Making Space for Community Resource Management in Fisheries

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> Before we can even hope to rebuild stocks, we must start to rebuild communities (Jentoft 1999: 29).

Fisheries are in a state of crisis worldwide (McGoodwin 1990) and, as a result, fisheries continue to be the often-cited example of the “tragedy of the commons” (Hardin 1968). The inspiration for many studies of common property, they are seen as the location where individual behavior, unfettered by community, continues to cause environmental degradation and, ultimately, the dissolution of potential wealth. Within this particular vision of common property, which is the foundation for the currently hegemonic discourse of fisheries, tragedy is overcome by necessary prescriptions designed to transform common property economies such that they resemble, in structure and use, private property regimes.

There are, however, signs that fisheries in many places are not driven solely by individual motives but are the sites of community organization and cooperative management of common property (Dyer and McGoodwin 1994). These examples provide important counter arguments to the dominant discourse of fisheries where common property necessarily results in tragedy. Unfortunately, examples of community management of fisheries have seldom been documented in the industrialized fisheries of the first world (Pinkerton 1989); visible only in distant places or a distant past, communal forms of resource management are, as an option, undermined.[1] Overcoming this “peripheralization,” making communities visible and viable in the “center,” requires a re-mapping of the center as the location of processes appropriate for community management of common property resources.

This paper relies upon research conducted in 1997 and 1998 that included an analysis of fisheries scientific and management discourse and a series of interviews with fishers from New England, an important center of fisheries science, management, and industrial development. The discourse analysis examined a wide range of materials (e.g., fisheries science texts, government and management council documents, and newspaper articles). What emerged was a common set of ontological assumptions about the subjects and spaces of fisheries (c.f. Kirby 1996). The interviews with fishers included mapping exercises and were part of an oral history project (S-K Grant 96-NER-166) belonging to the Gloucester Fishermen’s Wives Association (GFWA).[2] Twenty-four fishers were interviewed between May and December 1997. Most of the fishers interviewed were or had been fishing boat captains at some point in their careers, and all but one fished out of Gloucester, MA. The boats they worked were all trawlers (boats that drag nets on the ocean bottom in search of groundfish such as cod or haddock) except for two boats with gillnet gear (stationary nets placed on the ocean bottom that passively catch groundfish). All boats operated within the New England Region (Figure 1). Interviewees were asked a range of questions designed to assess their personal histories and the extent of their environmental knowledge; maps were used during interviews to record the spatial aspects of that information. The interviews revealed a “landscape” of fishing that is different than that assumed by the dominant discourse. This work begins to document this landscape, to re-map the domain of fisheries; it draws the basic contours of this unseen landscape and finds within it a potential for the community management of fisheries.

“Re-mapping” can be both a metaphoric re-understanding and a literal cartographic exercise that reveals previously unseen social, economic, or environmental processes. New “maps” can create the spaces within which new subjects, economic processes, or understandings of the environment can exist. Although mapping, as metaphor, is currently popular within social science and social theory (Smith, N. and Katz 1993; Gibson-Graham 1996), mapping in its more literal form is often overlooked as a basis for alternative understandings or actions. This paper does employ maps metaphorically, but it chiefly focuses on the literal spaces of fishing and their re-mapping as a method to reveal communities and the potential for communal forms of resource management that have been obfuscated by the dominant mapping of fisheries.

Re-mappings of resources and resource use are happening in a number of locations worldwide. These re-mappings are community-based attempts, often by indigenous groups, to reclaim rights to access and use of resources (e.g. Lewis 1995). They challenge the dominant, primarily national or international, mapping of their homes, places of work, and territories of use. Communities threatened by the expansion and dominance of a global system of capitalism are "counter-mapping" their environments in an effort to reveal alternative spaces of territory and tradition (Peluso 1995).

Examples in fisheries of counter-mapping are closely linked to notions of "community management" of fisheries resources. Importantly, community management advocates point repeatedly (if sometimes indirectly) to new spatial understandings of environmental and social spaces at new scales as an important basis for community management. Communities that have demonstrated successful fisheries management invariably work within bounded territories and maintain detailed, and spatially dependent, environmental knowledge that can be mapped (e.g., Nietschmann 1995). The documentation of these and other spatial processes that operate at the scale of the community is clearly important to community-based forms of resource management (Langton, et al. 1994). Communities and the territories within which they operate represent a very different subject and space than is evident in current fisheries science and management.

This paper examines the dominant discourse of fisheries science, bioeconomics, and outlines its fundamental assumptions of subject and space. Starting from particular understandings of both subject and space, fisheries science and the management it informs propose solutions to fisheries crisis that are limited by their initial assumptions and are often dissonant with fishers' perceptions of the resource and their desires for management. Fishers' alternative spatial understandings of fisheries as well as their patterns of fishing are explored. The potential for community participation in management is suggested by the local and community-based mapping of fisheries by fishers themselves.

BIOECONOMICS: MAPPING FISHERIES RESOURCES

Early in the 20th century a particular understanding of how fish populations were maintained and/or how they fluctuated evolved. Numeric equilibrium models were developed that attempted to mirror the demographic changes of fish populations due to fishing pressures (e.g., Russell 1931). By the late 1930s, a general equilibrium model for fisheries emerged that suggested a maximum sustainable yield (MSY) could be calculated and achieved through the control of a single variable, mortality due to fishing (e.g., Graham 1939). In the model, as fishing effort increases, catch will increase until the point of MSY, after which increased effort results in a decline in catch (Figure 2). Overfishing, or fishing in excess of the MSY, implies overcapitalization of the fishing fleet, inefficiencies of production, and declines in catch per unit of effort until effort exactly equals returns (the point of open access, OA in Figure 2). Since all other variables (e.g., recruitment, growth, or natural mortality of fish) are uncontrollable, attaining MSY and avoiding overfishing is only possible through the control and, as is now the case in most fisheries, the reduction of fishing effort.

The biological story of fish stock became an economic story about cost and revenue in 1954 with the advent of Gordon's seminal article entitled "The Economic Theory of Common Property: The Fishery." Hereafter, the objective of managing for MSY would be supplemented by the social-economic concept of maximum economic yield (MEY) (Figure 2). MEY was the point where economic returns would be maximized relative to cost. Economists added to biological fisheries dynamics certain assumptions about *individual* economic behavior that would explain why fisheries tended toward overfishing and how fisheries might better be managed to attain MSY or, ideally, MEY (Anderson 1986). They made clear that in the absence of private property new "fishermen"[3] would continue to enter a profitable fishery until costs equal revenue, eventually dissipating all resource rent and, hence, opportunity for individual profit (Clark 1985; Rettig et al. 1989).[4] This joint biological/economic approach is at the heart of bioeconomics and would prove to be increasingly influential through the post-war period (T.D. Smith 1994).

Propelled by an unambiguous story about lost wealth and new laws guaranteeing sovereignty over resources (such as new national jurisdictions out to 200 miles), bioeconomics would offer unifying concepts of common property and individual behavior that would make coherent a variety of scientific and political practices. In this sense, bioeconomics signifies an emerging and now dominant discourse of fisheries that encompasses the forms of data and analyses used by fisheries biologists, government documents and statistics, fisheries management policies, media stories about the industry, and the statements and practices of fishers themselves. And as a "discourse of development" (c.f. Escobar 1992), bioeconomics constitutes fisheries as a site of necessary economic transformation through the implementation of standard capitalist institutions such as private property, wage relations, and corporate structures (e.g., Keen 1988). Like other discourses of development emerging in the post-World War II era, it provided a rationale for top-down intervention and promised prosperity as a result.

This powerful discourse, originating with fish, would be borrowed and built upon by other common property thinkers such as Garrett Hardin. The "tragedy of the commons" (Hardin 1968) would become the standard explanation for a wide variety of resource scarcity and poverty issues and it would offer a clear remedy, the institution of property regimes and labor relations similar to those of modern capitalist society.

The general Gordon-Hardin model (after McEvoy 1986) continues to be hegemonic within fisheries science despite continued crises of fisheries and calls to broaden fisheries assessment and management to incorporate other socio-economic (Clay and McGoodwin 1995; Dyer 1994) or biological/ecosystem (Botsford et al. 1997; Sainsbury 1997) understandings. The strength of bioeconomic models as well as their resistance to alternative (e.g. community-based) approaches are maintained through foundational assumptions and the ways these assumptions have been institutionalized in data collection, fisheries analysis, and policy recommendations. Two basic ontological assumptions are of interest here: "fishermen" and "fisheries." These are the subjects and space that serve as the scripted actors and stage for the tragedy of the commons. Hardin captures well this configuration of subject and space when he writes about the commons in general.

> The tragedy of the commons develops in this way. Picture a pasture open to all. It is to be expected that each herdsman will try to keep as many cattle as possible on the commons. Such an arrangement may work reasonably satisfactorily for centuries because tribal wars, poaching, and disease keep the numbers of both man and beast well below the carrying capacity of the land. Finally, however, comes the day of reckoning, that is, the day when the long-desired goal of social stability becomes a reality. At this point, the inherent logic of the commons remorselessly generates tragedy (Hardin 1968: 1244).

To accept Hardin's model, and indeed that of fisheries bioeconomics, we must imagine a homogenous common resource open to all and at the same time we must assume a particular individual subject who desires to maximize personal wealth. In Hardin's article and elsewhere (e.g. Graham 1939; Gordon 1954) tragedy is circumvented only in locations distant from the modern developed society/economy in terms of either time (i.e. pre-development) or space (i.e. the "Third World").

Within bioeconomic discourse the reduction of agency to the individual subject, the "fisherman," displaces to the periphery any role for alternative subjects, such as "the community," to mitigate tragedy. In addition, the assumed homogenous commons makes any notion of an alternative space, such as community territory, equally foreign. The numeric modeling of fish and "fishermen" leaves no place for community in New England fisheries. Recognizing communities and their potential influence on fishing practices is impossible without a re-mapping of fisheries.

INSTITUTIONALIZED DATA COLLECTION

> Large scale surveys, as conducted by the National Marine Fisheries Service since 1963, have been extremely effective in documenting the persistence of patterns in the structure and geographic range of fish populations but they have not recognized the finer scale factors controlling fish behavior… In contrast, fishermen have focused their efforts on fishing grounds… or even at smaller scale habitat associations within a generalized fishing ground, reflecting localized knowledge of a particular fishes behavior… It is at this scale that more research effort has to be expended and it is at this scale that management efforts have to be developed (Langton et al. 1994: 46).

The space produced by fisheries science and informed by bioeconomics is a space whose history is one of statistical and numerical convenience rather than local cultural or social construction. The hegemonic "map" of fisheries in New England is constituted by particular forms of data that are defined, quantified, and utilized in ways that reify the initial assumptions of individual behavior and open access commons in bioeconomic theory. The offshore locations of fishing communities and the spatial practices of fishers are not visible in this dominant mapping; the scales of perception and data recording that govern assumptions of fish behavior and stock estimates differ dramatically between fisher and fisheries scientist. The assumptions of fisheries science as well as the geography it produces limit what can be said about fisheries and the options available to management.

Modeling changes in fish stock (by single species) requires estimates of two essential parameters: fishing effort and existing stocks.[5] Both measures are aggregate indices derived from area wide data. In the case of fishing effort, catch and landings data are reported by boats or fish buyers for each fishing trip taken. These data are then aggregated by species caught. Stock size for a given species, the other primary parameter for modeling fisheries, is estimated by sampling at stratified random locations over many years (Pierce and Hugl 1979). The National Marine Fisheries Service (NMFS) collects the catch data in an ongoing effort and conducts biological surveys biannually for both the New England and Mid-Atlantic management areas. Fishing effort data collected for each trip is aggregated by species caught in order to match the biological data. Together, they provide the essential information needed for numeric modeling of the resource.

Occasionally, these data are used to describe fisheries in areas smaller than the management area such as the individual statistical areas developed by NMFS, Northeast Fisheries Science Center (Figure 3), but this discrete and hierarchical grid is used primarily for aggregation purposes.[6] It is based on the North Atlantic Fisheries Organization (NAFO) designations developed earlier in the century and remains the dominant geography of assessment and management in New England. Occasionally, and increasingly, other more disaggregated and flexible spaces are being used in science and management (e.g., a 30 minute grid used to assess and manage Gulf of Maine groundfish stock).[7] Analyses of stock using such large-scale geographies are, however, questionable given the characteristics of the initial data collected (per. comm. NMFS). In addition, the space of these grids, whether NMFS statistical areas or 30 minute squares, differs dramatically from the actual pattern and scale of fishing as reported by the fishers who where interviewed (Figure 4).

Translated into bioeconomic terms, fishing effort is the collective effort of all "fishermen" who are attempting to maximize their individual use of common fisheries resources. This aggregation of effort obscures the social heterogeneity of harvesting enterprises in terms of their economic structure, the communities to which they belong, their territories of use, or the skill level of individual boat captains. In addition, aggregate measures make it difficult to connect changes in fishing effort with other factors such as the demands of processors, union regulations, community or ethnicity-based practices, crew dynamics, or voluntary agreements amongst industry participants (cf. Durrenburger 1997). Without such connections, the general increase in effort can only be seen as "too many fishermen chasing too few fish." Under these conditions, it is difficult to imagine "fishermen" as anyone but the individual owners of the fishing boats from which effort data is derived. As a result, the individual subject of fisheries, the "fisherman" who is a boat owner, becomes the focus and potential benefactor of management policies (Copes 1986; Palsson and Helgason 1994; St. Martin 1999).

The biological sea-surveys assess the status of the commons itself; they measure the resource in terms of quantities of fish by species, which is then linked directly to fishing effort. Standard critiques of traditional fisheries science point to this single species (i.e. non-ecological) understanding of fish populations (e.g., Botsford et al. 1997; Costanza et al. 1998; Megrey and Wespestad 1988). Although more ecological and explicitly spatial approaches are proposed (M. E. Smith 1990; Wilson et al. 1994; Wilson and Kleban 1992), numeric single species models remain dominant. In these models, populations are reduced to a function of fishing effort leaving other processes such as pollution, environmental change, predator and prey relations, and habitat alteration as, at best, secondary determinants of population change. This standard criticism implies not just overlooked biological relationships within fisheries environments but an environmental spatiality that is lost in the models of fish and fishers.

The insistence on the aggregate behavior of "fishermen" as the essential cause of environmental crises obscures local variability of fishing enterprises which is often due to environmental conditions, as well as to the influence of communities on patterns of fishing. The institutionalized forms of data collection based on bioeconomic assumptions set the stage for the inevitable "tragedy of the commons." As Gordon and Hardin have informed us, however, the tragedy can be avoided if management appropriately intervenes.

INSTITUTIONALIZED MANAGEMENT OPTIONS

The fisheries of New England have long been exploited by North Atlantic nations but are now managed by the New England Fisheries Management Council, one of several councils set up in the United States via the Magnuson Fishery and Conservation Act of 1976. The New England council is made up of industry and other representatives and works closely with the National Marine Fisheries Service (NMFS), the principal scientific and advising body for fisheries in the United States, to manage fisheries within the New England Region.[8] Since the council is ultimately answerable to the government, their plans are increasingly aligned with government sponsored data collection, scientific reports, and recommendations on fisheries. Management, dominated by numeric modeling (NRC 1998), has become a function of NMFS biological inventories of individual fish stock and its measurements of fishing effort on a fishery by fishery basis.[9]

Currently, most regulations in New England are designed to limit harvest capacity through fishing gear restrictions such as the size of net mesh, size and power of boats, numbers of crew members, and the size of fish that can be legally landed. Bioeconomic theory, on the other hand, suggests restricting access rather than effort as a more efficient and ultimately necessary path to avoid tragedy. In New England, regulations such as moratoria on licenses and limitations on the number of days at sea (DAS) can be seen as a general movement toward limiting access to the resource, in many regards they represent a nascent privatization of fish stocks (Clay 1997; Davis 1996).

Although limiting access in steps, as is happening currently, could be seen as a gradual privatization, many feel that they are only partial and flawed steps. "True" privatization is, in contemporary industrial fisheries, associated with the introduction of individually transferable quotas (ITQs) as a management strategy. Quotas work by numerically allocating quantities of fish stock to individual "fishermen" (assumed to be boat owners), making that allocation transferable on the market, and allowing recipients of quotas to harvest anywhere within the management area. ITQs are seen by many as the ultimate solution to the problem of fishing (Copes 1986).

The logic of ITQs is derived from the bioeconomic assumptions of individual subjects and the homogeneous open access space of fisheries. ITQs are given to boat owners that, in some sense, represent the rational individual "fisherman" competing on the commons; other fishers who are not boat owners (e.g., many captains, mates, deck hands) are denied direct access to the resource itself despite a long tradition of sharing catches on a trip by trip basis.[10] ITQs would, in a sense, place all "shares" of the resource in the hands of boat owners before capture; current restrictions on access and effort leave the resource open or "un-owned" until capture, after which it is shared between crew members and "the boat."[11] In addition, those individuals who are awarded ITQs are able to employ them in any geographic location within the management area;

the spatial domain of quotas, a space of industrial production, corresponds to the space of stock assessment, without which quotas could not be calculated. ITQs reify the individual subject and the open access space assumed by fisheries bioeconomics; they demonstrate a discursive continuity that has been institutionalized in processes that range from primary fisheries data collection to management policies.

Fishers and fisher advocacy groups (e.g. Gloucester Fishermen's Wives Association) challenge and dispute many assessment reports and management strategies by putting forward the idea of the community. In addition, the community, as opposed to individual "fishermen," is celebrated by academics as a basis for resource management (e.g. Davis 1991; Leal 1996; Palmer 1994; Pinkerton 1990). These alternative stories about fisheries present communities as threatened and endangered by fisheries management, particularly schemes that get ever closer to formal systems of privatization. It is thought that the individuals who will benefit from ITQs will not be the families and crews embedded in local communities; they will be corporations or boat owners who, with guaranteed returns on investment, will consolidate ownership of quotas and transform the industry. In general, forms of management that tend toward privatization are awarding the chance to catch fish (in the form of a license, days to fish, or a quota) to boats themselves which can be capitalized upon by the boat owners rather than boat crews or fishing communities (Davis 1996; Palsson and Helgason 1994).

The implicit spatial aspect of this story is perhaps easy to see in the recent case of the Atlantic Star. This 369 foot "factory" trawler was due to start fishing for herring in New England waters in 1998. A license to fish for herring could, theoretically, be given to non-national companies provided the fishery, according to the NMFS, was not being utilized to full capacity. Local fishers and environmentalists, however, argued that the numerically calculated "surplus" of herring was necessary as a food fish for other more valuable species such as cod. The removal of the herring "surplus" by the factory boat would have disastrous effects, they claimed (Greenpeace 1998). A locally produced T-shirt captures the sentiment of local fishers (Figure 5). In the illustration small family-owned boats are devoured by the corporate owned giant; the coming of the factory boat is linked to privatization (note the ITQ flag); and the environment itself, a complex ecosystem represented by many species, is also threatened.

The cartoon clearly demonstrates fishers' fears about the economic transformation of the industry, but it might also be read as a story about space and territory. The implication of the image is of a place invaded and a resource, upon which other commercial fish depend, unjustly taken away. The transformation of the subject, the loss of community boats and the rise of corporate owned boats (with attendant ITQs), is resisted, in part, by creating a sense of place and local rights to herring. One interviewed fisher spoke in just such terms when talking about the government's attempt to encourage all fishers to catch more herring. His testimony conjures a community territory unmapped by NMFS and made irrelevant by the strictly numeric accounting of herring.

> Biologists tell us there's a lot of herring in the ocean…. Now, all outside boats… boats from other states… they come get our herring. They should limit the herring… That's our fish! (interview data, 1997).

RE-MAPPING THE "LANDSCAPE" OF FISHING

Environmental, political, social, or economic differences within a particular management area are masked by the importance given to measuring aggregate harvest in relation to aggregate fish stock for the entire area. Data used in models that do not account for processes over space (e.g., proximity or correlation) might provide accurate numbers of fish and good estimates of the overall fishing pressure for the entire area, but they tell us little about local fish habitats or the variable fishing behavior of individual fishing enterprises and fishing communities (Langton et al. 1994, 1995).[12] The later aspects of fisheries would require a very different spatialization than that devised for numeric modeling.

The scale and spatial parameters instituted by fisheries science, appropriate for statistical analysis of the management area as a whole, are not the scale and spatial parameters familiar to fishers (Clay 1996). Most fishers, given their local experience and knowledge of fish populations, think the geography of fisheries science is inappropriate for studying fisheries. One fisher who participated on a NMFS sea-sampling cruise and who was enlightened as to the statistical necessity for a sampling process still noted that the sample areas visited do not correspond to locations where fishers work.

> The problem with the whole thing -- well, it's not actually a problem, because all those strata were picked out by the computer. The computer didn't care if there was a fishing problem [in terms of difficulty to trawl or abundance of fish], if there was a ledge, if there was a rock… They didn't go in fishing grounds that everybody's fishing. A lot of the areas that we went [on the sea-sampling cruise], 80 percent of the areas that we went, we [commercial fishers] didn't fish in (interview data, 1997).

The long standing contention by fishers that scientists' measures of abundance must be incorrect because most of the areas they sample do not traditionally contain fish is often used to illustrate the ignorance of fishers regarding scientific protocol, an issue that participation on the NMFS sea-sampling cruise was intended to address. Yet, the differences between fishers and scientists also point to different spatial languages and understandings of fish populations and not just a lack of information on the part of fishers. Fishers, as seen below, operate using detailed maps of fishing locations. These maps have relative levels of fish abundance and other characteristics important to fishing, rather than overall measures of individual species for the entire management area. Fishers move through, talk about, and map these spaces in both a literal (they make maps) and conceptual (mental maps) sense and they can offer insight into a variety of processes important to fisheries. Fishers gather and exchange information about the environmental landscape (e.g., bottom types, particular flora, depth, and water conditions), they work within cultural and social landscapes of fishing domains and traditions, and they map their own landscapes of successful pathways and places where fish are most likely to be found.

The remainder of this paper locates spatial heterogeneity in the fisheries of New England; it reveals a diverse environmental and social "landscape" known to and produced by fishers that is substantially different from the space of fisheries constructed by fisheries science and management. It is assumed that understanding the spatial aspects of fishing might inform an alternative approach to stock assessment appropriate for local fishing communities rather than abstract individual “fishermen” and it might also contribute to an alternative community management.

Maps of Environmental Processes

The success of fishing enterprises is dependent upon information about specific locations that they repeatedly visit and about which they collect information. It is not surprising that fishers would notice differences between locations according to a variety of environmental factors. The environmental knowledge of fishers, then, is inherently a cartographic knowledge. Theirs is knowledge of the locations of fish and the environmental processes coincident with those locations rather than environmental processes *per se*. Local or traditional ecological knowledge is currently celebrated as an important resource for sustainable development in many countries, and in fishing it is the spatial aspect of that knowledge which secures its value as important to the success of fishing.

Government sponsored fisheries science suffers from a significant lack of local environmental data; information concerning, for example, habitat and multi-species interactions in specific locations has not been collected by government agencies charged with the numeric assessment of single species stock over wide areas. Many, however, are calling for a new focus in science that would be more ecosystems (rather than single species) oriented, a focus that would necessitate the incorporation of local environmental information (e.g. Costanza et al. 1998; Pauly 1997; Wilson, 1998). The federal government, with the passage of the Sustainable Fisheries Act (SFA, Public Law 104-297 1996), has, perhaps, taken the first steps toward such a “paradigm shift” (c.f. Sainsbury 1997). This act added broader environmental concerns to traditional government sponsored fisheries assessment; councils must now address multi-species relationships and fish habitats to some degree. The impact of these initiatives is, however, doubtful given current limitations of data collection and forms of analysis.

Although local environmental knowledge remains largely irrelevant to fisheries science and management (Durrenberger 1990; Smith and Jepson 1993; Stoffle et al. 1994), it has the potential to be the focus of cooperation between management and fishing communities (Neis et al. 1999). Information important to new approaches is readily available from fishers themselves, but generally only under conditions of cooperation such as found in “co-management” regimes.[13] Similarly, sharing local environmental information is thought to be fundamental to community (non-government) management of fisheries as is evident in a number of empirical examples (Nietschmann 1995; Pinkerton 1989; Ward and Weeks 1994; Wilson 1990; related Freeman 1989). Therefore, assessing the existence and nature of the local environmental information held by fishers is an important precursor to establishment of community or co-management regimes in fisheries.

Multi-species relationships

Many of the fishers who were interviewed expressed knowledge about several multi-species relationships even though they were not explicitly asked to discuss this knowledge. They eagerly volunteered information about currently controversial issues that they believe were contributing (or might eventually contribute) to local scarcities of commercial species. These same issues also highlighted management’s lack of sensitivity to multi-species relationships, especially regarding their importance within specific locations. Permits for underutilized species (in the context of the entire management area) were granted to fishing enterprises whose spatially concentrated harvest efforts negatively effected other species and other fishers who worked in the same locations. Management, in an attempt to "develop" new fisheries based on underutilized species, granted rights to harvest based only on the overall abundance of the underutilized species and did not incorporate the geography of harvesting and its attendant multi-species effects.

One fishery with evident multi-species effects is hagfish, which is also referred to as "slime eels." Hagfish are not a traditional commercial fish, but a market of Korean buyers has been recently developed. Hagfish are currently unregulated in terms of allowable size and quantity landed; they are scavenger fish that clean the ocean bottom of dead and rotting animals. The success of the hagfish fishery is thought to result in a bottom littered with rotten fish that produces a poor environment for other commercial ground fish such as cod, haddock, and flounder. One fisher summarized the situation within his traditional near-shore fishing area.

> A lot of gillnetters and lobstermen… switched over to hagfish. I don't know if you are familiar with that slime animal. Now we used to go… fish for flats [flounder and other flat fish], we used to do pretty well… but since the boats started hagfishing, the flounder has disappeared completely… The government doesn't study that… why are the flounder landings down… and does it coincide with the hagfish or not? (interview data, 1997).

In the case of hagfishing, fishers expressed their dismay at the council and NMFS's reluctance to look more closely at multi-species relationships and the effects of developing underutilized species on already commerical species. The granting of permits in an attempt to develop fisheries while disregarding these spatial/environmental relationships appears foolhardy and dangerous to the fishers interviewed.

> But the government is handing out these permits… to the haggers and they say "go 'head, go 'head."… You've got to look at the hagfish [fishery], do studies, and see if it is going [to] destroy the bottom… This bottom must be rotten, there are no hagfish [remaining] there (interview data, 1997).

Multi-species interactions are important to fishers when new fishing pressures on undervalued species negatively effects traditional commercial species. In addition, fishers see multi-species relationships and the results of new fishing practices in particular locations or territories, rather than within the entire management area or some statistical sub-area. At the level of the entire management area the effects of harvesting species that have limited markets such as hagfish may be insignificant; but the effect might be very damaging locally and only be visible within the local landscapes of individual fishing communities.

Bottom Morphology and Fish Habitats

Fish habitat is getting more attention as a critical aspect of fisheries, and its protection is increasingly seen as vital to sustainable fisheries. Since the passage of the SFA in 1996, essential fish habitats (EFH) must be identified and mapped for each commercial fish species that is managed under an official fishery management plan. The definition and delineation of essential fish habitat is difficult for NMFS who have neither the appropriate data nor the ability to identify local habitats for each stage of a fish's life from spawn to adult (per. comm. with industry consultant). Nonetheless, offshore habitats are directly important to fishers who harbor a wealth of knowledge concerning their locations and characteristics. Fishers' have spatial knowledge of bottom morphology and composition that coincides with fish habits and habitats, and fishers refer to a large range of bottom-type classifications as well as their geographic extents. The fishers interviewed characterized bottoms according to composition: mud, slime (algae), grass (sea grasses), trees (soft corals), boulders, cobble, gravel, or sand. They identified textures: prickly, smooth, or rough. They referred to morphological features: flat, humps (sea mounts); spikes, (pot)holes, ridges, ledges, shoals, banks, and reefs. And they noted uncharted artifacts, particularly (ship)wrecks.

These characteristics of a complex and differentiated environment are the ontological categories used by fishers. Most fishers interviewed displayed an intimate knowledge of bottom type and related this to fish habitats; their information was often about specific locations as well as general patterns of bottom type and habitat associations.

> A lot of it is so sight-specific, that if you get on the 47 line [a Loran navigation system coordinate] in between the 20 and the 25 you won't see fish there; but if you get in between the 14 and 19, you can walk on the fish… A lot of times you'll find fish right at the top of an edge, or right at the bottom of an edge, where it stops being hard and the rocks get smooth, and just where it breaks down…. I find it much better to work the bottom [type], than to figure out what the fish are trying to do (interview data, 1997).

Fishers consistently identified general habitat associations as well as specific locations where fish could be found. In addition, 15 of the 24 respondents who participated in the interviews displayed specific knowledge of fish spawning locations; only a handful could identify specific juvenile areas.[14] This retired fisher could identify several specific spawning areas that he believed were consistent from year to year.

> They spawn in almost the same place every year…In Georges [Bank], it would be up there [indicating on the chart], southeast parts, what we call Southeast Parts, way down there, that is one big spawning area. Up in here in Cultivator [Shoal], there is another big spawning area… [continues to identify other locations] (interview data, 1997).

Fishers language and landscape of bottom type have the potential to describe not only essential fish habitats, spawning areas, and perhaps juvenile areas but also areas of environmental alteration and damage. Fishers point to locations where the landscapes have been altered by fishing itself. One fisher describes an area that used to be rich in soft corals that he refers to as “trees.” The heavy gear used by large factory boats in the 1960s significantly altered this area.

> Thirty-five, forty years [ago]… they started coming in with those big, heavy implements, huge rollers. Then you'd have bigger boats, bigger power. What used to be [called] The Trees is now what they call The Desert. They knocked everything down (interview data, 1997).

Successful fishers collect and retain large amounts of information on fisheries. Log books, annotated charts, maps that they produce themselves, digital information, and memory all serve as repositories for both locational and attribute information about the environment. This environmental/spatial knowledge of fishers is potentially important to fisheries science and sharing this information with scientists may provide one of the conditions necessary for community or co-management (Pinkerton 1989). Under such conditions, fishers might offer their knowledge to "fill in the blanks" (Wilson and Kleban 1992) of an ecosystem and community based approach to management. Importantly, the rich environmental geography described by fishers is at the same time a cultural and social geography of industrial utilization. Differentiation within the ocean according to environmental attributes, such as bottom type, defines the domains and territories of fishing enterprises differentiated by gear type, home ports, and boat size.

MAPS OF SOCIAL TERRITORIES

The social spaces of fishing, like the environmental spaces noted above, are at a different scale and have a different character than that of the dominant forms of fisheries science and management. Within fisheries bioeconomics, the space of fishing is characterized in social-economic terms as an open access commons populated by "fishermen" who all have equal access and individual motivation to harvest. The social-economic space of fishers differs dramatically from these assumptions. It is a space of territoriality, limitations on access, and conflict between distinct/differentiated communities of fishers.

Although the environmental spaces of fishing may provide an important condition for community management, the social space of fishing that corresponds to local environmental conditions must also be a consideration. In Pinkerton's (1989) list of the conditions necessary or preferred for community management there are several spatial processes that have more to do with potential communities and their domains than environmental regions *per se*. The list includes the following as important to the establishment and maintenance of community managed fisheries: a local area, relatively few fishers for effective communication, small government bureaucracies that are locally supported, cohesive groups of fishers, and communities whose membership is clear. These social and cultural attributes all have a spatial dimension; they imply the existence of socially constructed spaces that correspond to areas of management and community as well as fisheries resources.

Some notion of a social space or territory is fundamental to community management, but defining communities and their territories can be difficult in locations where neither is formally recognized. In New England, the dominant discourse prioritizes individual "fishermen" over communities and a single open-access management area over pre-existing territories. In addition, involving all members of "the" community in management decisions, where community is thought to correspond to port or region, is nearly impossible for many reasons, not the least of which are the deep divisions between fishers from different ports, who use different gear, who fish different grounds, etc. This interviewee is commenting just on fishers from the single port of Gloucester.

> Yeah we have an organization called the [Gloucester] Fishermen's Wives, and stuff like that, [but] as far as fishermen… it is terrible, nobody likes each other. Gillnetters don't like draggers, and draggers don't like gillnetters. They don't [like] hookers, lobstermen don't like gillnetters or recreational boats that go out and take people out, [they] hate gillnetters cause they fish the same area as the hard bottom (interview data, 1997).

Divisions like these between fishers even in a single port could be sited as evidence that there is no basis for community management, that fishers are simply individuals competing on the commons, and that there is no cohesive or spatially coherent community of fishers upon which to build alternative management schemes. Nevertheless, when processes relevant to the territories of fishers are examined, cohesive groups of cooperating fishers can be found and might serve as the potential basis for community.

In New England, while there are few examples of static territories or coherent communities of fishers, there are innumerable processes of community affiliation and processes of territoriality that together constitute the social spaces of fishing. The interviews produced many individual examples of the domains of fishers from Gloucester, and the interviews attempted to assess various processes that would constitute those spaces. In particular, fishers were asked questions concerning their propensity to share information (spatial and otherwise) within a group, the coincidence of other boats in areas they fished, and, of course, where they fished. Processes relevant to community and territory development emerged. Although the data collected in the interviews did not specifically map those social spaces,[15] it nevertheless uncovered processes responsible for their construction and maintenance.

Sharing information concerning the fishing environment and the quality and quantity of fish caught in specific locations is fundamental to success in fishing. It is virtually impossible for any individual fisher to expect success without first gathering detailed spatial knowledge about where fish might be located, the environment in that location, and the other boats that fish there. Obtaining such information is a gradual process of strategically sharing information with other fishers. Giving away information "for free" is unlikely given the competitive nature of fishing, but completely withholding information is also unlikely since it is most often obtained through "trade." The most successful fishers are those that are the most successful at trading information.

Sharing information presumes a group of fishers who cooperate, have the same interests, and work in the same general areas. It points to the existence of loose communities of fishers with at least temporary affinity. Wilson (1990) refers to "clubs" of cooperating fishers who work together and share much of their information, particularly that which is related to the problem of "search." Theories of the commons and open access overlook the problem of searching for fish (Palsson 1994); they equate entry into a fishery with success at fishing and neglect knowledge as a limitation to fisheries access. Although the industry is made up of neither isolated individuals nor harmonious communities (Peters 1987), there are groups of individuals with shifting alliances (based on knowledge in this case) that serve to define access to fisheries resources and, eventually, fishing success.

> Skills -- in fishing or doing fieldwork (or anything else, for that matter) -- are indeed individual in the sense that they are properties of the body, dispositions of the *habitus*. However, to isolate their acquisition and application from everything outside the boundaries of their soma is to subscribe to a normative theory of learning and a natural conception of the individual. An alternative approach recognizes the sociality of the individual being and the situated nature of human activities. If, as Bakhtin has argued, every word in conversation is half someone else's, every fish that gets caught is partly that of others (Palsson 1994).

Sharing information and working together, then, is a process that constitutes community and the social spaces of fishing; it indicates a potential for community management.

Of the 24 fishers interviewed in Gloucester, 14 indicated that they share information on a regular basis with other fishers; none responded negatively. In addition, 12 indicated that they have fished in a group at some point in their careers and prefer to fish in a group. Four respondents said they preferred not to fish in a group. Of those 4, one was a gillnet fisher (a fixed gear type) and 2 were from the same trawl boat. Many of the fishers interviewed reported learning their fishing skills from family members (fathers or uncles); those "skills" include specific spatial and environmental information shared between generations or amongst family members. Sharing information is not random; this fisher was asked if he fished in a group or with friends on other boats.

> Yes, yeah, all the time… Especially like the boat, MaryAnn, we work together all the time, Carolina Star, The Vinny B; a lot of boats, they work together. Sometimes, they work 10 boats all together… If you catch the fish… So I call the other boats, and they call me and we go together … (interview data, 1997)

Information that was useful over the long term generally concerned good "tows," places where trawl fishers could successfully drag their nets with little damage but plentiful fish. Such information, along with the position of wrecks to be avoided, is recorded by fishers directly on charts that they often keep for many years. Individual tows or entire charts might be shared. Information is also stored in the form of "papers," individual sheets of paper placed in plotter machines that trace the paths of boats as they tow their nets. Papers can have varying degrees of information depending upon the number of times the same paper is overwritten while mounted in the plotter and are easily copied and traded (Figure 6). This type of information might also be recorded in personal logbooks or in detailed oral descriptions based on "landmarks" known to members of the group. This fisher got his start working as a crew member but was given a wealth of information from his captain before starting on his own boat. The information was vital to his success.

> Ya. To be absolutely truthful, I fished so many years on the [Boat Name]. One thing about [the captain] -- he's got an old boat [but with] top-notch electronics. He was one of the first guys to have a sonar. Everything was marked out with a sonar. I just copied his charts. There's nothing I did on my own; I didn't (interview data, 1997).

Another process constitutive of the social space of fishing is "territorialization." It is the collection of forces and processes that limit fishers to specific areas or regions and bind them into groups with shared interests. The term "territory" in the anthropological and community/co-management literature often refers to some historical claim by a distinct group of fishers (e.g., some First Nations) to a specific area and its fisheries resources. Finding such territories in New England is currently unlikely, but identifying processes of territorialization can point to the spatial limitations and practices of different groups of fishers and to the processes that bind them, however temporarily, into communities with shared interests. That is, territorialization has both a spatial and social effect important to the constitution of the social spaces of fishing and, ultimately, to community management.

The division between inshore and offshore fishing boats is longstanding and acknowledged by fishers, scientists, and managers and acts, to some degree, as a process of territorialization that is less ephemeral than that of "clubs" that share information. For example, Massachusetts and other coastal states have regulations that restrict large boats when they are in state waters. This type of regulation is only possible insofar as inshore areas correspond to state waters (within three miles of the shore) where federal regulations do not necessarily apply.

Inshore boats, however, fish out to twenty miles from shore (Clay 1996) within both state and federal waters. State jurisdiction does not capture all inshore fishing grounds and creates areas of potential conflict between inshore and offshore boats. For example, recent federal regulations designed to alleviate fishing pressure on the juvenile and spawning area of Jeffrey's Ledge (Figure 1) by closing it to fishing did not account for a spatial or territorial effect between inshore and offshore boats. Nor did the shape of the closure (described pejoratively by one fisher as "neat" because it consisted of straight lines rather than lines following natural boundaries) account for the specific geography of either the fish or the fishers who worked there. To the fisher quoted below, the closed area was larger than what was necessary and it transferred fishing pressure inshore, in this case to Cape Cod Bay.

> The bay area took a beating when they closed… Jeffrey['s Ledge]. The Jeffrey['s] closure is right here [indicating on the chart], but it extends all the way down to… here, which takes up the whole area where we work… The codfish are all concentrated in here [indicating on the chart]; however, they had to close all of this area here, to make it nice and neat. They put everybody in the bay, 500 boats were up in the bay, and they destroyed it [i.e. other bay fisheries] (interview data, 1997).

The division between inshore and offshore fishing is one of the most visible processes of territorialization, but it does not capture many of the other processes that differentiate fishers within those categories. The most obvious "sub-division" is amongst inshore fishers who are tied to their home port by the range of their boats; these inshore fishers work close to their home ports, creating segments of the inshore area each fished by fishers from proximate communities.

> I usually stick in a 30-mile range from Gloucester. That's the range that I can day-fish in. This time of year, when the weather starts getting worse, you got to keep knocking it back… At this point, I'm working 10-11 miles off (interview data, 1997).

Proximity to home port, as opposed to distance from shore, is also evident in the offshore boats, although now more than in the past. Since the advent of restrictions on the annual number of days-at-sea (DAS) for offshore boats, they no longer venture as widely as in previous years because they cannot afford to waste time (i.e. DAS) travelling as opposed to fishing. This has created increased pressures on inshore areas, a new territorialization where even large boats fish areas proximate to their home ports.

> It's tough, I can't afford to steam 14, 16 hours to go [to distant fishing grounds], and 16 hours back. It's a whole day, more than a day, that I would loose just from steaming time, … I am going to stick as close as I can [to Gloucester], trying to use my days as wisely as I can (interview data, 1997).

Restrictions on large boats in terms of DAS or closed areas increasingly limit where they can fish. The new territories of use created by new regulations often push one group of boats into the established territory of another group (e.g. offshore boats into inshore areas).

The final contributing factor to territorialization directly results from different fishers' preferences for different bottom types. Fishers who use different gear types (e.g., lobster pots and trawls) have, in the past, been relegated to particular bottom types: lobster and gillnet fishers worked hard and rocky bottoms while trawl fishers worked smoother areas that were less likely to damage their nets. However, with changes in gear (e.g., rock hoppers) and location due to new regulations, social spaces once divided by bottom type are now objects of contention. This gillnet fisher notes the problems he is facing as groups of fishers shift and expand their territories.

> It's always extremely dangerous territory to fish, because of the big [trawler] boats. You used to try and get up on the hard bottom; you can't get up on hard bottom anymore. You're better off setting in the mud. They [the trawlers] seem to want the hard bottom now, whereas before they would do damage [to their nets] and they just couldn't work it. Now they have the ability to work it. Very, very few of them have the integrity and self-discipline, and respect, to give you your space (interview data, 1997).

Bottom type, as a contributing factor to territorializaiton, is important not just between different gear types (e.g., gillnet and trawl) but within gear types as well. Knowledge of the bottom is fundamental to the success of fishers and that knowledge is not evenly spread amongst fishers, even amongst fishers of the same gear type. This implies that those with more expert knowledge may gain exclusive use of particular territories.

In addition to the processes that form social spaces discussed above, the place names used by fishers also confirm the existence and use of a rich and diverse landscape. A sampling of the place names that emerged during the Gloucester interviews includes: Jaws, Scotties Dump, George Adams, The Pasture, Straw Hat, The Leg, The Funnel, The Trees, and Horse Pike. These place names can be read as indicators of the social spaces created and maintained by fishers.

The processes of sharing information and territorialization point to distinct social spaces of fishing that are erased by the assumptions of current forms of fisheries assessment and management. The social spaces of fisheries, sometimes temporary and shifting, indicate a space different from the homogenous commons accessible to all “fishermen.” Recognition of these spaces, re-mapping fisheries to include community processes (and environmental variability) at the scale of fishing itself, reveals a source of dissonance between fishing communities and government sponsored science and the management it informs. However, it also suggests fisheries might be better managed using area-based methods rather than exclusively numeric approaches. Rethinking management in terms of the cultural and ecological aspects of an area, in ways that disaggregate the commons, has the potential to also transform “fishermen” into distinct communities of fishers.

DO FISHERS PREFER AREA MANAGEMENT?

Perhaps not surprisingly, interviewed fishers indicate a preference for forms of management that are area-based rather than numeric. This type of management is called by Wilson et al. (1994) “parametric” and focuses more on local environments, multi-species interactions, and the environmental effects of particular fishing practices. These parametric issues are distinct from numeric methods that attempt to accurately count fish stock and predict changes based on aggregate levels of fishing effort. Fishers, suspicious of numeric approaches, have resisted numeric management and, as a result, it is often assumed that they prefer no management or regulations in any form. Over a third of the interviewed fishers, however, volunteered what they thought would be a more reasonable approach to management; their suggestions could all be characterized as spatial or "parametric" approaches (see also Clay 1996).

Fishers see spatial management as an alternative to regulations that are designed to limit catches *per se*; making fishing less efficient and more expensive has been one of the primary methods for reducing effort in New England. Such regulations must be continually updated as fishers devise other ways to catch more fish, a process frustrating to fishers who must pay for new equipment and to managers who must continually amend regulations to limit fishers. The following fisher would rather have limits on where he fished than on the amount allowable per trip.

> Canada has a different way. That way I understand. They say to you: this month you got to fish over here, whatever you [catch] you bring it in, that is the way I know. Next month they close over here and they open over here. Whatever you catch, [you bring] in. The other month they close over here, you know what I mean? (interview data, 1997).

The boat owner quoted below also prefers area management to controls that cause the escalation of the cost of fishing.

> No, we don't want it no more, a different kind of net. We spend enough money already… [T]hey have five and a half inch mesh [and] in less than two years they come up with a six inch. Who ends up paying? Me and all the other owners... Now they want the box [a satellite based remote tracking system for boats]…$14,000. I'm going to pay? We want to close areas; close this spot over here, one month this spot open, open another one, close this one, open another one. That's how you do conservation (interview data, 1997).

Fishers also indicated their preference for spatial management relative to environmental issues such as habitats and, more specifically, spawning areas. Many fishers were able to locate spawning areas on maps as distinct from other areas where fish were found. It seemed reasonable to them that spawning areas be closed to fishing at least during the months most important to spawning. One fisher thought sanctuaries to protect spawning and juvenile areas should not only be designated but limited in terms of fishers' access, including his own (the sanctuary he mentions was not, at the time, closed to commercial fishing despite status as a national sanctuary).

> Different fish [have] different habitats. You need sanctuaries… [T]hat place, [Stellwagon Bank], they call it a sanctuary, but that's bull. It should be a sanctuary. …I went there, I made one tow, and I got the hell out of there. I was literally plastered with small flounders... You had to take a squeegee to get the flounders off [the deck]. Little tiny, tiny codfish [were] all over you! I went directly home, I took the net off, and I went out to [the] National Marine Fisheries Service, and told them they had to do something about this. …Yeah, it's a sanctuary! Ha, ha! (interview data, 1997).

Although closing areas for environmental purposes was reasonable to many of the fishers interviewed, they supported closing specific areas for short periods of time and for clear reasons rather than large and permanent closures.

> I don't know what kind of people [government/managers] they are. This, we don't understand. I suggest they close more areas: a month here, a month here, a month here, but don't close the whole thing all at once. (interview data, 1997).

Despite the continued dominance of numeric approaches, the management of some fisheries in New England is becoming more area-based. The lobster fishery is managed using a total allowable catch (TAC) scheme but distributed amongst several zones where access is limited to local communities. The offshore scallop fishery is moving away from management based solely on effort control toward temporary closures of scallop beds. Also, Gulf of Maine groundfish are now managed using temporary "rolling" closures; 30 minute blocks along the coast are, in sequence, closed for one month during the fishing season. Although these examples differ in their use of areas, particularly in terms of the overlap of areas with community territories and the degree to which communities are involved in the designation of areas, they represent a trend that is increasingly popular with both fishers and managers. Indeed, a prominent fisheries biologist even suggests that

> …in the future, fisheries management and its associated science will have to deal with 'places' far more than they have in the recent past. Indeed, I shall suggest that they will have to return, in many cases, to ancient modes of allocating fisheries resources to local communities, rooted in physical places. (Pauly 1997: 125).

The emergence of such sentiments and their attendant geographies is, perhaps, due to the current political limitations of numeric management. Fishing communities are resisting further effort controls and have flatly rejected individual quota-based management schemes, but they often support limited closures and other area restrictions provided they are fairly distributed. In addition to the pressures from fishers for area management, environmental groups are pushing managers to consider more closely issues of local habitat and ecosystems. Initiatives such as the designation of essential fish habitat (EFH) as mandated by congress imply a significantly more important role for area based management in the future.

Although many fishers, environmentalists, scientists, and managers appear aligned relative to area management, there are significant problems that must also be addressed. In particular, there is the potential for "dissonance" between the areas utilized by fishing communities and the areas designated by fisheries science and management (Clay 1996); this and other outcomes are symptomatic of a management process that remains "top-down" (McCay and Jentoft 1996). The following example provides insight into the potential for building communities via area management and/or co-management; it also makes clear the discursive barriers to such management.

THE CASE OF AREA MANAGEMENT IN THE GULF OF MAINE

NMFS has identified the cod fishery of the Gulf of Maine as a sub-fishery of the Northeast management area in terms of fish stock. While cod and other groundfish are elsewhere slowly rebounding due to strict regulations, they are seriously overfished in this region. In the autumn of 1997, NMFS announced the need for a 63 percent reduction in landings from the Gulf of Maine and directed the New England Management Council to develop a plan that would meet that goal. The plan, proposed by NMFS, called for rolling two month closures along the Gulf's coast as well as a permanently closed area offshore (Jeffery's Ledge) parallel to much of the coast. A grid of blocks, each 30 minutes square, was used as the template for the rolling closures (Figure 7). Other restrictions such as catch limits were also part of the plan.

The proposed plan infuriated inshore fishers who would have their proximate fishing grounds closed for a two month period and who no longer had access to the permanently closed Jeffery's Ledge, which was further offshore but still within their reach. In addition, the long, closed area parallel to the coast acted as a barrier to fishing grounds beyond, since boats could not traverse it and small boats could not go around it during the course of a day trip. Although the plan was innovatively spatial (as opposed to simply numeric), it revolved around a geography that did not correspond to the patterns of fishing of these inshore fishers. The plan would have greatly damaged communities and an industrial infrastructure dependent upon the inshore fishers. One council member said

> I think this is too big a pill to take. I am quite aware of the infrastructure collapse that is going to take place in my community. It has taken them 20 years to build a fragile infrastructure and with this it's gone (CFN, 2/98: 20A).

Unlike the smaller inshore boats, large boats could go further offshore where fish catches were again improving. Indeed, the mobility of the offshore boats was cited by the inshore boats as the primary cause of the overfishing problem in the Gulf of Maine. During council meetings inshore fishers claimed that earlier regulations, which had closed offshore fishing grounds, had forced the offshore boats to crowd and ultimately overfish the Gulf's inshore resources; the inshore fishers wanted this unfairness to be acknowledged as part of a duly adjusted management plan. The council, citing the Sustainable Fisheries Act (SFA) which forces the council to end overfishing in a verifiable manner, could not make allowances for the hardship of this sub-category of fishers and their spatial constraints (CFN, 1/98: 8A). Although social spaces in the Gulf of Maine may be defined according to a variety of processes such as gear type, home port, species targeted, or bottom type, the territorializing process that surfaced during council meetings as the most significant was that of inshore and offshore.

Public council meetings were held to discuss several variations of the proposed plan, none of which satisfied the inshore fishers. During one such meeting in December of 1998, Erik Anderson, a council member from New Hampshire proposed separating inshore and offshore fishing grounds and fishers respectively. Anderson is quoted as saying "What I'm trying to develop here is a stakeholder position… It's about time we pass some responsibility on to the industry. Individuals can take responsibility for an area" (CFN, 1/98: 8A). His proposal, which would draw a line between two territories and two communities of fishers, was met with apprehension by the council and NMFS, but it became the "battle cry" of the fishers who attended the meeting (CFN, 1/98: 9A). Fishers formed a new organization, The Gulf of Maine Fishermen's Alliance, made up of a variety of smaller (gear and port specific) organizations and encompassing both inshore and offshore fishers. The alliance then developed its own plan for a reduction in landings from the Gulf that revolved around the distinction between inshore and offshore territories. Fishers would have to identify themselves as fishing in either the inshore or offshore zones where different catch restrictions would apply, a rolling closure reduced to one month would still be in effect, and the closure of Jeffery's Bank would not restrict travel. Many elected officials and other organizations (including environmental and community groups) supported the new plan (CFN, 2/98: 1A).

This alternative plan of the alliance was rejected because it could not guarantee compliance with the SFA's overfishing guidelines. The flexibility and self-management aspects of the Alliance's plan made strict numeric assessment and the prediction of deadlines for stock rebuilding difficult at best. The council stayed with a somewhat modified version of its original plan. Citing the burden on inshore fishers for rebuilding this local stock of fish, the council reduced the rolling closures from two months to one month, but NMFS remained skeptical as to the ability of the plan to meet the targets demanded by the overfishing rule (CFN, 5/98: 12A).

More recently, another attempt has been made by fishers to introduce an alternative management plan. This new plan again included closures as well as trip limitations. The new proposed closures were locations fishers thought important to close for environmental and fishing-pressure reasons and they were based on their own local knowledge of the region. The fishers' plan, however, designated areas that varied in size and shape from the 30 minute squares used in the NMFS proposed plans (Figure 8).[16] The irregularity of the fisher defined areas made it impossible for NMFS scientists to accurately assess the numeric effects of these closed areas. The following quote, from a management council document, explains the reason for the rejection of the plan proposed by the Alliance.

> The fishermen who designed this proposal, intended it to… protect cod spawning and habitat, reduc[e] overall fishing power, …and to provide equitable access to alternative species and fishing grounds. The PDT [fishery management plan development team] discussed the components of this option and noted that one of the primary distinguishing elements is the area closures. The size and configuration of the area closures precludes the use of the same analysis method that is used for Options 1 and 2 area closures that are based on quarter-degree squares [these options were proposed by the PDT itself]... The PDT could not make a comparative analysis of this option… because of the limitations on the area closure analysis (Northeast Multispecies Fishery Management Plan, Framework Adjustment 33).

The dissonance between these spaces made this second plan presented by the Fishermen's Alliance untenable.

Neither the council nor NMFS took advantage of the significant precedent of the Alliance's plans, which brought together fishers of many different communities, developed comprehensive plans to reduce fishing effort, included fishers' local knowledge, and made clear the relevance of a spatial/territorial approach to management. The Alliance and its alternative plans pointed to fluid but nevertheless vital processes of community and territory as well as a local geography of fishing use and environmental knowledge. A large community of fishers formed to self-manage their territory, the Gulf of Maine. Within this structure, they agreed to self-identify as either inshore or offshore fishers and restrict themselves to particular sub-territories and rules within each. Although other communities and territories exist within the Gulf of Maine, this particular community and territory emerged as a structure upon which to build an alternative co-management plan.

NMFS has spoken highly of co-management as a future goal, but it is clear that the institutionalization of particular forms of data collection, analysis, and a top-down approach to management are making that goal difficult to obtain. Community or co-management, as in this example, involves a recognition of processes of community and territory that can not be accommodated within the present structure of management, which insists upon a numeric and verifiable approach only available though NMFS and corresponding to its geography of fisheries. The result, as in this case, is a form of area management that ignores the territories of local fishers (e.g. inshore and offshore in the Gulf of Maine), heightening the dissonance between the spaces of management and the spaces of communities.

CONCLUSION

Bioeconomics, built upon equilibrium notions of nature and society, has evolved since the 1950s into the primary tool for "developing" fisheries around the world. Bioeconomics clearly indicts common property as the "problem of fishing," and it proposes the transformation of fisheries into regimes of production characterized by capitalist institutions such as private property as the solution. The logic of bioeconomics is built upon assumptions of individual behavior in the context of an open access common property. In this case, "fishermen" compete within the management area of New England to catch various stocks of commercially harvested fish.

The particular arrangement of subject and space in bioeconomics discourse has prefigured the forms of data collected, analyses performed, and recommendations to management. Numerical data are collected on fish stock and fishing effort in ways that reify assumptions that individuals operate in a homogenous and unbounded commons. This mode of management produces analyses based on equilibrium functions that reduce environmental and social heterogeneity to a balance between stock and effort. Other possible determinants are marginalized and all solutions to crises of overfishing rely on decreasing fishing effort, ideally through forms of privatization such as individually transferable quotas.

There have been many challenges to the basic assumptions of the "tragedy of the commons" thesis in terms of individual behavior and the role of community. In fisheries, there is evidence to suggest that communities often form around processes of cooperation between individual fishers and can even act as the basis for more formal forms of resource management that both avoid depletion of resources and sustain their equitable distribution. Examples from around the world emphasize the many processes that support and determine successful community management, many of which have important spatial components. In particular, local environmental knowledge and processes of territorialization are vital to community management of common resources.

In New England, the proposition of alternative and community based forms of management is as yet unimaginable. The institutions that currently manage the resource leave no room for alternative conceptions; there is no *place* for community management. Fishers in New England, however, exhibit many of the practices thought necessary for community management: they maintain a significant store of local environmental knowledge (itself strikingly cartographic); they share information on the environment amongst themselves under conditions of reciprocity; they work within territories on the commons; and while they cherish "independence," they have a strong preference for area-based and cooperative forms of management. These processes and, in particular, their spatial manifestation are overwritten by the assumed subject position and space of bioeconomics.

An examination of bioeconomic discourse as well as the spaces of fishers in New England has made clear the ways subjectivity, space, environment, and economy are mutually constitutive. The gridded and enumerated space of bioeconomics provides a template for individual enterprises to act independent of communities, to treat the commons as open access, and to precipitate a tragedy unavoidable without the transformation of economic relations. Alternatively, the diverse and territorial spaces of fishing communities, once made visible, suggest an opportunity for forms of area management that might facilitate community rather than individual prosperity, they might let us imagine other futures where fisheries are the site of potential rather than always a tableau of tragedy.

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NOTES

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[1] Community management refers to resource management regimes that are solely managed by resource users themselves or by the local community to which they belong. Community management is most often associated with traditional resource management regimes (Dyer and McGoodwin, 1994).

[2] Angela Sanfilippo (director of the GFWA), Dr. Madeleine Hall-Arber (MIT, Sea-Grant Program), and Dr. Christopher Dyer (URI, Marine Affairs) were the principal investigators on the project.

[3] Here I use the term "fishermen" to signify the imagined individual fisher of bioeconomic theory. For that reason I will use the term in quotes so as not to confuse it with some naturalized and romantic notion of fishers. The term *fisher* will apply to all people who work as harvesters of fish within commerical enterprises regardless of their position. A fisher is any one of several crew members: captain, mate, engineer, deckhand, etc. Some definitions of fisher, however, might also include shore-side workers involved in unloading or processing catch, spouses and families of fishers, and other non-harvesting community members. This paper focuses on fishers as harvesters and is concerned to show the multiple positions and behaviors of fishers in terms of their spatial practices at sea. For example, it is important to note that boat owners, who are often the assumed subject when the term "fisherman" is used, may not be involved in harvesting or even go to sea at all. More specific terms will be used to reflect specific institutions or positions as needed (e.g., *fishing enterprise* to describe what is usually a single boat and its crew; *boat owner* to describe a person or organization that owns a boat; and other terms such as *captain*, *first mate*, or *crew member*).

[4] Indeed, the very impetus for Gordon's economic understanding of fisheries was an attempt to understand why "fishermen" are chronically impoverished.

> The result of this [loss of economic rent due to common property] is that the fishery, a rich and self-renewing resource, almost invariably provides a poor

> livelihood for the great bulk of those engaged in its exploitation (Gordon 1957: 65).

The answer was clear, the absence of private property was the *essential* problem. Although Gordon's article neglects the many waves of wealth (both industrial and pre-industrial) created by fisheries, his theory would, nevertheless, become a standard and influential understanding of common property.

[5] Fisheries science and economics is, of course, much more complex than this statement implies. Information from a variety of sources are often used for estimates of stock size and fishing effort. However, the fundamental conceptual model of bioeconomics rests upon single species analysis using these two variables.

[6] The areas defined by the NFSC map (and the NAFO map from which it is derived) were drawn with fish stock boundaries in mind. However, it was administrative and enforcement issues that determined the unnaturally strait boundaries, the scale, and the nearly equal size of these areas (Clay 1996).

[7] For related ideas relevant to area management and GIS see Edwards et al. 1999 and Walden et al.1999.

[8] The New England council is made up of appointed members primarily representing boat owners and the commercial fishing industry. Although this council produces the laws and regulations that govern the fishing industry, it is answerable to NMFS. Federal law now requires all managed fisheries to be assessed and effort reduction plans instituted if a fishery is found to be "overfished." It is NMFS that determines the status of fisheries and can force the council to institute effort reduction plans.

[9] In this paper, it is important to note that NMFS as well as the New England Management Council are considered sites of bioeconomic discourse where particular notions of subject and space have been institutionalized. Although many individuals within these institutions are sympathetic to alternative approaches to both science and management, their actions are, nevertheless, restricted by the dominant discourse and its assumptions about fish and fishers.

[10] Virtually all boats in New England operate using a share system of compensation where the catch for a given trip is divided amongst the crew members and "the boat." This form of compensation is thought to be an adaptation of capital to the high uncertainty found in fisheries that make traditional wage relations impossible (Doeringer and Terkla 1995). The share system also makes all fishers (i.e. crew members who fish) stakeholders in the resource itself, rather than simply the employees of boat owners. Indeed, fishers are legally self-employed "co-venturers" in fishing and have legal recourse to their share of the catch as independent seamen under maritime law (per. comm. with a fisheries lawyer). The implications for all fishers of boat-based quotas have been obscured by the dominant discourse that equates boats with "fishermen."

[11] Crew members can be thought of as owning their share of fish from a fishing trip from the point of capture (see footnote 8). When asked who owned the share of a trip's catch earmarked for the boat, interviewees, many of them boat owners, invariably replied "the boat." When asked if this meant the boat owner, many interviewees were hesitant to equate "the boat" with the boat owner. Although the implications of such an understanding of catch ownership are not clear, they point to a resistance to assume that any portion of the fish caught belongs to the boat owner in an unmediated fashion.

[12] However, with the collapse and closure of important fisheries despite years of close scientific management, fisheries science is no longer seen as always accurate and without bias, especially

in terms of numeric management (see Finlayson 1994 on the cod crisis in Canada). Recent crises have resulted in more "precautionary" approaches to assessment and management (Crean and Symes 1996).

[13] Co-management refers to resource management regimes where resource users and government agencies work together on management issues that might include data collection, resource assessment, decision making, allocation of resources, and enforcement (Pinkerton, 1989, 1990).

[14] A few fishers noted that juvenile areas are difficult to identify now that there are minimum mesh regulations. Very small fish are simply not caught in the nets that are used today. Spawning adults, however, are easy to identify when they are caught.

[15] To map the social space of a particular "at-sea" spatial community presents a problem in terms of methodology. In the case of this research, for example, fishers from one port, Gloucester, were interviewed. Although these fishers sometimes fished in the same locations, their fishing territories varied considerably. In addition, the locations of Gloucester fishers often overlapped with fishers from other ports. Further research is needed to identify and interview a sample "at-sea," rather than port-based, community of fishers.

[16] Figure 8 illustrates a geography produced by fishers that is clearly at a different scale and differently focused (e.g. on critical habitat as opposed to effort reduction per se) than that of NMFS. However, the hastily hand-drawn map, rejected by NMFS, also illustrates the limited scientific, cartographic, and ultimately rhetorical resources available to the Fishermen's Alliance.

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FIGURES

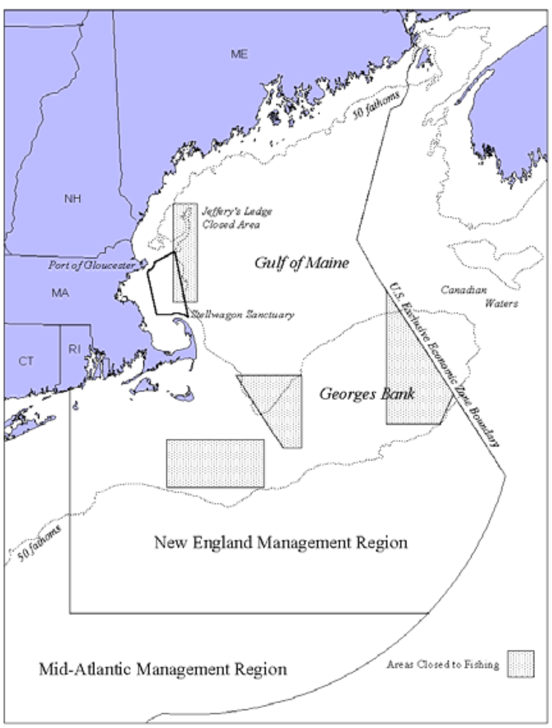

Figure 1 The New England Management Region. The trawl fishers who were interviewed fished primarily in the Gulf of Maine and on Georges Bank, and inside the U.S. EEZ since 1976.

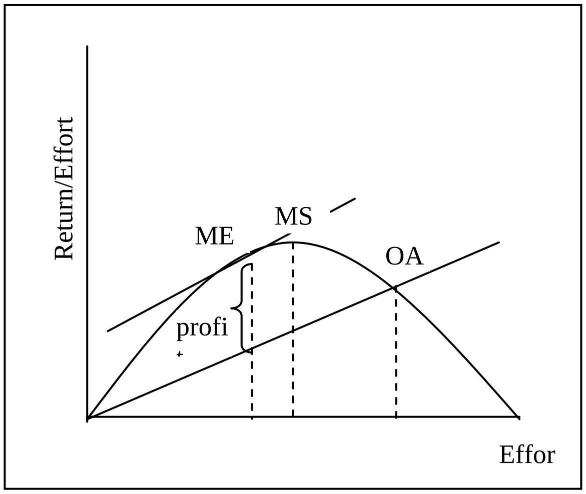

Figure 2 Maximum economic yield, maximum sustainable yield, and open-access yield (from NMFS 1996).

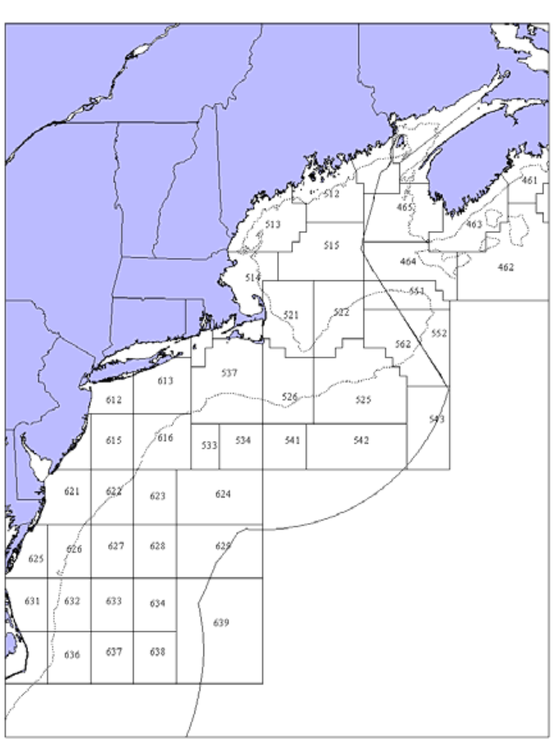

Figure 3 NMFS, Northeast Fisheries Science Center Statistical Areas. Areas labeled in the 500's and extending to the EEZ boundary represent the New England Management Region. Areas labeled in the 600's are the Mid-Atlantic Management Region.

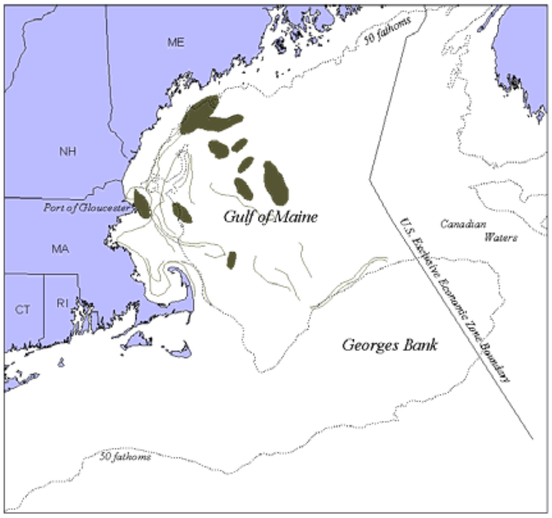

Figure 4 Fishing areas drawn by an interviewed fisher and later digitized. The gray lines and oval shaped polygons are areas used by this fisher who, for each area, also identified unique characteristics (e.g. dominant species caught, bottom type, seasonal spawning ground).

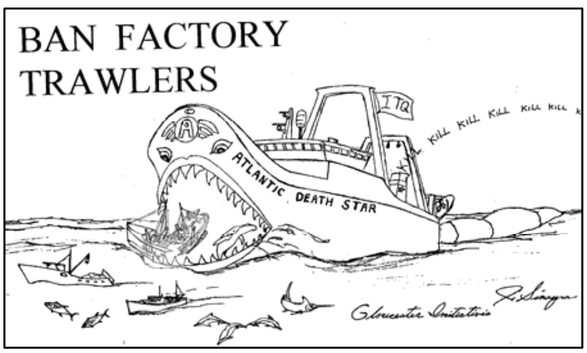

Figure 5 “Ban Factory Trawlers” (copyright Joe Sinagra 1998).

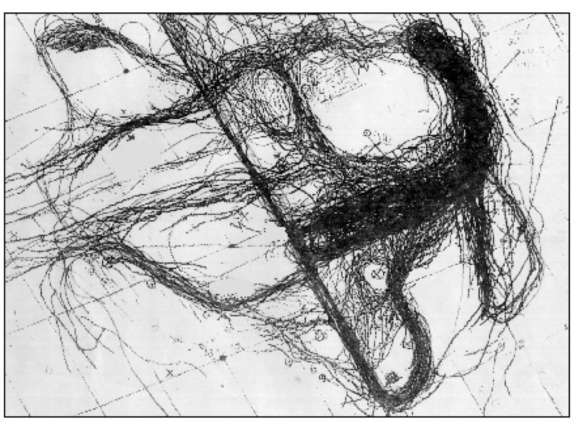

Figure 6 A scanned “paper” showing the repeated successful pathways of a trawl fisher. The most heavily used paths represent routes that avoid (in this case, encircle) net-damaging

obstacles (e.g. rocks, ship-wrecks) but yield good fish catches. The coordinates of this map have been obscured at the request of the fisher who provided it.

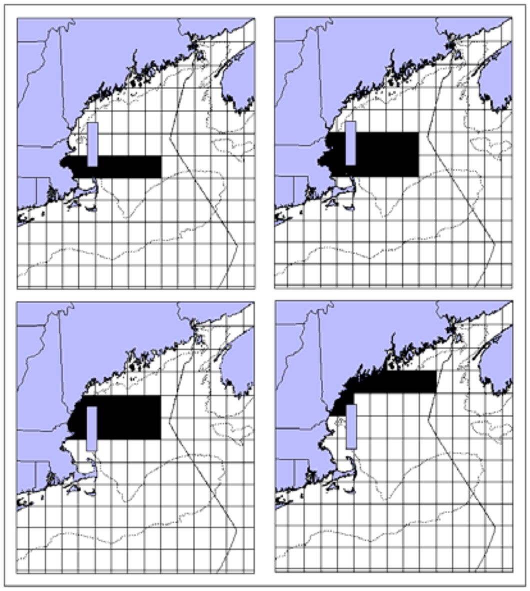

Figure 7 The 30 minute grid with monthly “rolling closures” in the Gulf of Maine groundfish fishery. The closures progress Northward over the course of the four spring months (March, April, May, June). The gray horizontal rectangle is the Jeffery’s Ledge closure.

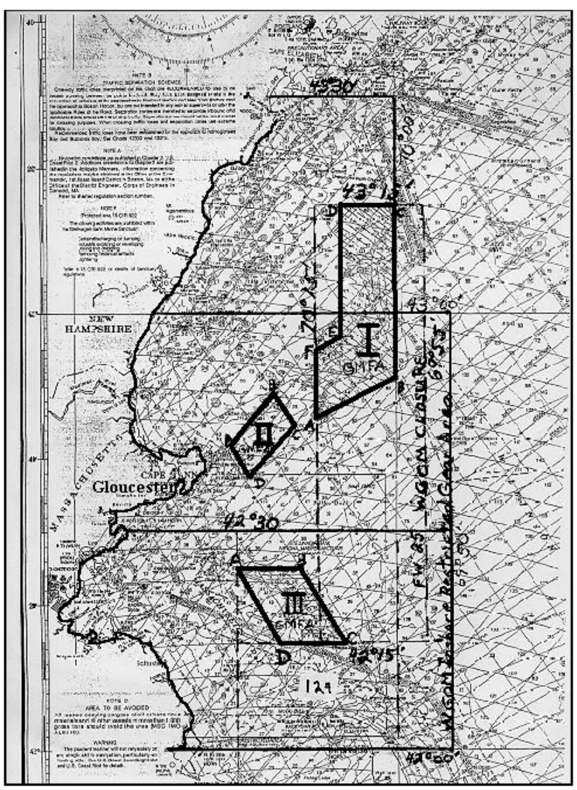

Figure 8 Closed areas proposed by the Fishermen's Alliance as part of an alternative management scheme for the Gulf of Maine. The map shows only the western part of the Gulf of Maine just off the coast of Cape Ann (home to Gloucester). The outlines of the proposed areas and the coastline have been enhanced in this image.