An Atlas-based Audit of Fishing Territories, Local Knowledge, and the Potential for Community Participation in Fisheries Science and Management

FINAL REPORT PERTAINING TO SUBCONTRACT 06-028 (6/1/2005 – 5/31/2006) AND REPLACING THE INTERIM FINAL REPORT PERTAINING TO SUBCONTRACT 01-840 (7/1/2001 – 5/31/2005) WHICH WAS SUBMITTED AUGUST 22, 2005

SUBMITTED TO THE NORTHEAST CONSORTIUM SEPTEMBER 14, 2009

Dr. Kevin St. Martin
Department of Geography
Rutgers University
54 Joyce Kilmer Drive
Piscataway NJ 08854-8045
tel: 732.445.7394
fax: 732.445.0006
kstmarti@rci.rutgers.edu

Dr. Madeleine Hall-Arber
Sea Grant College Program
Massachusetts Institute of Technology
292 Main Street, E38-300
Cambridge, MA 02139
tel: 617.253-9308
fax: 617.252-1615
arber@mit.edu

ABSTRACT

The project's main objective was to produce an atlas that would document those areas and resources upon which fishing communities in the Northeast depend most. A series of maps were produced that make clear "who to ask" when proposing a collaborative research project grounded in a specific location or who would be most impacted by a particular area-based management initiative. In addition, the maps were designed to complement a participatory research process where community researchers took them into fishing communities and used them to interview fishermen. Through this process the maps were not only vetted and amended by fishermen, they were also used to assess the nature of fishing communities' territories, their local environmental knowledge, and their propensity to work cooperatively with fisheries scientists and managers; the interview process gave texture and meaning to each community's territory.

Making the maps involved analyses of NMFS data sets and the development of a GIS-based methodology to depict fishing communities and their territories. The analyses revealed a spatial clustering of fishing trips by peer groups of fishermen. The potential of these novel maps relative to fisheries management appeared obvious to not only fishermen to whom they were presented (e.g. interested to maintain rights to particular fishing grounds) but, in subsequent presentations, to fisheries scientists and managers (e.g. interested to integrate "human dimensions" into management). A total of 57 interviews with fishermen in ports from Chatham, MA to Port Clyde, ME were performed. Those interviewed discussed the nature of fishing communities, the areas upon which they most depended, their knowledge of these locations, and their ideas for management.

While the research revealed a wide range of community-territory practices and understandings, it made clear that fishing communities consistently work in many of the same locations over time and maintain a shared environmental knowledge of those locations. This suggests that most fishing communities in New England (even mobile gear fleets) have considerable knowledge of specific environments and are amenable to area-based management provided spatial/community impacts are taken into account.

INTRODUCTION*

The assessment and management of marine resources is an increasingly spatial affair [1, 2]. For example, fisheries management practices are increasingly relying upon area-based methods [3, 4, 5]; impact analyses of energy and industrial offshore development primarily focus on spatial displacement and access to place-based resources [6]; and marine protected areas (MPAs) are widely viewed as a key resource management tool [7]. As a result, the marine environment is rapidly becoming a collection of habitats, natural processes, multi-stakeholder practices, and use rights that are tied to places.

This "spatial turn" is reflected in recent increased efforts to collect geo-coded environmental information [8]. Remote sensing, tracking technologies, and global positioning systems are rapidly making visible what had previously been hidden or inaccessible. Living and mineral resources, marine habitats, environmental conditions, sea bottom morphology, and species ranges and interactions are all increasingly documented and mapped. Indeed, geo-technologies are revolutionizing marine resource management and are suggesting the technical possibility of comprehensive marine spatial planning (MSP).

In fisheries, single-species stock models, largely devoid of environmental parameters, are giving way to more complex ecosystem-based approaches that foreground not only environmental diversity but also species interactions (including non-commercial fish species, marine mammals, turtles, etc.), tradeoffs between sectors (including commercial fishing, recreational fishing, tourism, conservation, etc.), as well as the multiple uses of fisheries habitats by a variety of stakeholders. In addition, fisheries management, once essentially numeric and a-spatial [11], is experimenting with a variety of spatial management tools such as "rolling closures", zoning, and marine protected areas. Finally, participatory science and management models that solicit the environmental knowledge of fishers and engage them more directly in decision-making processes are slowly emerging. There is an evident shift in fisheries from single-species/single-sector models to more comprehensive spatial and ecosystems-based approaches [12, 13].

Such a shift toward spatial understandings and spatial management/planning will also require a shift in technical methods, in particular, an increased reliance upon GIS [14, 15]. For example, ecosystems-based approaches for either fisheries management or MSP are invariably paired with GIS methodologies within articles, workshops, and management initiatives that promote the former [e.g., 16, 17, 18]. GIS is quickly becoming the forum where marine spatial data is aggregated, planning options are visualized, impact analyses are performed, and regulatory zones are established and mapped.

In the case of fisheries, the challenge of producing new streams of geo-encoded data is already being met by a wide range of initiatives that include the deployment of remote-sensing technologies [e.g., 20], finer scale and more localized data collections [e.g., 21], as well as the incorporation of local ecological knowledge of fishers into existing systems of assessment and management [e.g., 22, 23]. The advent of new layers of data is opening fisheries science and management to new assessment and management possibilities that range from the "discovery" of local fish populations and their revival [24] to the use of rotational area closures [25].

---

* What follows incorporates text from St. Martin, K. and M. Hall-Arber. 2008. "The Missing Layer: Geo-technologies, Communities, and Implications for Marine Spatial Planning" *Marine Policy* 32: 779-786.

While the bio-physical environment is being mapped in ever greater detail and incorporated into systems of spatial analysis, the "social landscape" of fisheries and fishing communities remains largely undocumented. Detailed information concerning which fishing communities utilize, rely upon, and maintain local knowledge concerning which areas of the marine environment is only vaguely known. This is symptomatic of representations of the human dimensions of the marine environment generally. Mining, shipping, energy development, recreational fishing, tourism, etc., to the degree they are mapped, are represented as occurring in locations at-sea but those locations and activities are only rarely linked to onshore locations or dependent communities. There is, then, a "cartographic silence" present within current mappings of the marine environment that threatens to structure decision-making such that communities dependent upon particular marine resources or uses of marine space will be difficult to see and include in terms of either participatory science/management of place-based resources or analyses of the differential impacts of any spatial management (in terms of fisheries see [26]).

Yet, in fisheries as in ecosystems-based management generally, the success of the spatial turn and its acknowledgement of heterogeneous habitats, place-specific flora and fauna, and species interactions across space will require a parallel acknowledgement of a heterogeneous "social landscape" of communities, fishing and other resource-dependent practices, and local knowledge that similarly varies across space [10]. Within a variety of initiatives it is increasingly clear that documentation of and engagement with local communities and resource users is vital if local and area specific schemes are to work. For example, advocates of ecosystems-based approaches in fisheries have suggested that such approaches will require "local participation" [27, 28], obtaining local ecological knowledge from fishers directly will only work in the long-term if fishers are partners in the scientific and management process [22], and marine protected areas (MPAs) appear most sustainable when the variety of local stakeholders are included in their design and administration [29]. Even broad calls for co-management or cooperative research suggest engagements with fishers and other resource users in particular places and from particular communities [30, 31].

In the case of fisheries, where fishing communities are integrated into fisheries management, typically as sites for regulatory impact analysis, they are relegated to terrestrial/port locations [32] and do not appear within the space of natural resource management itself [26]. As a result, the territories, local practices, assemblages, and communities to which fishers might be connected remain largely unmapped and unavailable to increasingly GIS dominated fisheries science and management.[1] This is also an issue beyond fisheries. For example, the impacts and economic multiplier effects of some individual offshore development (e.g., a wind farm) may be calculated for terrestrial locations, but specifically who is displaced by the same offshore development will be difficult to assess because of the absence of any data or map depicting existing or traditional use of offshore locations. Finally, linking port-based communities to the locations at sea that they utilize, know, and depend upon is fundamental to community-level participation and cooperation relative to ecosystem and area-based approaches to marine resource management.

Incorporating the diverse, dynamic, and multi-scalar social landscape of the ocean into planning will require new methodologies and data collection efforts that document the "at-sea" locations, interests, and dependencies of specific communities and groups of stakeholders. If

[1] This is clearly not the case in developing nations and peripheral locations of the first world where local territories are tied to communities, fishing villages are assumed to have traditional resource areas upon which they depend, and co-management is more easily imagined [43].

communities are relegated to terrestrial locations and if they are only considered as sites of impact, their ability to engage in cooperative science, management, restoration of environments, and stewardship of marine resources will be severely limited. In addition, the displacements and dispossessions that will inevitably occur as a result of ecosystem and area-based management of the marine environment (e.g., area closures that overwrite the traditional territories of particular fishing communities) will be difficult to trace or avoid.

PROJECT OBJECTIVES

The project's main objective was to produce an atlas, a collection of maps, vetted and amended by fishing communities that would document those areas and resources upon which fishing communities depend most. The atlas would then serve to facilitate greater cooperation between fishers and fisheries scientists and managers. The maps of various areas at different scales would make clear "who to ask" when proposing a collaborative research project grounded in a specific location or who would be most impacted by a particular area-based management initiative. It would also provide fishing communities with information on "how to respond" to particular area-based management schemes (both fisheries related and otherwise, e.g. windfarms).

The atlas was to map a selection of representative (and diverse) fishing ports/communities from 7 sub-regions within the Gulf of Maine area (based on a previously MARFIN-funded project). In addition, the maps would be designed to complement a participatory research process where community researchers would take them into the fishing communities of each sub-region and use them to interview fishermen. Through this process the maps would not only be vetted and amended by fishermen, they would also be used to assess the nature of fishing communities' territories, their local environmental knowledge, and their propensity to work cooperatively with fisheries scientists and managers; the goal was to give texture and meaning to each community's territory. The atlas-based approach worked such that the maps were eagerly discussed, amended, and annotated by fishermen.

The use of community researchers (fishermen and other industry members employed to interview fishermen) points to yet another objective of this research: to facilitate new conversations, attitudes, and initiatives from within fishing communities relative to "their" areas/territories. Might fishing communities develop a greater sense of stewardship once "their" areas are mapped and their stories are linked to those areas? While the resultant interview-based conversations were recorded, transcribed, and coded and have, to date, informed a variety of presentations and publications, there is also evidence that participation in the project itself has fostered innovations from within fishing communities. For example, the Mid-Coast Fishermen's Association in Maine gives credit to the project as the impetus for their formation and subsequent vision for a sustainable trawling fleet based on community supported agriculture principles (see Appendix I).

While the development of a methodology for producing community territory maps was very well received, and the resultant maps were instrumental to the success of the participatory research that followed, the production of a printed atlas was, in the end, not possible. Indeed, because the second contract resulted in a reduction of funding (approx. 30%) and because printing static maps grew ever more tangential as the project advanced (see Methods), the goal of a printed atlas was abandoned. Nevertheless, the maps used in the project exist in digital form (as large format PDFs) and are available upon request or through the project's webpage.

Finally, the project's objectives for the distribution of results and publication have exceeded original expectations. Indeed, the project has proven popular in both national and

international venues where it is being hailed as an example of how "human dimensions" might be integrated into MSP and/or EBM (see Impacts and Applications). While the distribution of the original maps via a printed atlas was not achieved, the methodology developed for the project makes sense across a variety of interests and applications, and is being distributed through a series of well received presentations and publications.

PARTICIPANTS

In addition to the project principal investigators and their student assistants, participants included workshop attendees representative of various communities/regions and "community researchers" who worked interviewing fishermen from a variety of ports from Chatham, MA to Port Clyde, ME.

The original proposal aimed to engage participants in seven regions of coastal Massachusetts, New Hampshire, and Maine (based on MARFIN-sponsored research). In each region, workshops were to be used to inform and recruit community researchers. Due to reduced funding, the project relied upon smaller meetings with prospective participants and one region-wide workshop in May 2005 attended by 15 prospective community researchers. Through this process the project recruited 7 community researchers who worked in key ports within 5 of the original 7 regions. They performed a total of 57 interviews that incorporated 59 fishermen into the project.

The community researchers were all trusted industry members with either professional or personal connections to fishing communities. While we initially invited a mix of fishermen and industry advocates (e.g. a researcher working for NAMA and the president of the Gloucester Fishermen's Wives Association) as well as men and women to be community researchers, our most active researchers were all women, only one of which was currently employed as a fisherman. While this was an unplanned deviation from "fishermen interviewing fishermen," the project benefited from the productive rapport each of the interviewers developed with their respective interviewees. This rapport, we believe, was a result not only of each interviewer's skill but also their position as women and as non-fishermen.

Community Researchers:

LOCATION	*PORTS*	*FIRST*	*LAST*	*Address*
MA - Gloucester	Gloucester and satellite ports	**Angela**	**Sanfilippo**	11-15 Parker Street, Gloucester, MA 01930
MA - Gloucester	Gloucester and satellite ports	**Jay**	**Michaud**	25 Ocean Avenue, Marblehead, MA 01945
MA - Gloucester	Gloucester and Boston	**Tom**	**Brancaleone**	3 Ocean View Drive, Gloucester, MA 01930
MA - New Bedford	New Bedford and Fairhaven	**Tove**	**Bendickson**	9 Cleveland Street, S. Dartmouth, MA 02748
MA - Cape Cod	Chatham, Harwich, and P-town	**Renee**	**Gagne**	P. O. Box 35, W. Chatham, MA 02669
NH - Portsmouth	Hampton, Portsmouth	**Ellen**	**Goethal**	23 Ridgeview Terrace, Hampton, NH 03842
ME - Portland	Saco, Portland, and Port Clyde	**Jen**	**Levin**	200 Main Street, Saco, ME 04072

The fishermen who were interviewed were chosen by each community researcher rather than the PIs of the project. The communities where the interviewees were found were those communities in which the community researcher was embedded, was doing research, or was resident. Each researcher was instructed to seek out "key informants" within their community or group of communities. Appropriate interviewees were those who would be willing to speak on behalf of their community and who were knowledgeable enough such that they were able to detail the spatial/environmental experiences of their community. It was vital that each key informant understand that they would be asked not about their personal "hot spots" but about their peer group's experience and knowledge relative to areas at sea.

A Note about the Politics of Participation:

The project began in late 2002, after a delayed start, with a literature review on participatory methods and analyses of NMFS data. Throughout 2002 and into 2003, representatives of the project attempted to contact potential community researchers and others interested in participating in initial workshops. During this period it was, unfortunately, very difficult to solicit fishermen's participation. We believe that this period leading up to Amendment 13 (to the New England Fishery Management Council's Multispecies Fisheries Management Plan) was a time when fishermen were unable or unwilling to entertain any mapping of their use of the marine environment (as interviewers or interviewees). A common response to the atlas project was that it "would be used against us [fishermen]." Fishermen were afraid that if they revealed the areas important to them, those areas would then be closed to fishing in the Amendment 13 process. Despite the development of a methodology for mapping "community territories" and other advances in the analysis of available data, the inability to get fishermen involved delayed the project significantly.

After Amendment 13 (May 2004), however, there was a change in favor of the project and fishermen were interested to become involved. Amendment 13 changed fishermen's attitudes about revealing where they work. In this context, the atlas project became (to at least some fishermen) a mechanism by which they could document both their history of use of particular fishing grounds and their dispossession from them. Fishermen saw the atlas project as a vehicle for conveying their spatial, territorial, and post-Amendment 13 management concerns. By this time, however, the original award was about to end and most of the funds had to be returned to the Northeast Consortium ($102,272 primarily earmarked for industry participation). Given the late groundswell of interest in the project on the part of fishermen, however, the Northeast Consortium generously disbursed a second award ($50,000) aimed at industry participation. The renewed funding allowed the project to engage nearly 60 fishermen in variety of Gulf of Maine communities.

METHODS

The project utilized both spatial analytical techniques and a participatory research approach to develop GIS data layers depicting the territories of fishing communities that were then interpreted and given meaning by fishermen themselves. It builds upon the PIs' previous GIS research at the NMFS Northeast Fisheries Science Center (where St. Martin held a post-doc position) and extensive ethnographic fieldwork in the New England region (where Hall-Arber has worked on a variety of community-centered research projects).

The first half of the project used existing datasets from the National Marine Fisheries Service (NMFS) and spatial analytical techniques to produce a series of provocative maps depicting community utilization of fishing areas. The second half was a community-based participatory project involving "community researchers" and fishermen that resulted in a

collection of narratives that complemented, explained, and added meaning to the maps. The results from the project, then, include not only a series of vetted maps showing the locations of resource areas important to particular communities, but a qualitative database detailing the boundaries (social and geographic) of fishing communities, their relationship to specific resource areas over time, and the effects of recent legislation on their spatial patterns and practices.

GIS Methods to Map Community Resource Areas

Initial maps of the patterns and territories of fishing communities were produced using vessel trip report (VTR or "logbook") data collected by NMFS since 1994. On a trip-by-trip basis, all fishing vessels engaged in federally-regulated fisheries (that include virtually all commercial species in the Gulf of Maine) must submit VTRs that detail, amongst other things, catch and bycatch (by species and weight), numbers of crewmembers, date and time of departure and landing, type and size of gear, latitude and longitude coordinates of the trip,[2] and vessel permit number. This dataset is unique insofar as it contains geo-coded trip data that can be linked (via vessel permit number) to vessel attributes. For this project, the essential link was between trip location and the declared "principal port" of the vessel. This link allowed us to filter the VTR data by what we considered to be tentative "communities" – combinations of declared principal port and gear type.[3]

We developed code that merged and filtered the VTR and vessel permit datasets found in the NMFS Oracle database for the available years (1994 - 2004). The result was a set of annual tables that could be queried using ArcGIS to map commercial fishing trips by gear type, principal port, crew size, vessel size, etc. The tables excluded VTR records that did not have valid coordinate information.[4] As a result, the dataset, for any query, could be considered only a sample of trips that limited our analysis to relative comparisons. As a rough measure of locational accuracy, we observed that the data tended to be strongly auto-correlated when filtered by principal port and/or gear type (our initial measures of "community") suggesting only minimal misreporting (or a well-coordinated conspiracy of misreporting) by individual fishers.[5]

An obvious spatial clustering emerged from the data when filtered by principal port and gear type, and this became the basis for assuming that community territories might exist (see Appendix II). While different communities exhibited different spatial patterns at-sea, we were encouraged by the degree to which discrete clusters were identifiable and, in many cases, consistent from year to year. Principal component analysis by gear type suggested a high degree of consistency for the period 2002-2004 (see Appendix III); data from these three years were then aggregated and were considered to represent the most recent spatial pattern of commercial

---

[2] Coordinates are actually required for each gear deployment rather than trip. In practice, however, the vast majority of VTRs specify only one gear deployment and, therefore, one set of "trip" coordinates. Where multiple sets of coordinates were available for a given trip, we used only the first pair and considered the data to represent "trip locations" rather than gear deployment locations.

[3] We based our tentative "community" definitions upon many years of research and participant observation within fishing communities of the Northeast. Combinations of principal port and gear type are the main axes along which fishers self-identify and relate to one another.

[4] VTRs were discarded when latitude/longitude coordinates were not included, when coordinates were nonsensical due to data entry mistakes or misreporting, when coordinates did not match official statistical areas (that are also reported), or when coordinates were technically correct but outside of the Northeast region.

[5] This point is important to note given the constant disparagement of VTR data because it is self-reported by fishers.

fishing in the Gulf of Maine. Combining years also provided sufficient data such that we could identify clusters for even relatively small ports with few vessels.[6]

The point maps, however, also made obvious the limitations of using individual trips and point symbols, albeit clustered, to represent community use of resource areas. Discerning a measure of presence by community was difficult because of point overlap as well as community overlap. In addition, while the points indicated trip locations, they did not account for different length trips or crew size, both of which are important considerations when calculating community rather than simply vessel presence.

To address these issues, trip length was multiplied by crew on board to create a new variable called "fisherman days," a measure of labor time. This new variable serves here as a measure of "community presence" in the marine environment that is independent of amount caught or catch value (measures that highlight large vessel locations rather than small vessel, labor intensive, and, typically, inshore locations) [c.f. 33].

We employed two basic methods for visualizing "community presence" at sea. The first was by density mapping that transformed the point data, which we grouped by gear type and/or community, into a continuous variable surface. A Gaussian kernel function was used to create the density surfaces. Each surface was then broken into equal intervals depicting different levels of fisherman days per kilometer for any of several communities as well as all communities together (e.g. Figure 1). The second approach, akin to "home range" mapping of wildlife, utilized percent volume contours (PVC) to outline areas of primary and secondary importance to specific gear types and/or communities (e.g. Figure 1).[7] The PVC outlines were generated using a similar kernel density process but the surface was then contoured such that each contour outlined a percentage of the total number of fisherman days on the map. For the project, 50%, 75%, and 90% contours were used and represented areas of primary, secondary, and tertiary importance to a given community.

Integrating Maps into a Participatory Interview-based Process

The density surfaces and PVCs for specific gear types and communities were then superimposed onto familiar NOAA nautical charts. Other summary information (e.g., numbers of vessels per port, percent trips by season) was also calculated and placed on the charts in the form of pie charts and tables (see Appendix IV). The final charts where then integrated into a qualitative and participatory research design [39, 40]. The recruited community researchers used the maps while interviewing local fishermen.

Each semi-structured interview incorporated a series of three maps depicting fishing patterns by gear type from the level of the Gulf of Maine to the more local level of the fishing community of the interviewee. Interviewees were invited to correct and amend each map and, relative to each, were asked questions concerning community composition, spatial pattern, change over time, and local environmental knowledge (see Appendix V).

Throughout the interviews, interviewees were repeatedly reminded that they should provide information about their community or peer group rather than their personal fishing locations or experiences. This last strategy, along with recent area-based management initiatives

---

[6] Ports/communities with less than four vessels were not mapped for reasons of confidentiality.

[7] Both density surfaces and PVCs were calculated using: Beyer, H. L. 2004. *Hawth's Analysis Tools for ArcGIS.* Available at http://www.spatialecology.com/htools.

(e.g., seasonal closures) that clearly affected some fishing communities more than others, was key to circumventing the reticence of fishers to reveal fishing locations.

The interviews were recorded, transcribed, input into an NVIVO (text analysis software) database, and coded for key themes, concepts, and research interests. Analysis of this database is ongoing by the PIs and graduate students at Rutgers University and has informed several presentations and publications. In addition, interviews from key ports from each sub-region are subject to an ongoing analysis designed to produce narrative descriptions of the issues facing those particular communities. The narratives produced to date are available on the project webpage. Others will be posted as they are developed.

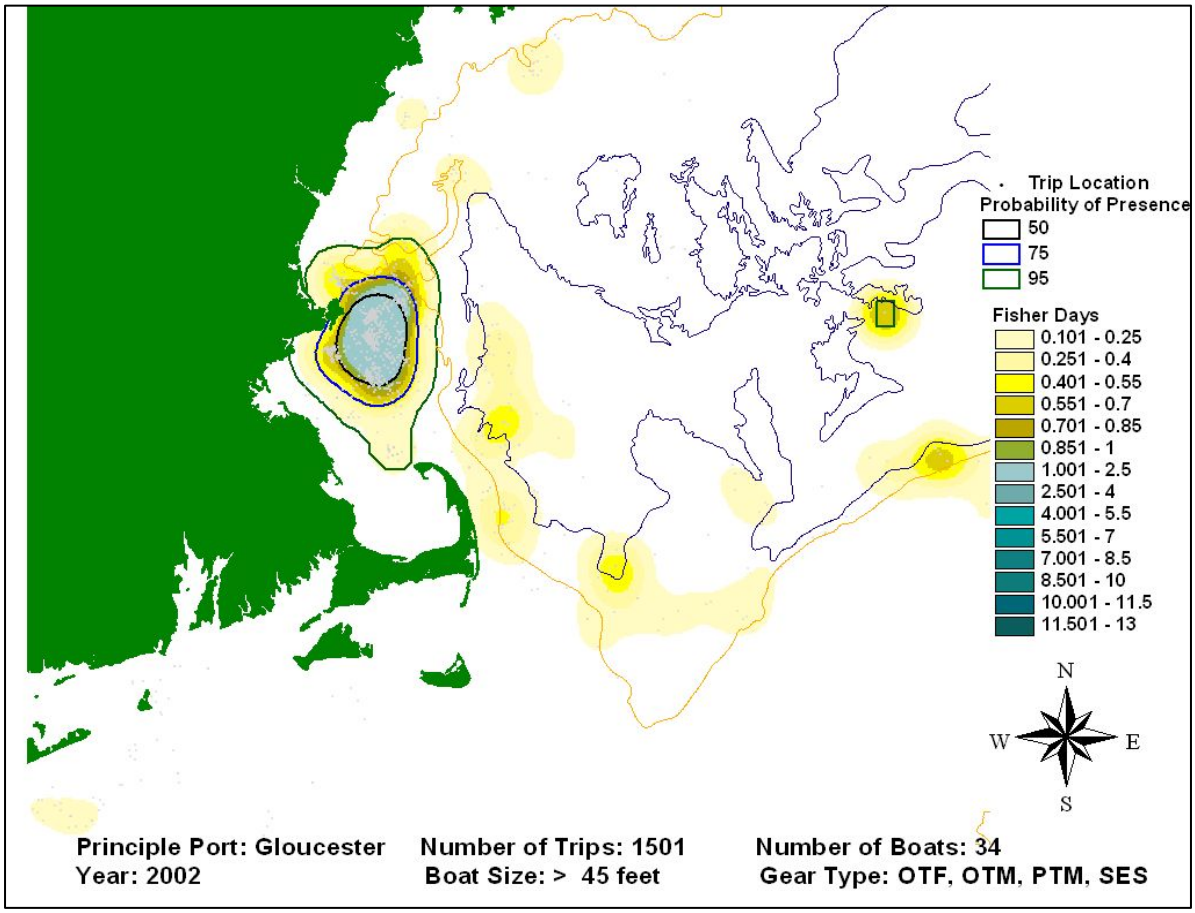


Figure 1. Raster density surface and PVCs based on "fisherman days" variable for small trawler vessels from Gloucester, MA.

DATA

The primary data developed for this project include the following:

- A database of all valid vessel trip locations (linked to vessel principal port) by year derived from NMFS vessel trip report and permit tables. This database, originally developed for change analysis and for mapping the "most recent patterns" of fishing in the Gulf of Maine for the project, has been regularly updated and continues to be useful for mapping and change analysis. The tables are in an ArcGIS DBF format and currently reside on a secured computer at Rutgers University. Given the confidential nature of

individual trips and vessels, this dataset cannot be distributed in its current form. Nevertheless, a website is under development that will allow users to query the data by an appropriate level of aggregation (see Related Projects).

- From the database of trip locations, 43 unique maps were developed for the project. These maps, both general for the entire Gulf of Maine and tailored to each community-based interview, contain considerable annotation in addition to layers derived from trip locations. Summary statistics such as numbers of vessels, average crew size, average catch, etc. by port/community are also included on the maps. These maps have been sent to the Northeast Consortium and are available on the project website.
- The transcribed interviews have been input into an NVIVO (text analysis software) database. There they can be coded and qualitatively analyzed. In addition to a recorded conversation, each interview also produced amended and/or marked up maps. These paper maps are available for qualitative analysis along with the transcribed texts. The database and paper maps reside with the PIs and are being used for ongoing qualitative analysis and comparative analysis with other related projects. The transcribed interviews will be edited and formatted for inclusion into NOAA's Voices from the Fisheries Oral History Database (this will be achieved using workstudy students at Rutgers during the Fall 2009 semester).
- The ongoing qualitative analysis of the interviews is yielding a series of descriptive narratives detailing the issues of concern in select ports throughout the region. Several narratives have been produced as well as related and illustrative summary statistics by port. Existing narratives are being made available on the project website (a graduate student at Rutgers is currently employed to develop these narratives).

RESULTS AND CONCLUSIONS

Below we report upon our experiences implementing the method outlined above as well as representative analyses based upon the responses of fishers. Our goal is to reflect upon the feasibility of producing a data layer representing community territories, and to convey the nature of the qualitative assessments that might accompany such data layers. Given the participatory nature of the project, we necessarily include the goals and objectives of the participants themselves that clearly emerged during project workshops and interviews. In addition, we briefly report upon the general responses of project participants to each of the three charts (representing different scales of experience) used in each interview setting.

In total, seven community researchers interviewed 59 commercial fishermen representing a range of gear types, vessel types, and port sizes.[8] All but four of those interviewed were captains and 46 were vessel owners. All were experienced fishers, with from 15 to 46 years on fishing vessels (averaging 29 years). Gear types included trawl gear on vessels both over and under 65 feet; pots and traps; gillnets and longline; and dredges. Approximately two-thirds of the interviewees fished for multispecies (groundfish) using otter trawls, gillnets or hooks. Eight lobstermen and nine scallop fishermen were also interviewed. All interviews were recorded and transcribed. The resultant database reflects a range of stories at different scales and from a

[8] Fourteen interviewees listed their homeport as Gloucester; 13 were from New Bedford/Fairhaven; five from Portland, ME; one from Boston; five from four different ports in New Hampshire; five from three ports in Maine outside of Portland; six were from Chatham/Harwich and one from New York.

variety of perspectives concerning fishing communities, the places to which they are intimately linked, and the knowledge of those places that they maintain.

From these interviews, there is clear evidence of social-spatial groupings/territories based on gear type and port. The findings suggest that the nature of these territories and the reasons for their formation vary considerably from one community to the next. Some stretch across the entire management region while others are only a few miles from port of origin, some are intensively fished while others only occasionally visited, and some are isolated while others overlap with several other communities. In addition, vessel size and range, knowledge of the environment, species sought, community traditions, season, and market location all contributed to the determination of territories/resource areas.

The variability of the spatial experiences of the communities investigated suggests that they will experience and respond to regulations differently. Indeed, our (and fishermen's) documentation of community territories and their histories highlighted the uneven experiences of fishing communities relative to recent fishing regulations (e.g., "rolling closures" and permanent closures in the Gulf of Maine). Furthermore, many of the interviewees saw their participation in the project as an opportunity to document experiences of, for example, spatial displacement or forced community overlap/competition resulting from area-based regulations. They hoped to legitimate their claims of injustice that they felt were previously dismissed as anecdotal.

While the variability of community territories may not be surprising, we were surprised to find the degree to which interviewees acknowledged and related to them, agreed with their boundaries, pointed to their relative stability, and filled them with stories and knowledge reflecting years of community dependence on specific resource areas.

The Reactions of Fishermen to the Charts

While our focus on the spatial experiences of fishing communities allowed the issue of spatial displacement to clearly emerge, there were many other specific reactions and insights relative to each of the charts and their corresponding sets of questions. The first chart (titled: "Where in the Gulf of Maine do We Fish?") depicted the presence of fishers using the same gear type as the interviewee (Figure 2).

Figure 2. Here a fisherman amends a chart showing the locations of vessels with dredge gear in the Gulf of Maine.

Questions concerning the accuracy of the chart and change over time prompted most interviewees to discuss their fishery (e.g., those utilizing trawl gear were primarily associated with the groundfish fishery, pots and traps were primarily lobsters, etc.) in broad terms. They explained the current pattern of fishing, how it was (or was not) different in the past, and why the pattern changed over time. Changes in pattern were, invariably, linked to specific area-based regulations such as the Western Gulf of Maine Closure in 1998, Area 1 and Area 2 closures on Georges Bank in 1995, and the seasonal "rolling closures." While fishing community representatives have voiced similar stories in other fora (e.g., fisheries management council meetings), the maps of community territories worked to concretize their claims. Few of the communities engaged in the project were unaffected by these area-based regulations.

The second chart (titled: "Who Fishes in Which Locations?") included PVCs by individual port/gear type combinations (Figure 3).

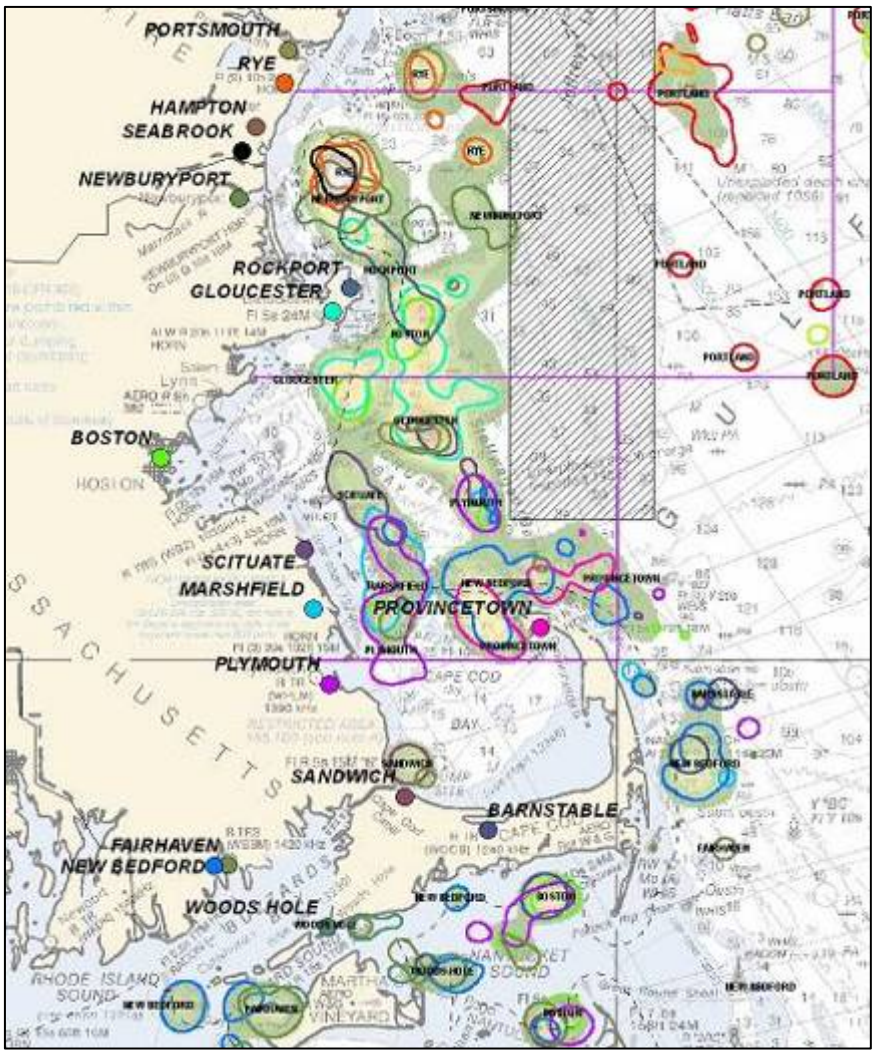


Figure 3. An extract from a "Chart 2" with color coded PVCs (here in grayscale) superimposed upon a NOAA nautical chart. The PVCs correspond to Gulf of Maine ports from which, in this case, small trawl vessels originate. Areas outlined represent primary fishing grounds by principal port. The chart also contains a raster density surface based on the aggregate of all vessels.

Interviewees were asked to again correct or amend these charts and were asked questions concerning community overlap, conflict, cooperation, and communication. Again, stories emerged relative to the closures mentioned above and many interviewees suggested that regulations forced fishers into smaller areas with increased community overlap. Curiously, while this produced competition due to crowding, in some instances it also produced new networks of communication and cooperation engendered by a sense of "all being in the same boat."

The final chart (titled: Where Does My Peer Group Fish?") included a density surface for the individual community and gear type of the interviewee (e.g., small trawl vessels from Gloucester) as well as PVCs for each of four seasons (i.e., areas of primary importance in the winter, spring, summer, and fall). Interviewees were asked to reflect on their own community, changes in fishing locations by season, and detailed environmental information for particular locations important to their community. Interviewees pointed to heightened awareness of local environments as demands for precision and efficiency emerge with fewer fishing days and other regulations that limit effort and location. In addition, they demonstrated considerable local ecological knowledge relative to the specific locations frequented by their community. That knowledge was, however, different for different communities. For example, fishers working with lobster pots had different knowledge than those working with ground trawling gear.

Overall, the depiction of community resource areas on nautical charts provided fishers with a graphic medium and graphic "language" that was very familiar to them. They were generally impressed by and agreed with these cartographic representations of their community resource areas and were eager to engage with them. The common language of the charts and acceptance of the project by fishers allowed them to clearly articulate (in reference to or literally on the charts) the effects of fisheries regulations on their communities. The positive reactions to the charts and the general desire expressed by interviewees to see them integrated into management, suggests that layers of information representing fishing communities and their territories can be successfully developed via the method described above.

In addition the project suggests that maps of community territories can be developed via a participatory methodology and will be well received by communities subject to ever-more spatial approaches to management. The results of the project make clear that participants will be eager to use maps depicting resource utilization and change over time as evidence of unfair displacements and overcrowding due to area closures or other place-based resource management initiatives. Participants' eagerness to document and thereby legitimize their histories of use and stories of displacement suggests that such information has been absent from resource assessments as well as the planning stages of management. Without its inclusion, and without detailed knowledge of the human dimensions of the marine environment, decision-makers are likely to face continued resistance to forms of management that spatially restrict use of the marine environment.

While fisheries are central to both ecological and social/cultural understandings of the marine environment, the social landscape is composed of more than fishing communities and their territories. Nevertheless, the project's method can work as a model for community-level involvement in marine resource assessment and planning beyond fisheries. Its techniques – the inclusion of community researchers, in-depth map-based interviews, and community workshops – are widely used for participatory conservation and development, particularly in developing countries, and, as we have shown, can be adapted to the maritime sectors of industrialized countries.

This project has resulted in a concrete set of maps (vetted by fishing community representatives). These maps, while not comprehensive for the entire Gulf of Maine, will be of

interest to scientists wanting to work cooperatively with "local communities", managers interested to link port-based communities to locations at-sea for impact analyses, and fishing communities hoping to maintain sustainable access to "their" fishing grounds and livelihoods.

PARTNERSHIPS

The initial design of the project was the product of the principal investigators. In addition, the principal investigators were responsible for the analysis of VTR data, the resultant map series, the initial research protocol, and subsequent analysis of data collected. Fishermen were, however instrumental in the review and refining of both the maps and the interview protocol in preparation for interviewing. The project PIs worked closely with fishermen and other industry representatives in meetings and at the initial workshop such that the interview protocol reflected the interests and desires of both the PIs and the variety of industry members involved. Importantly, fishermen (and related industry members) were key to the success of the interviews themselves. Indeed, the access provided by the community researchers to key informant fishermen would have been very difficult to replicate without their leadership and participation. Overall, the project worked well to facilitate cooperation and partnership between the PIs and the industry participants.

IMPACT AND APPLICATIONS

The outcomes of the project include not only the data (described above) but a proven methodology for producing maps depicting fishing communities and the resources upon which they most depend. The maps and other data produced will certainly have an impact as they are further analyzed and integrated into presentations and publications by the PIs. In addition, via the project website, the maps will act as visual representations of community presence and, taken together, the heterogeneous social landscape of the Gulf of Maine. These maps will likely serve as a valuable reference for policy impact analysis, place-specific scientific investigations, and community advocacy relative to particular fishing locations. While not in printed form, the large format PDFs developed for the project are available for viewing and download at the project's website.

Using the maps in a participatory research process has also had significant impacts. As noted above (also see Appendix I), the Mid-Coast Fishermen's Association of Maine gives credit to their involvement in the project as the impetus for their organization. Several members were interviewed for the project and their subsequent conversations about community and territory worked to facilitate their advocacy for an area-based management scheme as well as their highly successful (and copied) community supported fisheries (CSF) model.

The methodology developed for the project has, itself, generated substantial interest and is having a significant impact both nationally and internationally. Through invited lectures and key note presentations, the PIs have presented the project's methodology at venues that include Duke University's Marine Lab; Gulf of Maine Research Institute; NMFS Northeast Fisheries Science Center; and the Norwegian College of Fisheries in Tromso, Norway. In addition, they were invited to several workshops that focused on the development of social/spatial methods for EBM and MSP. Such workshops were hosted by NOAA's MPA initiative, the COMPASS organization, and UNESCO. Finally, related workshops in Germany and India were also receptive to the methodology developed and its implications for local economies and environments (see Presentations below).

RELATED PROJECTS

This project was not initially associated with or leveraged by any other project. As it progressed, however, it was linked to a number of projects that included the PIs. The following projects shared aspects of the methodology developed for the atlas project. In particular, they all used vessel trip report data and similarly mapped it by "community."

The *Communities at Sea Mapper* project listed below is an ongoing initiative to build a website that will not only serve much of the data from the atlas project (i.e. maps, summary statistics, and interpretive narratives derived from the interviews), but will also provide users the opportunity to select and map their own "communities." The website uses a database similar to that developed for the atlas project as the basis for the selection/mapping. The goal is to allow users to select data and produce maps that can be downloaded as ArcGIS shapefiles. These digital data layers depicting community presence at sea could then be integrated directly into impact analyses, ecosystem-based modeling, community advocacy campaigns, or other similarly social/spatial projects.

- NOAA, Cooperative Marine Education Research. *Recreational Fishing and National Standard 8: Assessing Community Impacts of Federal Regulations*, September 2001 – August 2004.
- NOAA, New Jersey Sea Grant program. *Cumulative Effects and New Jersey Marine Fisheries*, March 2004 – May 2006.
- Marine Ecosystem-Based Management Tool Innovation Fund (an initiative funded by the David and Lucile Packard Foundation and administered through Duke University's Marine Geospatial Laboratory). *Communities at Sea Mapper*, May 2008 – September 2009.

In addition to the above, St. Martin was recently awarded a Fulbright-Hays Scholar Award to conduct research at the University of Tromso, Norway. The project, titled *Drawing Communities Together: Assessing the Potential of Participatory Environmental Mapping for Marine Resource Management and Community Development*, builds directly upon the atlas project. The goal for the January-June 2010 project is to compare the methodology and outcomes of the atlas project to a similarly structured research project in Northern Norway.

RELATED PRESENTATIONS (CONFERENCES AND INVITED PRESENTATIONS)

- St. Martin, K. Speaker and participant at the "Sami Rights in Coastal Landscapes and Seascapes: Rights to Natural Resources and New Management Principles" conference and PhD course, University of Tromsø, Norway, April 22-24, 2009.
- St. Martin, K. Speaker at the "Ways of Knowing the Sea: The Integration Project" workshop, Memorial University, Newfoundland, Canada, February 5-6, 2009.
- St. Martin, K. Speaker and participant at the "Geospatial Technology, Wildlife Conservation, and Community" workshop, Jodhpur, Rajasthan, India, December 14-17, 2008.
- St. Martin, K. Speaker and participant at the "Socioeconomics, Markets, and Space: Performing Markets" workshop, Hirschberg, Germany, October 16-18, 2008.
- Murray, G., T. Johnson, B. McCay, K. St. Martin, S. Takehashi. "Cumulative Effects, Creeping Enclosure, and the Marine Commons of New Jersey" *International Associations for the Study of Commons (IASC)*, Cheltenham, UK, July 14-18, 2008.

- St. Martin, K. "Marine Spatial Planning as a Cartography of the Commons." *International Associations for the Study of Commons (IASC)*, Cheltenham, UK, July 14-18, 2008.
- St. Martin, K. Key note speaker/lecturer at "Sharing Ocean Space: Visions, Knowledge, Strategies, and Tools" a course in the political ecology series at the Norwegian College of Fishery Science, University of Tromsø, Norway, April 23-25, 2008.
- St. Martin, K. "Toward a Cartography of the Commons: Constituting the Political and Economic Possibilities of Place." *The Association of American Geographers Annual Meeting*, Boston, MA, April 15-19, 2008.
- St. Martin, K. Public lecture series speaker, Gulf of Maine Research Institute, Portland, ME, March 13, 2008.
- St. Martin, K. Panel participant at a public screening and panel discussion of the film *Fishing for the Future* sponsored by the Island Institute, Rockland, ME, August 16, 2007.
- St. Martin, K. "Quantitative and Critical GIS Methods to Foster Community Participation in Natural Resource Management." *The Association of American Geographers Annual Meeting*, San Francisco, CA, April 17-21, 2007.
- St. Martin, K. Seminar series speaker, National Oceanic and Atmospheric Administration, Northeast Fisheries Science Center, Woods Hole, MA, December 18, 2006.
- St. Martin, K. Seminar series speaker, Department of Natural Resources, University of New Hampshire, Durham, NH, December 6, 2006.
- St. Martin, K. Key note speaker at the "Sea Use Management and Marine Spatial Planning" workshop, United Nations Educational, Scientific, and Cultural Organization (UNESCO), Paris, November 7-11, 2006.
- St. Martin, K. and M. Hall-Arber. "Charting Fishing Communities at Sea: Revealing New Potentials for Participation in Fisheries Science and Management." *ICES 2006, Fishing Technology in the 21st Century.* Boston, MA, October 30 – November 3, 2006.
- St. Martin, K. and M. Hall-Arber. "Mapping Resilience in the Fishing Communities of New England." *Society for Human Ecology – XIV International Conference.* Bar Harbor, ME, October 18 – 21, 2006.
- St. Martin, K. Seminar series speaker, Department of Geography, Hunter College, CUNY, New York, NY, May 11, 2006.
- St. Martin, K. "Fishermen, Territory, and the Inhabitation of Neoliberal Space." *The Association of American Geographers Annual Meeting*, Chicago, IL, March 7-11, 2006.
- St. Martin, K. Panelist "Politics of Participation." *The Association of American Geographers Annual Meeting*, Chicago, IL, March 7-11, 2006.
- St. Martin, K. "Counter Mapping and the Production of Alternative Subjects and Spaces." *Indigenous Cartographies and Representational Politics – An International Conference*. Cornell University, Ithaca, NY, March 2-5, 2006.
- St. Martin, K. Speaker and participant at the "Mapping Human Activity in the Marine Environment: GIS Tools and Participatory Methods" workshop hosted by the National Oceanic and Atmospheric Administration's National Marine Protected Areas Center, MPA Science Institute, Monterey, CA, November 30 – December 1, 2005.

- St. Martin, K. The 2005-2006 Geography Lecture, Department of Political Science, College of Charleston, Charleston, SC, November 16, 2005.
- Hall-Arber, M. "Mapping Fishing Communities At Sea." *American Fisheries Society Annual Meeting*, Anchorage, AK, September 11-15, 2005.
- St. Martin, K. Colloquium speaker, Duke University Marine Laboratory, October 12, 2005.
- St. Martin, K. "GIS and the (Re)production of a Fisheries Commons." *The Association of American Geographers Annual Meeting*, Denver, CO, April 5-9, 2005.
- St. Martin, K. Colloquium speaker, University of Arizona, Department of Geography and Regional Studies, February 25, 2005.
- St. Martin, K. Speaker and participant at the "Spatial Planning for the Sustainable Management of the Seas," workshop hosted by the Maritime Institute at the University of Ghent. Ghent, Belgium. January 15-16, 2004.
- St. Martin, K. "Re-Mapping the Commons and Constituting a Community-based Economy: The Case of Fisheries." *International Association for the Study of Common Property (IASCP)*, Oaxaca, Mexico, August 9-13. 2004.

PUBLISHED REPORTS AND PAPERS

- St. Martin, K. and M. Pavlovskaya. Forthcoming. "Secondary Data: Engaging Numbers Critically," in *Research Methods in Geography: A First Course*. J.P. Jones III and B. Gomez eds. (Wiley-Blackwell).
- St. Martin, K. 2009. "Toward a Cartography of the Commons: Constituting the Political and Economic Possibilities of Place" *Professional Geographer* 61(4).
- St. Martin, K. and M. Hall-Arber. 2008. "The Missing Layer: Geo-technologies, Communities, and Implications for Marine Spatial Planning" *Marine Policy* 32: 779-786.
- St. Martin, K. and M. Hall-Arber. 2008. "Creating a Place for 'Community' in New England Fisheries" *Human Ecology Review* 15(2): 161-170.
- St. Martin, K. 2008. "Mapping Community Use of Fisheries Resources in the U.S. Northeast" *Journal of Maps* 2008: 38-41.
- St. Martin, K., B. McCay, G. Murry, T. Johnson, and B. Oles. 2007. "Communities, Knowledge, and Fisheries of the Future" *International Journal of Global Environmental Issues* 7(2/3): 221-239.
- St. Martin, K. 2007. "The Impact of 'Community' on Fisheries Management in the U.S. Northeast," *Geoforum* 37(2) 169-184.
- St. Martin, K. and M. Hall-Arber. 2007. "Environment and Development: (Re)Connecting Community and Commons in New England Fisheries," in *Connecting People, Participation and Place: Participatory Action Research Approaches and Methods*. S. Kindon, R. Pain and M. Kesby eds. (Routledge), pp. 51-59.
- St. Martin, K. 2007. Contributor to *Visions for a Sea Change. Report of the First International Workshop on Marine Spatial Planning*. Published by the UNESCO Intergovernmental Oceanographic Commission (ICAM Dossier Series): Paris.

IMAGES

See the section above on Data

FUTURE RESEARCH

Future research will be in two broad directions associated with this project. The first is to improve the web-based delivery of data layers representing fishing communities and their territories of use. While the original maps are available in PDF format on the project website and a new website is nearly complete (based on more recent funding, see Related Projects), neither website does all that could be done with this unique data and methodology. In particular, we are seeking funding to more explicitly tailor the data layers available via this method for ecosystems-based modeling and GIS-based marine spatial planning.

The second relevant research direction is the comparative analysis St. Martin will be performing while in residence at the University of Tromso next year. That project, inspired by the recent accomplishments of the Mid-coast Fishermen's Association, will investigate how the documentation of local ecological knowledge (LEK), particularly via mapping technologies, works to support community and place identities as well as community-based social and economic development. The project entails collaboration with partners in the *Fávllis* network[9] who are currently producing a searchable database of transcribed interviews and maps that documents LEK and other socio-ecological data in the fishing communities of Northern Norway. Engaging with the *Fávllis* project and comparing it with the similarly structured atlas project will provide a basis for an analysis of the relationships that exist between LEK, community identity, and local community development in two locations.

REFERENCES

[1] Hughes TP, Bellwood DR, Folke C, Steneck RS, Wilson J. New paradigms for supporting the resilience of marine ecosystems. Trends in Ecology and Evolution 2005; 20(7):380-386.

[2] Rajabifard A, Binns A, Williamson I. Administering the marine environment: the spatial dimension. Journal of Spatial Science 2005; 50(2):69-78.

[3] Botsford L, Castilla JC, Peterson CH. The management of fisheries and marine ecosystems. Science 1997; 277: 509-15.

[4] Caddy JF. Regime shifts and paradigm changes: is there still a place for equilibrium thinking? Fisheries Research 1996; 25:219-30.

[5] Wilson JA, Acheson JM, Metcalfe M, Kleban P. Chaos, Complexity and community management of fisheries. Marine Policy 1994; 18(4):291-305.

[6] Firestone J, Kempton W, Krueger A, Loper CE. Regulating offshore wind power and aquaculture: Messages from land and sea. Cornell Journal of Law and Public Policy 2004; 14(1):71-111.

[7] Kaiser MJ. Are marine protected areas a red herring or fisheries panacea? Canadian Journal of Fisheries and Aquatic Sciences 2005; 62(5): 1194-99.

[8] Turner MD. Methodological reflections on the use of remote sensing and geographic information science in human ecological research. Human Ecology 2003; 31(2): 255-79.

[9] "Fjord Ecosystems – Sami communities: Local ecological knowledge and socio-ecological history" A multi-year multi-institute research project at the University of Tromsø (see attached letter inviting me to participate in the *Fávllis* project while in Tromsø).

[9] St. Martin K. 2004. GIS in Marine Fisheries Science and Decision Making. In Geographic information systems in fisheries, pp. 237-258, eds. Fisher WL, Rahel FJ. American Fisheries Society; 2004.
[10] St. Martin K, McCay B, Murray G, Johnson T, Oles B. Communities, knowledge, and fisheries of the future. International Journal of Global Environmental Issues 2007; 7(2/3): 221-239.
[11] St. Martin K. Making space for community resource management in fisheries. Annals of the Association of American Geographers 2001; 91(1):122-42.
[12] Booth AJ. Incorporating the spatial component of fisheries data into stock assessment models. ICES Journal of Marine Science 2000; 57(4):858-865.
[13] Sanchirico JN, Wilen JE. Bioeconomics of spatial exploitation in a patchy environment. Journal of Environmental Economics and Management 1999; 37:129-50.
[14] Meaden GJ, Chi TD. Geographical information systems: applications to marine fisheries. Rome: FAO; 1996.
[15] Meaden GJ. Applications of GIS to fisheries management. In marine and coastal geographical information systems, pp. 205-226, eds. Wright D, Bartlett D. London: Taylor and Francis; 1999.
[16] Babcock EA, Pikitch EK, Mcallister MK, Apostolaki P, Santora C. A perspective on the use of spatialized indicators for ecosystem-based fishery management through spatial zoning. Ices Journal of Marine Science 2005; 62(3):469-76.
[17] Douvere F, Maes F, Vanhulle A, Schrijvers J. The role of MSP in sea use management: the belgian case. Marine Policy 2007; 31: 182-191.
[18] Wright DJ, Scholz AJ, eds. Place matters: geospatial tools for marine science, conservation, and management in the pacific northwest. Corvallis: Oregon State University Press; 2005.
[19] Eastman JR, Jin W, Kyem PAK, Toledano J. Raster procedures for multi-criteria/multi-objective decisions. PE&RS 1995; 61(5): 539-547.
[20] Dentzman RC. Integrated ocean observing systems: the role of seafloor mapping technologies. Oceans Conference Record (IEEE) 2002; 3:1695-704.
[21] Stokesbury KDE. Estimation of sea scallop abundance in closed areas of Georges Bank, USA. Transactions of the American Fisheries Society 2002; 131(6):1081-92.
[22] Neis B, Schneider DC, Felt L, Haedrich RL, Fischer J, Hutchings JA. Fisheries assessment: what can be learned from interviewing resource users. Canadian Journal of Fisheries and Aquatic Science 1999; 56:1949-63.
[23] Otero J, Rocha F, Gonzalez AF, Gracia J, Guerra A. Modelling artisanal coastal fisheries of Galicia (NW Spain) based on data obtained from fishers: the case of octopus vulgaris. Scientia Marina 2005; 69(4):577-85.
[24] Ames EP. Atlantic cod stock structure in the Gulf of Maine." Fisheries 2004; 29(1):10-28.
[25] Murawski SA, Brown R, Lai H-L, Rago PJ, and Hendrickson L. Large-scale closed areas as a fishery-management tool in temperate marine systems: the Georges Bank experience. Bulletin of Marine Science 2000; 66(3):775-98.
[26] St. Martin K. The impact of ‘community’ on risheries management in the U.S. Northeast. Geoforum 2006; 37(2):169-84.
[27] Hanna SS. Institutions for marine ecosystems: economic incentives and fishery management. Ecological Applications 1998; 8(1 SUPPL):S170-S174.
[28] Wilson JA. Matching social and ecological systems in complex ocean fisheries. Ecology and Society 2006; 11(1):9.
[29] National Research Council. Marine protected areas: tools for sustaining ocean ecosystems. Washington, D.C.: National Academy Press; 2001.

[30] Pauly D. Putting fisheries management back in places. Reviews in Fish Biology and Fisheries 1997; 7(1):125-27.
[31] Pinkerton E, ed. Co-operative management of local fisheries. Vancouver: University of British Columbia Press; 1989.
[32] Olson J. Re-placing the space of community: a story of cultural politics, policies, and fisheries management. Anthropological Quarterly 2005; 78(1):247-68.
[33] Scholz A, Bonzon K, Fujita R, Benjamin N, Woodling N, Black P, Steinback C. Participatory socioeconomic analysis: drawing on fishermen's knowledge for marine protected area planning in California. Marine Policy 2004; 28(4):335-49.
[34] McCay BJ, Wilson DC, Lamarque J, St. Martin K, Bochenek E, Stoffle B, Oles B, Johnson T. Port and community profiles and social impact assessment, Amendment 13 of the Surfclam and Ocean Quahog Fishery Management Plan: a report to the Mid-Atlantic Fishery Management Council. New Brunswick: The Fisheries Project, Rutgers University; 2002.
[35] Hartley TW, Robertson RA. Emergence of multi-stakeholder-driven cooperative research in the Northwest Atlantic: the case of the Northeast Consortium. Marine Policy 2006; 30: 580-592.
[36] Crang M. Qualitative methods: the new orthodoxy? Progress in Human Geography 2002; 26(5):647-55.
[37] Pavlovskaya M. Theorizing With GIS: A Tool for Critical Geographies? Environment and Planning A 2006; 38(11): 2003-2020.
[38] Kwan MP. Feminist visualization: re-envisioning GIS as a method in feminist geographic research. Annals of the Association of American Geographers 2002; 92(4): 645-61.
[39] Pain R. Social geography: on action-orientated research. Progress in Human Geography 2003; 27(5):649.
[40] Pain R. Social geography: participatory research. Progress in Human Geography 2004; 28 (5):652-63.
[41] Community Economies Collective. Imagining and enacting noncapitalist futures. Socialist Review 2001; 28(3+4):93-135.
[42] Gibson K, Cameron J. Transforming communities: towards a research agenda. Urban Policy and Research 2001; 19(1):7-24.
[43] St. Martin K. Mapping economic diversity in the First World: the case of fisheries. Environment and Planning A 2005; 37:959-79.

APPENDIX I: IMPACT OF PROJECT ON PARTICIPANTS

Below is a newsletter form the Mid-coast Fishermen's Association. Here they tell the story of the founding of their organization. They cite the influence and inspiration of Jen Levin, who was a community researcher working on the atlas project and who interviewed a number of fishermen from Port Clyde.

Fresh News from Port Clyde Fresh Catch

If it were any fresher, it would still be swimming!

THE STORY, "FINAL" INSTALLMENT

In the summer of 2006, several different things happened that were responsible for the birth of a new organization here in Port Clyde – an organization made up solely of fishermen who were thinking about doing things in a different way. The old way was clearly not working and anyone who had just the smallest bit of foresight could see the end of groundfishing in Port Clyde right around the corner.

First, Jen Levin, who worked for an organization called the Northwest Atlantic Marine Alliance (NAMA), called us. Her organization's mission was to create sustainable fisheries, and one goal was to get fishermen to self-organize into small groups, then join NAMA, as separate entities. This plan was designed to create a strong voice for conservation of marine resources among many different regions of the coast. Craig Pendleton, NAMA's executive director, was a longtime fisherman from Saco, Maine who had been around long enough to know what a healthy fishery should look like. Like us, he was keenly aware of what had been lost: fish no longer came to shore to spawn in any great numbers, the stocks had declined, and the "days at sea" system was not working.

Next, Jen came to Port Clyde to interview some of our fishermen for a project that she was working on with Rutgers University. Fishermen are usually reluctant to subject themselves to this type of thing; they have work to do. Jen offered to pay us to talk to her and, wth the offer of a few bucks to sit and talk for a couple hours, a few of us grudgingly agreed to submit to what surely, in our minds, would be a torturous exercise.

Her project was designed to encourage fishermen to start thinking about the areas they used in the ocean to pursue their living as "theirs". The goal was to see if there was, in fact, a sense of community that extended out from the shore and encompassed regions of the Gulf of Maine. Did fishermen consider the areas that they fished something to protect or something to exploit? Jen's research verified that, although we fishermen rarely talked about it, we did feel protective and caring about the areas of the ocean that we fished.

After meeting with the fishermen of Port Clyde, Jen realized that the strong bond among us was the same as it was everywhere else in these types of small fishing communities. We all lived and worked together, but the catch was rarely discussed and secret fishing spots were a closely guarded secret. Getting the biggest trip was a status symbol, and catching the most was how you measured success among your peers. Jen urged the fishermen of Port Clyde to organize and work together; a new concept for our fishing community.

This project was soon followed by the establishment of Amendment 16 to the groundfish plan. If you recall, amendment 5 was mentioned in a previous installment and now we

WANT TO KNOW MORE ABOUT OUR ORGANIZATION?
VISIT OUR WEBSITES:
www.portclydefreshcatch.com www.midcoastfishermen.org
Phone: (207) 372-8065

Port Clyde Fresh Catch

PRODUCT OF PORT CLYDE, MAINE
WWW.PORTCLYDEFRESHCATCH.COM • 207.372.8065

were up to Amendment 16. All these amendments were an attempt to fix something that wasn't working quite the way it was planned., and were designed to fix the problems with the federal fisheries management plan. Up until Amendment 16, the "tweaks" (Amendments 1-15) to the management plan were focused on fixing the "days at sea" system. Amendment 16 was the Fisheries Service finally saying, "Okay, we can't seem to fix "days at sea" and we don't know what to do after 15 tries over 20 years, so maybe the fishermen will have some ideas. Let's ask them."

With the recent interviews by Jen Levin still fresh in our memory, and the advent of Amendment 16, some of the fishermen in Port Clyde finally decided to organize and offer some suggestions about what we thought would work in "our" area of the ocean. We organized a meeting at the town office in Tenants Harbor, and all of the groundfish fishermen from Port Clyde showed up (and even some from surrounding towns). The name Midcoast Fishermen's Association (MFA) was selected, officers were chosen and in a short time we came up with a plan.

We had been hearing about a plan called "area management" from a group based in Stonington, Maine called the Penobscot East Resource Center (PERC). Their original plan did not get a very warm reception from us as it included a provision to shut down "our" fishing area for three years. The idea, however, of protecting an area that we all depended on seemed to be a good idea to those of us who attended the meeting.

We selected a large area – half of the Gulf of Maine – and our idea was to restrict the gear allowed within it. In order to fish in this area, a fisherman would have to alter his fishing gear to reduce habitat impact and improve the selectivity of the gear.

Essentially, we had created a plan to catch fewer fish in order to help the stocks recover in this particular area, and the location selected was large enough to provide protection for fish throughout the year. Our fishermen knew that, for a plan to be successful, it had to restore the *inshore* stocks of fish. In order for this to happen, however, some had to be left swimming *offshore* to allow for the old migration patterns to be restored in the spring and summer. This plan, which called for less efficiency in order to protect the resource, exemplified the sense of conservation and community that the Rutgers University study had discovered among the fishermen of Port Clyde.

Soon after this, the Maine Department of Marine Resources held meetings all along the coast as a precursor to Amendment 16, and we unveiled our Port Clyde plan. Among fishermen from some other ports, the reception to this great idea was somewhat cool. Their arguments ranged from "You can't use gear restrictions as a management tool; the results are not proven" to "If you catch fewer fish, you will put yourselves out of business." Skeptics offered no solutions to these problems, just advice that "you can't," and the Port Clyde fishermen soon learned what the fisheries-management coun-

WANT TO KNOW MORE ABOUT THE MIDCOAST FISHERMEN'S ASSOCIATION?

VISIT OUR WEBSITES:

www.portclydefreshcatch.com
www.midcoastfishermen.org
Phone: (207) 372-8065

This newsletter is supported by the ISLAND INSTITUTE

-cils had known for some time now: there are lots of folks who do not want change even if the current plan is not working. Clinging to the familiar – even with disaster looming ahead – is a human trait that is hard to overcome.

Enter the Area Management Coalition (AMC). This group advocated for area management and included PERC, the originator of the area-management idea, as well as the Island Institute, The Nature Conservancy, NAMA, MFA and many others. This was a remarkable turn of events. The concept of fishermen's advocacy organizations, fishermen and environmental groups working together was a real departure from the past, as the latter two parties had always been at odds when it came to fisheries management.

The fight to get the area-management concept accepted by the Fisheries Service was long and hard, but the Service moves at a glacially slow pace. This lack of swift decision-making is probably prudent, as implementation of a plan as radical as area management – a real departure from the way business has always been done – should be done only with careful consideration. The Service removed area management from Amendment 16 in favor of a shared quota system called "sectors" that is still being worked on today. The area management plan will resurface in Amendment 17, along with some other fisheries advocacy groups' plans, so the dream lives on.

Now for the rest of the story: After area management was stalled until Amendment 17, the AMC conducted an assessment of "what went wrong" and identified one key problem as the lack of buy-in by a larger segment of fishing communities up and down the coast. One critical conversation that evolved from this debate about "how to get fishermen to accept our ideas" focused on finding a way to get more money for the catch. We realized that, if we could devise a way to offer fishermen an incentive to fish more sustainably, within the law, we would not need to ask the government for permission. From this discussion, the idea for "*Port Clyde Fresh Catch*" was born.

Of course, we didn't think up the name *Port Clyde Fresh Catch* during this conversation nor did we form the Midcoast Fishermen's Cooperative right away. Establishing a cooperative, and creating a marketing plan with conservation at its core, were no easy tasks for a group fishermen, even for those of us from Port Clyde who had created a plan to start to fish more sustainably. Again, with the help of NAMA and the Island Institute, we took the first tentative steps down this road.

To those of us who have been immersed in this whole project – including the original AMC exercise – the last two (or more) years have been a blur. There has been little time to relax, but the rewards so far have been well worth all the effort. For many years, fishermen have gone from being part of the Northeast's proud seafaring legacy to being maligned over and over again in the press. With the development of *Port Clyde Fresh Catch* and the establishment of the CSF program, however, our fishermen and our customers now share a bond and a common goal of the restoration of this once vibrant fishery along our shores. There is finally some good news to report about groundfishing in Maine.

There is still a tremendous amount of work that needs to be done, as our fishery still needs much help. The plan, however, is working. Fishing communities from all over the world have contacted us and are using the model that we have created to help keep their fishing communities alive and to address fishery depletion in their own areas.

Please believe me when I say that your support of this project has inspired a community of fishermen to continue to fight to preserve this way of life. Your enthusiasm for our efforts, and the interest shown in this new model by other fishing communities around the globe, has been truly humbling for us. We are determined to restore this fishery for our children and grandchildren and not to become "the last fishermen from Port Clyde."

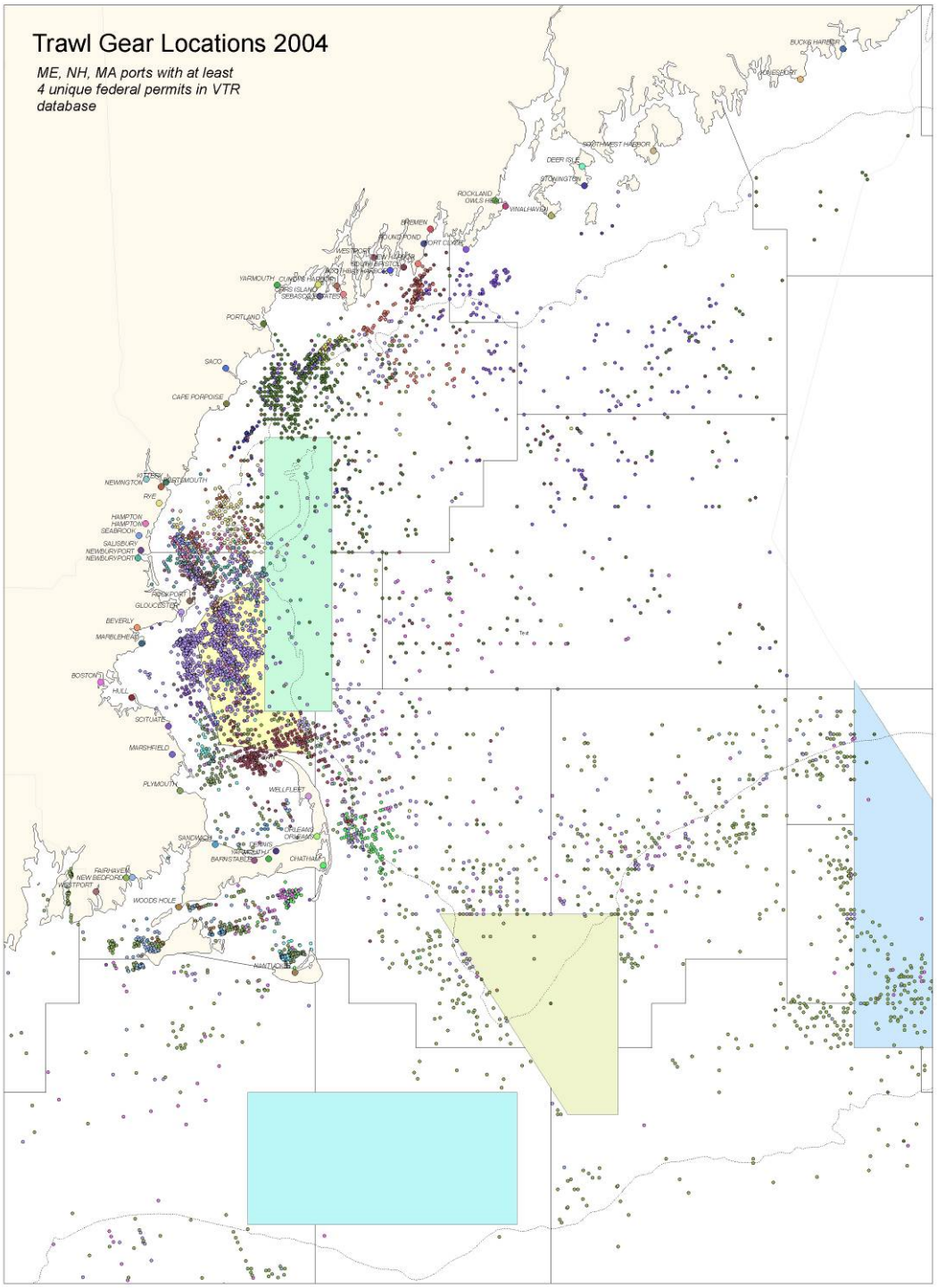
With heartfelt thanks for your continuing support,

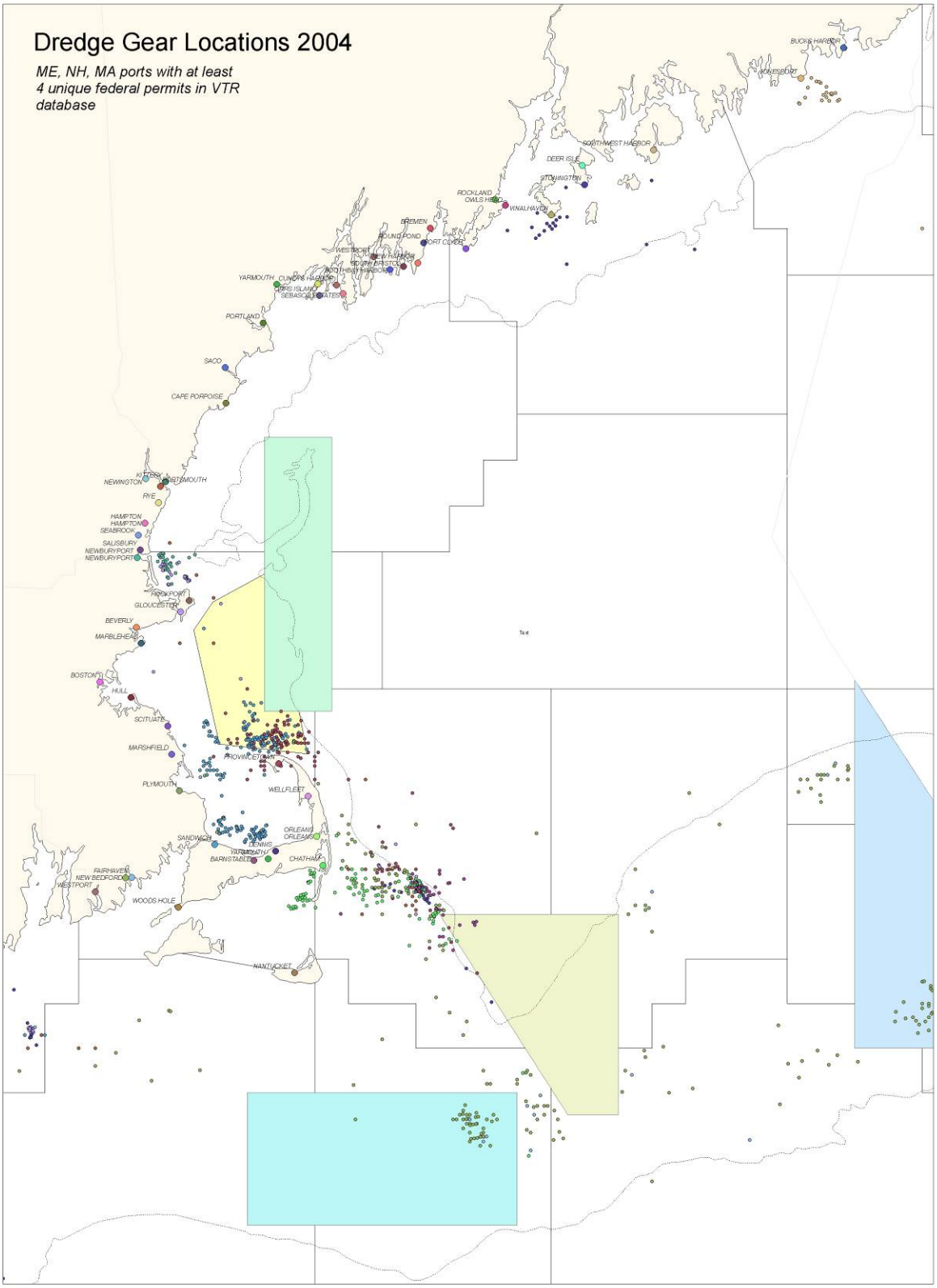
Glen Libby

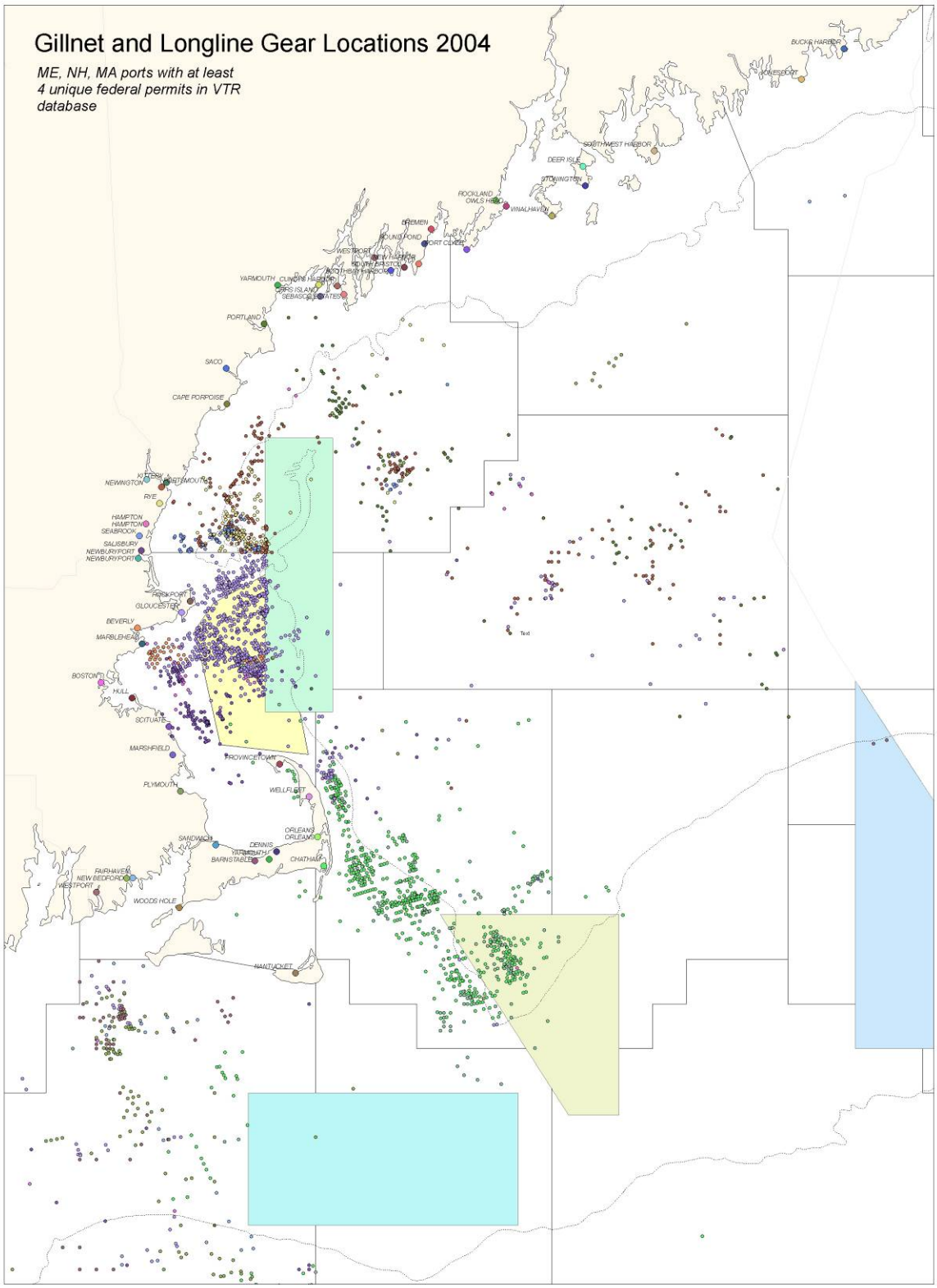
President, Midcoast Fishermen's Cooperative
Chairman, Midcoast Fishermen's Association

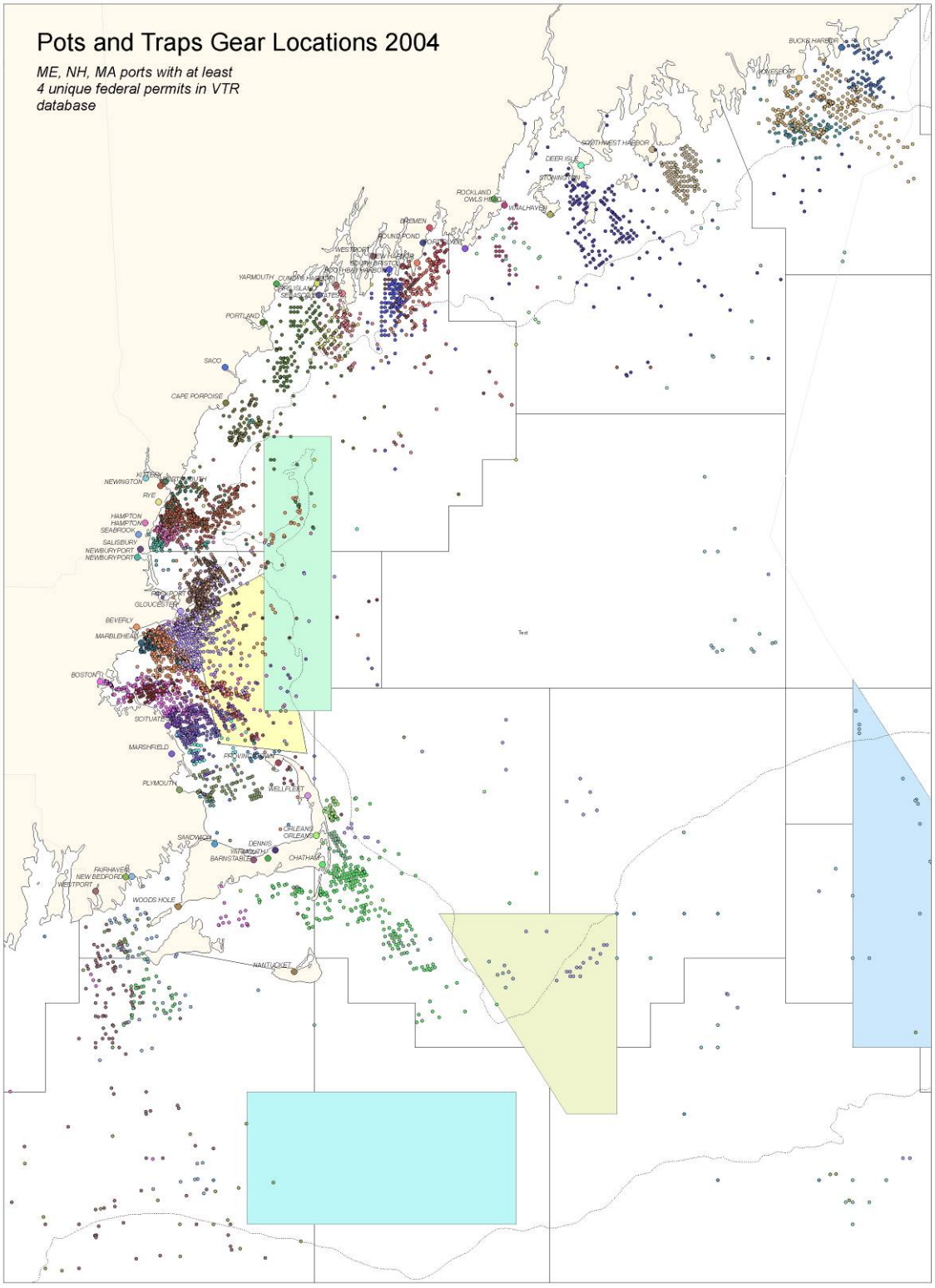
APPENDIX II: MAPPING TRIP LOCATIONS

Trip locations for vessels deploying 4 different gear type groupings (trawl, dredge, gillnet/longline, and pots/traps) for 2004. Trip location colors correspond to port symbol colors. Note that many of the clusters and community overlap is difficult to visualize with point symbols.




Dredge Gear Locations 2004
ME, NH, MA ports with at least
4 unique federal permits in VTR
database
BUCKS HARBOR
JONESPORT
SOUTHWEST HARBOR
DEER ISLE
STONINGTON
ROCKLAND
OWLS HEAD
VINALHAVEN
BREMEN
ROUND POND
PORT CLYDE
WESTPORT
BOOTHBAY HARBOR
YARMOUTH
CUNDYS HARBOR
PORTLAND
SACO
CAPE PORPOISE
KITTERY
NEWINGTON
PORTSMOUTH
RYE
HAMPTON
HAMPTON
SEABROOK
SALISBURY
NEWBURYPORT
NEWBURYPORT
ROCKPORT
GLOUCESTER
BEVERLY
MARBLEHEAD
BOSTON
HULL
SCITUATE
MARSHFIELD
PROVINCETOWN
PLYMOUTH
WELLFLEET
ORLEANS
ORLEANS
SANDWICH
DENNIS
YARMOUTH
BARNSTABLE
CHATHAM
FAIRHAVEN
NEW BEDFORD
WESTPORT
WOODS HOLE
NANTUCKET

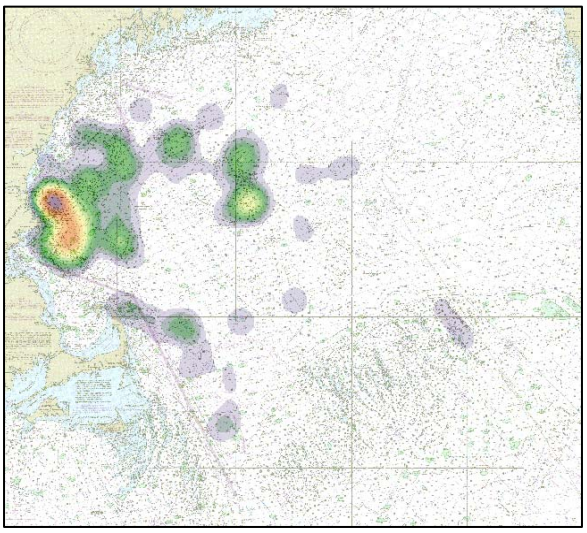

Gillnet and Longline Gear Locations 2004
ME, NH, MA ports with at least
4 unique federal permits in VTR
database
BUCKS HARBOR
JONESPORT
SOUTHWEST HARBOR
DEER ISLE
STONINGTON
ROCKLAND
OWLS HEAD
VINALHAVEN
BREMEN
ROUND POND
PORT CLYDE
WESTPORT
NEW HARBOR
SOUTH BRISTOL
NORTHEAST HARBOR
YARMOUTH
CUNDYS HARBOR
BIRS ISLAND
SEBASCO ESTATES
PORTLAND
SACO
CAPE PORPOISE
KITTERY
NEWINGTON
PORTSMOUTH
RYE
HAMPTON
HAMPTON
SEABROOK
SALISBURY
NEWBURYPORT
NEWBURYPORT
ROCKPORT
GLOUCESTER
BEVERLY
MARBLEHEAD
BOSTON
HULL
SCITUATE
MARSHFIELD
PROVINCETOWN
PLYMOUTH
WELLFLEET
ORLEANS
ORLEANS
SANDWICH
DENNIS
HYANNISPORT
BARNSTABLE
CHATHAM
FAIRHAVEN
NEW BEDFORD
WESTPORT
WOODS HOLE
NANTUCKET


Pots and Traps Gear Locations 2004
ME, NH, MA ports with at least
4 unique federal permits in VTR
database
BUCKS HARBOR
STONINGTON
ROCKLAND
OWLS HEAD
BREMEN
ROUND POND
WESTPORT
YARMOUTH
PORTLAND
SACO
CAPE PORPOISE
NEWINGTON
RYE
HAMPTON
HAMPTON
SEABROOK
SALISBURY
NEWBURYPORT
NEWBURYPORT
GLOUCESTER
BEVERLY
MARBLEHEAD
BOSTON
SCITUATE
MARSHFIELD
PLYMOUTH
WELLFLEET
ORLEANS
ORLEANS
SANDWICH
DENNIS
YARMOUTH
BARNSTABLE
CHATHAM
FAIRHAVEN
NEW BEDFORD
WESTPORT
WOODS HOLE
NANTUCKET

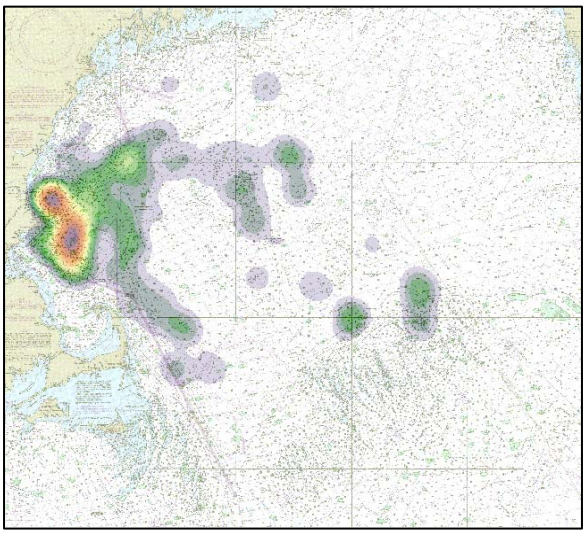
APPENDIX III: SPATIAL PATTERNS AND CHANGE OVER TIME

Change analysis of fishing patterns for the large trawler fleet from Gloucester, MA. In this case, data on trip locations for this fleet for the years 1994-2002 were converted into raster surfaces representing "community presence" (see description of this method in the main text).

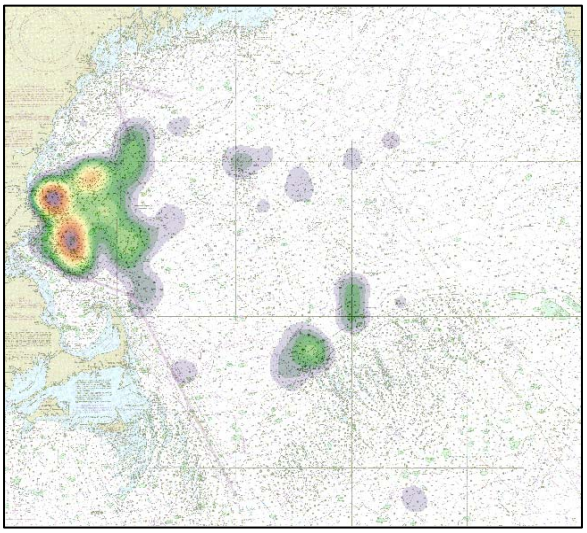
In addition, a principal components analysis was performed using these surfaces as input. The results (spatial and graphic) illustrate where and when significant change occurred. The resultant image shows areas of relative increase or decrease in "community presence" (red and blue) while the loadings graph suggests periods of change and/or relative spatial stability. Such analyses were later used to indentify a period of relative stability (2002-2004) for a variety of gear/port combinations. This time period set the range of data eventually used in the project interviews.



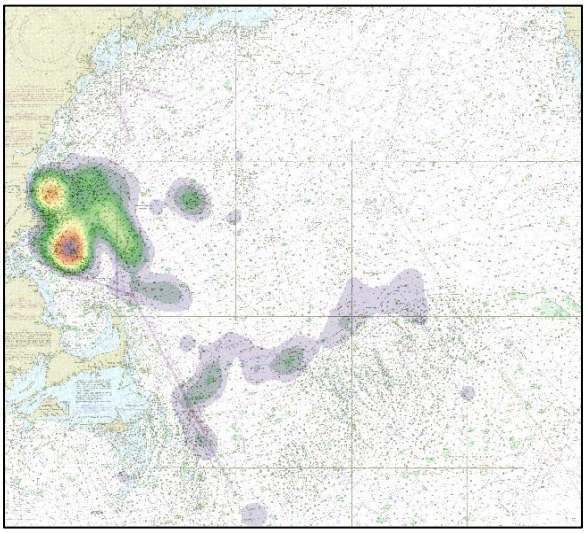
1994



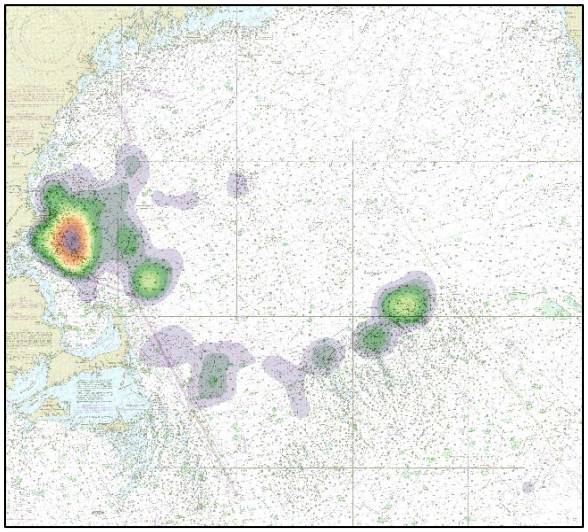
1995



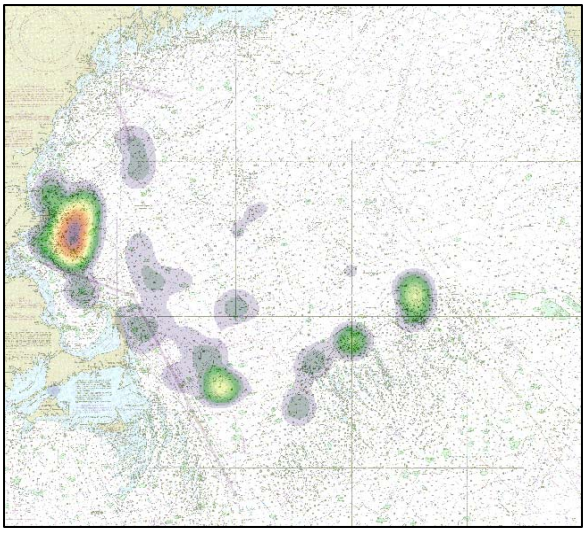
1996



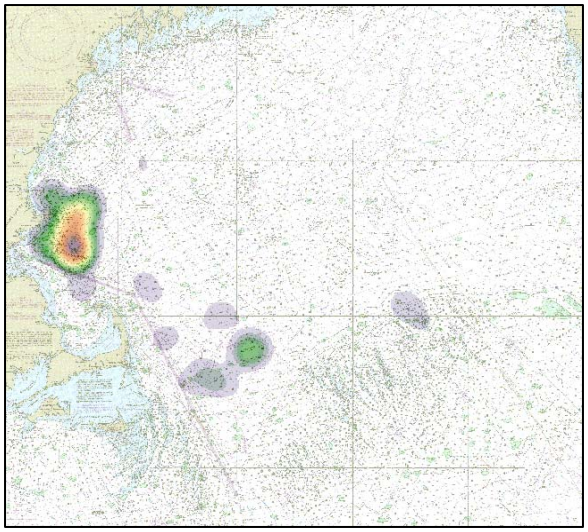
1997



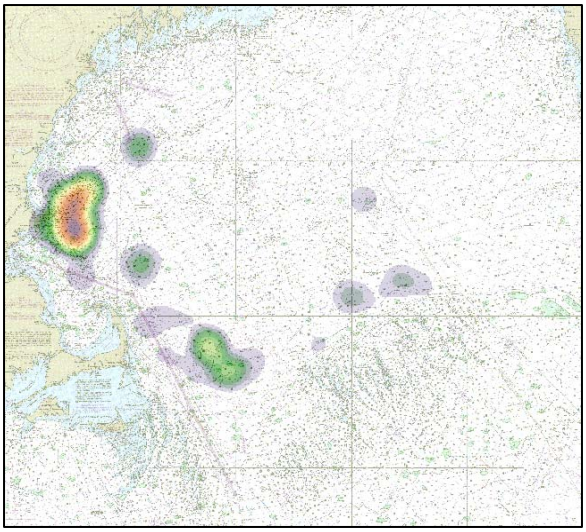
1998



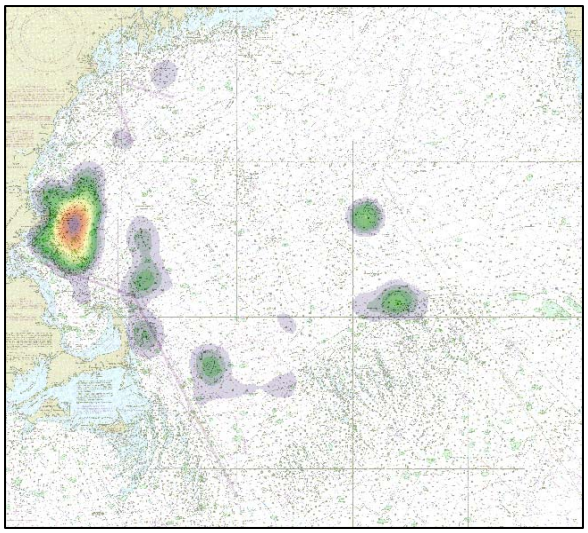
1999



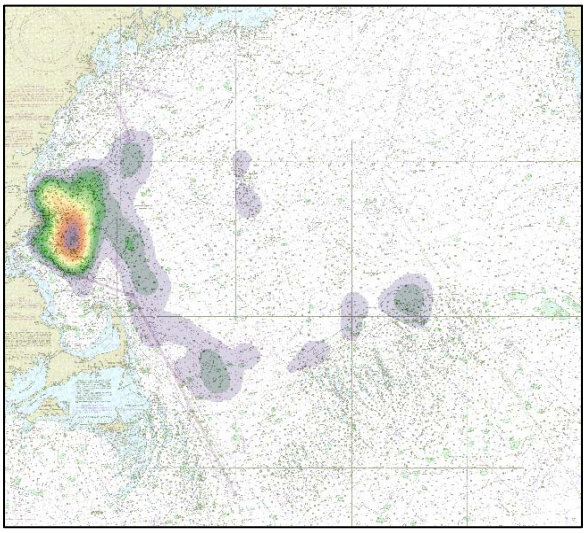
2000

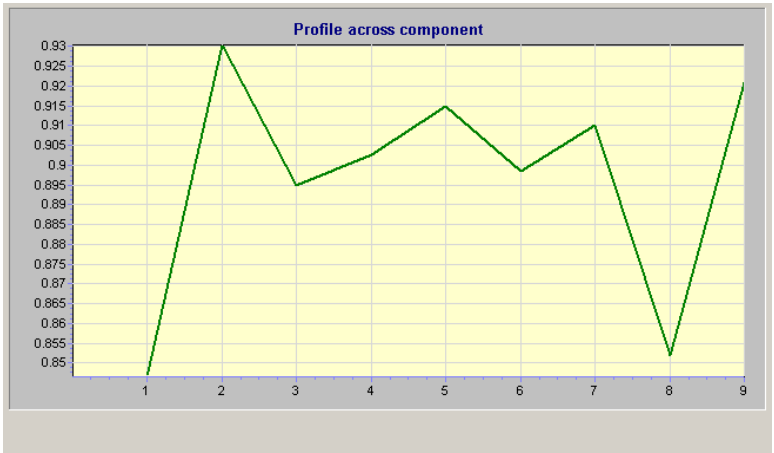


2001

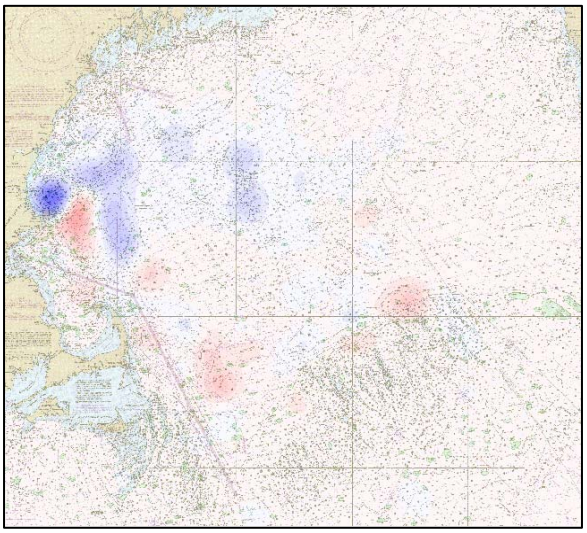


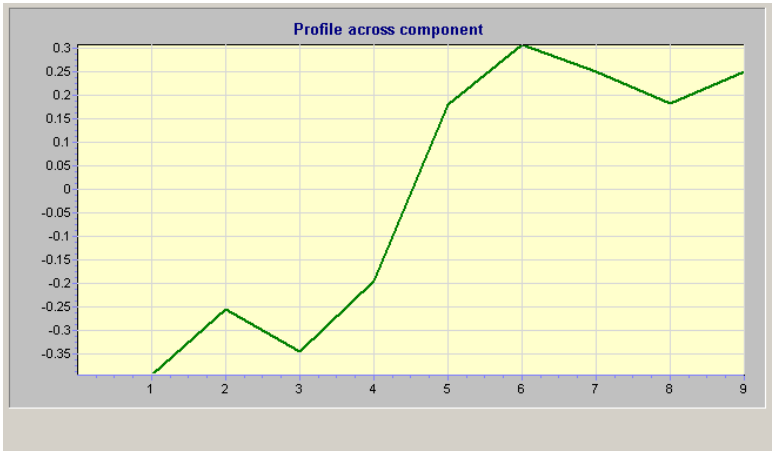
2002





Component 1





Component 2

	CMP 1	CMP 2	CMP 3	CMP 4	CMP 5	CMP 6	CMP 7	CMP 8	CMP 9
% Var	80.4890	7.3985	4.4598	2.2911	1.4941	1.2615	1.0335	0.8450	0.7275
Loadings :									
	CMP 1	CMP 2	CMP 3	CMP 4	CMP 5	CMP 6	CMP 7	CMP 8	CMP 9
strwingc3_94lrg	0.8465	-0.3956	0.1885	0.2589	0.0664	-0.0620	-0.1143	0.0206	-0.0510
strwingc3_95rg	0.9304	-0.2563	0.0101	0.0954	-0.0536	0.0548	0.1569	-0.0925	0.1431
strwingc3_96rg	0.8948	-0.3451	-0.0188	-0.1949	-0.0761	0.0078	0.1128	0.0703	-0.1354
strwingc3_97rg	0.9026	-0.1940	-0.2686	-0.1808	0.0526	0.0495	-0.1633	0.0349	0.0983
strwingc3_98rg	0.9149	0.1796	-0.2654	0.0228	-0.0716	-0.1565	-0.0289	-0.1573	-0.0677
strwingc3_99rg	0.8986	0.3081	-0.0438	0.1487	-0.2176	0.1175	-0.0417	0.1036	-0.0053
strwingc3_00lrg	0.9100	0.2514	-0.1229	0.0709	0.2493	0.1332	0.0701	-0.0012	-0.0615
strwingc3_01rg	0.8520	0.1833	0.4370	-0.1718	-0.0109	0.0685	-0.0689	-0.1019	-0.0071
strwingc3_02rg	0.9208	0.2510	0.1215	-0.0467	0.0626	-0.2085	0.0609	0.1227	0.0773

APPENDIX IV: ATLAS MAPS

Below are samples of the maps which were used in project interviews. These are the three maps that would have been used to interview fishermen from Gloucester's fleet of relatively small trawling vessels. One set of maps was produced for each interview, and interviewees were encouraged to draw directly on the maps during the interview process. Other map sets are of a similar design.

The first of the three maps in each interview is at the scale of the Gulf of Maine and is titled "Where in the Gulf of Maine do We Fish?" The second, at the same scale, is titled "Who Fishes in Which Locations" and depicts areas fished by particular ports. The third zooms in to the areas visited only by the immediate peer group of the interviewee and is titled "Where Does My Peer Group Fish." These maps also include other summary statistics in the form of pie charts and tables. They were designed to be printed at 24x20 inches (some larger) and, as a result, are difficult to read in this document (and at this resolution). A complete set of approx. 40 unique maps has been made available to the Northeast Consortium on CD and are also available at http://aesop.rutgers.edu/~fisheries/. *

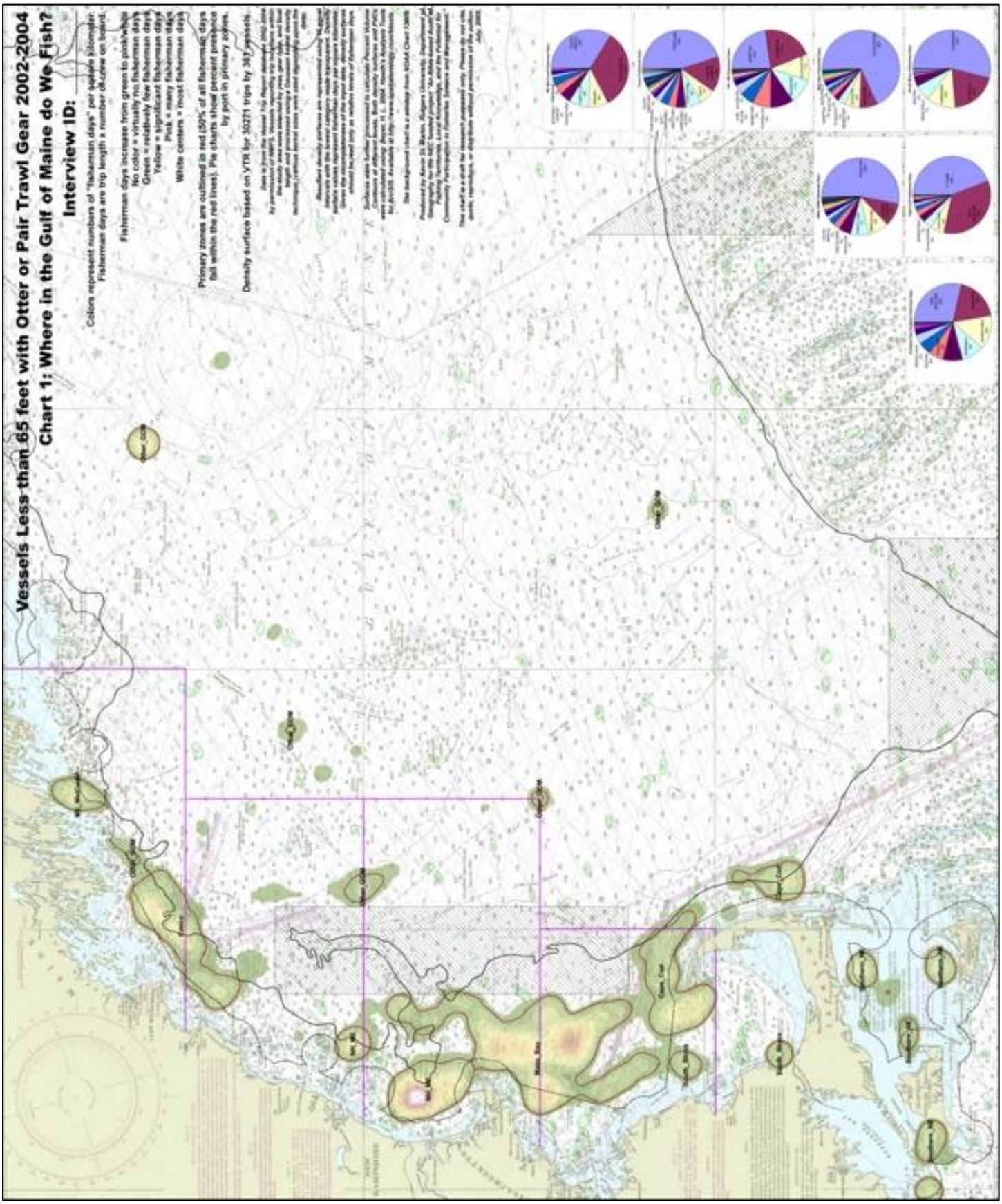
	Total Printed	Delivered to CRs
Chart 1		
36x30 Format		
Large Trawl	15	9
Small Trawl	13	9
Pots and Traps	14	12
Gill Net Long Line	8	7
Dredge	8	6
24x20 Format		
All Trawl by Length	1	0
Large Trawl	23	14
Small Trawl	15	7
Pots and Traps	13	4
Gill Net Long Line	15	2
Dredge	10	7
Chart 2		
36x30 Format		
Large Trawl	6	5
Small Trawl	6	6
Pots and Traps	9	8
Gill Net Long Line	0	0
Dredge	0	0
24x20 Format		
Large Trawl	19	15
Small Trawl	16	3
Pots and Traps	12	2
Gill Net Long Line	15	2
Dredge	11	7

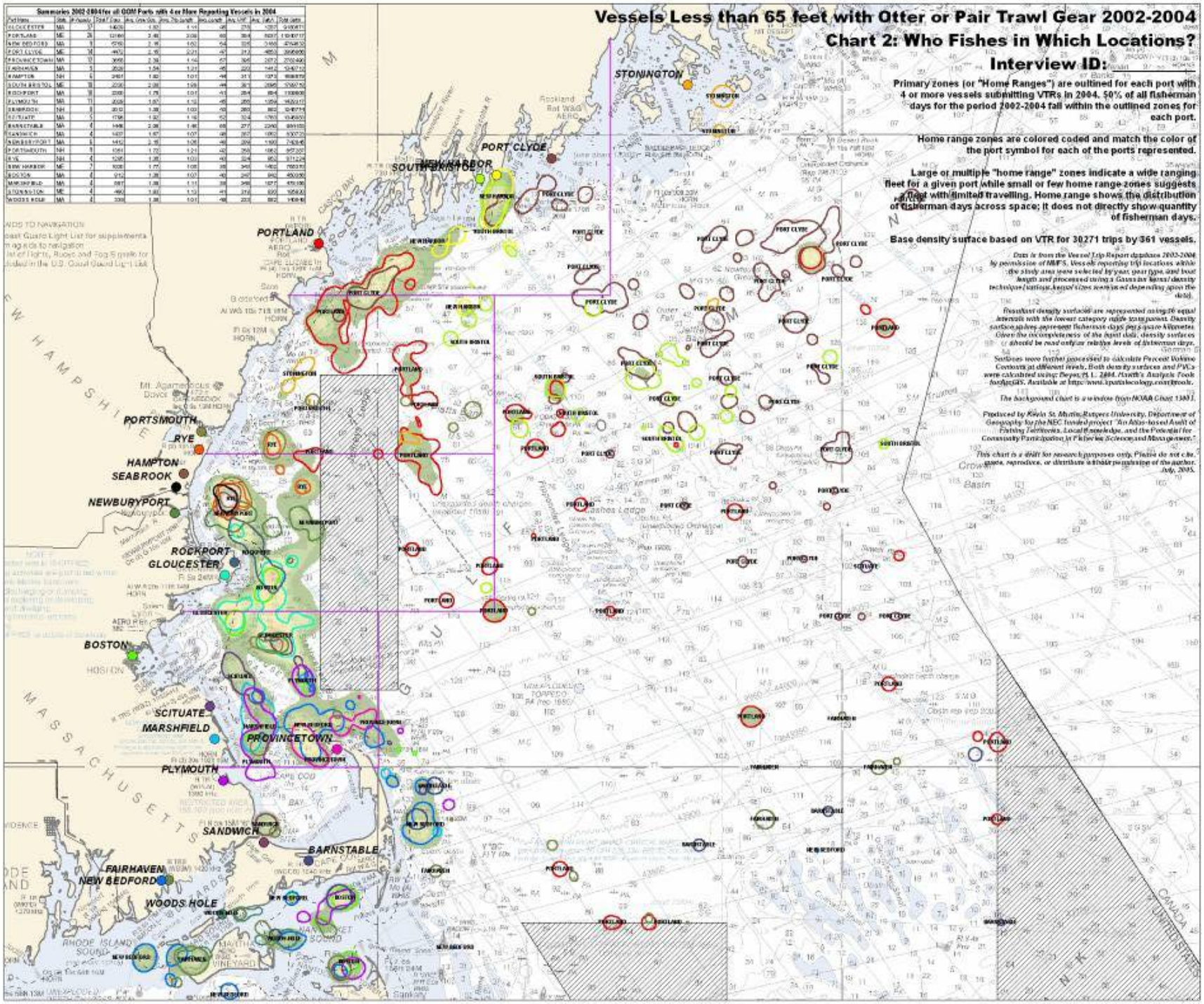
	Total Printed	Delivered to CRs
Chart 3		
36x30 Format		
Gloucester, MA		
Large Trawl	3	0
Small Trawl	3	1
24x20 Format		
Gloucester, MA		
Large Trawl	7	7
Small Trawl	10	6
Gill Net Long Line	2	0
Rockport, MA		
Small Trawl	2	0
Beverly/Marblehead, MA		
Gill Net Long Line	1	0
Boston, MA		
Large Trawl	6	3
New Bedford, MA		
Large Trawl	10	10
Dredge	7	7
Chatham, MA		
Gill Net Long Line	4	0
Massachusetts Bay		
Pots and Traps	5	0
Provincetown, MA		
Small Trawl	3	0
Dredge	2	0
Scituate, MA		
Gill Net Long Line	1	0
Harwich Port, MA		
Gill Net Long Line	3	0

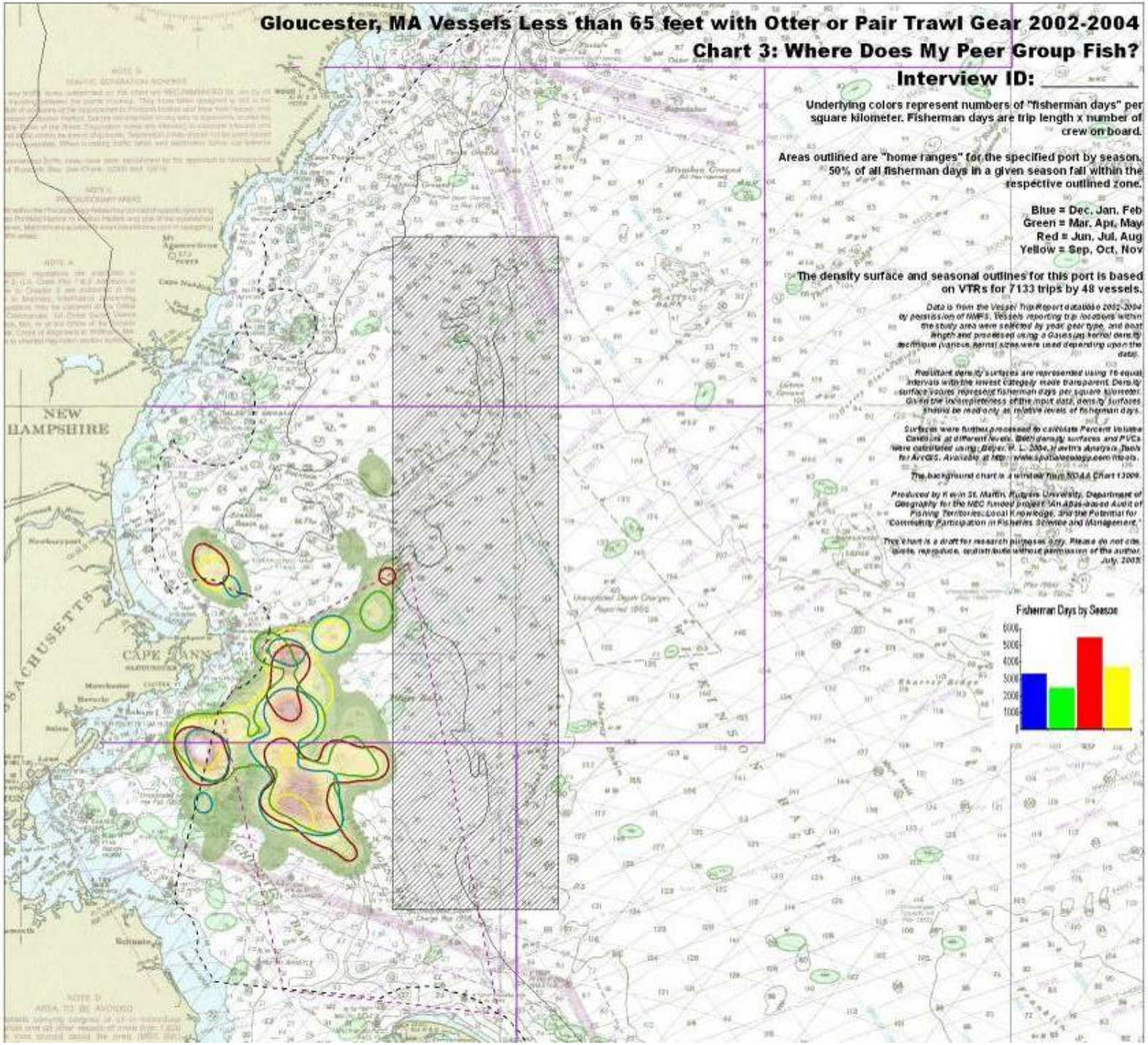
	Total Printed	Delivered to CRs
Chart 3		
Portland, ME		
Large Trawl	6	3
Small Trawl	5	3
Gill Net Long Line	1	2
Stonington, ME		
Pots and Traps	3	3
Downeast, ME		
Pots and Traps	4	0
MidCoast, ME		
Pots and Traps	5	4
Port Clyde, ME		
Small Trawl	2	3
Bigelow Bight		
Pots and Traps	2	2
Portsmouth, NH		
Small Trawl	2	2
Gill Net Long Line	2	2
Hampton, NH		
Small Trawl	1	1
Totals	**331**	**184**

This table lists all maps designed for the project (not all were delivered to community researchers and some were dismissed as poor design given interviewee feedback).

* For more information on the design aspects of the maps see St. Martin, K. 2008. "Mapping Community Use of Fisheries Resources in the U.S. Northeast" *Journal of Maps* 2008: 38-41.


Vessels Less than 65 feet with Otter or Pair Trawl Gear 2002-2004
Chart 1: Where in the Gulf of Maine do We Fish?
Interview ID:
Colors represent numbers of "fisherman days" per square kilometer.
Fisherman days are trip length x number of crew on board.
Fishermen days increase from green to pink/white
No color = virtually no fisherman days
Green = relatively few fisherman days
Yellow = significant fisherman days
Pink = many fisherman days
White centers = most fisherman days
Primary zones are outlined in red (50% of all fisherman days fall within the red lines). Pie charts show percent presence by port in primary zones.
Density surface based on VTR for 30271 trips by 347 vessels.


Vessels Less than 65 feet with Otter or Pair Trawl Gear 2002-2004
Chart 2: Who Fishes in Which Locations?
Interview ID:
Primary zones (or "Home Ranges") are outlined for each port with 4 or more vessels submitting VTRs in 2004. 50% of all fisherman days for the period 2002-2004 fall within the outlined zones for each port.
Home range zones are colored coded and match the color of the port symbol for each of the ports represented.
Large or multiple "home range" zones indicate a wide ranging fleet for a given port while small or few home range zones suggests fleet with limited travelling. Home range shows the distribution of fisherman days across space; it does not directly show quantity of fisherman days.
Base density surface based on VTR for 30271 trips by 361 vessels.
STONINGTON
PORT CLYDE
SOUTH BRISTOL
PORTLAND
PORTSMOUTH
RYE
HAMPTON
SEABROOK
NEWBURYPORT
ROCKPORT
GLOUCESTER
BOSTON
SCITUATE
MARSHFIELD
PROVINCETOWN
PLYMOUTH
SANDWICH
BARNSTABLE
FAIRHAVEN
NEW BEDFORD
WOODS HOLE
MASSACHUSETTS
NEW HAMPSHIRE
CANADA


Gloucester, MA Vessels Less than 65 feet with Otter or Pair Trawl Gear 2002-2004
Chart 3: Where Does My Peer Group Fish?
Interview ID: _____
Underlying colors represent numbers of "fisherman days" per square kilometer. Fisherman days are trip length x number of crew on board.
Areas outlined are "home ranges" for the specified port by season. 50% of all fisherman days in a given season fall within the respective outlined zone.
Blue = Dec, Jan, Feb
Green = Mar, Apr, May
Red = Jun, Jul, Aug
Yellow = Sep, Oct, Nov
The density surface and seasonal outlines for this port is based on VTRs for 7133 trips by 48 vessels.
Data is from the Vessel Trip Report database 2002-2004 by permission of NMFS. Vessels reporting trip locations within the study area were selected by year, gear type, and boat length and processed using a Gaussian kernel density technique (various kernel sizes were used depending upon the data).
Resultant density surfaces are represented using 16 equal intervals with the lowest category made transparent. Density surface values represent fisherman days per square kilometer. Given the incompleteness of the input data, density surfaces should be read only as relative levels of fisherman days.
Surfaces were further processed to calculate Percent Volume Contours at different levels. Both density surfaces and PVCs were calculated using Beyer, H. L. 2004. Hawth's Analysis Tools for ArcGIS. Available at http://www.spatialecology.com/htools.
The background chart is a winter hour NOAA Chart 13009.
Produced by Kevin St. Martin, Rutgers University, Department of Geography for the NEC funded project "An Atlas-based Audit of Fishing Territories, Local Knowledge, and the Potential for Community Participation in Fisheries Science and Management."
This chart is a draft for research purposes only. Please do not cite, quote, reproduce, or distribute without permission of the author. July, 2005
Fisherman Days by Season
6000
5000
4000
3000
2000
1000
0
NEW HAMPSHIRE
CAPE ANN

APPENDIX V: INTERVIEW PROTOCOL (CONDENSED FORMAT)

Interview Questions -- Gulf of Maine Fishing Atlas

Official Project Title: "An Atlas-based Audit of Fishing Territories, Local Knowledge, and the Potential for Community Participation in Fisheries Science and Management"

General Interview Information

Interview I.D. _____ Interviewer_____

Interviewee name (optional)_____

Interviewee peer group description (e.g. large trawlers from New Bedford):

A. Interviewee Profile

1. Please circle every category that describes the fishing career of the interviewee:
   Commercial Recreational Owner Captain Other_____
2. How long have you been fishing?_____years
3. How long have you been a captain?_____years
4. How long have you been an owner?_____years
5. Are you currently captaining a vessel? If not, when were you last working as a captain?
6. Interviewee brief vessel history and port information (allow interviewee to fill out if easier):

	2004	2000	1994
Home Port (reported)			
Principal Port (reported)			
Primary port of Landing			
Gear			
Length			
Year built			
Horsepower			
Primary target species			

There has been much talk recently about "fishing communities" and the effects of regulations upon them. Indeed, there is a federal level mandate to assess impacts upon communities due to fisheries management initiatives. Defining a "fishing community" is, however, difficult.

7. Do you consider yourself to be a member of a "fishing community"?
8. How do you define your community?
9. How is this community useful to you, if at all?
10. Do you see a role for community in fisheries management?

B. Fishing Peer Group Profile

1. How many vessels in (Interviewee's Port) are similar in gear, size, and species targeted?
2. Were there more or fewer vessels of your type in recent times?
3. Is the fishing pattern of these vessels generally similar to yours (here we mean general patterns and not individual 'hot spots')? ☐ Yes ☐ No
4. If not, how do they differ?
5. To what degree do members of your group typically depend upon each other or fishermen of other groups? In what ways?
6. Do you share information with members of your peer group? (What, when, how?)
7. How common is leasing of days among the groundfish vessels in your port? Has this effected cooperation amongst peer members?
8. What other ports do you or members of your group visit and for what reasons? For example, where do you and members of your cohort:

Land catch (specify season, if applicable)
Tie-up (specify season, if applicable)
Purchase gear
Purchase supplies
Get repairs (e.g., Railways)

Other interactions? _____

9. Are there boats in other ports that you would consider part of your group? (Explain)
10. Do the members of your peer group belong to any formal **organizations related to fisheries**? Please specify organizations to which members of your group belong (or belonged). What are the benefits of belonging, if any?

	Your Peer Group	You	Benefits
Commercial Fishing Organizations			
For example: Northeast Seafood Coalition, State Lobstermen's Assoc., GFWA, etc.			
Financial/employment institutions			
For example: Settlement house, retraining programs, insurance programs, union, etc.			

11. Do the members of your peer group regularly **participate in fishing related events**? Please specify events and the benefits of participation.

	Your Peer Group	You	Benefits
Community events			
For example: Community protests, waterfront celebrations, etc.			
Religious events			
For example: Blessing of the fleet, religious festivals, etc.			
Sports and competitions			
For example: Lobster boat races, etc.			

12. Are members of your peer group **active in the fisheries management, science, or other government**? Please specify and note to what degree they are active.

	Your Peer Group	You	Benefits
Federal management			
For example: Attend council meetings, participate on committees, appointed representative, write letters, etc.			

State management			
For example: Addend management meetings, participate on committees, appointed representative, write letters, etc.			
Cooperative science			
For example: NEC projects, Cod tagging, MFP initiatives, etc.			
Local government			
For example: Selectman, conservation commission, shellfish commission, harbor master, etc.			

C. Where in the GOM Do We Fish? (Chart 1)

This first chart shows current fishing patterns based on VTR data for all vessels that are similar to yours (in terms of gear and size) that originate in MA, NH, or ME. The data used is an aggregate of data from 2002, 2003, and 2004.

The colors (from green to pink/white) represent fishermandays spent in that area. Areas that are not colored were seldom visited by fishing vessels of this type and contain virtually no fishermandays. Green areas contain some but relatively few fishermandays, yellow areas contain more fishermandays, and areas that are red to pink are those containing most fishermandays.

Those areas outlined in red contain 50% of all fishermandays for this vessel/gear type. As such, they are the primary or core areas for this vessel/gear type. Yellow and green areas are secondary fishing locations for this vessel/gear type.

1. Looking first at the extent of the colored areas (areas colored versus areas not colored): Do you think this chart is accurate in terms of the extent of areas important to vessels similar to yours?
2. Looking at the change in color from green to red/pink as well as the 50% outline: Do you think this chart accurately represents the relative importance of locations in terms of fishermandays?
3. Are there areas that you think are missing or have been incorrectly mapped as important for your class of vessel (**when pointing to and discussing areas on the map make sure you or the interviewee name them for the tape**)?

At this point we would like you to correct or amend the charts as you see fit. Please add or delete areas by circling them with one of the colored markers.

4. If an area is added: How important is the added area relative to other areas already mapped? Use the colored marker that best fits the relative level of importance (green, yellow, and red). **(Label the added areas A, B, C... When discussing, refer to "addition A"…).**
5. Do you have some insight as to why this area did not show up in the VTR data?

The following questions ask about change over time relative to this current pattern of fishing.

6. This is the most recent pattern for this vessel/gear type. Would the pattern be significantly different for earlier years (before 2002)?
7. If possible, please use the black marker to circle major areas that were significant in the past, before 2002 **(Continue labeling drawn areas with letters …D, E, F, etc. and refer to these newly outlined areas by these letters)**.
8. Please use the blue marker to circle major areas that now show as significant but were not significant in the past (before 2002).
9. What was the cause of these changes?
10. How did these changes affect your peer group? How did they affect the larger community?

D. Who Fishes in Which Locations? (Chart 2)

The second chart is similar in terms of fisherman days colors but the outlined areas are those important to specific ports. The colored outlined areas (colors match port symbols) contain 50% of all fisherman days for each port on the chart; they are the "home range" or area of major importance to that port.

The ports mapped are only those ports with 4 or more vessels carrying federal permits (i.e. those required to fill out vessel trip reports). Ports with fewer than 4 vessels cannot be mapped for reasons of confidentiality.

1. Do you think this characterization of port activity is accurate? Please explain why or why not.
2. The home ranges for any of the ports shown might be incomplete. Do you know of any areas that we should add? If so, please add them and label by port name using the black marker.
3. Are there major ports that are missing entirely that should be included? If so, please add them and label them appropriately.

Let's find and look more closely at the zones that represent the home range of your port and note the degree of overlap with other ports (if any). This is most easily done by "coloring in" your home range area with pencil.

4. Are these the ports/communities that overlap most with your peer group?

5. Has there always been this overlap in these locations? Is it something new? Is the overlap an issue?
6. Do you communicate with people from these other communities/ports? While at sea? Elsewhere? When and where?
7. Do you share information (e.g. catch, environment, conditions, weather, safety, gossip) with people from these other communities/ports? While at sea? Elsewhere?

E. Where Does My Peer Group Fish? (Chart 3)

This chart shows the areas that are important to your port. The chart shows fisherman days but only for your port and gear/vessel type. This chart, however, has additional information concerning seasons. The outlined areas are areas of primary importance by season.

1. Looking at the change in color from green to red/pink as well as the areas outlined: Do you think this chart accurately represents the relative importance of locations in terms of fisherman days to your port?
2. Do you think the seasonal characterization is accurate? Do you see familiar patterns that correspond to your experience?
3. Are there areas that you think are missing or have been incorrectly mapped as important to your port?

As with the first chart, please add any areas that have been left out by circling the area. Use the marker that best fits the relative level of importance (recall that green is somewhat significant, yellow is significant, and red is most significant in terms of fisherman days). If an area is added:

4. Is it important to all members of your peer group? Many? Some?
5. Do you have some insight as to why this area did not show up in the VTR data?

The following questions ask about change over time relative to the current pattern of fishing of your port.

6. Would the pattern be significantly different for earlier years (before 2002)?
7. If possible, please use the black marker to circle areas that were significant in the past (before 2002).
8. Please use the blue marker to circle areas that now show as significant but were not significant in the past (before 2002).
9. What was the cause of these changes?
10. How did these changes affect your peer group? How did they affect the larger community?

This chart shows one or several distinct zones that are important to your port. We would like to ask you questions about each zone beginning with the zone most familiar to you. Please circle the zone and give it a name. Write the name on the chart and refer to the zone by this name (for the sake of the tape). **[Questions concerning individual zones are on the two pages attached at the end of this document. Use a copy of those pages for each zone discussed. Return to section F after discussing zones.]**

F. Community Issues and Alternative Futures

1. Despite change, loyalties persist within the industry. For example, some bait suppliers continue to keep prices low and sell first to small operations. Are there any of these kinds of loyalties within your peer group or the ports within which it operates?

2. Are there any other aspects of or stories about your peer group that you think might be relevant to a better understanding of fishing “communities”?
3. We have asked many questions about specific areas of the GOM relative to your fishing experience. These included questions about community and the environment. Would you be willing to share what you know about these locations with fisheries scientists or fisheries managers? Under what conditions? Would your peers be willing to share this information?
4. Has this interview changed how you think about fishing communities, in general and your fishing community, in particular?
5. In this interview we focused on the spatial patterns of peer groups. How might this information be relevant to fisheries management?
6. Would a greater consideration of fishing territories change or improve fisheries management? How so?

Questions Concerning Individual Zones (Chart 3)

Zone Name_____, Interview I.D._____.

Use another copy of these two pages for each additional zone discussed in Chart 3.

The following questions will characterize individual zones in terms of community processes among peer group members and environmental knowledge held by the peer group.

1. What is your experience in this zone? For how long have you fished there?
2. How do you compare fishing here versus other locations? Why would you fish here as opposed to the other locations?
3. Do you know other people who fish here? Please characterize your relationship with other people who fish here (e.g. Do you talk with them? Share information? Friends?).
4. What ports rely upon this zone other than your own? Have they always? Has the mix of ports changed over time? Is there conflict between ports? Cooperation? Please specify.
5. What other gear types can be found in this zone? Have they always been there? Is there conflict between gear types? Cooperation? Please specify.
6. Please briefly characterize the environment of this zone (e.g. in terms of bottom type, vegetation, species mix, etc.).
7. For this zone, are there particular fish behaviors, patterns, migrations, etc. that you know about? What about non-fish species (e.g. whales, turtles)?
8. Is this zone a spawning area for any particular species? Is it a juvenile area?
9. Is the environment consistent within this zone? Is it the same everywhere within the zone or does it vary?
10. How has the environment for this zone changed over time? Please be as specific as possible (e.g. in terms of bottom composition, species mix, species behavior, etc.).
11. What environmental information do fishermen know about this zone? Is it different than what scientists know?
12. Do you know from older people’s stories if this zone has changed over generations? If yes, please explain.
13. What are the most important things to know about the environment when fishing in this zone?