herring and menhaden caused similar fluctuations in cod landings, although this cannot be proven. However, catch per vessel is remarkably consistent across region and zone over the four-year period (Chart 2).

This system allowed us to aggregate landings by combinations of zones to reflect larger patterns within regions. Zones 3,4,5,8, and 10 are all close to shore, within the comfort range of a 25-ton vessel. These zones admitted dayfishing. We call this inshore zone group Small Boat Grounds. (Although zone 5, Approaches to Frenchman’s Bay and Blue Hill Bay, appears to be an offshore according to the map, shore breezes allowed vessels from Frenchman’s Bay and Blue Hill Bay to safely dayfish along its northern edge and still make it home at night. No one
Figure 1. Contour map and landing by Fishing Zone, 1861-1864

Chart 2. Fishing Effort on Fishing Zones, 1861-1864, with overall trendline.
appears to have fished much in Zone 9, between Moosabec and Machias.) Offshore zones 7 and 11 are called the Outer Grounds. Vessels fished here for several days or weeks at a time. Table 4 shows that 91% of Frenchman’s Bay landings came from Small Boat Grounds; and Chart 3 shows daily distribution of inshore and offshore landings. The frequent spikes in landings are caused by the religious and cultural tradition of resting on Sunday. Most vessels fishing inshore found a harbor on Sunday. Log entries at sea on Sunday mention that all hands reading, sleeping, smoking or mending nets.

**Fishing Grounds or Hotspots:** Fishing grounds provide the best spatial resolution for landings, but some of them are only a few acres across, and only Bank Comfort appeared to have supported an independent fishery, that is, a few vessels which fished there for an entire trip. Since Bank Comfort catch

<table>
<thead>
<tr>
<th>Year</th>
<th>Small Boat Grounds</th>
<th>Outer Grounds</th>
<th>% inshore</th>
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</thead>
<tbody>
<tr>
<td>1861</td>
<td>1613048</td>
<td>188206</td>
<td>89.55%</td>
</tr>
<tr>
<td>1862</td>
<td>704026</td>
<td>36764</td>
<td>95.04%</td>
</tr>
<tr>
<td>1863</td>
<td>391518</td>
<td>43625</td>
<td>89.97%</td>
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<td>1864</td>
<td>692399</td>
<td>76302</td>
<td>90.07%</td>
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<tr>
<td>1865</td>
<td>132962</td>
<td>5152</td>
<td>96.27%</td>
</tr>
<tr>
<td>total</td>
<td>3533953</td>
<td>350049</td>
<td>90.99%</td>
</tr>
</tbody>
</table>

Table 4. Comparison of inshore and offshore landings by Frenchman’s Bay vessels, 1861-1865.

Map 6. Some fishing Grounds or hotspots in Blue Hill Bay and Frenchman’s Bay, showing aggregate catch in 1861. Note the landings in Bass Harbor and Cranberry Isles Harbor. The only ground mapped by Goode or Rich is Martin’s Ridges. Map, a composite of historic US Coast Survey Charts from the 1860s, by K. Alexander.

Chart 3. Daily landings on Small Boat Grounds (blue) and the Outer Grounds (red). 1861.
is aggregated in offshore Zone 7, its contribution to total landings is minimal. At this scale it is clear that a few cod were landed on many little grounds not very far from shore (Map 6). These results reiterate that the codfishery from Blue Hill Bay to Grand Manan was largely an inshore fishery. However, at this scale the average distance of fishing grounds from shore appears to increase slightly from 1861 to 1865 (Chart 4), as does the distance of fishing grounds from home port between from 1861 to 1864. A change in licensing in 1865 made that year exceptional in several ways that will be described in the final section of this report.

From locations described by ranges and bearings in the logs we have identified 37 GoM fishing grounds not in Goode or Rich, and documented 10 harbors in which cod were landed by vessels at anchor. These hotspots have been added to the GIS dataset of 226 fishing grounds described by George Brown Goode (1887) and Walter Rich (1929), 88 of which were fished by Frenchman’s Bay vessels. We call the former Loggrounds and the latter Richgrounds. Map 7 shows the centroids for the Loggrounds with the Richgrounds in the same region. Loggrounds are closer to shore (9.27 km vs. 22.59 km on average) and many are well within bays. Many appear to have been small local hotspots separated by just a few miles. Captain Edward Swett, in the log of the boat Wasp, 6.7 tons out of Gouldsboro, distinguished 12 separate hotspots in Pleasant Bay at the mouth of Indian River, five of them around Shipstern Island. Placentia Sound, Swan’s Island Grounds, Lighthouse Piece, Mackerel Cove and Green Island Reef all lie at the mouth of Blue Hill Bay. While none of these hotspots alone contributed much to overall landings (Map 6), their aggregate contribution was significant. From 1861 to 1865, fishermen visited slightly more Loggrounds than Richgrounds, but landed slightly fewer cod on them (Table 5). This may indicate that cod were once spread more or less diffusely closer to shore, and concentrated on known grounds farther out.

Chart 4. Landings related to distance from shore, Frenchman’s Bay fleet, 1861-1865.
Names for some of these new spots have been found in historical and genealogical literature. Ralph Stanley, Maine wooden boat builder and descendant of Cranberry Isles Captain Enoch Stanley of the Waterwitch, 1862, and the Rozella, 1864, has generously shared his knowledge of local spots once fished by oldtimers. Aaron Smith of Jonesport, descendent of Barney Beale, has also shared fishing knowledge and charts compiled in the past by family members. Linking source material has enabled us to identify uncharted fishing spots with greater precision, or occasionally to attach a name to a one described in the logs by range and bearing. For the remainder we resorted to the old practice of naming the spot after a nearby landmark.

The most prolific fishing ground discovered in the logs, and at 34.2 km the farthest from shore, was the ledges within 5 miles of Mt. Desert Rock, which we call, with little imagination, Mt. Desert Rock Grounds. Although Rich describes Clay Bank 7 miles to the SSW of Mt. Desert Rock, this is not where Frenchman’s Bay vessels fished. Most fished within miles of the Rock on all sides. In good weather, small vessels sailing out of Frenchboro, Long Island, or

Table 5. Comparison of Loggrounds and Righgrounds, 1861-1865.

<table>
<thead>
<tr>
<th>Year</th>
<th>Grounds Discovered in Logs</th>
<th>Grounds in Goode and Rich</th>
<th>% landings, grounds discovered in logs</th>
<th>% number, grounds discovered in logs</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Catch</td>
<td>Number of grounds</td>
<td>Catch</td>
<td>Number of grounds</td>
</tr>
<tr>
<td>1861</td>
<td>242664</td>
<td>41</td>
<td>281896</td>
<td>26</td>
</tr>
<tr>
<td>1862</td>
<td>99974</td>
<td>32</td>
<td>100549</td>
<td>22</td>
</tr>
<tr>
<td>1863</td>
<td>65923</td>
<td>18</td>
<td>57403</td>
<td>16</td>
</tr>
<tr>
<td>1864</td>
<td>99667</td>
<td>13</td>
<td>133703</td>
<td>18</td>
</tr>
<tr>
<td>1865</td>
<td>20091</td>
<td>5</td>
<td>12986</td>
<td>4</td>
</tr>
<tr>
<td>total</td>
<td>528319</td>
<td>109</td>
<td>586537</td>
<td>86</td>
</tr>
</tbody>
</table>
Cranberry Isles could make Mt. Desert Rock safely in a long day trip, and it was worthwhile. In 1861, 89,125 cod were landed there. Today, no commercial codfishery exists in the region except for a vestigial effort around Grand Manan.

**Project Results:**

*Identified Fishing Regions that correspond to the sailing ability of vessels in prevailing winds, the economic strategy of fishermen, and accumulation of local knowledge systems.*

*Described 13 Fishing Zones between Monhegan and Grand Manan that aggregate landings from individual grounds as well as reflect the fishing patterns of localities.*

*Discovered 37 new fishing grounds between Blue Hill Bay and Grand Manan (Loggrounds) not known to Goode and Rich (Richgrounds) that lie closer inshore.*

*Aggregated seasonal and daily landings for the Frenchman’s Bay fleet by region, zone and ground.*

*Mapped Loggrounds, Richgrounds and Fishing Zones in GIS for geographic display of data.*

*Showed that the Frenchman’s Bay fishery in the Gulf of Maine from 1861 to 1865 was primarily an inshore fishery on small fishing grounds and hotspots, the majority of which were within sight of land. Offshore landings were concentrated on known fishing banks.*

*The pattern of landings and fishing effort suggest that cod were extremely abundant near shore from Blue Hill Bay to Grand Manan in the 1860s. Although they concentrated in local hotspots well known to fishermen, landings suggest a diffuse distribution of cod along shore, the locus of which appears to have shifted periodically up and down the coast.*

**Variation in Seasonal Weight of Cod:** With the exception of the Grand Banks fishery, inshore and offshore cod fishing during a season was conducted in two or more separate trips, called fares. Fishing agreements sometimes recorded 5 or more separate fares for Gulf of Maine vessels, however, only 22.71% of Frenchman’s Bay fishing agreements listed the weight of cod per fare. Although the data is thin, knowing where and when the cod were landed allowed us to plot average fish weight aggregated over location per month (Figure 2). Only data from vessels
with weight breakdowns by fare were included since seasonal data would have dampened variations in the signal.

It is known today that cod travel in loose schools based on fish size. They migrate on and offshore during the year and today there is some mixing between Gulf of Maine, Georges Bank and Scotian Shelf cohorts. In the past, however, fishermen described numerous distinct schools that could be distinguished by size, coloration and migration patterns as they appeared along the coast at different times of the year. Early Fish Commission scientists corroborated these observations and even postulated a large subspecies of GoM cod, Gadus morhua Americanus, with denser flesh than its Newfoundland counterpart. Modern trawl and tagging surveys reveal none of this complexity, and these observations have been largely discounted today. However, Ted Ames’ work identifying once-prolific spawning grounds, now barren, suggests the extent to which strains of spawning stock may have been lost. There is no modern counterpart to these data we present, yet we believe that they, too suggest a much more complicated sub-structure for Gulf of Maine cod.

Column 1 in Figure 2 shows weight of cod per day aggregated by Region. From Blue Hill Bay to Grand Manan, overall weight decreased during late spring, summer and early fall and increased at the end and beginning of winter. This conforms to scientific observations of GoM cod populations, in which smaller fish come near the coast to feed during warmer weather, and larger fish arrive to spawn in the spring and fall. However, when viewed year to year, this pattern fluctuates. Average weight drops in November in 62 and 64, and spikes much higher in 63. That year, spring cod averages 30 lbs and fall cod 35lbs. Large cod appear to have remained on the grounds until May the next year.

Column 2 compares Small Boat Grounds and the Offshore Grounds. It confirms that the average weight of cod in this region is largely based on catch from Small Boat Grounds. Although data for the Offshore Grounds are meager, they suggest that offshore cod were generally, although not always, larger. This agrees with modern findings and suggests that the average weight of cod based on Frenchman’s Bay data may be biased towards inshore averages and, therefore, low.

Column 3, however, looks like a crazed wiring diagram. The overall average weight of cod aggregated by Fishing Zones (7) and combinations of Zones (3) fluctuates between 5 and 15 lbs for most areas, with a low of 2.5 lbs for Zone 4, Frenchman’s Bay, and an off the chart high of 48.22 lbs for the composite of Zones 8 and 10, Schoodic to Grand Manan in the spring of 1863. The chart for 1861 indicates that the average size of cod, based on landings, is reversed in Zone 3, Blue Hill Bay, and Zone 4, Frenchman’s Bay. Large cod appear to have come into Frenchman’s Bay in May and were replaced by juvenile cod in October, while in Blue Hill Bay a roughly uniform population of smaller adults was replaced by larger cod in late October. Interestingly, the size composition in Zone 5, Approaches to Frenchman’s Bay and Blue Hill Bay, appears to roughly follow the trend for Blue Hill Bay. Average cod weight for 1862 also fluctuates between 5 and 15 lbs for the most part with lows of 2.5 lbs occurring in Frenchman’s Bay in June, August and September. Zone 8, Schoodic to Moosabec is not much fished this year by vessels reporting weight per fare. Eighteen-sixty-three is notable for the very large cohort appearing in Composite Zones 8 and 10 from late May to early July, already noted in the overall average.
Figure 2. Charts of average weight of cod per month by region, inner and outer grounds, and zone (including composite zones)

Column 1.
GoM-Blue Hill Bay to Grand Manan

Column 2.
Small Boat Grounds, Outer Grounds

Column 3.
Fishing Zones: 3, 5, 6, 7, 8, 9, 10, 11, 12, 13

Aggregated average weight of cod

Mar Apr May Jun Jul Aug Sep Oct Nov
Mar Apr May Jun Jul Aug Sep Oct Nov
Mar Apr May Jun Jul Aug Sep Oct Nov
Otherwise fish size fluctuates between 5 and 15 lbs. Larger cod over 15 lbs come into Zones 10, Inner Grand Manan, 11, Outer Grand Manan, and 3, Blue Hill Bay, in 1864, and the 1861 pattern for Blue Hill Bay appears to repeat this year. Unfortunately, no corresponding data exists for Frenchman’s Bay in 1864. These results only make sense of they depict different age cohorts that replace each other in particular geographic locations in order to feed or spawn. If this is true, they supply the first quantitative evidence of this phenomenon, supporting 19th-century observations of fishermen and early scientists who described many cohort of cod varying widely in size, which once coexisted in the GoM. We continue to look for comparable modern data and suitable analytical tools to explain this dataset.

Project Results:

Seasonal variations in cod size appear to reiterate modern conditions at the regional level overall, and for inshore and offshore populations. The average size of cod is larger during winter than in late spring, summer, and early fall; and cod are larger offshore than inshore. However, rapid, abrupt seasonal changes in cod size within all fishing zones each year and in aggregation over five years suggest that today’s more uniform population was once a disparate collection of different age cohorts that moved on and off shore or migrated independently along the coast to feed or spawn.

FURTHER DISCUSSIONS:

Sustainability: The question of sustainability comes up as it did in the Scotian Shelf study. There, we found that the hook and line fishery in the 1850s was not sustainable under the conditions that obtained at the time. The Scotian Shelf cod population was overfished by 1859, and that fact was noted by the Nova Scotia Provincial Legislature a few years later. For the Frenchman’s Bay fishery, we could not assess sustainability in the same way for reasons discussed earlier. No unit of effort exists, total removals can only be estimated for one year, and the time series is too short, spanning only five years. In addition, 1861-1864 are the Civil War years, a time of great national upheaval which both stimulated and depressed the codfishery. While Maine fishermen do not appear to have enlisted in the Union Army in great numbers, they may have replaced Cape Ann fishermen, who went to war or entered the factories to produce war goods, in the deepwater fleet. A few Maine captains expressed concern about Confederate commerce raiders, but they don’t appear to have changed fishing patterns during the war. Cost rose for provisions, ships stores and, particularly, salt, but the price of cod per quintal went from $3.00 in 1861 to $8.00 in 1864 and 1865. We expected to see a jump in fishing effort reflecting that jump in market price, but we did not. Chart 2 shows that effort is remarkable consistent over all fishing zones during the four-year period of the War. Although distance from shore and homeport increased slightly at the smallest level of resolution, fishing grounds or hotspots, indicating that telltale overfishing may have been occurring inshore, not enough data exist to make a clear case.
A Delury graph of cod landed per man-day from Blue Hill Bay to Grand Manan shows a positive trendline from 1861 to 1865, suggesting that the fishery was sustainable (Figure 3A). However the trendline from 1861 to 1864 declines very slightly (Figure 3B). This is explained by human behavior. During the 1800s, the question of the cod bounty raised as much political ire as the question of farm subsidies does today. Senators and Representatives from New England states fought tooth and nail against its repeal even though the balance of power in Congress had shifted to the Midwestern and Western states. The cod bounty was not repealed during the Civil War, but in 1865, because ships had grown rapidly in size during the past 20 years, regulations standardizing vessel measurement changed. Under the new system, the licensed tonnage of fishing vessels dropped about 40%, and the average tonnage of the Frenchman’s Bay fishing fleet dropped from 40 tons in 1864 to 23.7 tons in 1865. Because the subsidy for salt cod was based on tonnage, it was slashed across the board, and the Frenchman’s Bay fleet dropped by 38 vessels. “Bounty catching,” the fishing strategy of choice for profit minimizers, was no longer profitable. In 1866 the bounty was repealed. A decrease in fishing pressure caused the sharp increase in catch per man-day in 1865, and may have, at the same time, protected the stock from overfishing. However, this is speculation. Even though the market price for salt cod more than doubled from 1861 to 1865, we see no clear evidence of damage to this fishery. Circumstantial evidence suggests that a high level of landings may have been sustainable over long periods of time. We are coming historical records for other GoM catch statistics to investigate this question further.
**Ecosystem implications:** What did 78,600 mt of cod eat in the GoM in 1861? What are the ecosystem implications when the target for a restored population today differs by less than 10% from the amount of cod landed 150 years ago? Ecosystem components and processes appear to have been profoundly different. Fishermen and other observers left accurate descriptions of conditions in the past that can be used to recover ecosystem information.

Although ecology did not yet exist as a science in the 1860s, the relationship between marine predator and prey species was well known, and the importance of bottom conditions as species habitat was better understood than until just recently. To a much greater extent than in the offshore fisheries, Gulf of Maine captains observed and noted the relationship between bait-fish like herring (spelled phonetically “herron”) and menhaden (“pogies”) and cod. Many logs contain descriptions of observed estimates of “bate” and “fish” (meaning cod). Signs of baitfish were important to fishermen for two reasons. First, most of the Maine inshore fleet caught their own bait whenever they could. Alternately, they dug clams, or bought bait from the weirs lining the rivers and bays. Catching or digging bait cut costs. Secondly, fishermen appear to relate the abundance of bait to the abundance of cod and alter fishing strategy accordingly. In 1828, the town of Gloucester MA voted in Town Meeting to limit yearly catch of lobsters in Gloucester Harbor to 10,000 in order to preserve the inshore codfishery by maintaining lobsters as food for cod. Particularly in the deepwater fleet, some daily log entries give the depth and composition of the ocean floor where conditions indicated the likelihood of finding cod. According to the entries, cod were more likely to be found on small rocks or pebbles, called “rough bottom,” and on deepsea coral, colloquially named after fruit and vegetables (“pumpkiny bottom”) or shellfish beds (“rough mussel bottom”). To them it would have come as no surprise that destroying bottom habitat would have a dramatic effect on the fishery.

Species including right whales, sturgeon and halibut had disappeared commercially from most inshore grounds by the 1860s, but vigorous fisheries existed for mackerel, herring as well as hake and other groundfish species besides cod. The first lobster canneries opened in the 1840s. The GoM ecosystem in the 1860s was still enormously productive after more than 200 years of European style fishing for many different species. Coastal communities had long attempted to preserve the abundance of valuable, high trophic level predators by maintaining high levels of prey through regulation. When ecosystem functions were redundant and vigorous, fisheries were not a zero sum game.

**Conversion factor:** The question of conversion factors in historical marine ecology deserves more attention that it has received. We convert dressed, salted and dried cod measured in quintals to metric tons live weight for meaningful comparison with today’s estimates. Here we employed the same dry weight to live weight conversion factor we used in 2005 (4.9), derived empirically by Canadian DFO scientists in the 1950s. With that conversion factor, Scotian Shelf cod landed in the 1850s were three times larger than their descendants today. Gulf of Maine cod in 1861, however, appear to be only 7% larger than in 2000. Since our 2005 paper was published we have found a number of additional conversion factors for dry cod on the flakes to live (round) cod just out of the water in historical literature. All different, but lower, and they decrease estimates of live weight by as much as 40%. Because they apply to different size fish, in
different seasons, different localities, different climates and even using different qualities of salt, because controlled dessication varied considerably according to the intended market, and because we know little about how most such factors were derived, it is difficult to know how to employ them today. We are currently working on a paper summarizing what we have learned and suggesting options, such as calculating a range of probable weight, or estimating the uncertainty in converting from one scale to another. It’s worth noting, however, that scaling down by a factor of two does not change the order of magnitude of these results or the nature of these conclusions.

**Report on preliminary grant, and future work:** Funding from a NH Sea Grant Preliminary Grant in 2006 allowed landings data from the Maine State Fish Commission Reports, 1867 to 1965, to be entered into databases for analysis. Species include: herring, salmon, alewives, shad, bass, smelt, sturgeon, cod, crab, lobster, halibut, menhaden, sardine, scallops, eels, mackerel, skate, sea urchin eggs, swordfish, squid, tuna and oysters. Although reporting standards were uneven and data collection spotty (time series for many species begin after 1880), these reports still provide data on 22 species performing different ecosystem functions at different trophic levels in the Gulf of Maine over nearly 100 years. When combined with data from the US Fish Commission Reports and Bulletins being extracted and collated now, the resulting time series will give unprecedented information on long-term ecosystem change. Funding from the Moore Foundation currently supports collating data for 12 of the 22 species, beginning with cod. The time series for cod will be finished by Christmas.


PROFESSIONAL DEVELOPMENT:

Graduates:
Lesley Rains, MA in History awarded May 2007.

Graduate Students:
Stefan Claesson, Ph.D. Candidate in Natural Resources
Catherine Marzin, Ph.D. Candidate in Natural Resources
Emily Klein, M.A. Candidate in Natural Resources

Visiting Scholars:
(2006) Dr. Dmitry Lajus, Department of Ichthyology and Hydrobiology at St. Petersburg State University, Russia, Fulbright Scholar, 2006, working on collaborative topics comparing historic White and Barents Sea cod and salmon fisheries with those in the Gulf of Maine.
(2006) Dr. Julia Lajus, Department of History and Department of Marine Biology, European University of St. Petersburg, Russia, received the Breuninger Fellowship in Environmental History, a prestigious National Award in Russia, to compare US and Russian Fish Commission and Fisheries Expositions in the late 19th century.

Professional Appointments:
Dr. Matthew G. McKenzie (Ph.D. 2004), Department of American Studies, University of Connecticut, Avery Point Campus.
OUTREACH IMPACTS:

Public or Academic Presentations:
“Historical Perspectives on the Contemporary Crisis in the Cod Fishery,” Ocean Policy Seminar at Bates College, Lewiston, ME (W.J. Bolster) Jan 2004;
“What is the Gulf of Maine Cod Project?” York River Association, York, ME (K.E. Alexander) Apr 2004;
“19th-Century Codfishing in the Gulf of Maine,” Maine Historical Society, Portland, ME (W.B. Leavenworth), May 2004;
“Our Fisheries Crisis in Historical Perspective: How Many Cod Lived on the Scotian Shelf in the 19th Century?” UNH Retired Faculty Seminar, Durham NH (W.J. Bolster) Sep 2004;
“Retelling the History of New England and the Sea as if the Oceans Mattered,” University of Connecticut, Avery Point, CT (W.J. Bolster) Mar 2005;
“Retelling the History of New England and the Sea as if the Oceans Mattered,” Cape Cod Museum of Natural History, Brewster, MA (W.J. Bolster) Apr 2005;
“Opportunities in Marine Environmental History” New England Marine Environmental History Conference, Woods Hole, MA (W.J. Bolster) May 2005;
“Ship in the Forest,” Old Berwick Historical Society, South Berwick, ME (W.B. Leavenworth) Mar 2006;
“Trout Fishing on Cape Cod,” Massachusetts Audubon Society, Wellfleet, MA (M.G. McKenzie) Jun 2006;
“19th-Century Codfishing in the Gulf of Maine,” Boothbay Historical Society, Boothbay, ME (W.B. Leavenworth), Jul 2006;
**Media Presentations (Documentary Films):**

Maine Public Broadcasting’s production, Quest, featured an interview with Rosenberg for the 2004 episode 104, “Gulf of Maine;” Leavenworth and Alexander acted as consultants for background material on historical marine ecology.

In 2005 Rosenberg, Bolster and Leavenworth were interviewed for a documentary on overfishing by independent film producer Bailey Pryor, and in 2007 provided material on 19th-century codlandings in the Gulf of Maine. The film will be aired in 2008.

Also in 2005, Alexander provided background information to Jean Michel Cousteau’s production company, which was researching his film on the National Marine Sanctuaries.

In 2007, with funding from the National Marine Sanctuary Foundation, work began on a film about the historical marine ecology of the Gulf of Maine. Its working title is A Changing World through the Eyes of a Fisherman. David Conover, Compass Light Production Company, Camden ME, is producer. The film will use computer animation to repopulate the water column with large fish and marine mammals to illustrate past abundance evident in archaeological and historical records. The script will be completed by November 1, 2007. Possible venues are National Geographic, NOVA, the American Experience and the BBC.

**Publicity:**

A Census of Marine Life press release for the 2005 “The History of Ocean Resources: Modeling Cod Biomass Using Historical Records,” paper in Frontiers in Ecology and the Environment resulted in more than 20 news articles around the world. This work was reported on CNN, UPI, Reuters, CPI, MSNBC, the Washington Times, and the Kerala (India) Daily New, among others. [The last was particularly gratifying to the historians on this project because Gilbert Westin and Calvin Foster, schooner captains from Beverly, Massachusetts in the 1850s, were quoted in the Indian Newspaper as experts on the fishery.]

Canadian Public Broadcasting produced a report on “The Abundance of Cod on the Scotian Shelf in the 19th-Century,” in which Rosenberg and Bolster were interviewed; Leavenworth and Alexander acted as consultants and were filmed reading logbooks in the Old Berwick Historical Society.

GMCP historical marine ecology featured in:


**Websites:**

Gulf of Maine Cod Project: www.fishhisstory.org;

HMAP: www.hmapcoml.org

**Museum Exhibits:**

From Abundance to Aquaculture: Changes in New England’s Fisheries (2006-2007), exhibit at the Seacoast Science Center, designed by G. Smith.
Conferences (Participation):
Gulf of Maine Mapping Initiative Conference, Darling Marine Center, Walpole ME, Oct 2004 (Alexander);
New England Marine Environmental History Conference, Woods Hole, MA, May 2005 (McKenzie, conference organizer; K.E. Alexander, S. Claesson attending);
NSF Human and Social Dynamics Award Recipient Conference, Washington, DC, Sep 2005 (Rosenberg, Alexander);
NSF Human and Social Dynamics Award Recipient Conference, Washington, DC, Sep 2006 (Alexander, Cooper).

Conference Papers:
“Historical Perspectives on Gulf of Maine Coastal Cod Fisheries,” Conference on the Gulf of Maine Cod Fishery, Island Institute, Rockland, ME (W.J. Bolster) Apr 2005;
“Opportunities in Marine Environmental History” New England Marine Environmental History Conference, Woods Hole, MA (W.J. Bolster) May 2005;


“Opportunities in Marine Environmental History” Ministry of Foreign Affairs, Paris, FR, (K.E. Alexander) Jun 2006;

“Analyzing 19th-century Fisheries Records to Determine the Historical Abundance and Distribution of Gulf of Maine Cod,” Sea Grant Annual Meeting, Portsmouth NH, (W.J. Bolster) Sep 2006;


Posters:


“Mapping Catch and Effort in the 19th-Century Gulf of Maine Codfishery,” Sea Grant Annual Meeting, Portsmouth NH, (Bolster, Leavenworth and Smith) Sep 2006;


Outgrowth Funding:


NOAA Stellwagen Bank National Marine Sanctuary Grant, “NOAA Historical and Cultural Resources (Stellwagen Bank)”, Jul 2004-Sep 2007;


REFERENCES:

Primary Sources:

*Logs and fishing agreements-*

Frenchman’s Bay, Machias, Bath, Penobscot-Castine, Salem-Beverly:
NARA, Waltham MA [RG36 Customs Records (by district name)].
Newburyport: John Duncan Phillips Library, Peabody Essex Museum, Salem MA
[MSS 282, series 12 box 31-35].
Kennebunk: G. Blunt White Library, Mystic Seaport Museum, Mystic CT
[Various call numbers].

*Cod Licenses-*

NARA Washington [RG41 Treasury Dept, Bureau of Navigation
(vessel licenses by town name)]

US Fish Commission Reports and Bulletins, especially-


Secondary Sources:


Illustration on cover and back page from the log of the Bath ME fishing schooner Rainbow, 1854 (NARA Waltham, RG36).

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