J. Northw. Atl. Fish. Sci., Vol. 19: 103–126

Management Regions, Statistical Areas and Fishing Grounds: Criteria for Dividing up the Sea

Patricia M. Clay
National Marine Fisheries Service, Northeast Fisheries Science Center
166 Water St., Woods Hole, MA 02543, USA

Abstract

The delimitation of areas of the sea is common practice in fisheries management, particularly when addressing problems associated with size selection and by-catch issues. Fishermen, scientists and managers divide up the sea to delimit stock units, species ranges, nursery and fishing grounds, faunal boundaries and political jurisdictions. Biological, political, social and economic criteria are all used in establishing closed and restricted areas, delineating regional management zones and community specific grounds, and in setting area/stock specific management measures (e.g. quotas, minimum landing sizes, gear zones, etc.). The delimitation and configuration of these areas can lead to dissonance in fisheries management, particularly when the criteria used for management decisions affecting the spatial distribution of fishing are not those which fishermen consider to be critical. This paper discusses some of the criteria by which fishermen divide up the sea, compares these criteria to some of those used in fisheries management, and discusses potential implications.

Key Words: Fishing areas, management, statistical area

Introduction

As fishermen[1] often say, "fish have tails". This means that the idea of owning a piece of the ocean for harvesting purposes is often considered impractical, as most finfish and shellfish species move or migrate from one location to another[2]. Nonetheless, the delimitation of areas of the sea is common practice in fisheries management, particularly in addressing issues associated with the selectivity of fishing gear for fish sizes and species concurrences. Fishermen, scientists and managers divide up the sea to delimit stock units, species ranges, nursery and fishing grounds, faunal boundaries and political jurisdictions. Biological, political, social and economic criteria are all used in establishing closed and restricted areas, delineating regional management zones and community specific grounds, and in setting area/stock specific management measures (e.g. quotas, minimum landing sizes, gear zones, etc.).

The delimitation and configuration of these areas can lead to dissonance in fisheries management, especially when the criteria used for management decisions affecting the spatial distribution of fishing are not those which fishermen consider to be critical. In developing and implementing Fishery Management Plans (FMPs) in the Northeastern United States, a variety of spatial divisions are considered. These include the Hague Line delimiting USA from Canadian waters; the 200 mile Exclusive Economic Zone (EEZ) boundary; the boundary between state and federal waters; Fishery Management Council regions; International Commission for the Northwest Atlantic Fisheries (ICNAF)/Northwest Atlantic Fisheries Organization (NAFO) and United States (USA)/Northeast Fisheries Science Center (NEFSC) statistical areas; fish stock boundaries; and fishing patterns.

This paper begins with a description of key international, national, regional, and state boundaries used in fisheries management in the Northeast United States. It then examines the interaction of fishermen's territorial behaviour and conceptions of critical variables influencing their spatial fishing patterns with some common spatial divisions used

[1] There is a debate within social science circles over the appropriateness of a gender-specific term such as "fishermen". However, in the Northeast United States most harvesters are men and even those who are women tend to prefer the title "fisherman". Since this paper concentrates on the Northeast, the gender-specific term is used.

[2] In many small scale societies, nonetheless, communities or tribal or family groups do own or at least possess exclusive access rights to marine territories (McGoodwin, 1990; McCay and Acheson, 1987). Among industrialized nations, Japan manages its inshore fisheries through territories owned by community cooperatives (Matsuda and Kaneda, 1984; Ruddle and Akimichi, 1984).

in fisheries management, and discusses potential areas of dissonance. Finally, it describes some of the current spatially-based management measures being implemented or considered in the Northeastern United States which offer promising avenues for limiting such dissonance.

Data on fishermen's criteria and fishing behaviour were gathered through site visits to ports and interviews with fishermen, computer database searches, and literature reviews. The computer searches involved two National Marine Fisheries Service (NMFS) databases, "weigh out" and "permit". Information on management measures in the Northeast was drawn from FMPs, Environmental Impact Statements (EISs), and notes taken at public meetings where fisheries management issues were discussed.

Fisheries Management in the United States

In the United States, NMFS is the government agency charged with overseeing management of the nation's marine fisheries in the EEZ. NMFS supplies scientific advice for and approves/disapproves FMPs, or portions of FMPs, created by Regional Fishery Management Councils.

Council members consist of representatives from NMFS, the member states' agencies charged with regulating coastal marine fishing, and members of the public appointed by the member states' Governors (chief executive at the state level). The private citizens represent the various states within each region, as well as diverse groups with an interest in fishing; most commonly, fishing vessel owners, recreational harvesters and fish processors. The precise background of the members varies from region to region and over the life of each Council. The Northeastern seaboard of the USA is overseen by the New England (NEFMC) and Mid-Atlantic (MAFMC) Councils. The New England Council has management responsibility from Maine to Connecticut, and the Mid-Atlantic Council from New York to Virginia (see Fig. 1).

International, National, Regional and State Boundaries

There are a number of legally-defined spatial boundaries which must be taken into account for fisheries management in the Northeastern United States. These include EEZs, the borders between state and federal waters, and Council region boundaries. These boundaries are often partially based on ecological and fisheries criteria, but are also influenced by other concerns (including ease of administration and enforcement).

Fishing patterns comprised a large portion of the discussions and testimony considered when deciding the appropriate location for the Hague Line. The ultimate placement of the Hague Line, however, was not based on fishing practices (Churchill, 1993) because fisheries issues could not easily be resolved between the parties. Similarly, the distinction between state waters and federal waters has only marginal relationship to fishermen's own inshore/offshore distinction[3].

Though roughly based on biological factors such as faunal boundaries, the precise location of the boundary between New England and the Mid-Atlantic Council regions at the Connecticut–New York border appears designed to minimize political disputes over jurisdiction and to facilitate data collection (Halliday and Pinhorn, 1990). Further, administration of fisheries requires coordination among states and between state and federal governments. Setting the Council region boundaries at a state line facilitates this coordination, since no state is divided between the New England and Mid-Atlantic regions.

There are numerous statistical areas defined for the Northeast United States coast. At the most aggregate level the areal boundaries were originally defined by ICNAF and subsequently adopted by NAFO conventions (see Fig. 2). In theory, the NAFO demarcations correspond to general fish stock boundaries, whether based on fish density (Rounsefell, 1948) or stock composition (Côte, MS 1953). However, very few stocks have geographical distributions exactly coinciding with these demarcations (Halliday and Pinhorn, 1990). Thus, fisheries and fishing were important considerations when statistical areas were being developed. Yet it was administrative and enforcement concerns such as the need for relatively uniform size and configuration which governed boundaries in the end (Halliday and Pinhorn, 1990). Ease of administration requires that jurisdictions should be discrete and hierarchical. Enforceability concerns necessitate that when areas are used as a management tool they must be as large as possible, with clean straight borders.

[3] Fishermen's concept of the division between offshore and inshore is somewhat fluid, but can be approximated as occurring at about 20 miles offshore. Management is more likely to use an existing administrative division such as the 12 mile territorial sea. This could be seen in one option which was considered for Amendment 5 to the Northeast Multispecies Fishery Management Plan where inshore night fishing was to be prohibited and inshore was in fact designated as within 12 miles of shore.

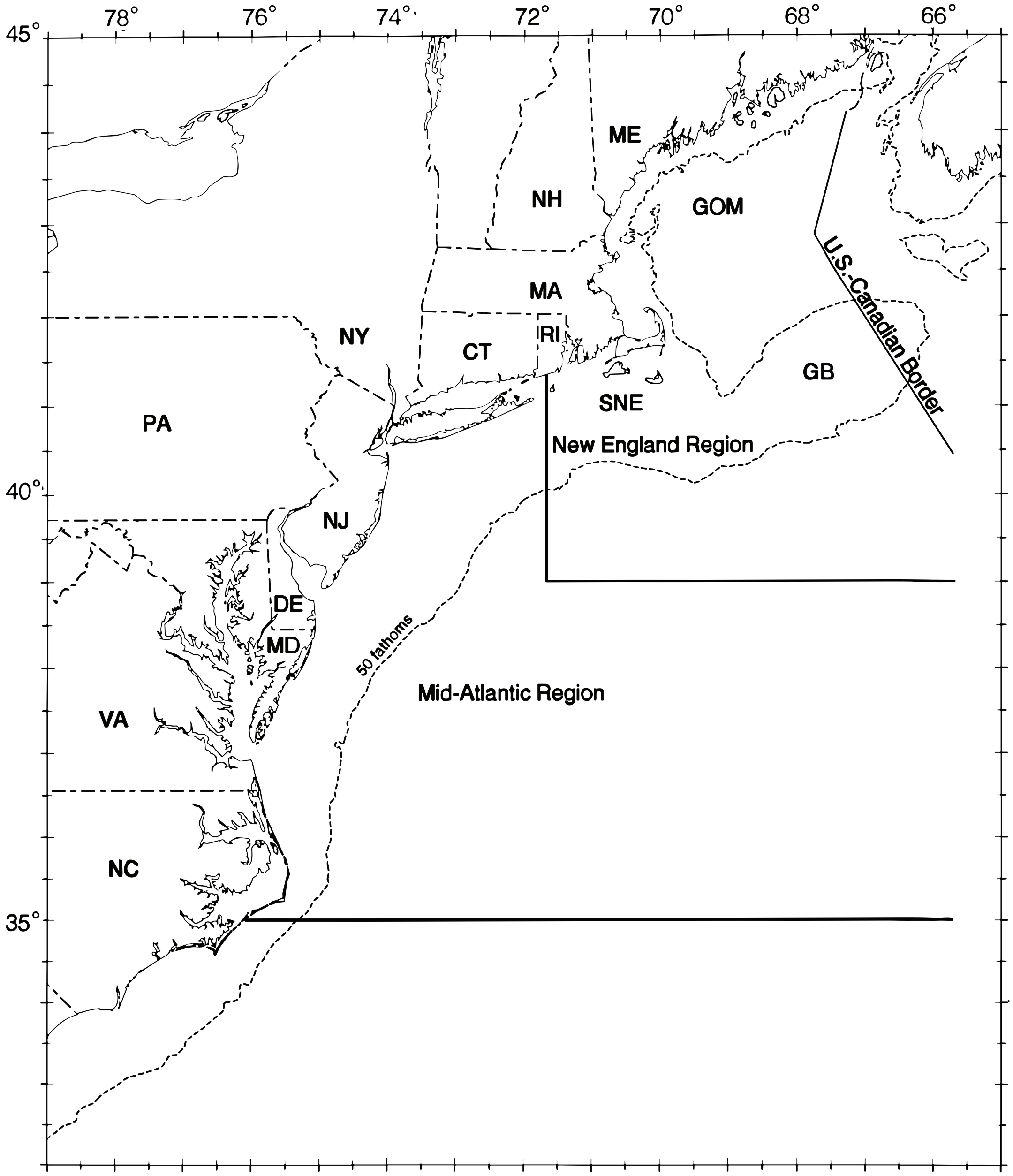

Fig. 1. United States Fishery Management Regions in the Northeast.

Materials and Methods

Site Visits and Field Interviews

The field portion was conducted during the months of April and July of 1993 in the Northeast United States ports of: Stonington and Portland, Maine; Portsmouth, Rye and Seabrook, New Hampshire; Boston, Gloucester, New Bedford and Chatham, Massachusetts; and Point Judith, Rhode Island. A one-day visit was made to each of the nine ports to speak with fishermen about their fishing grounds and fishing practices. A total of 38 fishermen were interviewed and 22 drew maps. See Table 1 for a breakdown by port, gear/target species, and vessel length. Those drawing maps included 3 different groundfish/other finfish trawl fishermen, 5 groundfish/dogfish gillnet fishermen, 5 fishermen who use a seasonal mix of groundfish gillnets and small shrimp or scallop trawls along with some longlining or urchining, and 1 part-time lobster fisherman. Apart from the lobsterman, all fishermen were full-time. Vessels of those who drew maps

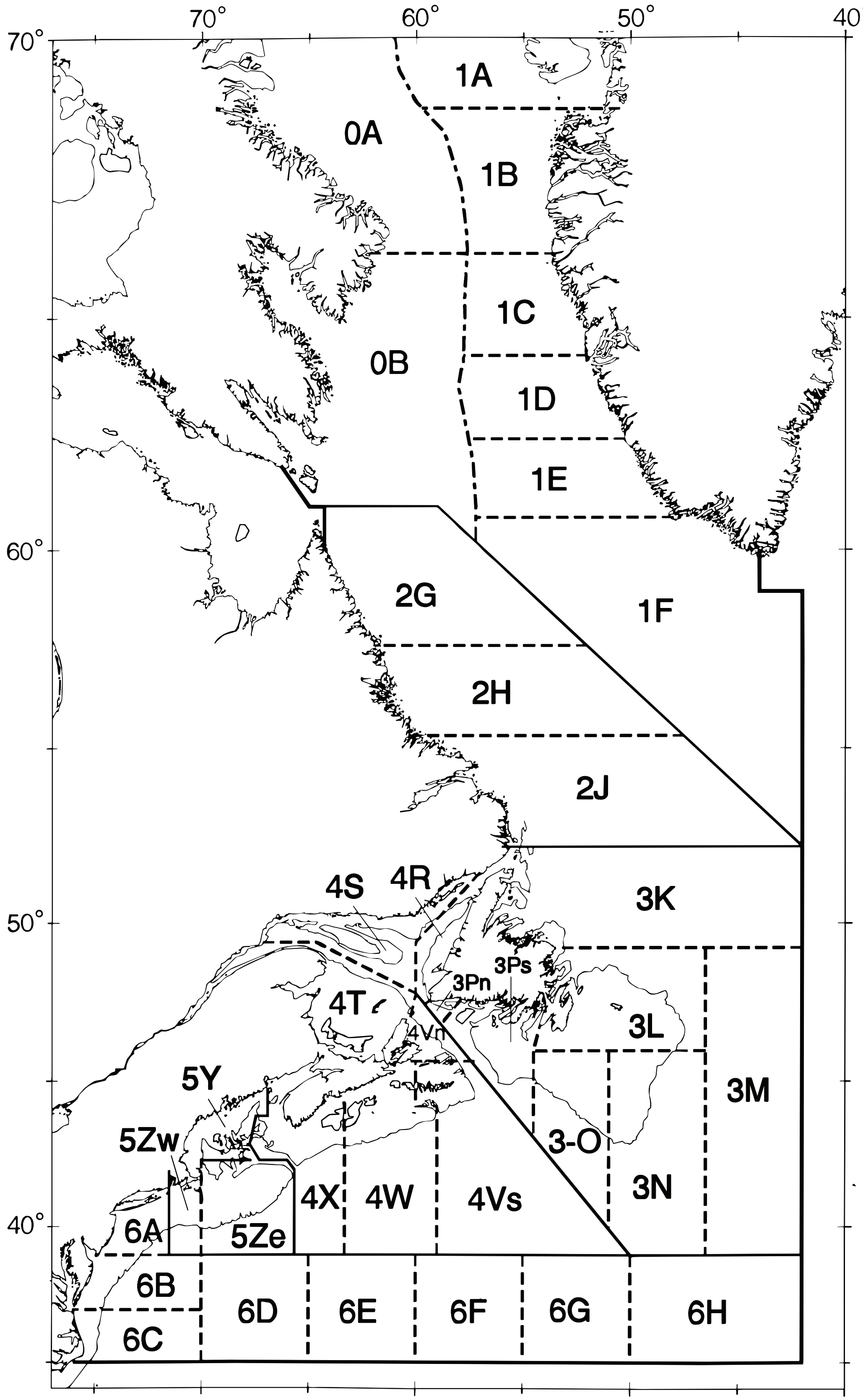

Fig. 2. NAFO Subareas, Divisions and Statistical Reporting Areas (from Halliday and Pinhorn, 1990).

ranged in size from 30 ft to 95 ft, with 16 being 60 ft or less in length and 6 being over 60 ft[4].

These ports were chosen because they are significant ports in terms of landings and value and/or they are representative of a large subset of ports having special characteristics such as predominant use of an annual round, significant ethnic fishing populations, specialization in a particular style of fishing, or presence of a large fish auction. See Table 2 for 1993 port characteristics. New Bedford, Portland, Point Judith, and Gloucester have a consistent presence in the NMFS commercial landings database ("weigh out", see below) from 1964 to present. These ports also all ranked in the top ten ports for landed value in the Northeast in 1993, with New Bedford and Portland being numbers one and two, respectively. Newport, Boston and Chatham are also within the top 25 of 225 ports with recorded landings. Boston, Portland and New Bedford all possess auctions[5]. Chatham, Portsmouth and Stonington are small boat ports. Boston, New Bedford, Portland and Gloucester are primarily large boat ports. Rockland, Newport and Point Judith are medium boat ports. Point Judith and Newport fish a different mix of species than the other ports, with fewer of the traditional groundfish and more summer flounder, squid, butterfish, and scup. Stonington and Chatham are most likely to fish an annual round based on changing gear. New Bedford is characterized by Portuguese trawl fishermen and Norwegian scallop fishermen. Gloucester fishermen are primarily Italian and fish with trawlers. Portsmouth and Stonington are gillnet ports. Chatham specializes in bottom longlines and gillnets. These ports thus represent the range of key fishing patterns in the Northeast.

Fishermen were asked for basic demographic data and their opinions on different types of management measures, and requested to create maps of where they fished by season and species – using tracing paper laid over NOAA nautical charts. A complete set of charts for the Northeast was available, and fishermen chose the chart they wished to use. While a number of fishermen were in the midst of unloading during the interviews and thus did not have time to draw maps, only one fisherman hesitated about the idea of drawing a map. He consented, but did so on the condition that his map not be shown to other fishermen. No one refused to be interviewed.

The "Weigh out" System

In the Northeast, NMFS has since 1964 collected information on landings. Through 1993 these data were collected via a network of 32 federal and state port agents located in the major ports. The agents routinely collect "weigh outs" (individual vessel sales receipts) at the point of first sale. This is done on a daily basis in the principal ports and through weekly and monthly visits to other ports. Another aspect of the port agents' data collection activities included voluntary interviews with vessel operators and/or crew during the time when the fish are landed or sold. These "interview records" contain the most reliable information on variables such as gear type, fishing location, and effort. The percentage of trips interviewed varied considerably by port, size of vessel and length or type of trip. Since April 1994 port agents no longer conduct interviews, however, many fisheries (groundfish, summer flounder, sea scallops) are now under a mandatory logbook system which provides generally similar data.

Virtually all of the landings recorded are associated with the type of gear which produced them. However, in some of the smaller ports it is often difficult to associate landings with a particular vessel or trip. Similarly, vessels under 5 gross registered tons (GRT) are called under-tonnage and are not distinguishable in the "weigh out" system as individual vessels; rather they are entered under a group identification code.

Much data are available by USA/NEFSC statistical area (Area) (see Fig. 3). These vary in size from 2 degrees by 2 degrees (Area 639) to an irregular shape approximately 1 degree by 30 minutes (Area 539). Interviewed trip data are available by quarter degree square beginning in 1975. Some data are available by ten minute square, primarily after 1981. A trip where fishing occurred in more than one Area or quarter degree square can be distinguished as a "split trip"[6].

In addition to the port agent interview data, interviews conducted in the "sea sampling" program are also entered in the "weigh out". Since 1989 a large-scale sea sampling program has been in place in the Northeast region of the United States in which trained scientific observers are sent to sea aboard commercial vessels. The observers collect information on the catch and by-catch (quantity,

[4] Peterson and Smith (1981) while conducting research in Massachusetts found a significant behavioral division between vessels of 60 ft and under or 40 GRT and under, which tended to fish inshore (within 20–25 miles of the coast) on single day trips, and larger vessels which tended to fish offshore on multiple day trips.

[5] The Boston auction opened in 1914 and the Portland auction in 1986. New Bedford has had a series of auctions, covering the period from the 1940s through present.

[6] A trip may be "split" due to a number of reasons: more than one area per trip, more than one quarter degree square per trip, more than one gear per trip, more than one mesh size per trip, or more than one port of landing per trip.

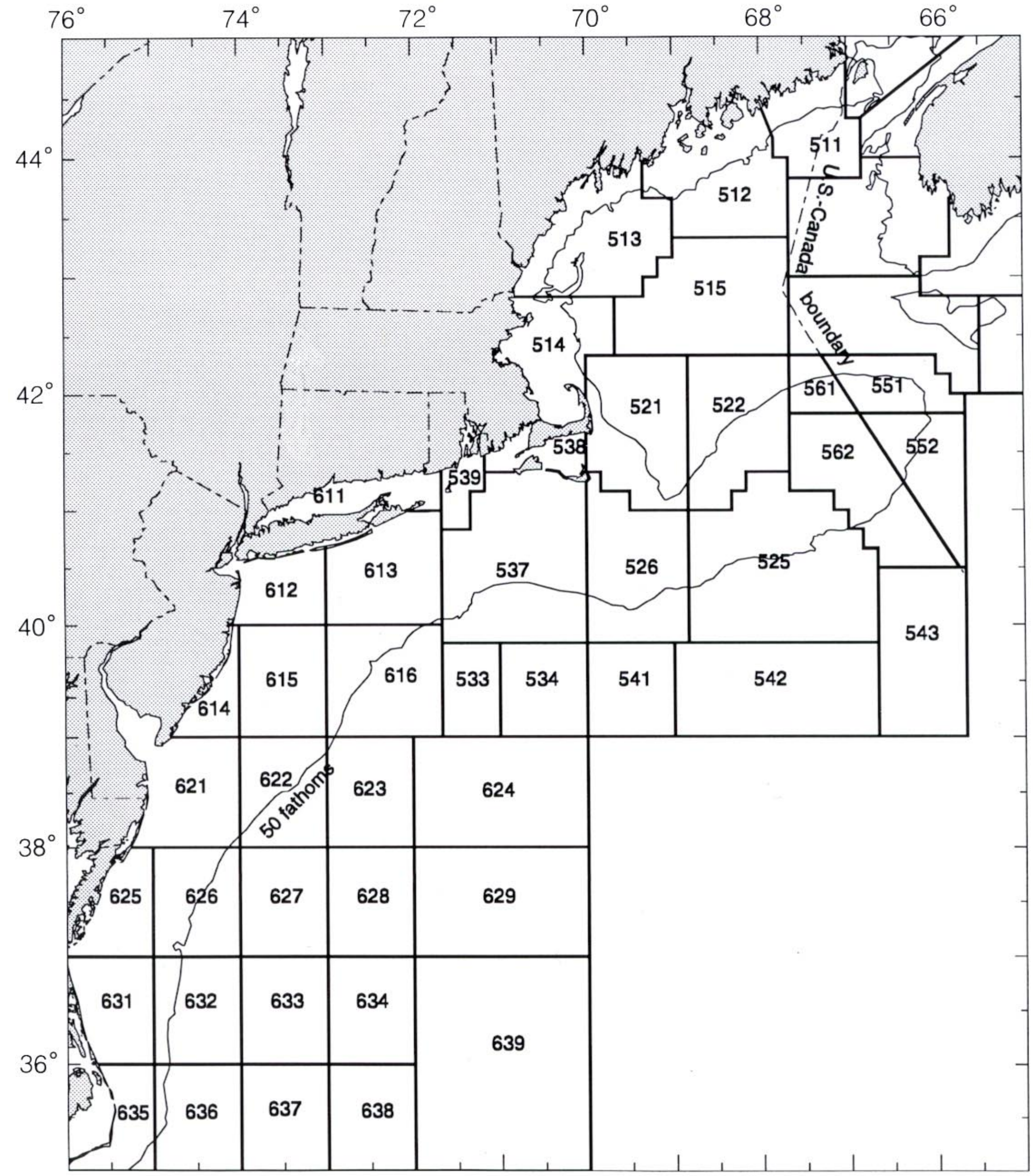

Fig. 3. USA/NEFSC Statistical Areas.

species composition, fish lengths and weights, and discards) as well as record other data on the vessel, gear and fishing operations. The number of fisheries and vessels covered has increased consistently since the program's inception. In 1989 only otter trawl, shrimp trawl and gillnet vessels were included. In 1993, in addition to these, sampled gear types were longline, tuna trawl, sea scallop dredge and lobster pot.

Data from all "weigh out", "sea sampling" and logbook interviewed trips are examined here. Annual data from 1964 through 1993 were examined with regard to numbers of NMFS statistical areas fished per trip, broken out by port, gear type and vessel size. Because vessel length was not recorded in the database until 1982, vessel size was assigned by tonnage class, using the tonnage class categories commonly used by NMFS: under-tonnage or tonclass 1 (0–4 GRT); tonclass 2 (5–50 GRT); tonclass 3 (51–150 GRT); tonclass 4 (151–500); tonclass 5 (501–1 000 GRT); and tonclass 6 (1 001–2 000 GRT). Tonclasses 1 and 2 combined approximate the small *versus* large vessel distinction of 0–40 GRT *versus* 41+ GRT developed by Peterson and Smith (1981) as one gloss for small inshore day boats versus large offshore trip vessels (Footnote 2). All ports, gears and vessel sizes were examined. However, when a particular category contained fewer than 30 records it was deleted from the analysis.

The Permit System

In the Northeast, any vessel fishing in a fishery for which there is an FMP must be permitted for that fishery. Originally, these permits were issued in perpetuity, but since 1987 they have been issued for fixed periods (usually a year) and must be renewed at the end of each period. Data listed on the permit include vessel and gear descriptions, the owner's address, the vessel's home port, and the vessel's primary port of landing (self-defined by the applicant). Fishermen may list ports which are not in the Northeast region. There is no charge nor, in most cases, any performance requirements to qualify for a permit and, therefore, the number of permitted vessels in a given fishery generally exceeds the number of active vessels. On their permit forms fishermen may list multiple gears per permit, and many fishermen possess permits for more than one fishery. Permits were examined for 1993 as an additional way of determining if field interviewed fishermen were representative of their ports. In addition, data for 1987 through 1993 were analyzed to determine the degree to which fishermen list their home port as their primary port of landing.

Results

Site Visits and Field Interviews

The scale and detail of the fishing grounds identified by fishermen during the port interviews varied considerably. Some fishermen indicated areas which encompassed most of the Northeast coast and said they made little attempt to target by species. Others drew numerous small areas, each of which was specific to a certain time of year and species mix. None of the maps corresponded in even rough ways to statistical areas, management regions, or political boundaries.

The only mention of such boundaries were disparaging comments on the Hague line which since October 1984 divided U.S. and Canadian waters where the respective 200 mile limits previously overlapped. The Hague Line placed some portions of Georges Bank and other traditional grounds out of the reach of the USA fishermen. Nevertheless, the Northeast Peak of Georges, on the Canadian side of the Hague Line, remains firmly embedded in many fishermen's conception of available fishing area. Despite the Hague Line being in effect for a decade, fishermen constantly refer to the unfairness of its imposition and continue to propose alterations.

For example, the owner of a 65 ft Gloucester dragger noted, "if there is a line, and a closure of 50 miles on one side[7], then there should be another closure for 50 miles on the other side, because the fish will just swim from the closed area on one side of the line to the open area on the other, and the Canadians benefit." The owner of an 86 ft Boston dragger commented that what is frustrating to him is that he "sees" haddock just over the line in Canadian waters. "From the Hague line to Nova Scotia is a more productive area than from Boston to the Line. There's something about the bottom contour and maybe other factors. The fish don't cross the Hague Line... The Canadians are hitting the fish before they get here. You hear the Canadians talking [on the radio]... It would really help if the Hague Line could be extended from Grand Mannan down, 20 miles along the line (67 degrees). The Canadians don't fish there anyway." Scallop vessels also believe the Hague Line to be unfair and often fish along it, and occasionally over it, as demonstrated by several occasions in the early-1990s when scallop vessels were fined for fishing on the Canadian side of the Line.

Both vessel size and gear type appear to influence the type of grounds mapped; and because certain sizes and gears are more prevalent in large and urban ports versus small and rural ports, map types are also related to port. Smaller vessels have inherently smaller ranges than larger vessels and tend to fish small, well defined niches. For example, the owner-operator of a 60 ft otter trawler out of Point Judith said that in late-summer, when the inshore fishery is in the doldrums, he may make 2–4 trips to below the Dumping Area, for whiting[8] (see Fig. 4). In the autumn, there are scup northwest of the closed area. In spring there are winter flounder off Block Island, and in late spring whiting and flounder are in Block Island Sound. He also designated scattered other areas as "year round" for either, "flounder, squid, scup", "whiting, squid, flounder", "whiting, fluke, scup", or "whiting, flounder" – indicating the relative abundance of different species in each location. The owner-operator of a 40 ft

[7] He refers here to Area II, a US region which has generally been closed to fishing during late-winter and spring to allow haddock to spawn unmolested, and is currently closed year round. Currently Canada also enforces a spawning closure.

[8] See Table 3 for scientific names of species mentioned in the text.

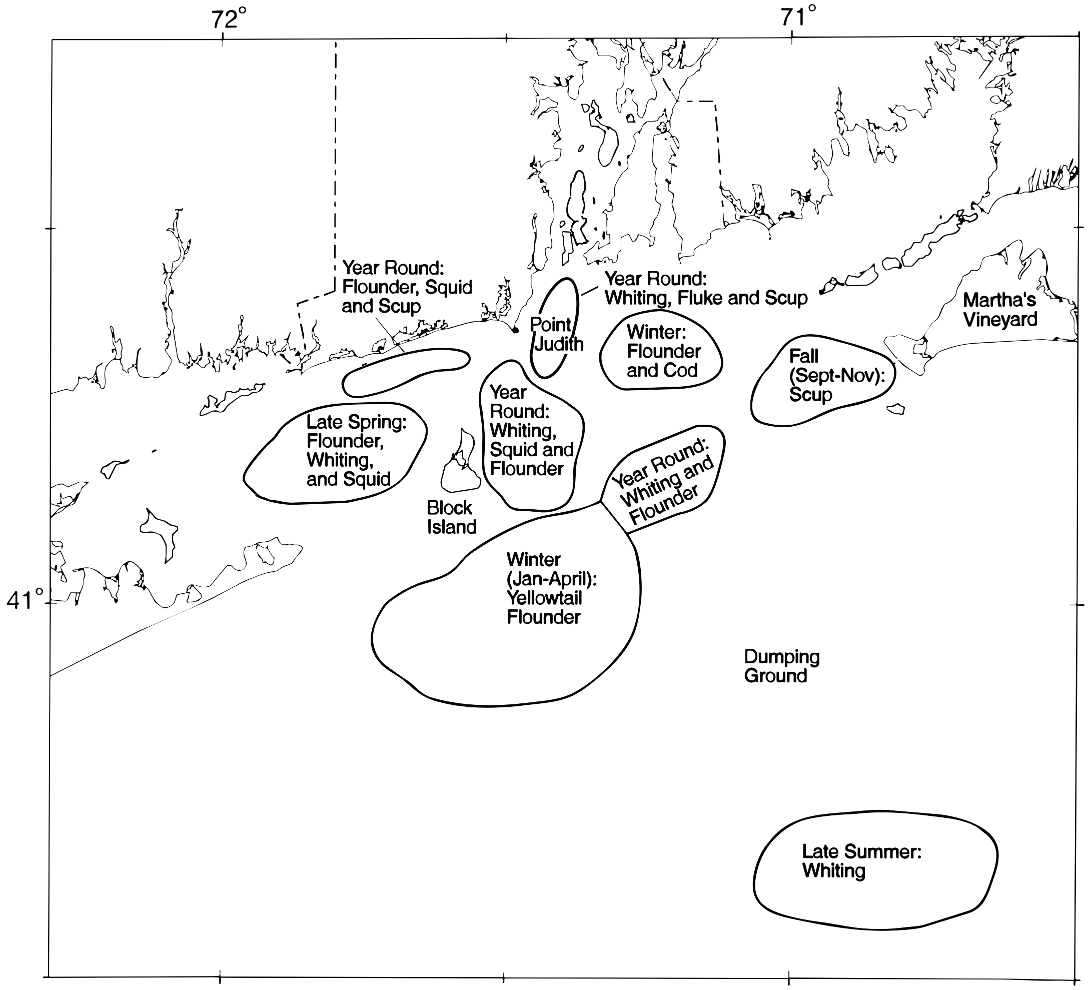

Fig. 4. Example fisherman's map of annual round of fishing, based on NOAA Chart 12300.

gillnetter out of Portsmouth stated, "inshore day gillnetters are almost as territorial as lobstermen."[9]

Turning to large vessels, an 86 ft otter trawler out of Boston groundfishes primarily for cod "from the Gulf of Maine to the Great South Channel". In the summer he and his crew fish on the northern portion of Georges Bank and on hard bottom offshore (Jeffreys Ledge, Fippenies Ledge, Platts Bank), often along the Hague Line. In the Spring they go to Nantucket Shoals and off the coast of New York. Another large vessel, a 95 ft groundfish otter trawler, distinguished hard versus soft bottom, and a tendency to fish more inshore in winter. But much of the Northeast Coast is simply fished "year round" (see Fig. 5).

Size also interacts with gear type and numbers of different gears used. Dewar (1983) noted that small boats often rely on gear switching, unlike large boats for whom such switching is frequently prohibitively expensive. Gillnetters were the most likely of those interviewed to have an "annual round" wherein they change target species and gear by season. The ability to change gear is related to the relatively small size of gillnet vessels (very few are larger than tonclass 2 or 45 ft), and to the similar deck configurations necessary using gillnets and longlines. In the Northeast, for instance, 93% of gillnet vessels fish with other gear for 20% of the year. In contrast, otter trawlers do not do significant amounts of fishing with other gears (U.S. DOC., 1994). The owner of a 42 ft Stonington

[9] Bisack (MS 1995) found (using sea sampling data) that in New England sink gillnet fishermen from adjacent ports tend to have fished in the same area. She has distinguished 4–5 separate fishing territories associated with groups of adjacent ports.

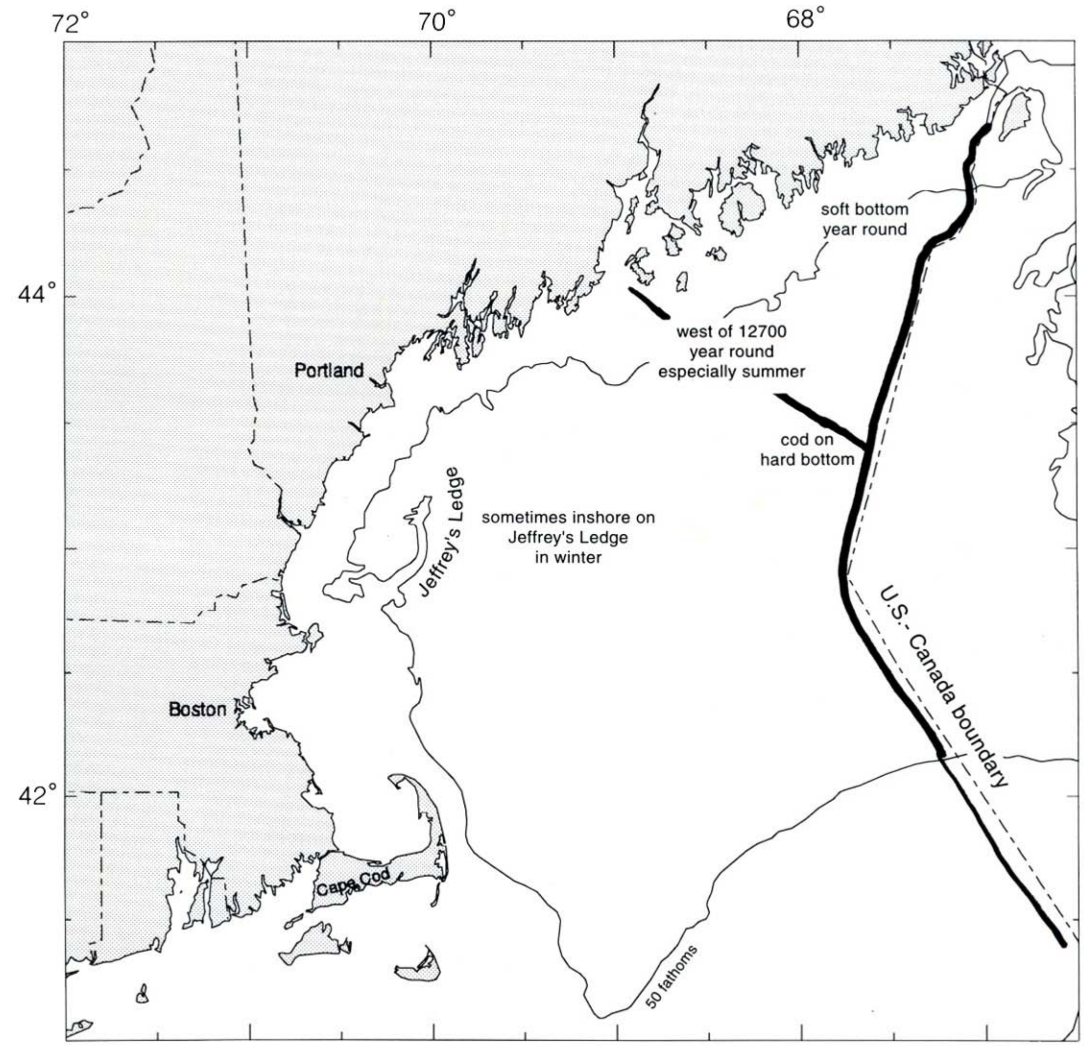

Fig. 5. Example fisherman's map of annual round of fishing, based on NOAA Chart 13260.

gillnetter fishes for cod from May through October, and also brings in some pollock and hake. In the winter he scallops. A Stonington man who owns 4 small boats says he has done gillnetting, clamming, lobstering, musseling and hauling bait. During winter and early-spring, these boats engage in inshore scalloping, groundfish gillnetting and sometimes shrimping. Two of the boats are now going hag fishing. For the last 2–3 years he has been going longlining from the end of November to April. Said the owner of a 42 ft Maine gillnetter, "it's too hard to switch to dragging". Some small draggers, though, do have an annual round, generally involving groundfishing and shrimping. The owner of a 45 ft otter trawler from Seabrook says, "the key to a small dragger is versatility. Some years you catch cod, haddock and yellowtail founder all year. Sometimes you shrimp in the winter. There are 4–5 different things we go for (including large and small mesh groundfish, shrimp and tuna) and all have different nets."

Gear can also interact with area fished and ideas of territoriality due to bottom topography. Trawlers frequently noted hard *versus* soft bottom on their maps. Said the owner of an 86 ft dragger from Boston, "even with electronics you still need to know the bottom". The owner of a 78 ft mixed species trawl in Point Judith said, "we need to be able to switch from one fishery to another. I have six different nets to do six different things. From New Bedford south it's like this. From New Bedford north it's either groundfish or scallop, one dimensional."

As well, changes in fishing technology can alter territorial patterns, sometimes creating gear conflicts. Trawl fishermen who frequent the hard bottom of the Gulf of Maine rely heavily on "rock hoppers" (roller gear) to prevent torn nets. Before the invention of rock hoppers, draggers were unable to fish hard bottom without considerable loss of gear; these areas were exclusive to gillnets and other stationary gear. Gear conflicts have resulted from this technologically-based behavioral change. Draggers report that, "gillnetters block off whole areas for themselves" or "are souring the bottom with lost nets", while gillnetters say trawlers destroy their gear. And again, size and gear interact. A Maine small boat gillnetter, for instance, says, "small draggers are not a problem. They are too small to get on our gear or tow through it. The big guys though, think the high fliers are goal posts! They just drive right through."

Most of the fine scale maps were associated with small inshore vessels in smaller ports. This is consistent with research showing that true territoriality is most commonly associated with the use of stationary or fixed gears and is more likely to be found in small, community-based, inshore fisheries (Cordell, 1989; Schlager, 1990). Davis (1984), though, did describe a case in Nova Scotia where different portions of the sea, both inshore and offshore, were delegated to specific gear types. Finally, Miller and Van Maanen (1981) noted, "many of the Gloucester boats (both inshore and offshore) have fished the same grounds for years and their charts reflect this fact for they are full of markings indicating safe lanes and alleys." In this case, it may be that Gloucester's close ethnic Sicilian community functions as a small enclave within the larger community of Gloucester (Doeringer *et al*., 1986).

Personal preferences and family characteristics also play a role in determining the specific target species and vessel sizes that fishermen concentrate on, with resulting implications for types of fishing grounds and ranges. Some fishermen simply like or dislike certain species or gear types; according to one fisherman "each fisherman has a forté, so not everybody will fish for everything". The owner-operator of a 65 ft dragger out of Gloucester, Massachusetts says that in winter he fishes first for cod, pollock and haddock in inshore waters from Cape Cod north along the Boston traffic lane and then out to Murray Basin. Only if fishing is poor will he go further offshore – around Wilkinson Basin – and fish for flatfish, because "flatfish are boring." A Stonington, Maine gillnetter, with a 40 ft boat says he catches urchins in the winter and could live off urchining now, but doesn't want to – too boring and he doesn't like working with the divers. A gillnetter from Seabrook, New Hampshire "tried dragging, but I liked gillnetting better. It's more selective." The owner of a small trawl vessel in Seabrook tried gillnetting, but switched to trawling because he "liked the quality of the product better."

Smaller boats are more likely to make single-day trips and large vessels to make multiple day trips. Many fishermen have very strong feelings about the choice of day *versus* trip fishing, due to issues such as time spent with family (especially when children are young) and predictability of schedule[10] (Binkley, 1990; Gatewood and McCay, 1990; Pollnac and Poggie, 1988; Apostle, 1985). The 36 year old owner of a 78 ft trawler that makes 2–5 day trips, said that he used to do 9–11 day trips all the time but has tried to be around more since his kids were born. Similarly the owner of a 44 ft trawler likes day fishing because he can easily take off for day activities and is home when his kids arrive from school. In contrast, a single fisherman who owns a 57 ft otter trawler says he tried day fishing but didn't like it, "getting up in the middle of the night to go out, coming home in the evening, falling asleep, and then getting up to do it all over again". Miller and Van Maanen (1981) noted that in Gloucester the most important division among fishermen is between inshore and offshore draggermen (otter trawlers).

The "Weigh Out"

The plurality of all interviewed trips fished within a single Area. However, the percentages (see Tables 4, 5 and 6) of trips to a single Area, and average number of Areas per trip (See Tables 7, 8 and 9) varied considerably across port, gear and vessel size, as well as to some extent over the 1964–1993 period. New England ports are more heterogeneous in their behaviour than Mid-Atlantic ports; all of whom are highly likely to fish in a single Area only. This may, however, be related to the relatively larger size of some of the Areas in the Mid-Atlantic rather than to actual differences in fishing behaviour.

Within New England, vessels in the ports of Boston, Gloucester and New Bedford are the most likely to range over a number of Areas, though for Gloucester, and to a lesser extent Boston, this tendency decreases considerably over time while New Bedford remains more constant. One factor that may explain these differences is that scallop trawl behaviour remains more constant over time than groundfish trawl behaviour. Groundfish trawls ex-

[10] There is some division by age among the fishermen with respect to day *versus* trips boats as well, with younger men more likely to work on the long trip boats and older men, near retirement, more likely to work day boats. Said one fisherman in his mid-thirties about his decision to leave a freezer boat for a boat which makes 2–4 day trips," I'm not 25 anymore".

hibit a modest trend toward fishing fewer Areas per trip. The presence of scallop trawls in New Bedford would mitigate the groundfish trawl changes. New Bedford vessels are primarily scallop trawls, groundfish trawls and scallop dredges. Gloucester vessels are primarily groundfish trawls and whiting gillnet vessels. Boston vessels are primarily groundfish trawls.

Stationary gears, as might be expected, show fewer Areas per trip than mobile gear. The exception in the mobile gear category is scallop trawls. This may be related to the relative size of scallop dredges and trawls. According to permit data, the average tonnage for a scallop trawl in 1993 was 34 GRT (small vessel), as opposed to 59 GRT for scallop dredges. Data on fishing behaviour by vessel size indicate a clear distinction between small vessels (tonclasses 1 and 2) and large vessels, with small vessels fishing fewer Areas. All vessel sizes, however, appear to be fishing fewer areas today than in the past, with the possible exception of tonclass 1 vessels. Statistical tests are required, however, in order to confirm whether this is a significant trend for the smallest vessels.

Even in cases of multiple Areas fished per trip, however, the specific Areas are virtually all adjacent, e.g. Area 613 and Area 537, Area 616 and Area 537, Area 522 and Area 562, Areas 616, 537 and 526 (see Fig. 3). On trips which fished entirely within one Area, the degree to which fishing occurred in more than one quarter degree square varies over time (see Table 10). Vessels seem to be fishing more quarter degree squares, though they are often fishing fewer Areas. This may indicate movement toward more fine scale targeting, perhaps due to recent regulations in the groundfish and scallop fisheries which limit the number of days a vessel can fish.

The Permit System

Over the 1987 to 1993 period, fishermen consistently list the same home port and primary port in approximately 70% of cases[11]. This is consistent across vessels permitted under three of the major New England FMPs: groundfish, scallop and lobster (see Table 11). In 1993, this can be broken out by size as 17% of tonclass 1 vessels, 63% of tonclass 2 vessels, 14% of tonclass 3 vessels and 6% of tonclass 4 vessels. Small vessels are thus more likely than large vessels to state that they land in their home ports. This trend also holds true when examined by state (see Table 12).

Discussion

Preliminary weigh out, permit and field interview data confirm the importance of port, gear and vessel size in influencing fishermen's spatial movements at sea. Work remains to be done with regard to further examination of quarter degree square data, examination of consistency in specific Areas fished by individual vessels, and on the influence of target species (see Gabriel, 1996, this volume). Significance tests should also be conducted for the trends highlighted here.

Current Management Measures and Implications for Management

When scientific sampling and management regions do not coincide with fishing grounds, it becomes difficult to create datasets which fishermen understand and trust. When management regimes and jurisdictions conflict with the continued use of these grounds, non-compliance risks increase. Recognizing this, Northeast managers, scientists and fishermen are beginning to work more closely on measures relating to area closures and sub-regional management.

A number of current management measures in the Northeast and elsewhere build in some way upon territoriality in fishing behaviour. Total Allowable Catch (TAC) legislation in international treaties and in national legislation has meant that the statistical regions have often become management regions as well. Different combinations of Divisions, sub-Divisions and time periods have been used for TACs for stocks of different species (Halliday and Pinhorn, 1990). Within the USA, TACs are increasingly being included in programs which have other primary governance mechanisms – simply as a backstop. These too must be designated for specific regions in order to allow for enforcement and achieve the desired effect on the resource; and these regions may not correspond to what fishermen would consider to be reasonable based on their knowledge of fish behaviour.

TACs demarcate the sea only indirectly, i.e. through the use of either statistical areas or state or federal waters as zones within which certain amounts of fish may be taken. However, failure to take into account fishermen's ranges and traditional fishing patterns can lead to dispute. In the Northeast, the summer flounder fishery is currently governed by a TAC divided into percentage shares allocated to states in the region. Initially, these shares

[11] Lower numbers in 1987 seem to be due primarily to blank fields as the new database system was implemented, rather than to real differences in levels of matching.

were non-transferable. Fishermen in the summer flounder fishery in the USA, however, often land in a state different from the one in which they live or in which their boat is registered. The States began to complain that their quotas were being filled by non-residents. This led to allowing quota trading among states. While there are some economic rent issues exacerbated by such trading, the practice does recognize the actual behaviour of fishermen and attempt to incorporate it into regulations.

Closed areas can be vital to rehabilitating habitat and providing refugia for stocks in decline. In the Northeast, area closures have gained in importance in recent years. Like quotas, though, they can disrupt the traditional annual round of fishermen by forcing a switch to different species or different gear, or different home port. Many factors will be involved in which of these choices is made. Level of community attachment will figure into whether or not migration is chosen, with day fishermen and fishermen from close-knit rural or ethnic communities being less willing to leave home. Draggers will be less likely to choose different gear. Closed areas however, make sense to fishermen in a way that quotas do not. Fishermen have a very strong aversion to throwing overboard anything that has already come on deck, especially if it is already dead, not withstanding the very high discard rate of non-economic species (see Murawski, 1996, this volume). They do however, generally recognize the need to protect spawning fish and juveniles. Further, to the extent that closed areas take into account fishermen's actual fishing patterns they will be better accepted, though not necessarily as feasible to administer and enforce.

Areas of restriction by gear are also in use in the Northeast. There are designated areas, for instance, where small mesh (under 6 inches) can be used for groundfish fisheries. Elsewhere in the region small mesh is banned for groundfish. Such closures are another measure which is more in line with existing fisheries practices. Increased overall crowding on the grounds has led to the abandonment of or conflict over many traditionally gear-specific areas, but there exists the possibility of building on and officially institutionalizing some of these spatial divisions. Again, however, complex regimes which allow certain gears at certain times are difficult to enforce.

Amendment 5 to the offshore lobster FMP specified four separate management areas. These are based to a large extent on traditional fishing grounds; i.e. they take into account which vessels (by port and gear) fish primarily in what territorial areas. Each zone has its own Effort Management Team (EMT) consisting of lobstermen, scientists and managers. This EMT, while only consultative to the Lobster Committee of the NEFMC, is charged with recommending the specific management measures to be adopted within its zone.

Similarly, one of the alternatives proposed for Amendment 5 to the groundfish FMP (though not an alternative that was implemented) was to divide the Northeast into three regions: the Gulf of Maine (GOM), Georges Bank (GB) and Southern New England (SNE). Each would have had somewhat distinct management rules, based on the differing species mixes, vessel behaviours, and ocean bottom topography of each region.

One of the alternatives initially discussed for Amendment 7 to the groundfish FMP (though never fully developed) created nine separate sub-regions and seven gear groups. Proposed by the NEFMC Groundfish Oversight Committee (Committee), vessels were to be regulated via time/area/gear closures which would open and close each sub-region to specific gear groups by quarter. The specific gears included in each group, and the dimensions and borders of the areas were based on industry practice, and on NMFS data on fishing patterns, stock ranges and stock densities. This proposal was eventually discarded by the Committee as too complicated to be enforceable, and thus not included among alternatives taken to Public Hearing[12].

In a similar vein, the Gear Conflict Advisory Committee (convened jointly by the New England and Mid-Atlantic Fishery Management Councils) proposed a resolution in early November 1994, which would have designated separate areas by Loran lines, season, and depth for fixed gear, mobile gear and drift gear, with buffer zones in between and some areas unrestricted. This measure was not adopted by the Councils. Also discussed, though not sent on to the Councils as resolutions, were zones based on vessel sizes (e.g. no vessels over 60 ft inside 25 miles; no vessels over 85 ft inside 50 miles; and so forth) and a ban on all fishing west of 70°W except by hook boats.

Finally, current gillnet vessel time/area closures for Harbor Porpoise protection (part of Amendment 5 to the groundfish FMP) are designed in part on

[12] When developing an FMP or Amendment, the Regional Council must hold a series of Public Hearings on a set of alternative measures. Based in part on the public comments, and in part on the Council's expertise and on information supplied by Council and NMFS staff, the Council subsequently decides on a single alternative which they send to NMFS for approval.

existing fleet territoriality. Bisack (MS 1995) found that, in New England, sink gillnet fishermen from adjacent ports of landing tend to have fished in the same area. She distinguished 4–5 separate fisheries territories associated with groups of adjacent ports. Additional refinements of the placement and boundaries of these areas are being discussed at meetings convened with managers, scientists and fishermen.

Conclusion

The primary management regions and statistical sampling areas used by managers and scientists are often constructed on the basis of different types and scales of data than those used by fishermen. The fact that scientists collect some of their data on non-commercial vessels and may use different criteria from fishermen can lead to poor communication. Yet, especially when creating seasonally closed areas or gear and species-specific measures (e.g. to address species and size selectivity issues), not only is fishermen's knowledge of ecosystem dynamics valuable, but compliance should be easier if the boundaries of the area form a logical subset of the fishermen's own cognitive maps of the sea (see Ostrom (1990) and Libecap (1989) for good theoretical discussions of cooperation and compliance).

These incompatibilities may be one reason (though others certainly abound) for the lack of communication and sense of isolation that fishermen feel with regard to managers and scientists. And yet, there are many potentially overlapping and complementary areas of knowledge between fishermen and scientists which could lead to mutual support rather than antagonism. Certainly, in the Northeast, increasing efforts have been made to respond to fishermen's criticisms of areal boundaries and seasons.

The problem in many of these cases, of course, is that if regulations attempt to conform closely with the all complex distinctions among fishermen and fishing patterns, they become increasingly difficult to enforce and may require re-organization of the existing management institutions. The challenge is to discern which patterns to build upon and which not. Recent experiences in the Northeast (also see McCay and Creed, 1989), and attempts at cooperative science and co-management in Canada (Pinkerton, 1989), Norway (Jentoft and Kristofferson, 1989) and elsewhere offer some guidelines for future efforts to include local knowledge and ability in the formulation and implementation of effective management.

References

APOSTLE, R. 1985. Work satisfaction and community attachment among fishermen in southwest Nova Scotia. *Can. J. Fish. Aquat. Sci.*, **42**: 256–267.

BINKLEY, M. 1990. Work organization among Nova Scotian offshore fishermen. *Human Organization*, **49**(4): 395–405.

BISACK, K. MS 1995. "1994 and 1995 by-catch estimates of Gulf of Maine Harbor porpoise in the sink gillnet fishery". NMFS, Northeast Fisheries Science Center, Protected Species Branch.

CHURCHILL, R. R. 1993. Fisheries issues in maritime boundary delimitation. *Marine Policy.*, **17**(1): 44–57.

CORDELL, J. 1989. A sea of small boats: customary law and territoriality in the world of inshore fishing. Report No. 62. Cambridge, MA: Cultural Survival.

CÔTE, J. MS 1953. Subdivision of Subareas. *ICNAF Meeting Document*, No. 18, Serial No. 90, 2 p.

DAVIS, A. 1984. Property rights and access management in the small boat fishery: a case study from southwest Nova Scotia. *In*: *Atlantic Fisheries and Coastal Communities: Fisheries Decision-Making Case Studies*. C. Lamson and A. Hanson (eds.). Halifax, Nova Scotia: Dalhousie Ocean Studies Programme, p. 133–164.

DEWAR, M. 1983. Industry in Trouble: economics and politics of the New England fisheries. Cambridge, MA: MIT Press.

DOERINGER, P, P. MOSS, and D. TERKLA. 1986. The New England Fishing Economy. Amherst: University of Massachusetts Press.

GABRIEL, W. L. 1996. Factors influencing technological interactions in Mid-Atlantic Bight groundfish fisheries. *J. Northw. Atl. Fish. Sci.*, this volume.

GATEWOOD, J., and B. McCAY. 1990. Comparison of job satisfaction in six New Jersey fisheries: implications for management. *Human Organization*, **49**: 14–25.

HALLIDAY, R. G., and A. T. PINHORN. 1990. The delimitation of fishing areas in the Northwest Atlantic. *J. of Northw. Atl. Fish. Sci.*, **10**: 1–51.

JENTOFT, S., and T. KRISTOFFERSON. 1976. Fishermen's co-management: the case of the Norwegian fishery. *Human Organization*, **48**(4): 355–365.

LIBECAP, G. D. 1989. Contracting for Property Rights. New York: Cambridge University Press, 132 p.

MATSUDA, Y., and Y. TANEDA. 1984. The seven great fisheries incidents in Japan. *In*: Maritime Institutions in the Western Pacific. K. Ruddle and T. Akimichi (eds.). Senri Ethnological Studies No. 17. Osaka, Japan: National Museum of Ethnology, p. 159–181.

MCCAY, B. J., and J. ACHESON (eds.). 1987. The Question of the Commons: the culture and ecology of communal resources. Tucson: University of Arizona Press, 439 p.

MCCAY, B., and C. CREED. 1989. Dividing up the Commons: co-management of the U.S. surf clam fishery. J. S. Thomas, L. Maril, and E. P. Durrenberger (eds.). Marine Resource Utilization: A Conference on Social Science Issues Mobile, AL: University of South Alabama.

MCGOODWIN, J. R. 1990. Crisis in the World's Fisheries: people, problems, and policies. Stanford: Stanford University Press, 231 p.

MILLER, M., and J. VAN MAANEN. 1981. Boats don't fish, people do: some ethnographic notes on the federal management of fisheries in Gloucester. James Acheson (ed.). Essays on Social and Curtural Aspects of New England Fisheries, NSF Final Report, Vol. II. Grant No. AER 77-06018, p. 27–53.

MURAWSKI, S. A. MS 1996. Factors influencing by-catch and discard rates: analyses from multispecies/multifishery sea sampling. *J. Northw. Atl. Fish. Sci.*,

(this volume).
OSTROM, E. 1990. Governing the Commons: the evolution of institutions for collective action. New York: Cambridge University Press, 280 p.
PETERSON, S. B., and L. J. SMITH. 1981. Small-scale commercial fishing in New England. Woods Hole Oceanographic Institute Technical Report No., 81–72. Woods Hole, MA: WHOI, 43 p.
PINKERTON, E. (ed.) 1989. Co-operative Management of Local Fisheries: new directions in improved management and community development. Vancouver, B.C.: University of British Columbia Press, 299 p.
POLLNAC, R. B., and J. J. POGGIE, JR. 1988. The structure of job satisfaction among New England fishermen and its implications for management. *American Anthropologist*, **90**: 888–901.
ROUNSEFELL, G. A. 1948. Development of fishery statistics in the North Atlantic. *U.S. Fish and Wildlife Service Special S*cience *Report*, **47**, 27 p.
RUDDLE, K., and T. AKIMICHI (eds.). 1984. Maritime institutions in the Western Pacific. *Senri Ethnological Studies*, No. 17. Osaka, Japan: National Museum of Ethnology, 327 p.
SCHLAGER, E. 1990. Model specification and policy analysis: the governance of coastal fisheries, Ph.D. dissertation. Workshop in Political Theory and Policy Analysis, Indiana University, Bloomington, Indiana, 247 p.
TERKLA, D., and P. DOERINGER. 1995. Troubled Waters: economic structure, industrial policy, and fisheries trade. Toronto: Univ. of Toronto Press.
U.S. DOC (U.S. Dept of Commerce) 1994. "Status of the fishery resources off the northeastern United States for 1993". NOAA Technical Memorandum NMFS-F/NEC-108, 140 p.

TABLE 1. Field interviewed fishermen (numbers following "maps", indicate vessel lengths).

	Groundfish Trawl	Dogfish or Groundfish Gillnet	Swordfish Draft Gillnet	Groundfish Gillnet/shrimp/ Scallop	Scalloper	Lobster or Fish Traps
Stonington				5 interviews 5 maps, 40–45 ft		
Rockland						3 interviews 1 map, 30 ft
Portland	3 interviews 2 maps, 60, 71 ft					
Portsmouth	1 interview 1 map, 38 ft	4 interviews 4 maps, 38–44 ft				
Rye		1 interview 0 maps				
Seabrook	1 interview 1 map, 45 ft	1 interview 0 maps				
Gloucester	2 interviews 2 maps, 65, 95 ft					
Boston	4 interviews 1 map, 86 ft					
New Bedford	1 interview 1 map, 60 ft	1 interview 0 maps	1 interview 0 maps		3 interviews 0 maps	
Chatham		2 interviews 1 map, 66 ft				1 interview 0 maps
Point Judith	3 interviews 3 maps, 59, 60, 78 ft					

KEY for Tables:

Pland	Portland. Maine
Rland	Rockland, Maine
Bton	Boston, Massacusetts
Glstr	Gloucester, Massachusetts
NBed	New Bedford, Massachusetts
Ptwn	Provincetown, Masachusetts
Swch	Sandwich, Massachusetts
Nport	Newport, Rhode Island
Pt J	Point Judith, Rhode Island
Pt. Pl	Point Pleasant, New Jersey
CMay	Cape May, New Jersey
Wwd	Wildwood, New Jersey
Ocn	Ocean City, Maryland
Hton	Hampton, Virginia
Nflk	Norfolk, Virginia
Chtg	Chincoteague, Virginia
CpCh	Cape Charles, Virginia
Nnws	Newport News, Virginia
Hpsh	Hampshire, New Hampshire
Gport	Greenport, New York
Mntk	Montauk, New York
HBay	Hampton Bays, New York
Chtm	Chatham, Massachusetts
Ston	Stonington, Maine

010	Bottom Longline
020	Hand Gear
030	Harpoon
040	Pelagic Longline
050	Fish Bottom Trawl
052	Scallop Trawl
056	Bottom Pair Trawl
058	Shrimp Bottom Trawl
080	Floating Traps
100	Sink Gillnet
115	Large Pelagic Draft Gillnet
120	Purse Seine
132	Scallop Dredge
142	Pound Net, Fish
160	Danish Seine
170	Midwater Pair Trawl
181	Fish Pots/Traps
200	Offshore Lobster Pots/Traps
360	Scottish Seine
385	Mussel Dredge
400	Surf Clam/Ocean Quahog Dredge
500	Runaround Gillnet

TABLE 2. Site visit port characteristics for 1993.

W/O Data	Pland	Rland	Ston	Bton	Glstr	Chtm	NBed	Ptmth	Sbrk	Nport	PtJ	All
Tot. Trips	4571	121	925	863	14 866	6 735	7 443	3 606	1 696	1 486	6 201	59 518
Tot. Lbs. *100K	78.6	31.7	5.2	9.8	63.1	10.2	64.4	6.3	1.6	10.5	57.8	1596
Tot. $ Value *100K	49.1	3.2	3.6	10.8	31.3	10.2	108	5.8	1.8	11.2	35.3	886
No. Intv Trips TC1	58	0	2	0	201	202	6	286	79	0	11	1545
No. Intv Trips TC2	545	37	92	149	842	557	41	166	38	118	238	4311
No. Intv Trips TC3	467	30	0	370	722	0	1643	21	0	399	1032	9116
No. Intv Trips TC4	131	2	0	266	444	0	1344	0	0	83	452	5998
No. Intv Trips Gear 050	806	48	0	737	1371	64	1771	167	85	39	1422	8752
No. Intv Trips Gear 100	233	0	88	0	470	401	25	1	360	44	56	2109
No. Intv Trips Gear 132	13	21	3	7	0	0	1097	1	2	0	3	1748
No. Intv Trips Gear 010	59	0	0	6	51	250	1	0	2	0	12	386
No. Intv Trips Gear 200	0	0	2	0	2	0	76	42	0	0	141	368
Permit Data												
No. Vessels TC1	5	0	1	5	51	72	6	19	26	2	20	1243
No. Vessels TC2	56	17	25	710	191	71	44	50	26	27	96	3617
No. Vessels TC3	23	2	0	128	46	0	107	1	3	14	43	930
No. Vessels TC4	11	3	0	38	19	0	100	0	0	2	13	331

TABLE 3. Scientific names of species mentioned in the text.

Common name	Scientific name
Butterfish	*Peprilus triacanthus*
Clam	*Spisula solidissima*
Cod, Atlantic	*Gadus morhua*
Crab, Stone	*Menippe mercenaria*
Dogfish, Spiny	*Squalus acanthias*
Flounder, Summer/Fluke	*Paralichthys dentatus*
Flounder, Winter	*Pleuronectes americanus*
Flounder, Yellowtail	*Pleuronectes ferrugineus*
Goosefish/Monkfish	*Lophius americanus*
Haddock	*Melanogrammus aeglefinus*
Hake	*Urophycis* spp.
Hake, Silver/Whiting	*Meluccius bilinearis*
Harbor Porpoise	*Phoceona phoceona*
Lobster, American	*Homarus americanus*
Mackerel, Atlantic	*Scomber scombrus*
Pollock	*Pollachius virens*
Scallop, Sea	*Placopecten magellanicus*
Scup	*Stenotomus chrysops*
Shrimp	*Penaeus* spp.
Skate	*Raja* spp.
Squid	*Illex illecebrosus*, *Loligo pealii*
Urchin, Green Sea	*Strongylocentrotus droebachiensis*

TABLE 4. Percentage of trips fishing only one USA/NEFSC statistical area, by port.

	Pland	Rland	Bton	Glstr	NBed	Ptwn	Swch	Nport	Pt. J	Pt. Pl	CMay	Wwd
1964	72	59	36	37	31	67						
1965	72	61	36	45	42	72			69			
1966	82	64	40	44	46	73			68			
1967	84	57	40	42	44	80			57			
1968		75	45	38	50	88			63			
1969			55	44	47	85			63			
1970			59	44	46				58			
1971	73		60	62	50	72		74	44			
1972	83	58	65	61	45	75		61	61	69		
1973	87	59	64	56	53	85		63	60			
1974	92	44	61	62	54	73		65	64			
1975	85	96	57	67	49	70	87	65	64			
1976	87	71	65	66	52	77	86	66	53			
1977	86	57	63	58	25	73	87	55	50			
1978	84	41	45	62	47	71	82	55	56	94	90	100
1979	76	60	45	63	38	64	80	49	57	91	94	
1980	92	66	55	70	34	61	78	53	47	96	95	
1981	97	64	57	64	39	69	72	60	45		91	
1982	86	65	58	63	35	78	94	66	45	93	94	
1983	84	62	61	64	39	79	89	64	61	92	89	100
1984	83	68	67	67	37	81	92	62	62	96	85	95
1985	78	74	56	65	41	81	95	59	62	91	91	93
1986	81	79	43	69	44	88		60	64	91	89	94
1987	75	84	52	67	46	87		74	64	91	85	94
1988	74	84	50	70	45	86	97	74	69	88	79	90
1989	80	86	64	67	44	72	100	77	69	91	77	88
1990	77	94	70	70	45	93	98	74	63	91	94	100
1991	81	95	73	73	47	95	100	73	64	79	61	79
1992	83	95	67	74	52	93	100	75	68	66	74	79
1993	84	88	70	80	48	90	100	75	67	74	68	78

	Ocn	Hton	Nflk	Chtg	CpCh	NNws	Hpsh	Gport	Mntk	HBay	Chtm	Ston
1982	83	90		88								
1983	82	90	93	89	79	93						
1984	86	89	95	92	94	97						
1985	92	92	92	91	98	95	89					
1986	86	93	94	87	83	96		95	90	94		
1987	87	91	93	87	97	94			86	93	95	
1988	86	90	97	90		92				91	96	
1989	63	90	97	86		87					100	
1990	96	92		95		89					100	
1991	67	86		98		92	95				100	94
1992	81	91		93		84					99	99
1993	90	94		97		91	95				100	100

	WHbr	BHbr	SBrtl	Jport	Ptmth	Sbrk
1991	77	100	98	93		94
1992	95	95	95	97	95	94
1993		98	98	87	87	88

TABLE 5. Percentage of trips fishing only one USA/NEFSC statistical areas, by gear.

	010	030	040	050	052	055	058	100	120	130	170	200
1964	100			41						44		
1965	98			43						71		
1966	95			43						83		
1967	97			43						71		
1968				47						55		
1969				49						66		
1970	91			45						72		
1971	91			52						71		
1972	92			56					97	65		95
1973	84			57					100	82	82	99
1974	90			59					100	81		97
1975	98	100	95	55		80	85	95	99	76	95	81
1976	98		94	57			89	97	94	75	97	75
1977	95	100		50			90	95	94	76	98	84
1978		93		53				89	100	78	100	85
1979		83	82	51				93	100	65	100	90
1980			83	55				95	100	63	98	82
1981			97	54			92	100	100	66	100	90
1982			92	61			91	91	100	62		94
1983		95	82	62			99	90	100	68		96
1984			84	63	100		88	90	100	64		90
1985			82	63			91	92	100	61		91
1986			78	64	95		91	93	100	63		84
1987	87		86	63	95		81	88	100	64		94
1988	94		90	64	99		83	83	100	61		92
1989	100		94	65	95		94	88	100	67		100
1990	100		88	66	95	97	91	88	97	68		95
1991	100		87	66	96	95	85	94	100	67		95
1992	96		91	68	98	89	93	93	96	65		96
1993	100		90	72	92	93	95	93	100	66		84

	020	080	115	142	181	360	370	385	400	500
1980									97	
1981										
1982					99				84	
1983				100	100				88	
1984		100		100	100	87			91	
1985				100	99	90	91			
1986					97	86			89	94
1987		100				100			88	
1988		100			96	100			83	
1989	97					95			100	79
1990			92		93			100	100	100
1991	100				96			100	71	
1992	100				97			100	76	
1993					100				74	

TABLE 6. Average number of areas fished per trip, by tonclass.

	Tonclass 1	Tonclass 2	Tonclass 3	Tonclass 4
1964		59	36	38
1965		63	40	45
1966		59	44	49
1967		60	40	47
1968		62	34	59
1969		68	37	63
1970		69	40	53
1971		69	51	54
1972		78	55	62
1973		73	56	62
1974		77	56	61
1975		77	57	59
1976		80	54	65
1977	100	77	51	57
1978	100	82	58	55
1979	100	80	51	49
1980	100	79	56	58
1981		82	55	57
1982	100	85	60	62
1983	100	88	61	66
1984	99	89	62	69
1985	97	88	63	68
1986	98	89	66	66
1987	99	88	67	67
1988	99	87	67	67
1989	99	90	70	65
1990	100	90	68	65
1991	97	92	64	62
1992	98	93	68	65
1993	94	94	69	68

TABLE 7. Average number of areas fished per trip, by port.

	Pland	Rland	Bton	Glstr	NBed	Ptwn	Swch	Nport	Pt. J	Pt. Pl	CMay	Wwd
1964	1.3	1.7	2.2	2.4	2.3	1.3			1.4			
1965	1.2	1.5	2.1	2.3	2.0	1.3			1.3			
1966	1.2	1.5	2.1	2.2	2.0	1.3			1.4			
1967	1.2	1.6	2.2	2.0	2.3	1.3			1.4			
1968	1.1	1.4	2.0	2.0	2.1	1.1			1.4			
1969	1.2	1.4	1.7	2.0	2.0	1.1			1.5			
1970	1.2	1.6	1.6	2.1	2.1	1.2		1.0	1.7			
1971	1.4	1.9	1.6	1.6	2.0	1.3		1.3	1.8			
1972	1.2	1.7	1.5	1.6	1.9	1.2	1.1	1.6	1.5			
1973	1.2	1.8	1.5	1.7	1.8	1.1		1.6	1.5			
1974	1.1	2.2	1.6	1.5	1.9	1.3		1.6	1.4			
1975	1.2	1.7	1.7	1.5	2.0	1.3	1.1	1.5	1.5			
1976	1.2	1.5	1.6	1.5	2.0	1.3	1.2	1.5	1.6			
1977	1.1	1.7	1.6	1.7	2.1	1.3	1.1	1.7	1.8			
1978	1.2	2.1	1.8	1.7	2.1	1.3	1.2	1.9	1.6	1.1	1.1	1.0
1979	1.3	1.6	1.9	1.6	2.5	1.5	1.3	2.2	1.6	1.1	1.1	1.0
1980	1.1	1.5	1.7	1.5	2.5	1.5	1.3	1.8	1.8	1.0	1.1	1.0
1981	1.0	1.6	1.6	1.7	2.3	1.4	1.3	1.6	1.8	1.1	1.1	
1982	1.2	1.5	1.6	1.7	2.4	1.2	1.1	1.5	1.8	1.1	1.1	
1983	1.2	1.5	1.5	1.6	2.4	1.2	1.1	1.5	1.5	1.1	1.1	1.0
1984	1.2	1.5	1.4	1.6	2.5	1.2	1.1	1.6	1.6	1.1	1.0	1.1
1985	1.3	1.4	1.6	1.6	2.4	1.2	1.1	1.6	1.6	1.1	1.1	1.1
1986	1.3	1.3	2.0	1.5	2.2	1.1	1.1	1.5	1.5	1.1	1.1	1.1
1987	1.3	1.2	1.7	1.5	2.2	1.1		1.4	1.5	1.1	1.1	1.1
1988	1.4	1.2	1.7	1.4	2.2	1.2	1.1	1.4	1.5	1.1	1.2	1.1
1989	1.3	1.1	1.5	1.4	2.2	1.3	1.0	1.3	1.4	1.1	1.3	1.1
1990	1.3	1.0	1.4	1.4	2.2	1.1	1.0	1.4	1.5	1.1	1.1	1.0
1991	1.2	1.1	1.4	1.4	2.2	1.1	1.0	1.4	1.5	1.2	1.5	1.3
1992	1.2	1.1	1.4	1.3	2.0	1.1	1.0	1.3	1.4	1.4	1.3	1.3
1993	1.2	1.1	1.4	1.3	2.0	1.1	1.0	1.4	1.5	1.3	1.4	1.3

	Ocn	Hton	Nflk	Chtg	CpCh	NNws	Hpsh	Gport	Mntk	HBay	Chtm	Ston
1982	1.2											
1983	1.2	1.1	1.1	1.1		1.1						
1984	1.2	1.1	1.1	1.1	1.1	1.0						
1985	1.1	1.1	1.1	1.1	1.1	1.1	1.1					
1986	1.2	1.1	1.1	1.1	1.2	1.0	1.1	1.1	1.1	1.1		
1987	1.1	1.1	1.1	1.1	1.1	1.1		1.1	1.1	1.1	1.1	
1988	1.2	1.1	1.0	1.1		1.1			1.3	1.1	1.0	
1989	1.2	1.1	1.0	1.2		1.1				1.2	1.0	
1990	1.0	1.1		1.1		1.1				1.1	1.0	
1991	1.4	1.2		1.1		1.1	1.1				1.0	1.1
1992	1.2	1.1		1.1		1.2	1.0		1.7		1.0	1.0
1993	1.1	1.1		1.0		1.1	1.0		1.3		1.0	1.0

	WHbr	BHbr	SBrtl	Jport	Ptmth	Sbrk
1991	1.2	1.0	1.0	1.1	1.2	1.1
1992	1.1		1.1	1.0	1.1	1.1
1993	1.1	1.0	1.0	1.1	1.1	1.1

TABLE 8. Average number of areas fished per trip, by tonclass.

	Tonclass 1	Tonclass 2	Tonclass 3	Tonclass 4
1964		1.6	2.3	2.1
1965		1.5	2.2	1.9
1966		1.6	2.1	1.8
1967		1.6	2.4	1.8
1968		1.5	2.4	1.7
1969		1.5	2.2	1.6
1970		1.4	2.3	1.7
1971		1.4	1.7	1.9
1972		1.4	1.7	1.5
1973		1.4	1.7	1.6
1974		1.2	1.8	1.7
1975		1.3	1.8	1.6
1976		1.2	1.5	1.9
1977	1.0	1.3	1.9	1.7
1978	1.0	1.2	1.8	1.7
1979	1.0	1.2	2.0	1.9
1980	1.0	1.3	1.9	1.7
1981		1.2	1.9	1.7
1982	1.0	1.2	1.8	1.6
1983	1.0	1.1	1.8	1.6
1984	1.0	1.1	1.8	1.5
1985	1.0	1.1	1.7	1.5
1986	1.0	1.1	1.6	1.6
1987	1.0	1.1	1.6	1.5
1988	1.0	1.1	1.6	1.5
1989	1.0	1.1	1.5	1.6
1990	1.0	1.1	1.6	1.6
1991	1.0	1.1	1.6	1.6
1992	1.0	1.1	1.5	1.5
1993	1.1	1.1	1.5	1.5

TABLE 9. Average number of areas fished per trip, by gear.

	010	030	040	050	052	055	058	100	120	130	170	200
1964	1.0			2.1						2.0		
1965	1.0			2.0						1.4		
1966	1.0			2.1						1.2		
1967	1.1			2.1						1.5		
1968	1.0			1.9						1.7		
1969	1.0			1.9						1.5		
1970	1.1			2.0					1.0	1.4		
1971	1.1			1.8					1.0	1.4		
1972	1.1			1.7					1.0	1.4		1.0
1973	1.1			1.7					1.0	1.3	1.2	1.0
1974	1.1			1.7					1.0	1.2		1.1
1975	1.0		1.1	1.8		1.2	1.2	1.1	1.0	1.3	1.1	1.2
1976	1.0		1.1	1.8		1.2	1.1	1.0	1.0	1.3	1.0	1.3
1977	1.1	1.0	1.3	1.9		1.0	1.1	1.1	1.1	1.3	1.0	1.2
1978		1.1	1.2	1.8				1.1	1.1	1.3	1.0	1.2
1979		1.2	1.2	2.0			1.2	1.1	1.0	1.5	1.0	1.1
1980		1.1	1.2	1.8				1.0	1.0	1.6	1.0	1.2
1981			1.0	1.8			1.1	1.0	1.0	1.5	1.0	1.1
1982			1.1	1.7			1.1	1.1	1.0	1.6	1.1	
1983		1.1	1.2	1.7			1.0	1.1	1.0	1.6	1.0	1.0
1984			1.2	1.7			1.1	1.1	1.0	1.6	1.0	1.1
1985			1.2	1.7			1.1	1.1	1.0	1.7	1.0	1.1
1986			1.3	1.6	1.1	1.3	1.1	1.1	1.0	1.6		1.2
1987	1.1		1.2	1.6	1.1		1.2	1.1	1.0	1.6		1.1
1988	1.1		1.1	1.6	1.0		1.2	1.2	1.0	1.7		1.1
1989	1.0		1.1	1.6	1.1		1.1	1.1	1.0	1.6		1.0
1990	1.0		1.2	1.6	1.1	1.0	1.1	1.1	1.0	1.6		1.0
1991	1.0		1.1	1.6	1.0	1.0	1.2	1.1	1.0	1.6		1.0
1992	1.1		1.1	1.5	1.0	1.1	1.1	1.1	1.1	1.7		1.0
1993	1.0		1.1	1.4	1.1	1.1	1.1	1.1	1.0	1.7		1.2

	020	080	115	142	181	360	370	385	400	500
1980									1.0	
1981					1.0				1.0	
1982					1.0		1.0		1.2	
1983				1.0	1.0				1.1	
1984		1.0		1.0	1.0	1.1			1.1	
1985	1.0			1.0	1.0	1.1			1.1	
1986					1.0	1.1			1.1	1.1
1987		1.0			1.0	1.0			1.1	
1988		1.0			1.0	1.0			1.2	
1989					1.1	1.1			1.2	1.0
1990			1.1		1.1			1.0	1.0	1.0
1991	1.0				1.0			1.0	1.4	
1992	1.0				1.0			1.0	1.3	
1993					1.0				1.3	

TABLE 10. Percent of quarter degree squares fished on trips that fished only one USA/NEFSC Statistical Area.

	One	Two
1982	47	52
1983	57	42
1984	48	50
1985	38	58
1986	55	39
1987	47	52
1988	48	48
1989	23	68
1990	27	47
1991	34	65
1992	23	73
1993	15	80

TABLE 11. Percentages of home port/primary port matches, all ports.

	All Permits	Multispecies Permits	Scallop Permits	Lobster Permits
1987	62	65	66	65
1988	70	71	70	72
1989	71	72	70	72
1990	71	72	70	72
1991	71	72	72	73
1992	71	71	73	73
1993	70	70	72	72

TABLE 12. 1993 percentages of permitted vessels by tonclass: where home port = primary port and all permits.

Hport=Pport	TC1	TC2	TC3	TC4	All Permits	TC1	TC2	TC3	TC4
ME	14	80	5	2		18	76	4	2
NH	38	59	4			51	47	2	
MA	29	51	12	8		23	56	13	6
CT	21	71	7	1		24	66	8	2
RI	22	58	16	4		33	51	14	3
DE	26	70	4			13	67	15	5
MD	13	52	32	3		15	49	31	5
NY	18	66	15	1		16	69	14	1
NJ	21	54	19	7		22	55	18	7
VA	3	26	49	22		4	33	40	24