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HOW 'MIXED' IS THE MIXED SPECIES TRAWL FISHERY ON GEORGES BANK?

or

EVALUATING FISHERY PERFORMANCE VIA AN OBSERVER PROGRAM

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ABSTRACT

In 1989, the Northeast Fisheries Science Center implemented a domestic observer program in which fisheries information is collected at-sea by trained observers placed aboard commercial fishing vessels. The major purpose of the program is to obtain real-time data on the quantities and biological characteristics of discards in the Georges Bank, Gulf of Maine, and Mid-Atlantic fisheries. Catches (both kept and discard weights) are recorded on a tow basis, and size frequency measurements are made, by species, on both the kept and discarded components of the catch. Vessel performance and hydrographic data are also recorded for each tow (i.e., tow depth, tow time, tow speed, tow direction, gear configuration, wind speed, wave height, etc). Annually, about 2800 sea-days are allotted to the observer program.

The data collected have been used for a variety of purposes including: (1) estimating non-fish (marine mammal, sea turtle and sea bird) by-catch; (2) estimating species-specific discard levels for use in assessment analyses; and (3) evaluating impacts of management measures - such as time/area closures and trip limits - on fleet behavior and performance. As an example of this latter use of the observer program, we report the results of an experimental fishery (in which observers were required) for Atlantic cod (*Gadus morhua*) during January-June 1994 in a closed area on Georges Bank established to protect haddock (*Melanogrammus aeglefinus*). The experimental fishery was authorized as a research initiative designed to assess whether a fishery for cod (and other mixed groundfish) could be prosecuted without having significant bycatches of haddock.

INTRODUCTION

Since 1970, a seasonal areal closure of the northeast corner of Georges Bank has been implemented annually to protect spawning concentrations of haddock (*Melanogrammus aeglefinus*) [1]. This spawning area closure (originally designated as Area B but subsequently referred to as Area II) was first enacted by the International Commission for the Northwest Atlantic Fisheries (ICNAF) in March and April 1970 (Fig. 1a). The closure prohibited *'fishing with gear capable of catching demersal species'* (ICNAF, 1969) and was designed to reduce haddock catches and supplement existing catch limitations by spreading catches throughout the year (Halliday, 1988). Fishermen's support for such closures has traditionally been very strong; in fact, the enactment of the haddock spawning closure in 1970 by ICNAF has been attributed to the insistence of USA fishermen (Halliday, 1988)

Both the USA and Canada retained the use of the ICNAF haddock spawning area fishery closures after extension of fishery jurisdictions in 1977, with minor adjustments in gear restrictions and closure duration (Clark *et al.*, 1982). After 1971, the duration of the Area II closure was expanded by both countries to include the months of March through May. In October 1984, the delimitation of the USA-Canada maritime boundary resulted in a subdivision of Area II between the USA and Canada. Nonetheless, the Area II closure has since been independently maintained by both countries with little change. Since 1985, Canada has continued to close its sector of Area II to fishing during March-May. Similar closures were enacted in USA Area II waters in 1985 and 1986. In 1987, the USA - under provisions of the Northeast Multispecies Fishery Management Plan (Groundfish FMP) - expanded the duration of the Area II closure to include the February-May period. This four-month closure period was maintained annually through 1993 in the USA portion of Area II.

Effective 1 January 1994, a revised USA management program was implemented for groundfish (i.e., Amendment 5 to the Groundfish FMP). As one part of a suite of conservation measures to *'eliminate the overfished condition of the principal groundfish stocks'* (NEFMC, 1993), the Area II seasonal area closure was extended spatially and temporally. Closed Area II was enlarged by 20 minutes longitude to the west and 15 minutes latitude to the south (Fig. 1b) and the closure implemented for six months, 1 January to 30 June. The rationale for this time/area enlargement was to provide additional protection to the concentrations of haddock in the area, viz.

> *'In the case of the expansion of Area II, significant landings of haddock are reported from the area around the current [pre-1994] boundary line and when the area is opened. There are reports of illegal fishing just over the boundary during the closure. Haddock that are aggregated to spawn in this area are extremely susceptible to being targeted, particularly around the margins of the area and upon the termination of the closure. Based on historical landings, nearly one quarter of the total landings of haddock are caught within the area included in the proposed expansion during the closure, and about one third of haddock landings are caught within the expanded area during January through June. Based on an analysis of the fishing effort in the area and displacing that effort to other areas in the region with the next-highest catch rates in the 1988-90 period, the haddock that would have been saved amounts to 21% of the total landings of haddock while the landings of other groundfish would have increased by 1 percent. Without calculating for displaced effort, the haddock savings would have amounted to 33 percent and other groundfish species to about one percent of the total landings (Ham et al., 1991).'* (NEFMC, 1993).

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[1] Scientific names for all species mentioned in the remainder of this paper are given in Appendix Table 1.

The 1994 regulations prohibited any fishing in Area II during the closure period, except for vessels using pot gear to fish for lobsters and for vessels using dredges to catch sea scallops. Retention of any haddock caught incidentally by scallop dredge vessels was not permitted.

Concurrent with the enactment of the expanded Area II closure in 1994, an Experimental Fishery program was established. This fishery was authorized as a research exemption under the Groundfish FMP, and allowed a restricted number of trawl vessels to fish in the newly-expanded, L-shaped portion of Area II during the closure period provided that scientific observers were carried aboard the vessels. The purpose of the Experimental Fishery was to monitor the catch and bycatch of cod and haddock in the expanded area during the January through June closure period. Additional objectives were to: (1) assess whether a limited trawl fishery for cod (and other mixed groundfish) could be prosecuted in the expanded area without incurring significant bycatches of haddock; and (2) determine when concentrations of spawning and post-spawning haddock were no longer resident in the area.

In this paper, we summarize and evaluate the performance of the 1994 Experimental Fishery using tow-by-tow data collected by the scientific observers placed aboard each vessel in the experiment. Information is provided on total catches, total fishing effort, species composition, discarding practices, size frequency composition of the landings and discards, and spatial and temporal trends in catch, effort and CPUE. Attention is focused on haddock and the 12 other finfish species covered under the Groundfish FMP [2] - although data are provided on all of the species caught in the Experimental Fishery. Comparisons are made between catches taken inside and outside of Area II, by species and month. We also report the results of two sea sampling trips made on Georges Bank in July 1994 after Area II was re-opened for fishing.

METHODS

Design and Conduct of the Experimental Fishery

The operational plan for the Experimental Fishery data required the deployment of scientific observers aboard commercial vessels authorized to fish in the expanded portion of Closed Area II. A limited number of trawl vessels were solicited to voluntarily participate in the experiment. Vessel and observer schedules were coordinated to ensure that all scientific data collection needs would be met.

Industry participation was initiated with inquiries to vessel owners and captains who had landed trips from the L-shaped area during the preceding winter/spring season. Prospective participants were briefed on the purpose, design, and administrative requirements of the experiment. All vessels licensed to fish in the groundfish fishery, however, received written notification in December 1993 that an experimental fishery would be conducted and that participating vessels would be required to take approved observers and submit logbooks. The number of participants was limited to that required to keep pace with the scheduled 2-4 experimental fishery trips per month.

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[2] The 13 finfish species covered under the Groundfish FMP are: haddock, cod, pollock, yellowtail flounder, winter flounder, witch flounder, windowpane flounder, American plaice, redfish, white hake, red hake, silver hake, and ocean pout.

Once a vessel was selected to participate in the Experimental Fishery, an 'Experimental Fishing Certificate for the Expanded Portion of Closed Area II' was issued and arrangements made to provide observer coverage. The Certificate was hand-delivered to the vessel captain, at which time the objectives and procedures of the experimental fishery program were discussed. Any questions or concerns on the part of the captain or crew were addressed. While fishing in the experimental area, each participating captain agreed to the following conditions:

1. The vessel could fish anywhere within the expanded closed area, but not within the inner triangle portion comprising the former Closed Area II. Within the L-shaped expanded area, the captain was free to decide where and when to fish. No restrictions were placed on the number of tows or how fishing operations should be conducted. However, each captain was informed that broad coverage of the expanded area would be beneficial in providing a synoptic basis for analyzing the experimental fishery data.

2. Vessels could fish only with regulated mesh (i.e., 5½ in [13.97 cm] during January-March; 6 in [15.24 cm] from April 1994 onwards).

3. Catches of 'regulated multispecies' (cod, American plaice, pollock, redfish, winter flounder, witch flounder, and yellowtail flounder) of legal size could be landed, but no haddock could be retained.

4. The vessel had to be accompanied by a National Marine Fisheries Service (NMFS) approved observer.

5. Vessels were under no obligation to remain in the experimental area for the entire trip.

6. An Experimental Fishery Certificate was issued and valid for a single trip. If a vessel wished to make a subsequent trip in the Experimental Fishery Program, a new Certificate had to be issued.

As word of the Experimental Fishery spread through the industry, vessel owners and captains contacted NMFS requesting details on the experiment and expressing interest in participation. In the few cases where the number of interested vessels exceeded the available observer coverage, vessels were selected randomly.

All scientific observers were provided by the Northeast Fisheries Science Center (NEFSC) Fisheries Observer Program. Observers were instructed to observe as many hauls as possible and, for each haul, record data on fishing location, fishing effort, catches, discards, gear characteristics, hydrographic information, and other information as specified in the NEFSC Foreign and Domestic Observer Manual. Additionally, the observers were requested to obtain length frequency samples from haddock and other Groundfish FMP species.

Cooperation at-sea was generally excellent between the vessel operators and the scientific observers. In addition to providing all required data, many captains and crew members provided additional anecdotal information on vessel operations and the status and management of the groundfish fishery.

Data Processing and Analysis

Copies of the tow-by-tow logs completed by the scientific observers on each trip in the Experimental Fishery were forwarded to the NEFSC Woods Hole Laboratory for review and analysis. Data analyses included: (1) individual tow summaries of fishing effort and catches, by species and disposition (retained or discarded); (2) trip summaries of the tow-by-tow locations where fishing occurred [both inside and outside of Area II]; (3) month/area summaries of catches, effort, and CPUE; and (4) size frequency summaries, by species and area fished, of landings and discard samples. Spatial and temporal patterns in fishing effort, catches, and CPUE were evaluated by month. CPUE was defined as catch (i.e., total, species, kept, discarded) per hour fished, expressed as pounds per hour (lb/hr). No adjustments were made for possible differences in fishing power among vessels. Discard rates were calculated by species and species groups (e.g., groundfish FMP species) and calculated as the percentage of the total catch weight (by species/species group) discarded.

Tows were assigned to Area II if all, or any part, of the tow was made inside of Area II. Tows made outside of Area II were collectively analyzed as a single group, although these hauls were made over a very wide geographical area. Comparisons of catches, species composition, and CPUE from tows made inside and outside of Area II were conducted to provide initial insight on the impacts of the Area II closure in protecting haddock and other groundfish FMP species. More refined GIS-type analyses, however, are required to delineate finer-scale spatial patterns - both within Area II and between Area II and externally adjacent (or more distant) areas.

RESULTS

Experiment-Wide

During the January - June 1994 Experimental Fishery, 14 trips were made by 12 different vessels (Table 1). Participating vessels were from the Massachusetts ports of Boston (1), Gloucester (6) and New Bedford (2), and the Maine ports of Portland (2) and Rockland (1). The vessels were absent from port for a total of 137 days, fishing 1,882 hours (78.4 days, gear on bottom) and accomplishing 522 tows. Average trip duration was 9.8 days [range: 9-13 days], average fishing time per trip was 134 hours [range: 62-186 hrs], average number of tows per trip was 37 [range: 20-58], and average tow duration was 3.6 hours [range: 2.1-4.8 hrs].

All trips but one (i.e., trip 10) fished both inside and outside of Area II (Table 1; Fig 2). Total catches, discards, fishing effort, number of tows, and haddock catch per unit effort (CPUE) for the entire experiment are summarized by area (inside vs outside Area II) in Tables 2-4; individual trip data are presented in Tables 5-7. Of the 522 tows made during the experiment, 445 tows (85%) were observed by the scientific observers (Table 2). Sixty nine percent (305) of the observed tows occurred in Area II and 140 tows were observed outside of Area II. Observed tows accounted for 90% of the total hauls in Area II and 76% of the tows made outside Area II. Retained catches were recorded by the scientific observers from all hauls (observed and unobserved), but discards could only be tallied in observed hauls. Fishing captains do not normally maintain records of discards. Therefore, discard estimates are not available from unobserved tows. Accordingly, all of the results subsequently presented are based solely on observed hauls.

Experiment-wide catches totaled 609,741 pounds (lb) [276.6 metric tons (mt)] of which 422,241 lb (191.5 mt) were Groundfish FMP species (69%) and 69,032 lb (31.3 mt) was haddock (Table 2). Haddock accounted for 11.3% of the total catches and 16.3% of the Groundfish FMP catch. Although total observed fishing effort in Area II - in terms of both number of tows and hours fished - was twice as great as outside of Area II, total Area II catches were 3.5X higher (474,491 vs 135,250 lb), Groundfish FMP catches 3.8X higher (333,366 vs 88,875 lb), and haddock catches 7.5X higher (60,934 vs 8,098 lb) than outside of Area II (Table 3). While Groundfish FMP species accounted for about the same percentage of the total catches in both areas (70% in Area II, 66% outside of Area II), haddock accounted for 18.3% of the Groundfish FMP catches in Area II compared to 9.1% of the FMP catches outside the closed area (Table 2). For the entire January-June period, haddock CPUE in Area II was 3X higher than outside Area II (53.1 vs 17.4 lb/hr: Table 4).

Nearly all (96%) of the haddock caught were discarded (Table 2). Within Area II, this was due to the experimental fishery requirement that any haddock caught could not be retained (although haddock were inadvertently kept on three tows inside the closed area due to a misunderstanding that haddock could be retained if a tow was not completely within Area II). Outside of Area II, retention of haddock was legally restricted to 500 lb (227 kg) per trip.

Discards of all species combined amounted to 206,867 lb (93.8 mt), of which the groundfish FMP species constituted 37% (75,845 lb; 34.4 mt) (Table 2). Haddock discards (66,052 lb; 30.0 mt) accounted for 32% of the total discards and 87% of the discards of FMP groundfish. Other species heavily discarded included skates (98,036 lb; 44.5 mt), and spiny dogfish (19,422 lb; 8.8 mt) (Table 3). Together with haddock, these species accounted for 89% of the total biomass of fish discarded.

In route to the fishing grounds, vessel captains were asked to identify the species targeted for fishing. Cod was designated as the target species sought in nine trips, 'mixed groundfish' in four trips, and pollock in one trip (Table 5). Trip catches were consistent with these designations (Tables 5-7). Cod accounted for 34% of the total catches during the experiment and 50% of the total catch of groundfish FMP species (Table 5). Captains generally fished according to the 'style' of their port, i.e., Gloucester vessels fished for a mix of groundfish, New Bedford vessels fished for cod and flounders, and Maine vessels fished for cod, pollock and American plaice.

Nearly 50 different species were caught during the Experimental Fishery (Appendix Table 1). Relative contributions (percent by weight) of individual species to the total experiment-wide catch of 609,741 lb were as follows: cod (34%), skates (19%), pollock (12%), haddock (11%), monkfish (5%), American plaice (3%), yellowtail flounder (3%), spiny dogfish (3%), white hake (2%), other fish [3] (1%), cusk (1%), witch flounder (1%), American lobster (1%), winter flounder (1%), ocean pout (1%), wolffish (<1%), redfish (<1%), silver hake (<1%), red hake (<1%), other invertebrates [4] (<1%), and windowpane flounder (<1%) (see Table 3). Additionally, two white-sided dolphins, *Lagenorhynchus acutus*, were incidentally captured during one of the trips and returned to the sea. No other marine mammals, sea turtles or sea birds were caught during the experiment.

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[3] Other fish were comprised of 20 different species (see Appendix Table 1).

[4] Other invertebrates were comprised of eight different species (see Appendix Table 1).

Area II

Within Area II, catches from the 304 observed tows (1,148 fishing hours) totaled 474,491 lb (215.2 mt), of which 302,634 lb (137.3 mt) were retained (64%) and 171,857 lb (78.0 mt) were discarded (Tables 8-10). Fishing activity occurred in all six months but was not evenly distributed in time or space. Experimental fishing effort was lowest in January (15 observed tows; 72 hrs fished), intermediate during February and May (32 and 37 tows; 76 and 110 hrs fished), and highest in March, April, and June (61-97 tows/month; 230-422 hrs fished/month) (Table 8). The majority of tows were made in the top northwest corner of the expanded closed area (Fig. 3). During March through June, fishing was concentrated along the north-south boundary line separating the expanded closed area from the former Closed Area II, and also along the USA-Canadian boundary line (i.e., the Hague Line). In the first few months of the experiment, vessels moved throughout the expanded area to locate target species; in the latter three months, some vessels towed in locations where it was felt haddock could be avoided.

Groundfish FMP catches (333,366 lb; 151.2 mt) comprised 70.3% of the total catch in Area II, and accounted for 88.3% (267,120 lb; 121.2 mt) of all retained catches (Tables 8 and 9). Cod was the most frequently caught species (161,997 lb; 73.5 mt) accounting for 34% of the Area II total catch and 49% of the catch of Groundfish FMP species. Haddock catches in Area II totaled 60,934 lb (26.7 mt), 12.8% of the aggregate Area II total and 18.3% of the areal Groundfish FMP catch. All but 2% of the haddock caught were subsequently discarded (Table 11).

Prior to April, haddock catches in Area II were minor (Jan-Mar total: 1,968 lb) accounting for less than 3% of the closed area catches per month and less than 4% of the monthly catches of FMP Groundfish (Table 8). The average catch per tow of haddock during January through March was only 18.2 lb (Jan: 12.0 lb; Feb: 0.3 lb; Mar: 29.2 lb); in these months, haddock CPUE averaged just 5.2 lb/hr (Jan: 2.5 lb/hr; Feb: 0.1 lb/hr; Mar: 7.7 lb/hr) (Fig. 4). The largest catch of haddock taken in any one tow during these three months was 407 lb (Table 5). Apart from this tow and another tow in which 102 lb of haddock were caught, none of the remaining 106 observed tows during January-March in the closed area caught more than 78 lb of haddock (Fig. 5).

Beginning in April and continuing through May, haddock CPUE markedly increased in every trip made in Area II, rising from 50 lb/tow (10.5 lb/hr) in trip 8 to 669 lb/tow (186 lb/hr) in trip 12 (Table 6). Average haddock catch per tow in April was 130 lb/tow (30 lb/hr) and 577 lb/tow (194 lb/hr) in May (Table 8; Fig. 4). During these two months, catches of haddock exceeded 100 lb in 51 (38%) of the 134 observed tows and exceeded 500 lb in 17 tows. Tows with the highest haddock catches occurred in the northwest corner of the closed area (near the 50 fathom contour) and along/near the boundary of former Closed Area II (Fig. 5). The largest catch of haddock taken in a single tow during April and May was 4,600 lb - more than twice the total haddock caught in Area II during the first three months of the Experimental Fishery.

In June, haddock CPUE declined to 105 lb/hr (396.7 lb/tow) - lower than in May but substantially higher than any other month (Fig. 4). The last trip in the Experimental Fishery made in June (i.e., trip 14) also fished on 1 July, the first day that all of Area II was re-opened. On this date, three observed tows were made in the inner triangle of former Closed Area II. Two large hauls of haddock were taken (9,000 lb and 3,500 lb) indicating that high concentrations of haddock still existed in the re-opened area.

Over the entire January-June period, 87 (28%) of the 305 observed tows in Area II caught no haddock, and in 114 other tows (37%) haddock catches were 50 lb or less (Table 12). Overall, 93% of the Area II hauls (284 tows) caught less than 500 lb (227 kg) of haddock.

Spatial distributions of haddock catches in individual hauls are presented, by month, in Figure 5. Similar distributions of catch per tow are presented for cod, flounders (yellowtail, winter, American plaice, and witch), white hake, and monkfish in Figures 6-12. Spatially, these relative density distributions are consistent with those observed in recent NEFSC spring research vessel bottom trawl surveys.

After cod (which accounted for 34% of the Area II catch), the most frequently caught species were skates (20%), haddock (13%), pollock (12%), yellowtail flounder (4%), monkfish (4%), American plaice (4%), and spiny dogfish (3%) (Table 8). However, the relative contributions of these species to the overall retained catch was quite different as 90% of the skates (84,159 lb; 38.2 mt) and all of the dogfish (13,672 lb; 6.2 mt) were discarded (Tables 10 and 11). As a result, cod accounted for 53% of the retained catches, pollock for 18%, yellowtail flounder and monkfish for 6% each, and American plaice for 5% (Table 9). The Groundfish FMP species accounted for 88% of the retained catches in Area II.

Fish were discarded for three main reasons. Haddock caught in Area II could not retained under the provisions governing the Experimental Fishery. Spiny dogfish, ocean pout, skates, other fish, and other invertebrates were heavily discarded ($\geq$ 90% discard rates: Table 11) due to the limited market value of these species to the vessels in the experiment. For the remaining species, discards generally reflected the culling of undersized fish - due to market considerations or existing legal minimum size restrictions.

Outside Area II

Catches, landings, and discards taken outside of Area II during the Experimental Fishery are summarized by species in Tables 13-15, respectively. Catches by trip are presented in Table 7. A total of 140 tows were observed comprising 466.2 hrs of fishing effort. Expectedly, the temporal distribution of fishing activity outside of Area II differed from that in Area II as the vessels in the Experimental Fishery differentially allocated their fishing activities between the two areas. Fishing effort outside of Area II was lowest in April (5 tows; 19 hrs fished) (Table 13) - when fishing effort in Area II was highest (Table 8). Highest fishing effort outside of Area II occurred in March (53 tows; 167 hr) and May (36 tows; 126 hrs); during these two months, effort in Area II was similar indicating that vessels divided their fishing activities nearly equally among the two areas.

Catches in observed tows made outside of Area II totaled 135,250 lb (61.3 mt) of which 66% (88,875 lb; 40.3 mt) were Groundfish FMP species and 6% was haddock (8,098 lb; 3.7 mt) (Tables 8 and 13). More than 75% (6,189 lb; 2.8 mt) of the haddock caught were discarded (Table 15). As in Area II, cod was the predominant species caught (45,272 lb; 20.5 mt), accounting for 35% of the total catch and 53% of the Groundfish FMP species catch.

Haddock catches outside of Area II did not exceed 500 lb per trip in the first 11 trips in the experiment (i.e., the trips made between January and mid-May: Table 7). In these trips, haddock catches accounted for about 2% (range: 0 - 9.6%) of the trip catches taken outside Area II, and for about 2.4% (range: 0 - 10.2%) of the Groundfish FMP species caught outside Area II (Table 7).

On a monthly basis, haddock catches accounted for less than 4% of the total catches outside of Area II during January through May (Table 13). Apart from April when haddock CPUE seemingly increased [to 16.5 lb/hr - although this is based on only 5 observed tows), monthly catch rates of haddock prior to June were extremely low (i.e., less than 6.9 lb/hr; less than 24 lb/tow) (Table 13). In June, haddock catches and haddock catch rates outside of Area II sharply increased (Table 13; Fig. 4); more haddock were caught in June (5,759 lb) that in the first five months combined (2,339 lb). This increase was due to two large hauls of haddock in June (3,500 lb and 1,000 lb) made just outside of the Area II boundary.

Of the 140 observed tows made outside of Area II during the experiment, 44% (61 tows) contained no haddock, and in 56 other tows (40%) haddock catches were 50 lb or less (Table 12). In only two tows did haddock catches outside of Area II exceed 500 lb (i.e., the June tows mentioned above).

The species composition of the catches made outside Area II was similar to that in Area II. Cod accounted for 35% the total catches followed by skates (15%), pollock (13%), monkfish (9%), haddock (6%), spiny dogfish (4%), white hake (4%), and American plaice (3%) (Table 13). Of the retained catches, cod accounted for 47%, pollock for 17%, monkfish for 12%, and white hake for 5% (Table 14). Since discarding practices outside of Area II were nearly identical to those inside Area II, species discard percentages were also similar (Tables 11 and 16).

July 1994 Sea Sampling Trips to Georges Bank

On 1 July, the entirety of Area II (both the expanded area and the inner triangle) was re-opened for fishing. To assess post-opening catch rates of haddock and other Groundfish FMP species, observers were placed on two vessels that intended to fish in the Area II region. Both trips sailed in mid-July and were absent from port for 10-11 days (Table 1). However, one of the trips (i.e, trip 15) fished completely outside of the Area II region targeting cod and flounders, while the second trip (i.e., trip 16) fished completely inside Area II targeting yellowtail (Figure 13).

Within Area II, 37 of 48 tows (77%) were observed (Table 17); haddock catches in these hauls amounted to only 22 lb, and comprised less than 1% of the total catch (24,792 lb; 11.2 mt). Haddock catches were negligible primarily because the vessel used a trawl designed for catching flatfish. As intended, yellowtail flounder was the principal species caught during the trip, accounting for 45% (11,331 lb; 5.1 mt) of the total catch and 77% (10,192 lb; 4.6 mt) of the retained catches (Table 18). Most of the yellowtail catches were taken in the inner triangular section of Area II (Figure 14). Large quantities of skates were also caught (10,178 lb; 4.6 mt), but 90% of these catches (9,258 lb; 4.2 mt) were discarded.

In the July trip that fished outside of Area II, 36 of 40 tows (90%) were observed (Table 17). Groundfish FMP species accounted for 66% (12,410 lb; 5.6 mt) of the total catches (18,877 lb; 8.6 mt), with cod and American plaice each accounting for 20% of the total (Table 18). Haddock catches totaled 798 lb, 4% of the aggregate catch and 6% of the FMP species caught. Approximately 25% of the total trip catch was discarded, consisting mostly of spiny dogfish and skates.

Size Composition of the Experimental Fishery Catches

During the January-June Experimental Fishery, 9,430 length frequency measurements were made from 13 species. Samples were taken inside and outside of Area II from both the retained catches and the discards. Most of the sampling (9,408 fish) focused on nine of the Groundfish FMP species and on monkfish (Table 19); sampling of three additional species was insignificant (halibut: 15 fish; American lobster: 5 individuals; shad, 2 fish).

Sampling of haddock was the top priority. A total of 4,801 haddock were measured, constituting 51% of all the sampled fish. Within Area II, length frequencies were taken from 3,968 haddock (3,884 discards; 84 kept); outside of Area II, 833 haddock were measured (564 discards; 269 kept) (Fig. 15). The size range of haddock discarded in both areas was similar (Table 19), but large haddock (> 60 cm) comprised a greater proportion of the discards in Area II than outside of Area II. Since, in both areas, nearly all of the haddock caught had to be discarded (i.e., culling was not much affected by the minimum legal size of 19 inches [48 cm]), the larger size composition of the Area II discards indicates that older, mature haddock were proportionally more dominant inside of Area II than outside.

For cod, the principal species caught in both areas, size frequency distributions inside and outside of Area II were virtually identical (Table 19; Fig. 16). Discarded fish ranged from 37 to 49 cm (14.6-19.3 in) and averaged about 42 cm (16.5 in); retained cod ranged between 47 and 117 cm (18.5-46.1 in) and averaged about 70 cm (27.6 in). The lack of overlap in sizes between discarded and retained fish reflects culling in accord with the legal minimum size for cod of 48 cm (19 in).

Size frequency plots for the other eight species sampled (yellowtail flounder, pollock, winter flounder, witch flounder, American plaice, windowpane flounder, white hake, and monkfish) are presented in Figures 17-23. In general, size compositions were similar inside and outside of Area II, with culling consistent with prevailing minimum size regulations (in the cases where these exist) or marketing demands. Of course, the presence of the scientific observers aboard the Experimental Fishery vessels may have subliminally affected culling practices - particularly for species regulated by minimum size restrictions.

Impact of the Closed Area II on Haddock and Other Groundfish FMP Species

Enlargement of Closed Area II in 1994 was enacted to protect haddock from being fished during the spawning season when they become concentrated. The closure period was expanded in time to include January to ensure that haddock beginning to aggregate in the area would be provided the fullest protection.

One obvious approach to evaluate the added protection afforded to haddock (and other Groundfish FMP species) by the expanded Area II closure is to examine the Experimental Fishery catch rates inside and outside of Area II. Higher catch rates generally reflect higher densities of fish. Hence, to the extent that catch rates in Area II are higher than those outside, the absence of a fishery in Area II will generate considerable 'savings' of fish beyond those that would have occurred under the pre-1994 closure design.

Overall catch rates (lbs/hr fished) in the Experimental Fishery during the January-June period are presented, by area and species, in Table 4. CPUE values (retained and discard catches combined) in Area II were higher than outside Area II for: (1) all species combined (414 vs 378 lb/hr); (2) total Groundfish FMP species (290 vs 262 lb/hr); and (3) for seven of the 13 Groundfish FMP species (haddock, cod, pollock, yellowtail flounder, winter flounder, American plaice and ocean pout). For the remaining FMP species, CPUE values in the two areas were identical for windowpane flounder and red hake, and only marginally different for witch flounder, white hake, and silver hake. Only redfish CPUE was substantially higher outside of Area II than inside.

Haddock CPUE in Area II was threefold higher than outside Area II (53 vs 17 lb/hr), cod CPUE was 39% higher and pollock CPUE was 31% higher. The catch rate of yellowtail flounder was nearly 3X greater inside Area II than outside (15 vs 6 lb/hr), while the Area II catch rate for American plaice was twice as high as that outside (15 vs 8 lb/hr) (Table 4 and Fig. 24).

During January-March, haddock catch rates both inside and outside of Area II were very low (< 8 lb/hr) (Tables 8 and 13; Fig. 4). In April and May, haddock CPUE within Area II was substantially higher than outside the area (April: 30 vs 17 lb/tow; May: 194 vs 7 lb/tow). In June, catch rates of haddock in both areas exceeded 100 lb/hr. As previously mentioned, the high catch rate of haddock in June outside of Area II was due to two large haddock catches made just outside the Area II boundary line.

Within Area II, catch rates of cod and all other Groundfish FMP species (excluding haddock) peaked in April, and were higher than those for haddock in each month but May and June (Fig. 4). Outside Area II, the catch rate of cod peaked in March and cod CPUE was higher than haddock in all months but June.

For other species taken in the Experimental Fishery, catch rates in Area II were generally the same or higher than those outside of Area II - except for monkfish (15 vs 26 lb/hr) and wolffish (0.4 vs 3.3 lb/tow) (Table 4).

In toto, the generally higher catches rates in Area II compared to those outside of Area II suggest that fish densities were higher inside the closed area than outside. Prohibiting a commercial fishery in the expanded area in 1994 therefore prevented high concentrations of fish from being exploited.

DISCUSSION

The purpose of the experimental fishery was to monitor the catch and bycatch of cod and haddock in the expanded portion of Closed Area II during January through June 1994. Commercial fishermen indicated that it was possible to prosecute a fishery for mixed groundfish in the newly-expanded portion of the closed area - without catching significant quantities of haddock.

During January through March 1994, haddock catches in the expanded closed area were low (1,968 lb in total) accounting for less than 2% of total Area II catches. During this same time period, 60,478 lb of other FMP Groundfish species were taken in the closed area. Clearly, fishing in these months had little negative impact on haddock.

However, during April through June, haddock comprised 16% of the total catches in Area II and 22% of the catch of FMP Groundfish species. In May and June when haddock catches and haddock CPUE were the highest in Area II, haddock comprised 34% of the total catches and 46% of the Groundfish FMP species caught. Obviously, had an open fishery for mixed groundfish been conducted in the expanded area during April-June, total haddock catches would have been extremely high.

Traditionally, the period of peak haddock spawning on the northeastern part of Georges Bank is during March and April (Overholtz, 1987). However, the timing and duration of spawning can vary from year to year due to influence of temperature. In 1994, high concentrations of haddock (i.e., > 400 lbs/tow) were not detected in the Experimental Fishery until mid-March suggesting that haddock spawning occurred later in 1994 than the traditional pattern. Catches of haddock in tows made in Area II in late June were among the highest observed in the experiment indicating that haddock were still aggregated in early summer.

After 1 July when Area II was re-opened for fishing, large catches of haddock from Area II were reported by commercial fishermen. Observations made from two sea sampling trips conducted in mid-July, however, did not substantiate the existence of large concentrations of haddock - although haddock may have already dispersed by this time. Also, the fishing gear used in the July sea sampling trip to Area II was not optimal for catching haddock.

Since haddock caught in Area II could not be retained, several of the vessels in the Experimental Fishery moved to different fishing locations after haddock were caught. These movements were likely intended to avoid subsequent catches of haddock and reduce culling time. The large catches of haddock taken during the last few trips in the Experimental Fishery prompted some of the vessel captains to suggest that the closure period should be extended further into the summer.

Haddock and cod accounted for 13% and 34%, respectively, of the total catches taken in Area II. As a group, catches of the 13 Groundfish FMP Species in Area II accounted for 70% of the overall areal total. Area II catches were thus dominated by species regulated under the Northeast Multispecies Fishery Management Plan. Haddock, cod and yellowtail flounder on Georges Bank are all presently at record-low abundance levels; the haddock and yellowtail stocks have 'collapsed' and an imminent danger exists that the Georges Bank cod stock will soon collapse (NEFSC, 1994). Given that these three species comprised a major fraction of the monthly catches made in Area II during the January-June 1994 Experimental Fishery, maintaining the enlarged Area II seasonal closure in 1995 (and thereafter) is prudent as one component of the suite of conservation measures aimed at eliminating the overfished conditions of these stocks.

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Table 1. Vessels participating in the 1994 Experimental Fishery (January - June) and in two July 1994 sea sampling trips to Georges Bank.

Trip No.	Vessel ID	Port	Trip Dates	Days Absent	Total Hours Fished	Number of Tows		
						Area I	Outside Area II	Totals
1	A	Gloucester	21-29 Jan	9	134.7	15	15	30
2	B	Gloucester	5-10 Feb	6	70.5	4	16	20
3	C	New Bedford	16-23 Feb	8	129.4	35	23	58
4	D	Boston	28 Feb - 8 Mar	9	66.9	4	23	27
5	E	New Bedford	5-10 Mar	6	62.5	11	15	26
6	A	Gloucester	14-23 Mar	10	143.1	8	28	36
7	F	Portland	15-27 Mar	13	179.4	40	3	43
8	G	Gloucester	31 Mar - 11 Apr	12	185.6	37	2	39
9	H	Gloucester	4-15 Apr	12	184.3	37	5	42
10	I	Rockland	11-19 Apr	9	105.4	29	0	29
11	D	Boston	12-20 May	9	112.7	29	12	41
12	J	Gloucester	23 May - 2 Jun	11	166.9	13	31	44
13	K	Gloucester	2-13 Jun	12	176.9	39	6	45
14	L	Portland	22 Jun - 2 Jul	11	163.9	37	5	42
15	M	Gloucester	12-21 Jul	10	162.4	0	40	40
16	N	New Bedford	15-25 Jul	11	159.7	48	0	48
Totals:		Trips 1 - 14	Jan - Jun	137	1881.9	338	184	522
		Trips 1 - 16	Jan - Jul	158	2204.0	386	224	610

Table 2. Summary statistics for the 1994 Experimental Fishery (January-June). Data are presented for tows made inside and outside of Area II. Fourteen trips were conducted using 12 different vessels.

	Area II	Outside of Area II	Total
Number of Tows Observed	305	140	445
Number of Tows Unobserved	33	44	77
Total Tows	338	184	522
Percent Observed	90	76	85
Avg Tow Time (hrs)[1]	3.8	3.3	3.6
Total Effort (hrs)[1]	1,147.7	466.2	1,613.9
Observed Tows			
Total Catch (lbs)	474,491	135,250	609,741
Haddock	60,934	8,098	69,032
Groundfish FMP Species[2]	333,366	88,875	422,241
Others	141,125	46,375	187,500
Total Discards (lbs)	171,857	35,010	206,867
Haddock	59,863	6,189	66,052
Groundfish FMP Species[2]	66,246	9,599	75,845
Others	105,611	25,411	131,022
Percent of			
Haddock Catch/Total Catch	12.8	6.0	11.3
Haddock Catch/FMP Species Catch[2]	18.3	9.1	16.3
Haddock Discards/Total Discards	34.8	17.7	31.9

[1] From observed tows.

[2] Northeast Multispecies Groundfish FMP Species (13): haddock, cod, pollock, yellowtail flounder, winter flounder, witch flounder, windowpane flounder, American plaice, redfish, white hake, red hake, silver hake, and ocean pout.

Table 3. Summary of retained catches (lbs) and discards (lbs) from observed tows in the 1994 Experimental Fishery. Data are presented from tows made both inside and outside of Area II during January - June.

Species	Area II			Outside Area II			Grand Total
	Retained Catches	Discards	Total	Retained Catches	Discards	Total	
No. of Observed Tows			305			140	445
Fishing Effort (hrs)			1147.7			466.2	1613.9
Haddock[1]	1,071	59,863	60,934	1,909	6,189	8,098	69,032
Cod[1]	160,879	1,118	161,997	46,681	591	47,272	209,269
Pollock[1]	54,573	38	54,611	16,864	62	16,926	71,537
Yellowtail Flounder[1]	17,096	464	17,560	2,487	70	2,557	20,117
Winter Flounder[1]	3,614	3	3,617	836	24	860	4,477
Witch Flounder[1]	3,765	169	3,934	1,666	170	1,836	5,770
Windowpane Flounder[1]	308	213	521	54	156	210	731
American Plaice[1]	16,442	367	16,809	3,314	201	3,515	20,324
Redfish[1]	154	3	157	889	337	1,226	1,383
White Hake[1]	8,442	172	8,614	4,530	267	4,797	13,411
Red Hake[1]	562	66	628	46	129	175	803
Silver Hake[1]	109	384	493	0	319	319	812
Ocean Pout[1]	105	3,386	3,491	0	1,084	1,084	4,575
Cusk	4,731	0	4,731	2,270	0	2,270	7,001
Wolffish	476	1	477	1,543	4	1,547	2,024
Monkfish	17,027	497	17,524	11,555	471	12,026	29,550
Skates	9,615	84,159	93,774	4,069	16,577	20,646	114,420
Spiny Dogfish	0	13,672	13,672	0	5,750	5,750	19,422
Other fish[2]	650	6,314	6,964	207	1,736	1,943	8,907
American Lobster	3,003	774	3,777	1,300	303	1,603	5,380
Other invertebrates[3]	12	194	206	20	570	590	796
Total	302,634	171,857	474,491	100,240	35,010	135,250	609,741
Total FMP Species[1]	267,120	66,246	333,366	79,276	9,599	88,875	422,241

[1] Thirteen species in Northeast Multispecies Fishery Management Plan (FMP): haddock, cod, pollock, yellowtail flounder, winter flounder, witch flounder, windowpane flounder, American plaice, redfish, white hake, red hake, silver hake, and ocean pout.

[2] Other fish were comprised of 23 different species (Appendix Table 1).

[3] Other invertebrates were comprised of eight different species (Appendix Table 1).

Table 4. Catch per unit of effort (lbs/hour fished) of retained catches and discards from observed tows in the 1994 Experimental Fishery. Data are presented from tows made both inside and outside of Area II during January - June.

Species	Area II			Outside Area II			Overall Total[4]
	Retained Catches	Discards	Total	Retained Catches	Discards	Total	
Haddock[1]	0.9	52.2	53.1	4.1	13.3	17.4	42.7
Cod[1]	140.2	1.0	141.2	100.1	1.3	101.4	129.7
Pollock[1]	47.5	0.1	47.6	36.2	0.1	36.3	44.3
Yellowtail Flounder[1]	14.9	0.4	15.3	5.3	0.2	5.5	12.5
Winter Flounder[1]	3.1	0.1	3.2	1.8	0.1	1.9	2.8
Witch Flounder[1]	3.3	0.1	3.4	3.6	0.4	4.0	3.6
Windowpane Flounder[1]	0.3	0.2	0.5	0.1	0.3	0.4	0.5
American Plaice[1]	14.3	0.3	14.6	7.1	0.4	7.5	12.6
Redfish[1]	0.1	<0.1	0.1	1.9	0.7	2.6	0.9
White Hake[1]	7.4	0.1	7.5	9.7	0.6	10.3	8.3
Red Hake[1]	0.5	<0.1	0.5	0.1	0.3	0.4	0.5
Silver Hake[1]	0.1	0.3	0.4	-	0.7	0.7	0.5
Ocean Pout[1]	<0.1	3.0	3.0	-	2.3	2.3	2.8
Cusk	4.1	-	4.1	4.9	-	4.9	4.3
Wolffish	0.4	<0.1	0.4	3.3	<0.1	3.3	1.3
Monkfish	14.8	0.4	15.2	24.8	1.0	25.8	18.3
Skates	8.4	73.3	81.7	8.7	35.6	44.3	70.9
Spiny Dogfish	-	11.9	11.9	-	12.3	12.3	12.0
Other fish[2]	0.6	5.5	6.1	0.4	3.7	4.1	5.5
American Lobster	2.6	0.7	3.3	2.8	0.6	3.4	3.3
Other invertebrates[3]	<0.1	0.2	0.2	<0.1	1.2	1.2	0.5
Total	263.7	149.7	413.4	215.0	75.1	290.1	377.8
Total FMP Species[1]	232.7	57.7	290.4	170.0	20.6	190.6	261.6

[1] Thirteen species in Northeast Multispecies Fishery Management Plan (FMP): haddock, cod, pollock, yellowtail flounder, winter flounder, witch flounder, windowpane flounder, American plaice, redfish, white hake, red hake, silver hake, and ocean pout.

[2] Other fish were comprised of 23 different species (Appendix Table 1).

[3] Other invertebrates were comprised of eight different species (Appendix Table 1).

[4] Total catches (retained and discards)/total fishing effort.

Table 5. Summary trip statistics for 14 trips accomplished during January - June in the 1994 Experimental Fishery. Data are presented for tows both inside and outside of Area II.

Trip No.	1	2	3	4	5	6	7	8	9	10	11	12	13	14	Totals
Month	Jan	Feb	Feb	Mar	Mar	Mar	Mar	Apr	Apr	Apr	May	May	Jun	Jun[2]	-
Target Species	Cod	Cod	Cod	Mixed	Mixed	Cod	Pollock	Cod	Cod	Cod	Mixed	Mixed	Cod	Cod	-
Mesh Size (in)	5.5	6.0	5.5/6.0	6.0	5.5	5.5	5.5	5.5	6.0	5.5	6.0	6.0	6.0	6.0	-
Number of Tows															
Total	30	20	58	27	26	36	43	39	42	29	41	44	45	42	522
Observed	24	17	41	24	20	27	43	39	34	29	34	39	38	36	445
Unobserved	6	3	17	3	6	9	0	0	8	0	7	5	7	6	77
% Observed	80	85	71	89	77	75	100	100	81	100	83	89	84	86	85
Observed Tows															
Effort (hr)	111.3	61.5	86.3	57.9	45.8	113.6	179.4	185.6	149.8	105.4	91.9	144.3	147.4	133.7	1614.0
Avg Tow Duration (hr)	4.6	3.6	2.1	2.4	2.3	4.2	4.2	4.8	4.4	3.6	2.7	3.7	3.9	3.7	3.6
Catches (lb)															
Total All Species	24,847	13,051	14,430	33,716	8,863	26,731	69,054	50,651	89,704	94,165	47,622	42,231	49,960	44,716	609,741
Haddock	362	228	9	554	28	119	1,817	2,159	3,784	7,004	12,821	9,393	11,943	18,811	69,032
Cod	7,171	1,348	8,527	6,682	2,433	23,435	16,883	16,240	31,063	56,218	5,682	7,934	21,221	4,432	209,269
Groundfish Species[1]	11,735	4,441	9,224	20,892	3,446	25,199	44,837	34,594	55,311	86,123	28,820	20,936	37,598	39,085	422,241
Haddock															
Catch/tow (lb)	15.1	13.4	0.0	23.1	1.4	4.4	42.3	55.4	111.3	241.5	377.1	240.8	314.3	522.5	155.1
CPUE (lb/hr)	3.3	3.7	0.1	9.6	0.6	1.0	10.1	11.6	25.3	66.5	139.5	65.1	81.0	140.7	42.8
Largest tow (lb)	67	82	9	121	13	29	407	400	486	1,462	4,600	4,000	7,000	9,000	9,000

[1] Thirteen species in Northeast Multispecies Fishery Management Plan (FMP): haddock, cod, pollock, yellowtail flounder, winter flounder, witch flounder, windowpane flounder, American plaice, redfish, white hake, red hake, silver hake, and ocean pout.

[2] Six tows on this trip were made on 1 July.

Table 6. Summary of trip catches (lbs: retained catches and discards combined) taken in Area II during the 199[illegible] Experimental Fishery. Data from observed tows.

Trip No.	1	2	3	4	5	6	7	8	9	10	11	12	13	14	Totals
No. of Observed Tows	15	4	28	4	10	7	40	37	31	29	24	13	32	31	305
Fishing Effort (hr)	71.5	14.2	61.7	12.0	21.9	27.4	168.7	177.3	138.8	105.4	63.4	46.7	121.3	117.4	1147.7
Haddock[1]	180	6	0	80	28	0	1,674	1,859	3,765	7,004	12,643	8,700	10,705	14,290	60,934
Cod[1]	4,499	397	8,355	126	932	1,535	15,563	14,440	30,677	56,218	4,676	3,536	17,521	3,522	161,997
Pollock[1]	975	21	0	106	327	0	19,576	8,757	3,418	17,222	775	71	318	3,045	54,611
Yellowtail Flounder[1]	93	8	134	4	113	2	595	4,774	10,340	0	236	126	1,120	15	17,560
Winter Flounder[1]	128	2	403	0	40	55	260	90	9	0	124	367	1,919	220	3,617
Witch Flounder[1]	219	0	0	18	25	2	973	129	345	723	463	2	0	1,035	3,934
Windowpane Flounder[1]	21	3	44	0	103	0	36	10	197	0	32	5	70	0	521
American Plaice[1]	421	95	18	101	63	135	794	1,435	982	3,043	4,094	2	0	5,626	16,809
Redfish[1]	1	0	0	0	0	0	144	0	2	9	1	0	0	0	157
White Hake[1]	341	30	0	0	0	0	2,019	50	162	1,786	679	0	7	3,540	8,614
Red Hake[1]	64	0	0	0	0	0	4	0	0	0	0	0	0	560	628
Silver Hake[1]	63	0	0	4	8	0	81	18	104	90	74	0	0	51	493
Ocean Pout[1]	135	0	0	31	0	28	205	82	2,299	28	165	103	410	5	3,491
Cusk	97	0	0	85	5	0	1,309	370	977	480	678	0	0	730	4,731
Wolffish	24	0	2	40	0	0	56	35	0	79	103	13	90	35	477
Monkfish	3,423	102	0	255	70	0	6,151	1,118	1,592	651	2,186	56	30	1,890	17,524
Skates	4,175	3,650	3,724	1,700	3,530	870	12,162	12,655	22,880	1,261	9,860	7,022	8,420	1,865	93,774
Spiny Dogfish	275	0	0	500	95	0	2,358	1,285	2,357	4,807	79	1,258	573	85	13,672
Other fish[2]	528	49	278	91	98	55	274	258	3,396	297	590	259	772	19	6,964
American Lobster	480	22	107	21	87	0	1,317	171	454	465	340	22	4	287	3,777
Other invertebrates[3]	26	1	3	6	3	0	0	0	36	2	27	7	95	0	206
Totals	16,168	4,386	13,068	3,168	5,527	2,682	65,551	47,536	83,992	94,165	37,825	21,549	42,054	36,820	474,491
Total FMP Species[1]	7,140	562	8,954	470	1,639	1,757	41,924	31,644	52,300	86,123	23,962	12,912	32,070	31,909	333,366
Haddock as a % of:															
All Species	1.1	0.1	0.0	2.5	0.5	0.0	2.6	3.9	4.5	7.4	33.4	40.4	25.5	38.8	12.8
FMP Species[1]	2.5	1.1	0.0	17.0	1.7	0.0	4.0	5.9	7.2	8.1	52.8	67.4	33.4	44.8	18.3
Haddock															
Catch/tow (lb)	12.0	1.5	0.0	20.0	2.8	0.0	41.9	50.2	121.5	241.5	526.8	669.2	334.5	461.0	199.8
CPUE (lb/hr)	2.5	0.4	0.0	6.7	1.3	0.0	9.9	10.5	27.1	66.5	199.4	186.3	88.3	121.7	53.1

[1] Thirteen species in Northeast Multispecies Fishery Management Plan (FMP): haddock, cod, pollock, yellowtail flounder, winter flounder, witch flounder, windowpane flounder, American plaice, redfish, white hake, red hake, silver hake, and ocean pout.

[2] Other fish were comprised of 23 different species (Appendix Table 1).

[3] Other invertebrates were comprised of eight different species (Appendix Table 1).

Table 7. Summary of trip catches (lbs: retained catch and discards combined) taken outside Area II during the 1994 Experimental Fishery. Data from observed tows.

Trip No.	1	2	3	4	5	6	7	8	9	10	11	12	13	14	Totals
No. of Observed Tows	9	13	13	20	10	20	3	2	3	0	10	26	6	5	140
Fishing Effort (hr)	39.8	47.3	24.6	45.9	23.9	86.2	10.7	8.3	11.0	0	28.5	97.6	26.1	16.3	466.2
Haddock[1]	182	222	9	474	0	119	143	300	19	0	178	693	1,238	4,521	8,098
Cod[1]	2,672	951	172	6,556	1,501	21,900	1,320	1,800	386	0	1,006	4,398	3,700	910	47,272
Pollock[1]	456	916	0	10,989	0	290	1,225	800	10	0	1,555	255	50	380	16,926
Yellowtail Flounder[1]	2	0	9	25	35	10	0	0	2,266	0	0	30	180	0	2,557
Winter Flounder[1]	2	0	58	3	150	0	0	0	11	0	0	61	295	280	860
Witch Flounder[1]	297	198	0	614	0	335	91	15	0	0	109	152	0	25	1,836
Windowpane Flounder[1]	0	0	17	47	110	0	0	0	0	0	0	36	0	0	210
American Plaice[1]	382	256	5	442	11	668	37	35	8	0	864	692	0	115	3,515
Redfish[1]	4	313	0	20	0	110	0	0	0	0	79	410	0	290	1,226
White Hake[1]	326	982	0	805	0	0	87	0	0	0	1,052	890	0	655	4,797
Red Hake[1]	175	0	0	0	0	0	0	0	0	0	0	0	0	0	175
Silver Hake[1]	90	41	0	119	0	0	10	0	11	0	15	33	0	0	319
Ocean Pout[1]	7	0	0	328	0	10	0	0	300	0	0	374	65	0	1,084
Cusk	347	268	0	626	0	5	60	40	0	0	696	163	0	65	2,270
Wolffish	8	17	0	874	0	20	0	0	0	0	200	403	20	5	1,547
Monkfish	2,930	2,320	26	2,118	0	0	408	45	45	0	2,603	1,231	50	250	12,026
Skates	163	1,030	925	5,545	1,443	265	40	20	2,180	0	720	6,370	1,765	180	20,646
Spiny Dogfish	44	544	0	409	3	0	16	10	50	0	450	3,784	240	200	5,750
Other fish[2]	76	46	118	291	41	230	18	25	421	0	77	447	153	0	1,943
American Lobster	463	185	23	206	6	87	48	25	4	0	173	213	150	20	1,603
Other invertebrates[3]	53	376	0	57	36	0	0	0	1	0	20	47	0	0	590
Totals	8,679	8,665	1,362	30,548	3,336	24,049	3,503	3,115	5,712	0	9,797	20,682	7,906	7,896	135,250
Total FMP Species[1]	4,595	3,879	270	20,422	1,807	23,442	2,913	2,950	3,011	0	4,858	8,024	5,528	7,176	88,875
Haddock as a % of:															
All Species	2.1	2.6	0.7	1.6	0.0	0.5	4.1	9.6	0.3	0.0	1.8	3.4	15.7	57.3	6.0
FMP Species[1]	4.0	5.7	3.3	2.3	0.0	0.5	4.9	10.2	0.6	0.0	3.7	8.6	22.4	63.0	9.1
Haddock															
Catch/tow (lb)	20.2	17.1	0.7	23.7	0.0	6.0	47.7	150.0	6.3	0.0	17.8	26.7	206.3	904.2	57.8
CPUE (lb/hr)	4.6	4.7	0.4	10.3	0.0	1.4	13.4	36.1	1.7	0.0	6.2	7.1	47.4	25.8	17.4

[1] Thirteen species in Northeast Multispecies Fishery Management Plan (FMP): haddock, cod, pollock, yellowtail flounder, winter flounder, witch flounder, windowpane flounder, American plaice, redfish, white hake, red hake, silver hake, and ocean pout.

[2] Other fish were comprised of 23 different species (Appendix Table 1).

[3] Other invertebrates were comprised of eight different species (Appendix Table 1).

Table 8. Summary of catches (lbs: retained catches and discards combined) in Area II, by month, from observed tows in the 1994 Experimental Fishery.

Species	Jan	Feb	Mar	Apr	May	Jun	Total
No. of Observed Tows	15	32	61	97	37	63	305
Fishing Effort (hr)	71.5	75.9	230.0	421.5	110.1	238.7	1147.7
Haddock[1]	180	6	1,782	12,628	21,343	24,995	60,934
Cod[1]	4,499	8,752	18,156	101,335	8,212	21,043	161,997
Pollock[1]	975	21	20,009	29,397	846	3,363	54,611
Yellowtail Flounder[1]	93	142	714	15,114	362	1,135	17,560
Winter Flounder[1]	128	405	355	99	491	2,139	3,617
Witch Flounder[1]	219	0	1,018	1,197	465	1,035	3,934
Windowpane Flounder[1]	21	47	139	207	37	70	521
American Plaice[1]	421	113	1,093	5,460	4,096	5,626	16,809
Redfish[1]	1	0	144	11	1	0	157
White Hake[1]	341	30	2,019	1,998	679	3,547	8,614
Red Hake[1]	64	0	4	0	0	560	628
Silver Hake[1]	63	0	93	212	74	51	493
Ocean Pout[1]	135	0	264	2,409	268	415	3,491
Cusk	97	0	1,399	1,827	678	730	4,731
Wolffish	24	2	96	114	116	125	477
Monkfish	3,423	102	6,476	3,361	2,242	1,920	17,524
Skates	4,175	7,374	18,262	36,796	16,882	10,285	93,774
Spiny Dogfish	275	0	2,953	8,449	1,337	658	13,672
Other fish[2]	528	327	518	3,951	849	791	6,964
American Lobster	480	129	1,425	1,090	362	291	3,777
Other invertebrates[3]	26	4	9	38	34	95	206
Totals	16,168	17,454	76,928	225,693	59,374	78,874	474,491
Total FMP Species[1]	7,140	9,516	45,790	170,067	36,874	63,979	333,366
Haddock Catches as a % of:							
All Species	1.1	0.0	2.3	5.6	35.9	31.7	12.8
Groundfish FMP Species[1]	2.5	0.1	3.9	7.4	57.9	39.1	18.3
Haddock							
Catch/tow (lb)	12.0	0.2	29.2	130.2	576.8	396.7	199.8
CPUE (lb/hr)	2.5	0.1	7.7	30.0	193.9	104.7	53.1

[1] Thirteen species in Northeast Multispecies Fishery Management Plan (FMP): haddock, cod, pollock, yellowtail flounder, winter flounder, witch flounder, windowpane flounder, American plaice, redfish, white hake, red hake, silver hake, and ocean pout.

[2] Other fish were comprised of 23 different species (Appendix Table 1).

[3] Other invertebrates were comprised of eight different species (Appendix Table 1).

Table 9. Summary of retained catches (lbs) in Area II, by month, from observed tows in the 1994 Experimental Fishery.

Species	Jan	Feb	Mar	Apr	May	Jun	Total
No. of Observed Tows	15	32	61	97	37	63	305
Fishing Effort (hr)	71.5	75.9	230.0	421.5	110.1	238.7	1147.7
Haddock[1]	0	0	0	500	71	500	1,071
Cod[1]	4,460	8,749	18,097	100,697	8,081	20,795	160,879
Pollock[1]	968	21	20,009	29,372	843	3,360	54,573
Yellowtail Flounder[1]	92	141	657	14,747	326	1,133	17,096
Winter Flounder[1]	128	403	354	99	491	2,139	3,614
Witch Flounder[1]	199	0	1,001	1,120	411	1,034	3,765
Windowpane Flounder[1]	0	38	81	110	9	70	308
[illegible]nerican Plaice[1]	390	113	1,082	5,337	3,945	5,575	16,442
Redfish[1]	0	0	144	9	1	0	154
White Hake[1]	341	30	2,019	1,905	602	3,545	8,442
Red Hake[1]	0	0	2	0	0	560	562
Silver Hake[1]	0	0	78	3	0	28	109
Ocean Pout[1]	0	0	0	105	0	0	105
Cusk	97	0	1,399	1,827	678	730	4,731
Wolffish	24	2	95	114	116	125	476
Monkfish	3,350	102	6,415	3,144	2,096	1,920	17,027
Skates	530	768	967	1,080	2,080	4,190	9,615
Spiny Dogfish	0	0	0	0	0	0	0
Other fish[2]	70	0	112	361	95	12	650
American Lobster	380	125	1,324	756	194	224	3,003
Other invertebrates[3]	0	0	0	10	2	0	12
[illegible]als	11,029	10,492	53,836	161,296	20,041	45,940	302,634
Total FMP Species[1]	6,578	9,495	43,524	154,004	14,780	38,739	267,120
Haddock Landings as a % of:							
All Species	0.0	0.0	0.0	0.3	0.4	1.1	0.4
Groundfish FMP Species[1]	0.0	0.0	0.0	0.3	0.5	1.3	0.4

[1] Thirteen species in Northeast Multispecies Fishery Management Plan (FMP): haddock, cod, pollock, yellowtail flounder, winter flounder, witch flounder, windowpane flounder, American plaice, redfish, white hake, red hake, silver hake, and ocean pout.

[2] Other fish were comprised of 23 different species (Appendix Table 1).

[3] Other invertebrates were comprised of eight different species (Appendix Table 1).

Table 10. Summary of discarded catches (lbs) in Area II, by month, from observed tows in the 1994 Area II Experimental Fishery.

Species	Jan	Feb	Mar	Apr	May	Jun	Total
No. of Observed Tows	15	32	61	97	37	63	305
Fishing Effort (hr)	71.5	75.9	230.0	421.5	110.1	238.7	1147.7
Haddock[1]	180	6	1,782	12,128	21,272	24,495	59,863
Cod[1]	39	3	59	638	131	248	1,118
Pollock[1]	7	0	0	25	3	3	38
Yellowtail Flounder[1]	1	1	57	367	36	2	464
Winter Flounder[1]	0	2	1	0	0	0	3
Witch Flounder[1]	20	0	17	77	54	1	169
Windowpane Flounder[1]	21	9	58	97	28	0	213
American Plaice[1]	31	0	11	123	151	51	367
Redfish[1]	1	0	0	2	0	0	3
White Hake[1]	0	0	0	93	77	2	172
Red Hake[1]	64	0	2	0	0	0	66
Silver Hake[1]	63	0	15	209	74	23	384
Ocean Pout[1]	135	0	264	2,304	268	415	3,386
Cusk	0	0	0	0	0	0	0
Wolffish	0	0	1	0	0	0	1
Monkfish	73	0	61	217	146	0	497
Skates	3,645	6,606	17,295	35,716	14,802	6,095	84,159
Spiny Dogfish	275	0	2,953	8,449	1,337	658	13,672
Other fish[2]	458	327	406	3,590	754	779	6,314
American Lobster	100	4	101	334	168	67	774
Other invertebrates[3]	26	4	9	28	32	95	194
Totals	5,139	6,962	23,092	64,397	39,333	45,940	171,857
Total FMP Species[1]	562	21	2,266	16,063	22,094	25,240	66,246
Haddock Discards as a % of:							
All Species	3.5	0.1	7.7	18.8	54.1	74.4	34.8
Groundfish FMP Species[1]	32.0	28.6	78.6	75.5	96.3	97.0	90.4

[1] Thirteen species in Northeast Multispecies Fishery Management Plan (FMP): haddock, cod, pollock, yellowtail flounder, winter flounder, witch flounder, windowpane flounder, American plaice, redfish, white hake, red hake, silver hake, and ocean pout.

[2] Other fish were comprised of 23 different species (Appendix Table 1).

[3] Other invertebrates were comprised of eight different species (Appendix Table 1).

Table 11. Discard percentages (discard weight/total catch weight), by species and month, in observed tows taken in Area II in the 1994 Experimental Fishery.

Species	Jan	Feb	Mar	Apr	May	Jun	Total[4]
Haddock[1]	100.0	100.0	100.0	100.0	99.7	98.0	98.2
Cod[1]	0.9	<0.1	0.3	0.6	1.6	1.2	0.7
Pollock[1]	0.7	0.0	0.0	0.1	0.4	0.1	0.1
Yellowtail Flounder[1]	1.1	0.7	8.0	2.4	9.9	0.2	2.6
Winter Flounder[1]	0.0	0.5	0.3	0.0	0.0	0.0	0.1
Witch Flounder[1]	9.1	-	1.7	6.4	11.6	0.1	4.3
Windowpane Flounder[1]	100.0	19.1	41.7	46.9	75.7	0.0	40.9
American Plaice[1]	7.4	0.0	1.0	2.3	3.7	0.9	2.2
[illegible]dfish[1]	100.0	-	0.0	18.2	0.0	-	1.9
White Hake[1]	0.0	0.0	0.0	4.7	11.3	0.1	2.0
Red Hake[1]	100.0	-	50.0	-	-	0.0	10.5
Silver Hake[1]	100.0	-	16.1	98.6	100.0	45.1	77.9
Ocean Pout[1]	100.0	-	100.0	95.6	100.0	100.0	97.0
Cusk	0.0	-	0.0	0.0	0.0	0.0	0.0
Wolffish	0.0	0.0	1.0	0.0	0.0	0.0	0.2
Monkfish	2.1	0.0	0.9	6.5	6.5	0.0	2.8
Skates	87.3	89.6	94.7	97.1	87.7	59.3	89.7
Spiny Dogfish	100.0	-	100.0	100.0	100.0	100.0	100.0
Other fish[2]	86.7	100.0	78.4	90.9	88.8	98.5	90.7
American Lobster	20.8	3.1	7.1	30.6	46.4	23.0	20.5
Other invertebrates[3]	100.0	100.0	100.0	73.7	94.1	100.0	94.2
Totals	31.8	39.9	30.0	28.5	66.2	58.2	36.2
Total FMP Species[1]	7.9	0.2	4.9	9.4	59.9	39.5	19.9
Total FMP Species[1] (excluding haddock)	5.5	0.2	1.1	2.5	5.3	1.9	2.3

[1] Thirteen species in Northeast Multispecies Fishery Management Plan (FMP): haddock, cod, pollock, yellowtail flounder, winter flounder, witch flounder, windowpane flounder, American plaice, redfish, white hake, red hake, silver hake, and ocean pout.

[2] Other fish were comprised of 23 different species (Appendix Table 1)..

[3] Other invertebrates were comprised of eight different species (Appendix Table 1).

[4] Total = total discards during January-June/total catches during January-June.

Table 12. Frequency distributions of observed tows in the [illegible]4 Experimental Fishery categorized by the catch (lbs.) of haddock. Data are summarized separately for tows inside Area II, outside Area II, and both areas combined.

Area II	Pounds of Haddock										Pounds of Haddock				
Month	0	1-50	51-100	101-150	151-200	201-250	251-500	501-1000	1001-5000	>5000	0	>0	>500	>1000	Total Tows
Jan	6	9	0	0	0	0	0	0	0	0	6	9	0	0	15
Feb	31	1	0	0	0	0	0	0	0	0	31	1	0	0	32
Mar	20	31	8	1	0	0	0	0	0	0	20	41	0	0	61
Apr	19	34	12	9	7	2	8	4	2	0	19	78	6	2	97
May	6	7	6	2	0	1	4	6	5	0	6	31	11	5	37
Jun	5	32	12	2	1	1	6	1	1	2	5	58	4	3	63
Total	**87**	**114**	**38**	**14**	**8**	**4**	**19**	**11**	**8**	**2**	**87**	**218**	**21**	**10**	**305**

Outside Area II	Pounds of Haddock										Pounds of Haddock				
Month	0	1-50	51-100	101-150	151-200	201-250	251-500	501-1000	1001-5000	>5000	0	>0	>500	>1000	Total Tows
Jan	4	4	1	0	0	0	0	0	0	0	4	5	0	0	9
Feb	17	7	2	0	0	0	0	0	0	0	17	9	0	0	26
Mar	30	18	2	3	0	0	0	0	0	0	30	23	0	0	53
Apr	0	3	1	0	1	0	0	0	0	0	0	5	0	0	5
May	8	22	5	1	0	0	0	0	0	0	8	28	0	0	36
Jun	2	2	0	1	1	1	2	1	1	0	2	9	2	1	11
Total	**61**	**56**	**11**	**5**	**2**	**1**	**2**	**1**	**1**	**0**	**61**	**79**	**2**	**1**	**140**

In & Outside Area II	Pounds of Haddock										Pounds of Haddock				
Month	0	1-50	51-100	101-150	151-200	201-250	251-500	501-1000	1001-5000	>5000	0	>0	>500	>1000	Total Tows
Jan	10	13	1	0	0	0	0	0	0	0	10	14	0	0	24
Feb	48	8	2	0	0	0	0	0	0	0	48	10	0	0	58
Mar	50	49	10	4	0	0	1	0	0	0	50	64	0	0	114
Apr	19	37	13	9	8	2	8	4	2	0	19	83	6	2	102
May	14	29	11	3	0	1	4	6	5	0	14	59	11	5	73
Jun	7	34	12	3	2	2	8	2	2	2	7	67	6	4	74
Total	**148**	**170**	**49**	**19**	**10**	**5**	**21**	**12**	**9**	**2**	**148**	**297**	**33**	**11**	**445**

Table 13. Summary of catches (lbs: retained catches and discards combined) taken outside of Area II, by month, from observed tows in the 1994 Experimental Fishery.

Species	Jan	Feb	Mar	Apr	May	Jun	Total
No. of Observed Tows	9	26	53	5	36	11	140
Fishing Effort (hr)	39.8	71.9	166.7	19.3	126.1	42.4	466.2
Haddock[1]	182	231	736	319	871	5,759	8,098
Cod[1]	2,672	1,123	31,277	2,186	5,404	4,610	47,272
Pollock[1]	456	916	12,504	810	1,810	430	16,926
Yellowtail Flounder[1]	2	9	70	2,266	30	180	2,557
Winter Flounder[1]	2	58	153	11	61	575	860
Witch Flounder[1]	297	198	1,040	15	261	25	1,836
Windowpane Flounder[1]	0	17	157	0	36	0	210
American Plaice[1]	382	261	1,158	43	1,556	115	3,515
Redfish[1]	4	313	130	0	489	290	1,226
White Hake[1]	326	982	892	0	1,942	655	4,797
Red Hake[1]	175	0	0	0	0	0	175
Silver Hake[1]	90	41	129	11	48	0	319
Ocean Pout[1]	7	0	338	300	374	65	1,084
Cusk	347	268	691	40	859	65	2,270
Wolffish	8	17	894	0	603	25	1,547
Monkfish	2,930	2,346	2,526	90	3,834	300	12,026
Skates	163	1,955	7,293	2,200	7,090	1,945	20,646
Spiny Dogfish	44	544	428	60	4,234	440	5,750
Other fish[2]	76	164	580	446	524	153	1,943
American Lobster	463	208	347	29	386	170	1,603
Other invertebrates[3]	53	376	93	1	67	0	590
Totals	8,679	10,027	61,436	8,827	30,479	15,802	135,250
Total FMP Species[1]	4,595	4,149	48,584	5,961	12,882	12,707	88,875
Haddock Catches as a % of:							
All Species	2.1	2.3	1.2	3.6	2.9	36.4	6.0
Groundfish FMP Species[1]	4.0	5.6	1.5	5.4	6.8	45.3	9.1
Haddock							
Catch/tow (lb)	20.2	8.9	13.9	63.8	24.2	523.5	57.8
CPUE (lb/hr)	4.6	3.2	4.4	16.5	6.9	135.8	17.4

[1] Thirteen species in Northeast Multispecies Fishery Management Plan (FMP): haddock, cod, pollock, yellowtail flounder, winter flounder, witch flounder, windowpane flounder, American plaice, redfish, white hake, red hake, silver hake, and ocean pout.

[2] Other fish were comprised of 23 different species (Appendix Table 1).

[3] Other invertebrates were comprised of eight different species (Appendix Table 1).

Table 14. Summary of retained catches (lbs) taken outside of Area II, by month, from observed tows in the 1994 Experimental Fishery.

Species	Jan	Feb	Mar	Apr	May	Jun	Total
No. of Observed Tows	9	26	53	5	36	11	140
Fishing Effort (hr)	39.8	71.9	166.7	19.3	126.1	42.4	466.2
Haddock[1]	177	171	495	0	567	500	1,909
Cod[1]	2,660	1,121	30,848	2,177	5,265	4,610	46,681
Pollock[1]	453	914	12,457	810	1,800	430	16,864
Yellowtail Flounder[1]	2	9	52	2,218	26	180	2,487
Winter Flounder[1]	2	56	131	11	61	575	836
Witch Flounder[1]	263	196	929	15	238	25	1,666
Windowpane Flounder[1]	0	14	39	0	1	0	54
American Plaice[1]	366	257	1,048	43	1,485	115	3,314
Redfish[1]	4	260	17	0	318	290	889
White Hake[1]	324	956	815	0	1,780	655	4,530
Red Hake[1]	46	0	0	0	0	0	46
Silver Hake[1]	0	0	0	0	0	0	0
Ocean Pout[1]	0	0	0	0	0	0	0
Cusk	347	268	691	40	859	65	2,270
Wolffish	8	17	890	0	603	25	1,543
Monkfish	2,850	2,346	2,347	78	3,634	300	11,555
Skates	85	151	1,650	230	1,238	715	4,069
Spiny Dogfish	0	0	0	0	0	0	0
Other fish[2]	8	0	158	5	18	18	207
American Lobster	355	202	273	23	277	170	1,300
Other invertebrates[3]	0	0	0	1	19	0	20
Totals	7,950	6,937	52,840	5,651	18,189	8,673	100,240
Total FMP Species[1]	4,297	3,953	46,831	5,274	11,541	7,380	79,276
Haddock Landings as a % of:							
All Species	2.2	2.5	0.9	0.0	3.1	5.8	1.9
Groundfish FMP Species[1]	4.1	4.3	1.1	0.0	4.9	6.8	2.4

[1] Thirteen species in Northeast Multispecies Fishery Management Plan (FMP): haddock, cod, pollock, yellowtail flounder, winter flounder, witch flounder, windowpane flounder, American plaice, redfish, white hake, red hake, silver hake, and ocean pout.

[2] Other fish were comprised of 23 different species (Appendix Table 1).

[3] Other invertebrates were comprised of eight different species (Appendix Table 1).

Table 15. Summary of discarded catches (lbs) taken outside of Area II, by month, from observed tows in the 1994 Experimental Fishery.

Species	Jan	Feb	Mar	Apr	May	Jun	Total
No. of Observed Tows	9	26	53	5	36	11	140
Fishing Effort (hr)	39.8	71.9	166.7	19.3	126.1	42.4	466.2
Haddock[1]	5	61	241	319	304	5,259	6,189
Cod[1]	12	2	429	9	139	0	591
Pollock[1]	3	2	47	0	10	0	62
Yellowtail Flounder[1]	0	0	18	48	4	0	70
Winter Flounder[1]	0	2	22	0	0	0	24
Witch Flounder[1]	34	2	111	0	23	0	170
Windowpane Flounder[1]	0	3	118	0	35	0	156
American Plaice[1]	16	4	110	0	71	0	201
Redfish[1]	0	53	113	0	171	0	337
White Hake[1]	2	26	77	0	162	0	267
Red Hake[1]	129	0	0	0	0	0	129
Silver Hake[1]	90	41	129	11	48	0	319
Ocean Pout[1]	7	0	338	300	374	65	1,084
Cusk	0	0	0	0	0	0	0
Wolffish	0	0	4	0	0	0	4
Monkfish	80	0	179	12	200	0	471
Skates	78	1,804	5,643	1,970	5,852	1,230	16,577
Spiny Dogfish	44	544	428	60	4,234	440	5,750
Other fish[2]	68	164	422	441	506	135	1,736
American Lobster	108	6	74	6	109	0	303
Other invertebrates[3]	53	376	93	0	48	0	570
Totals	729	3,090	8,596	3,176	12,290	7,129	35,010
Total FMP Species[1]	298	196	1,753	687	1,341	5,324	9,599
Haddock Discards as a % of:							
All Species	0.7	2.0	2.8	10.0	2.5	73.8	17.7
Groundfish FMP Species[1]	1.7	31.1	13.7	46.4	22.7	98.8	64.5

[1] Thirteen species in Northeast Multispecies Fishery Management Plan (FMP): haddock, cod, pollock, yellowtail flounder, winter flounder, witch flounder, windowpane flounder, American plaice, redfish, white hake, red hake, silver hake, and ocean pout.

[2] Other fish were comprised of 23 different species (Appendix Table 1).

[3] Other invertebrates were comprised of eight different species (Appendix Table 1).

Table 16. Discard percentages (discard weight/total catch weight), by species and month, in observed tows taken outside of Area II in the 1994 Experimental Fishery.

Species	Jan	Feb	Mar	Apr	May	Jun	Total[4]
Haddock[1]	2.7	26.4	32.7	100.0	34.9	91.3	76.4
Cod[1]	0.4	0.2	1.4	0.4	2.6	0.0	1.3
Pollock[1]	0.7	0.2	0.4	0.0	0.6	0.0	0.4
Yellowtail Flounder[1]	0.0	0.0	25.7	2.1	13.3	0.0	2.7
Winter Flounder[1]	0.0	3.4	14.4	0.0	0.0	0.0	2.8
Witch Flounder[1]	11.4	1.0	10.7	0.0	8.8	0.0	9.3
Windowpane Flounder[1]	-	17.6	75.2	-	97.2	-	74.3
American Plaice[1]	4.2	1.5	9.5	0.0	4.6	0.0	5.7
Redfish[1]	0.0	16.9	86.9	-	35.0	0.0	21.8
White Hake[1]	0.6	2.6	8.6	-	8.3	0.0	5.6
Red Hake[1]	73.7	-	-	-	-	-	73.7
Silver Hake[1]	100.0	100.0	100.0	100.0	100.0	0.0	100.0
Ocean Pout[1]	100.0	-	100.0	100.0	100.0	100.0	100.0
Cusk	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Wolffish	0.0	0.0	0.4	-	0.0	0.0	0.3
Monkfish	2.7	0.0	7.1	13.3	5.2	0.0	3.9
Skates	47.9	92.3	77.4	89.5	82.5	63.2	80.3
Spiny Dogfish	100.0	100.0	100.0	100.0	100.0	100.0	100.0
Other fish[2]	89.5	100.0	72.8	98.9	96.6	88.2	89.3
American Lobster	23.3	2.9	21.3	20.7	28.2	0.0	18.9
Other invertebrates[3]	100.0	100.0	100.0	0.0	71.6	-	96.6
Totals	8.4	30.8	14.0	36.0	40.3	45.1	25.9
Total FMP Species[1]	6.5	4.7	3.6	11.5	10.4	41.9	10.8
Total FMP Species[1] (excluding haddock)	6.6	3.4	3.2	6.5	8.6	0.9	4.2

[1] Thirteen species in Northeast Multispecies Fishery Management Plan (FMP): haddock, cod, pollock, yellowtail flounder, winter flounder, witch flounder, windowpane flounder, American plaice, redfish, white hake, red hake, silver hake, and ocean pout.

[2] Other fish were comprised of 23 different species (Appendix Table 1).

[3] Other invertebrates were comprised of eight different species (Appendix Table 1).

[4] Total = total discards during January-June/total catches during January-June.

Table 17. Summary statistics for July 1994 sea sampling trips on Georges Bank. Data are presented for tows made inside and outside of Area II. Two trips were conducted using two different vessels.

	Area II	Outside of Area II	Total
Number of Tows Observed	37	36	73
Number of Tows Unobserved	11	4	15
Total Tows	48	40	88
Percent Observed	77	90	83
Avg Tow Time (hrs)[1]	3.2	4.0	3.6
Total Effort (hrs)[1]	118.8	145.4	264.2
Observed Tows			
Total Catch (lbs)	24,792	18,877	43,699
Haddock	22	798	820
Groundfish FMP Species[2]	12,037	12,410	24,447
Others	12,755	6,467	19,222
Total Discards (lbs)	12,225	4,782	17,007
Haddock	0	287	287
Groundfish FMP Species[2]	1,448	653	3,549
Others	10,077	3,842	13,919
Percent of			
Haddock Catch/Total Catch	0.1	4.2	1.9
Haddock Catch/FMP Species Catch	0.2	6.4	3.4
Haddock Discards/Total Discards	0.0	6.0	1.8

[1] From observed tows.

[2] Northeast Multispecies Groundfish FMP Species (13): haddock, cod, pollock, yellowtail flounder, winter flounder, witch flounder, windowpane flounder, American plaice, redfish, white hake, red hake, silver hake, and ocean pout.

Table 18. Summary of retained catches (lbs) and discards (lbs) from observed tows in two July 1994 sea sampling trips on Georges Bank. Data are presented from tows made both inside and outside of Area II.

Species	Area II			Outside Area II			Grand Total
	Retained Catches	Discards	Total	Retained Catches	Discards	Total	
No. of Observed Tows			37			36	73
Fishing Effort (hrs)			118.8			145.4	264.2
Haddock[1]	22	0	22	511	287	798	820
Cod[1]	139	11	150	3,825	2	3,827	3,977
Pollock[1]	0	0	0	565	0	565	565
Yellowtail Flounder[1]	10,192	1,139	11,331	0	0	0	11,331
Winter Flounder[1]	28	0	28	0	0	0	28
Witch Flounder[1]	85	1	86	473	108	581	667
Windowpane Flounder[1]	26	14	40	0	0	0	40
American Plaice[1]	36	2	38	3,431	457	3,888	3,926
Redfish[1]	0	0	0	525	77	602	602
White Hake[1]	54	65	119	1,660	0	1,660	1,779
Red Hake[1]	0	0	0	480	0	480	480
Silver Hake[1]	7	59	66	0	9	9	75
Ocean Pout[1]	0	157	157	0	0	0	157
Cusk	0	0	0	205	0	205	205
Wolffish	0	0	0	743	0	743	743
Monkfish	1,438	54	1,492	1,257	10	1,267	2,759
Skates	920	9,258	10,178	410	1,565	1,975	12,153
Spiny Dogfish	0	0	0	0	1,920	1,920	1,920
Other fish[2]	13	673	686	10	192	202	888
American Lobster	74	18	92	0	0	0	92
Other invertebrates[3]	233	74	307	0	155	155	462
Total	13,267	11,525	24,792	14,095	4,782	18,877	43,669
Total FMP Species[1]	10,589	1,448	12,037	11,470	940	12,410	24,447

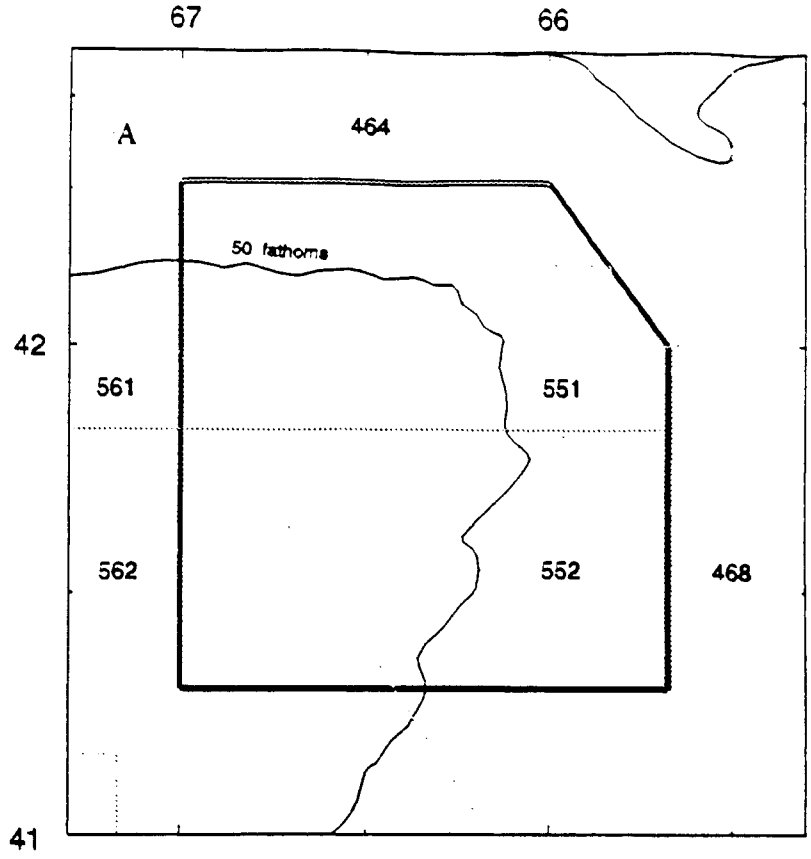
[1] Thirteen species in Northeast Multispecies Fishery Management Plan (FMP): haddock, cod, pollock, yellowtail flounder, winter flounder, witch flounder, windowpane flounder, American plaice, redfish, white hake, red hake, silver hake, and ocean pout.

[2] Other fish were comprised of 23 different species (Appendix Table 1).

[3] Other invertebrates were comprised of eight different species (Appendix Table 1).

Table 19. Summary size composition da[redacted](cm) of Groundfish FMP species sampled ([redacted]ained and discarded) in the 1994 Experimental Fishery. Monkfish samples are also presented. Data are from observed tows and are provided separately for samples taken inside and outside of Area II.

	Retained Catches				Minimum Legal Size	Discards				Total Numbers Measured
	N	Min	Max	Mean		N	Min	Max	Mean	
Area II										
Haddock	84	55	83	71.1	48	3884	32	88	62.1	3968
Cod	787	47	117	70.5	48	156	27	49	43.4	943
Pollock	29	61	105	81.4	48	3	44	52	48.3	32
Yellowtail Flounder	354	32	48	36.4	33	152	24	48	33.7	506
Winter Flounder	97	30	55	41.9	30	1	29	29	29.0	98
Witch Flounder	187	35	58	43.0	36	17	31	37	33.2	204
Windowpane Flounder	65	28	38	31.7	-	70	24	30	28.5	135
American Plaice	128	31	59	47.3	36	92	25	36	33.4	220
White Hake	260	42	83	62.9	-	2	36	36	36.0	262
Monkfish	341	30	92	57.0	-	15	18	31	24.7	356
Totals	2332					4392				6724
Outside Area II										
Haddock	269	46	84	58.8	48	564	23	80	49.4	833
Cod	823	48	111	68.9	48	254	29	49	41.0	1077
Pollock	128	52	106	78.5	48	3	39	47	41.7	131
Yellowtail Flounder	55	33	44	35.2	33	2	30	31	30.5	57
Winter Flounder	38	32	60	43.4	30	5	30	33	31.2	43
Witch Flounder	82	35	58	43.7	36	1	34	34	34.0	83
Windowpane Flounder	24	31	36	32.4	-	92	23	30	27.3	116
American Plaice	140	33	59	43.3	36	26	20	34	28.8	166
White Hake	57	43	76	59.7	-	21	29	51	39.8	78
Monkfish	66	31	88	54.0	-	34	15	30	24.6	100
Totals	1682					1002				2684



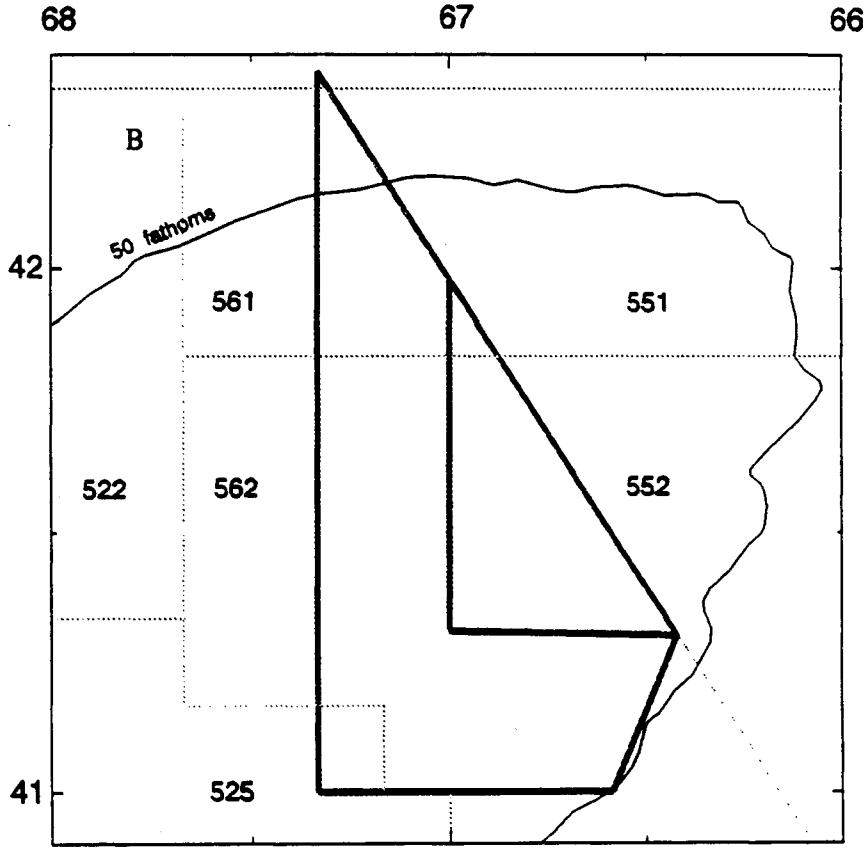


Figure 1. A) ICNAF haddock closed area established in 1970. B) US haddock closed Area II established in January 1994.

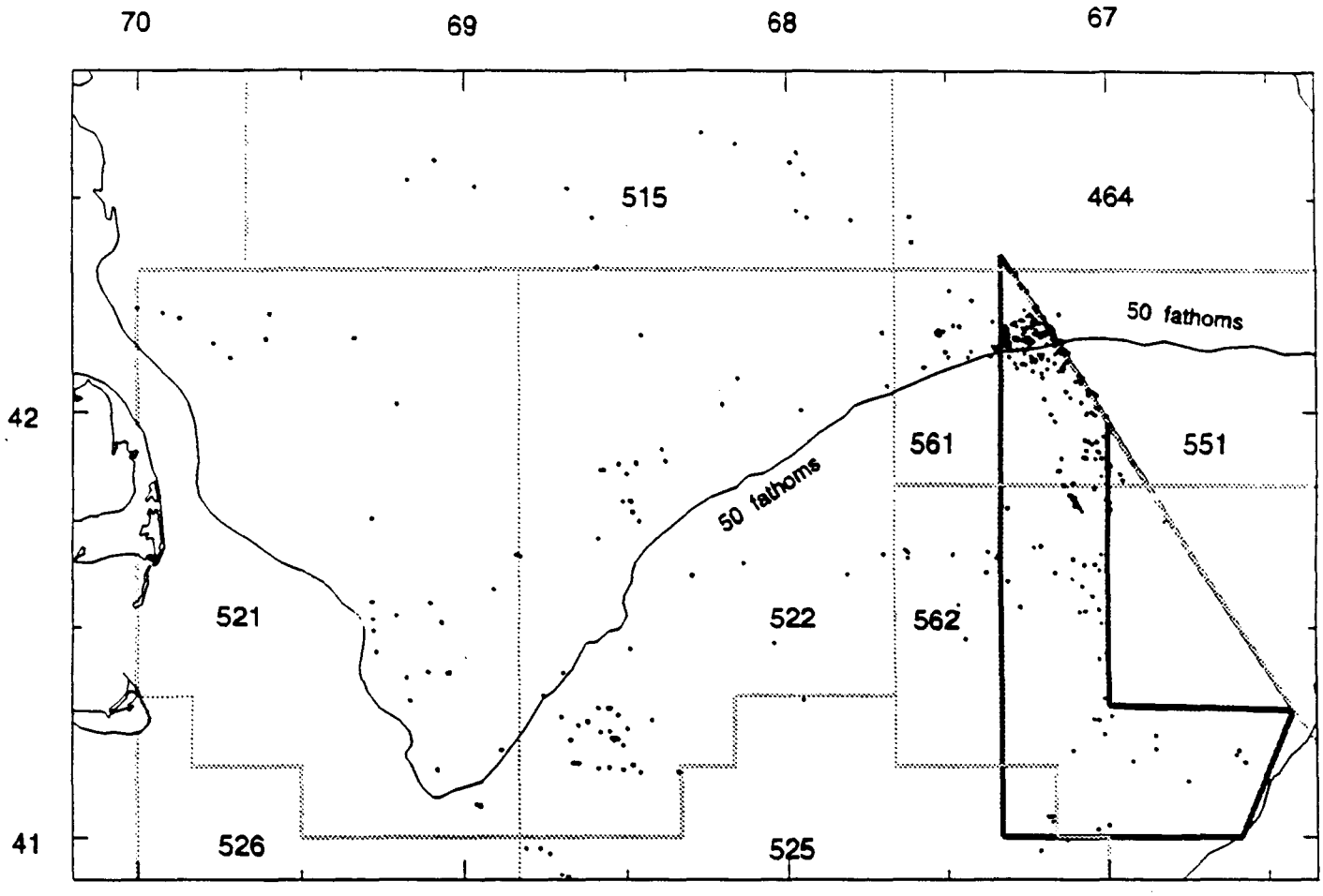


Figure 2. Location of all tows (observed and unobserved) in the 1994 Experimental Fishery (January- June). Three digit numbers refer to the NEFSC statistical catch reporting areas. Tows located within the inner triangle of Area II were made on 1 July.

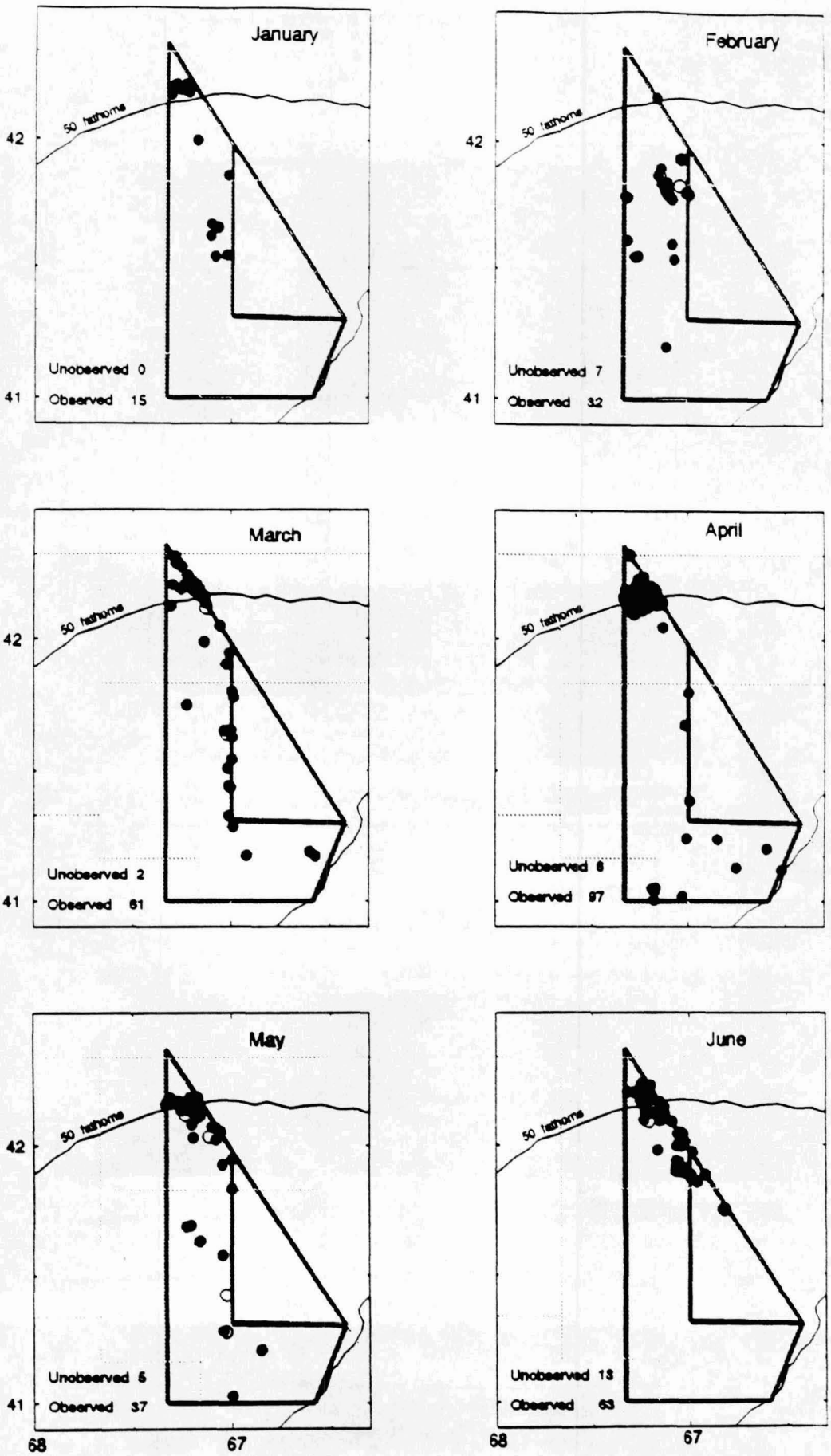


Figure 3. Location of all tows by month in the 1994 Experimental Fishery (Jan- June). Data are from observed and unobserved tows in Area II. Tows located within the inner triangle of Area II in June were made on 1 July.

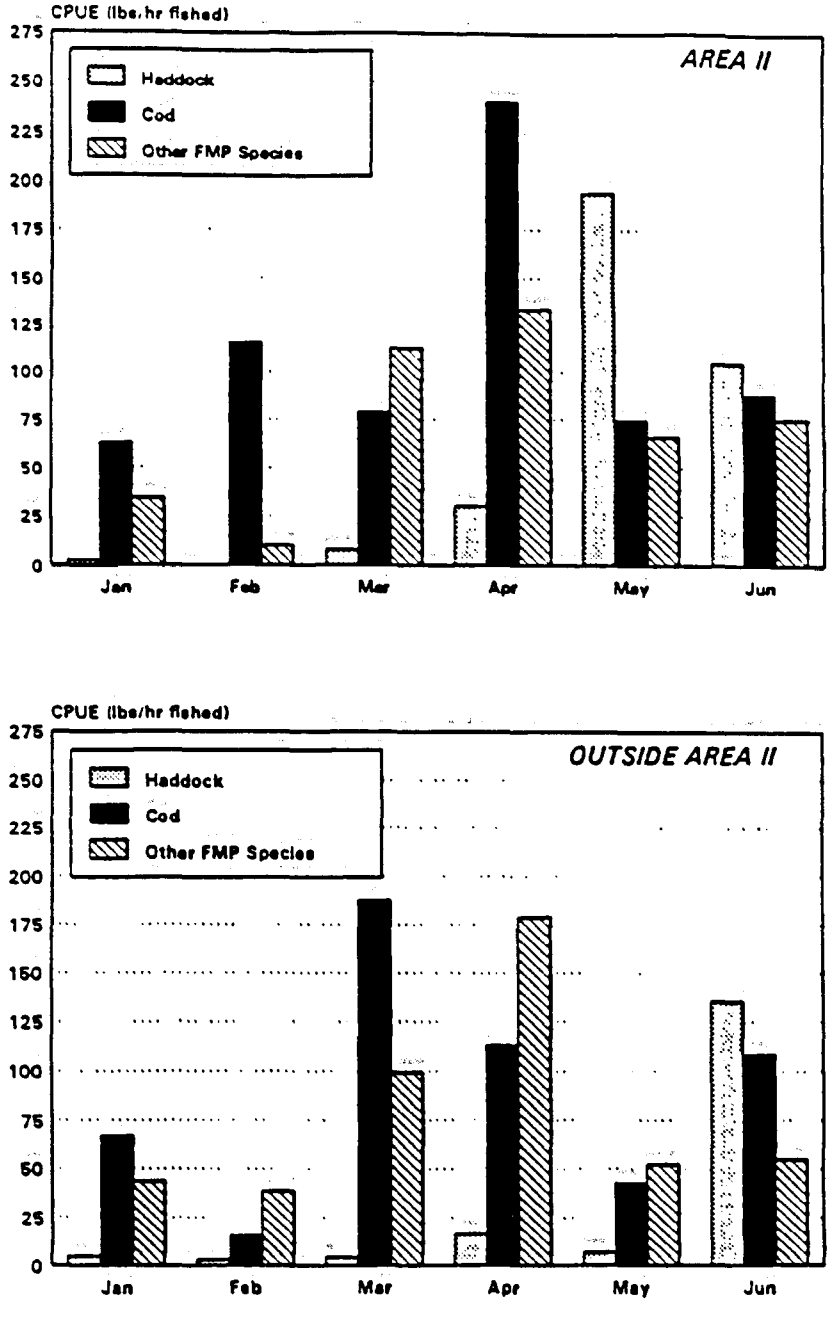


Figure 4. Catch per unit of effort (lbs/hr fished) by month for haddock, cod, and 11 other Groundfish FMP species taken inside Area II [upper panel] and outside Area II [lower panel] in the 1994 Experimental Fishery.

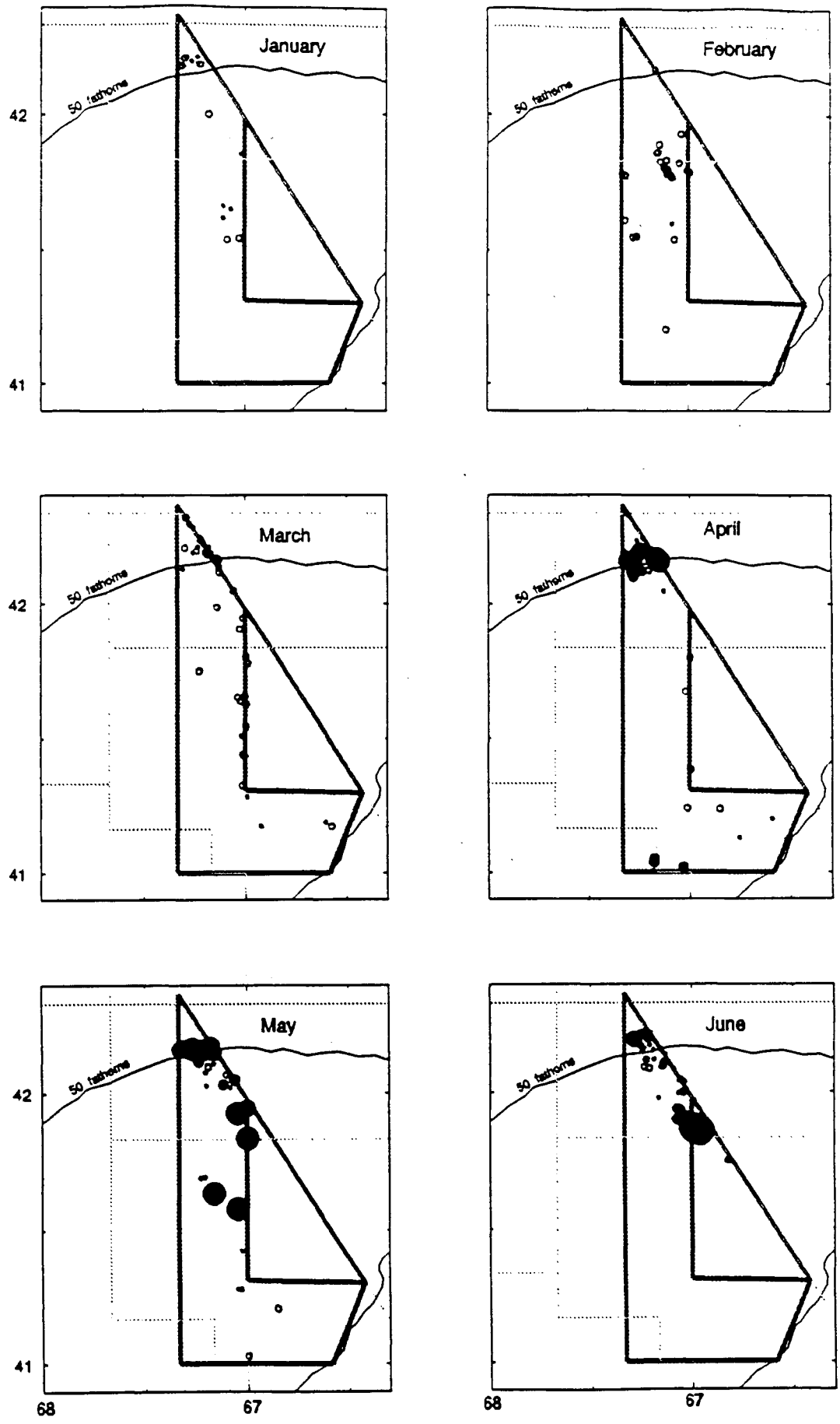


Figure 5. Distribution of haddock catches by month from the 1994 Experimental Fishery. Data are from observed tows in Area II.

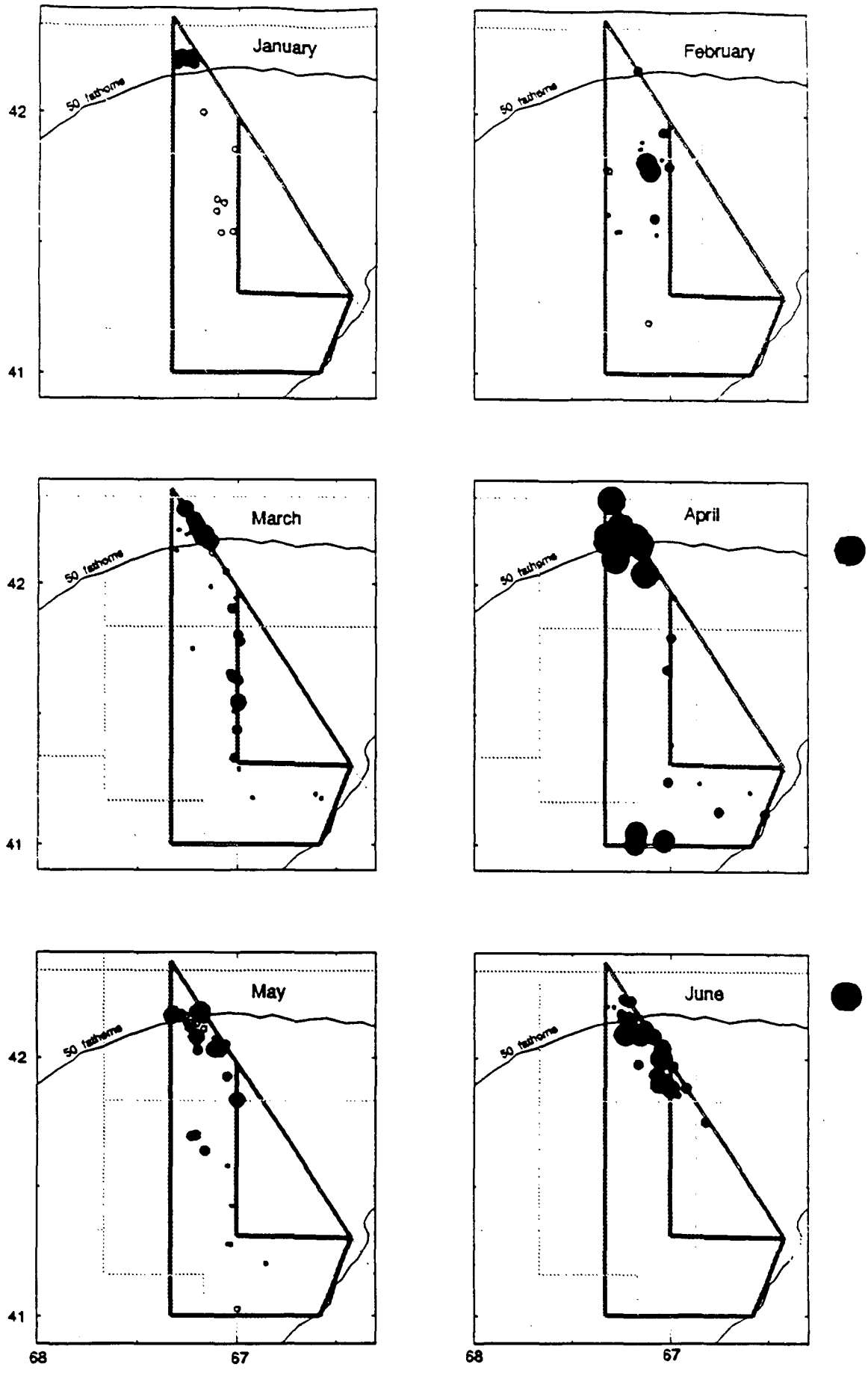


Figure 6. Distribution of cod catches by month from the 1994 Experimental Fishery. Data are from observed tows in Area II.

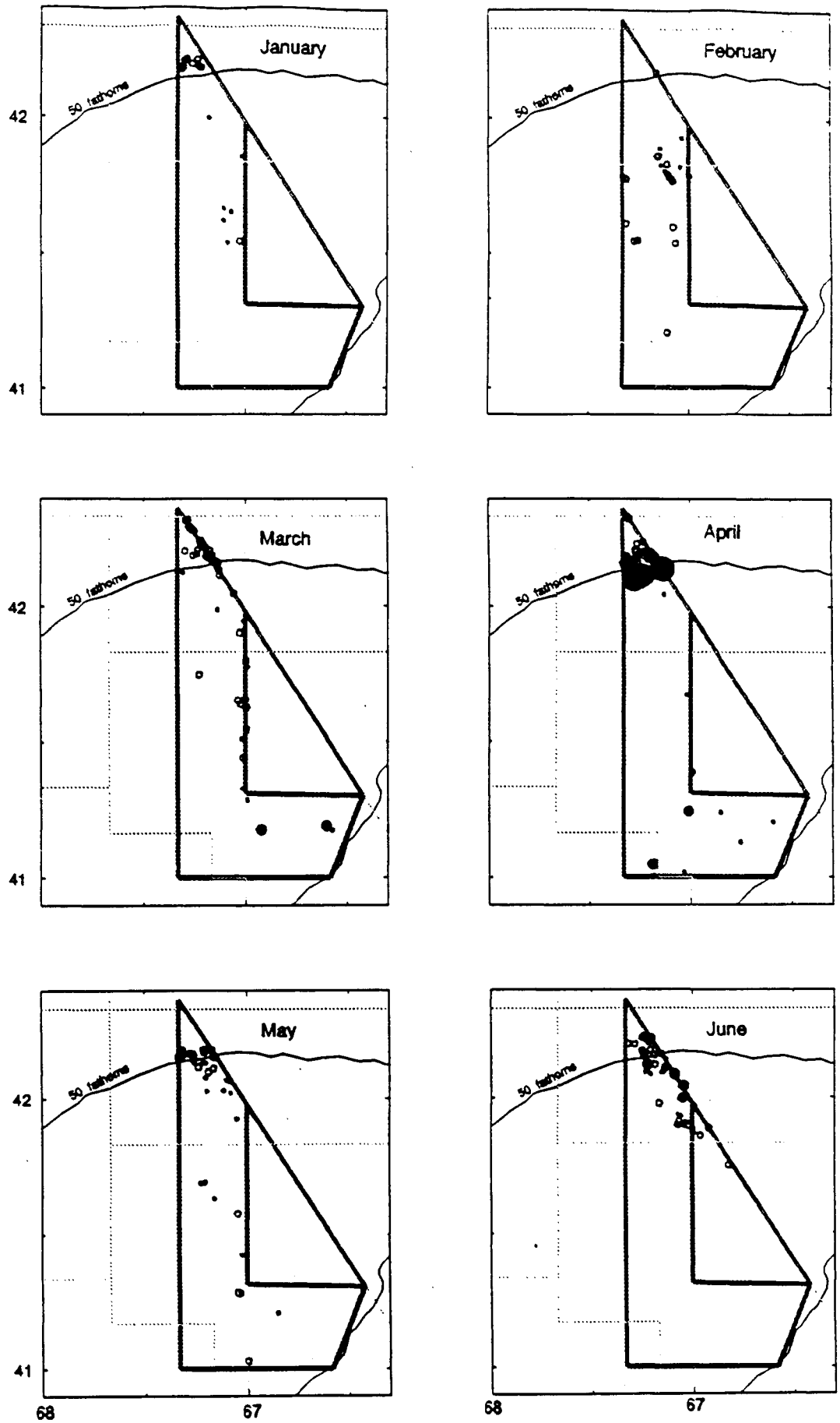


Figure 7. Distribution of yellowtail flounder catches by month from the 1994 Experimental Fishery. Data are from observed tows in Area II.

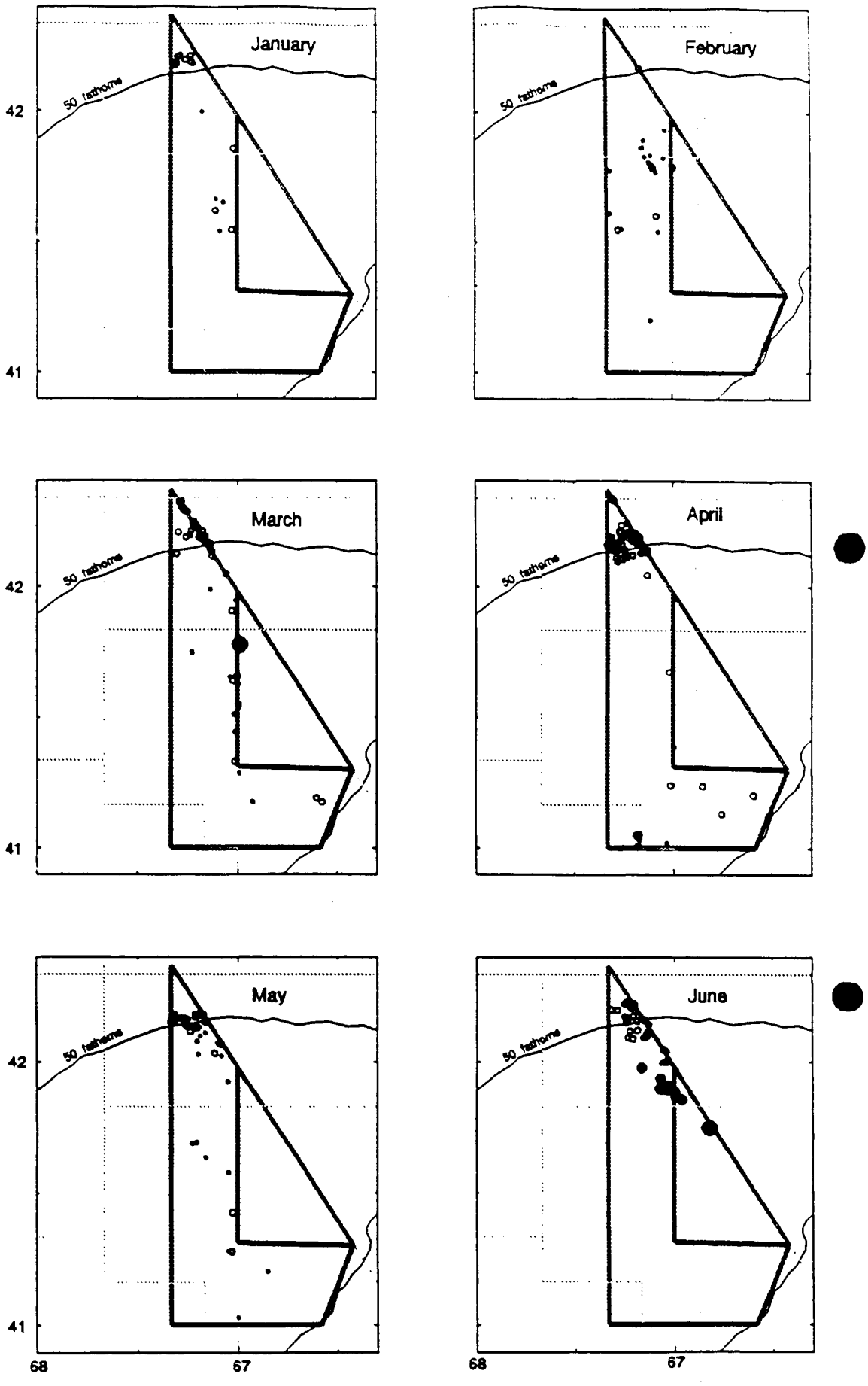


Figure 8. Distribution of winter flounder catches by month from the 1994 Experimental Fishery. Data are from observed tows in Area II.

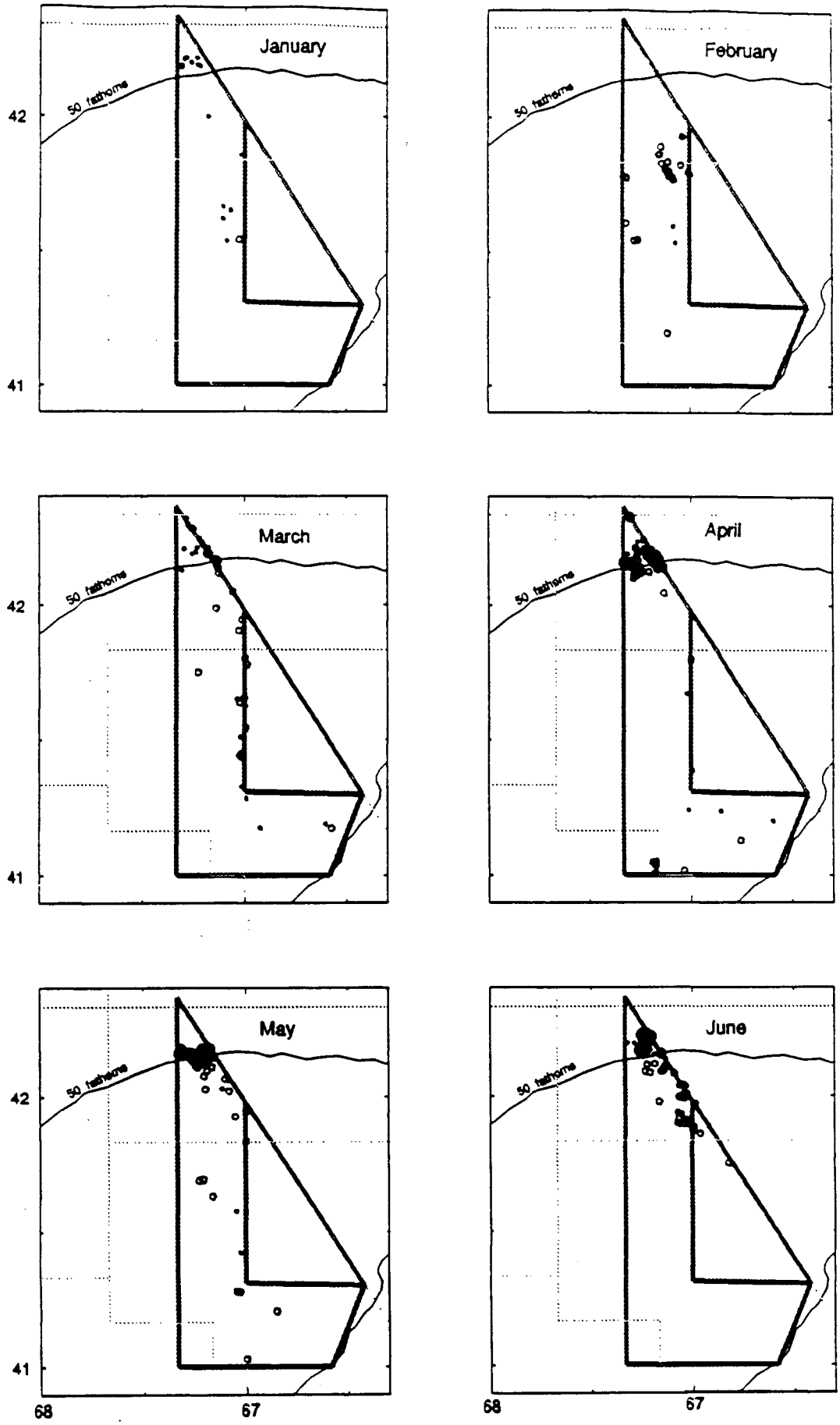


Figure 9. Distribution of American plaice catches by month from the 1994 Experimental Fishery. Data are from observed tows in Area II.

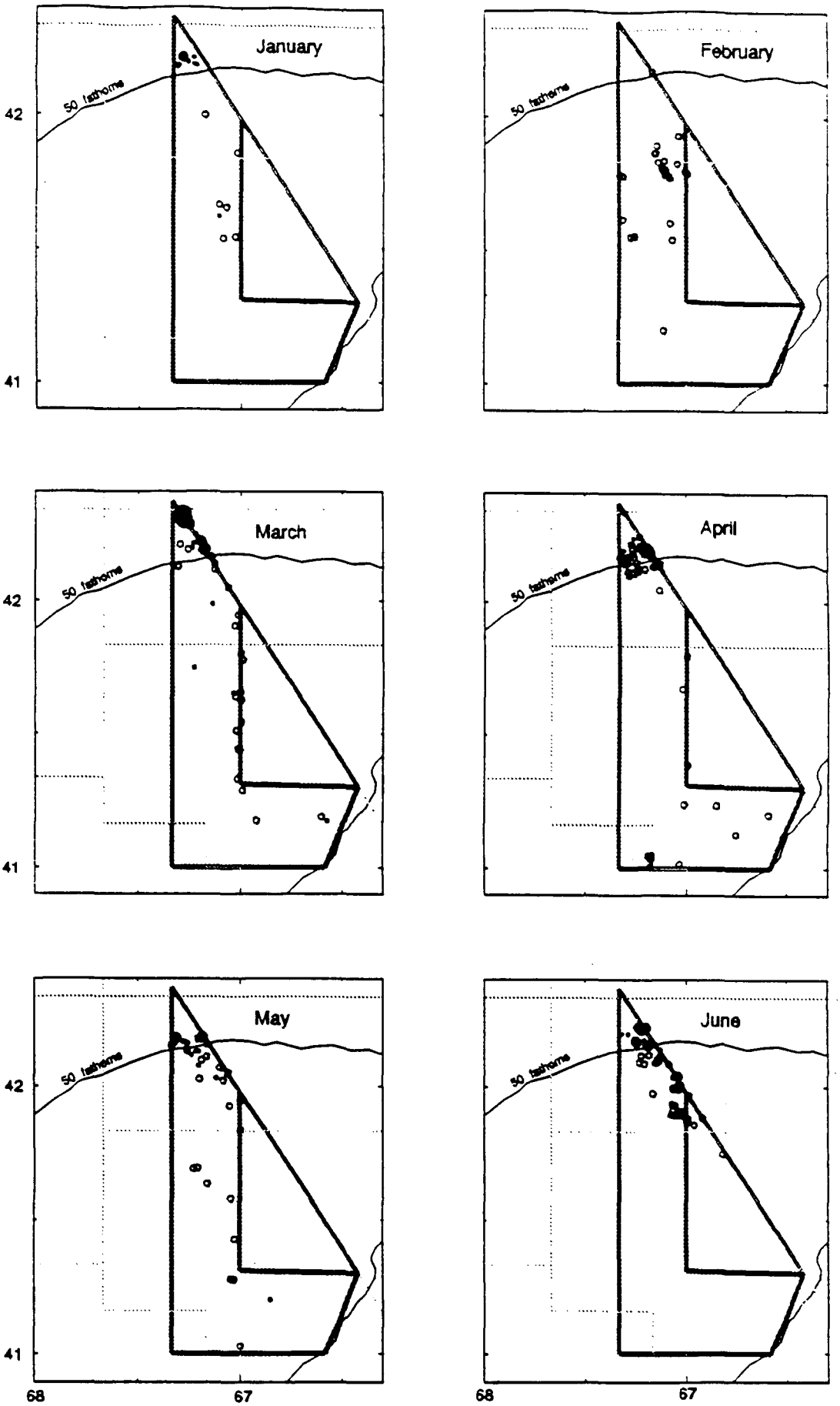


Figure 10. Distribution of witch flounder catches by month from the 1994 Experimental Fishery. Data are from observed tows in Area II.

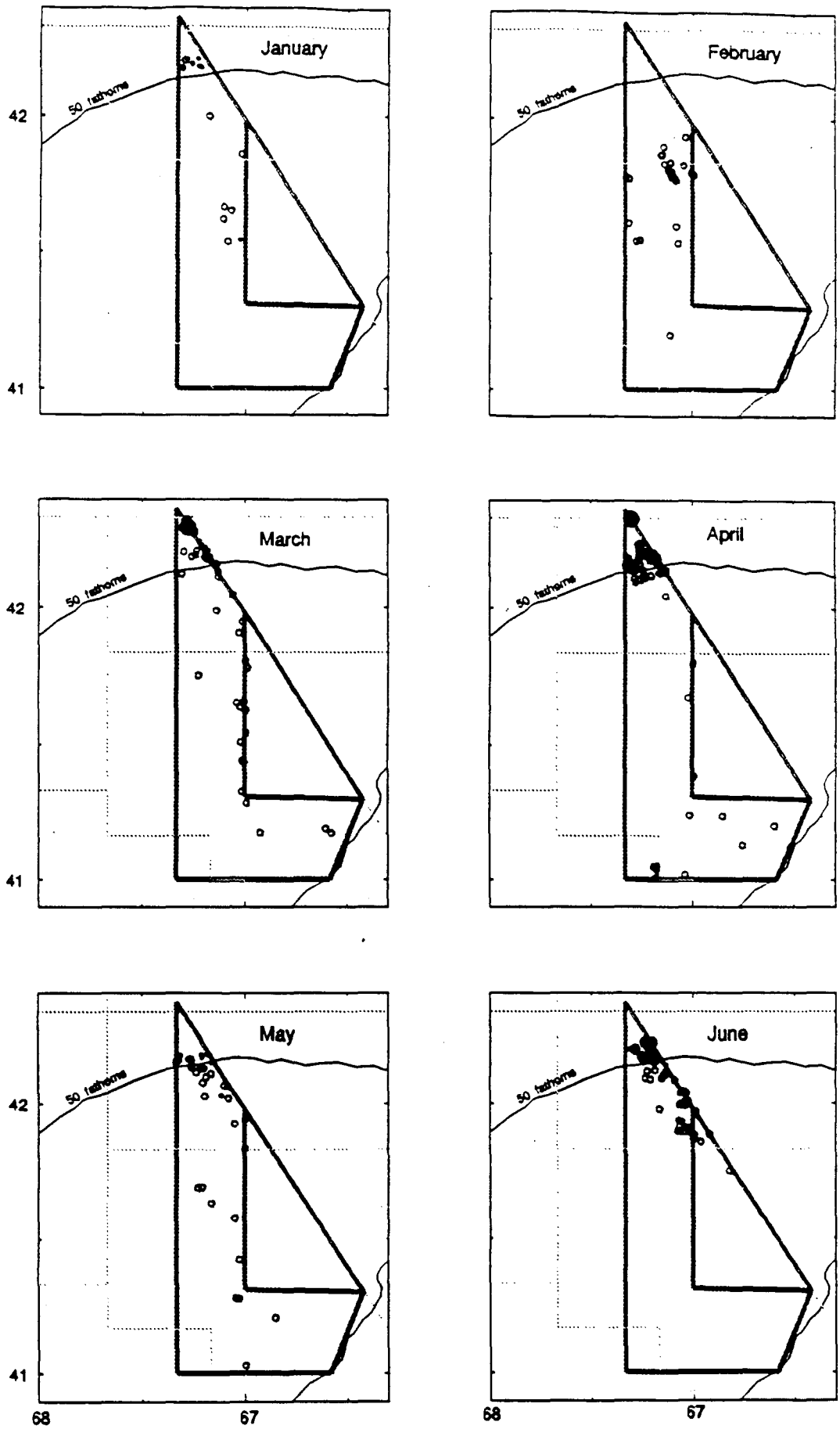


Figure 11. Distribution of white hake catches by month from the 1994 Experimental Fishery. Data are from observed tows in Area II.

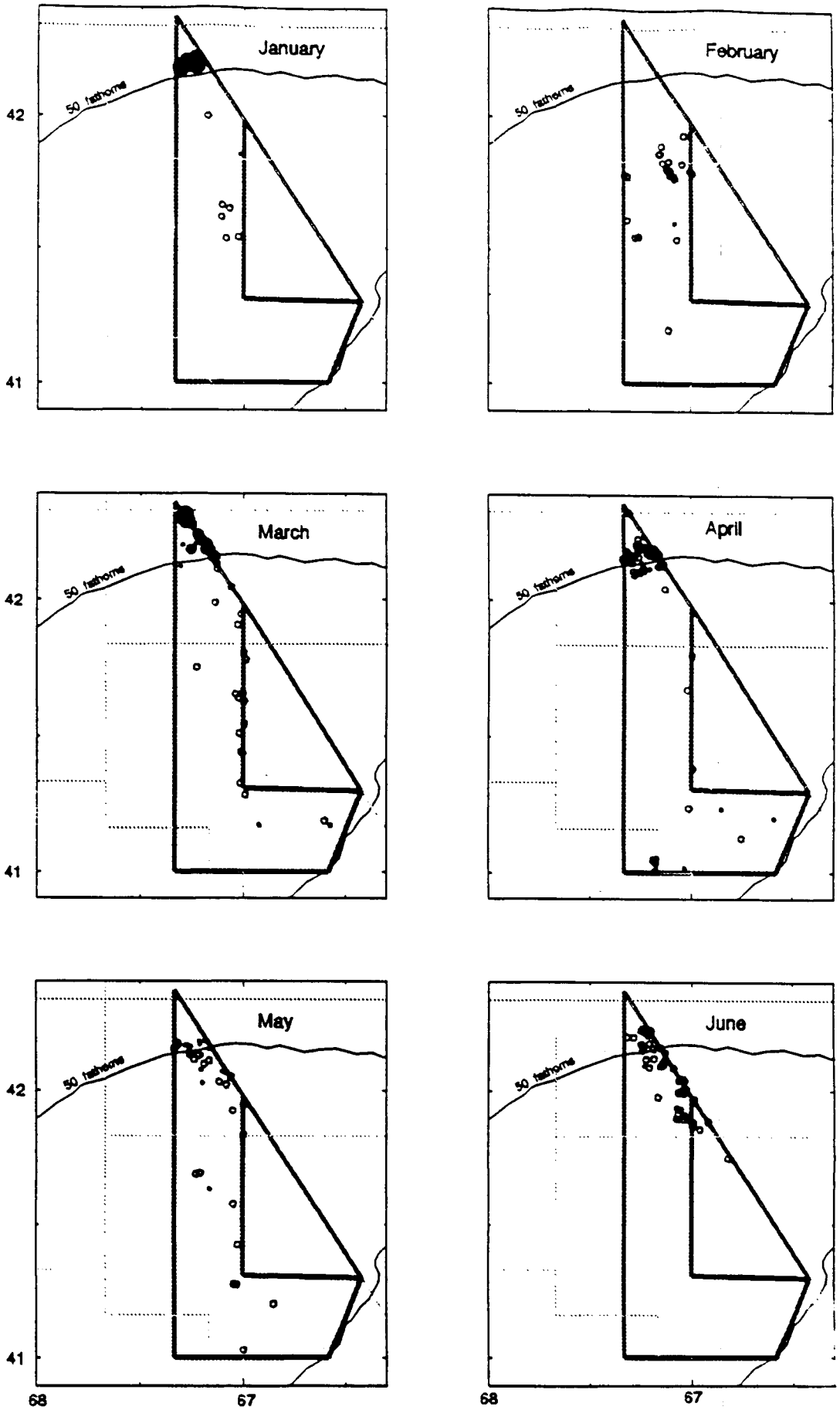


Figure 12. Distribution of monkfish catches by month from the 1994 Experimental Fishery. Data are from observed tows in Area II.

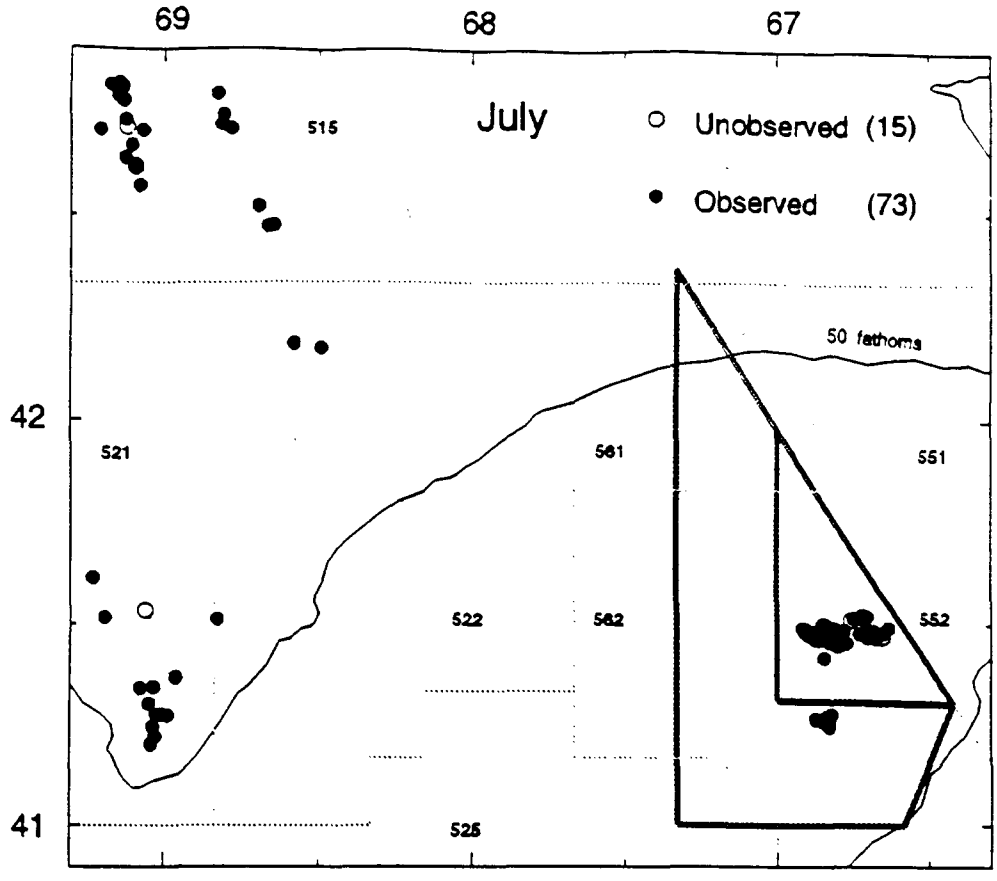


Figure 13. Location of all tows (observed and unobserved) in the two Georges Bank trips (July 1994).

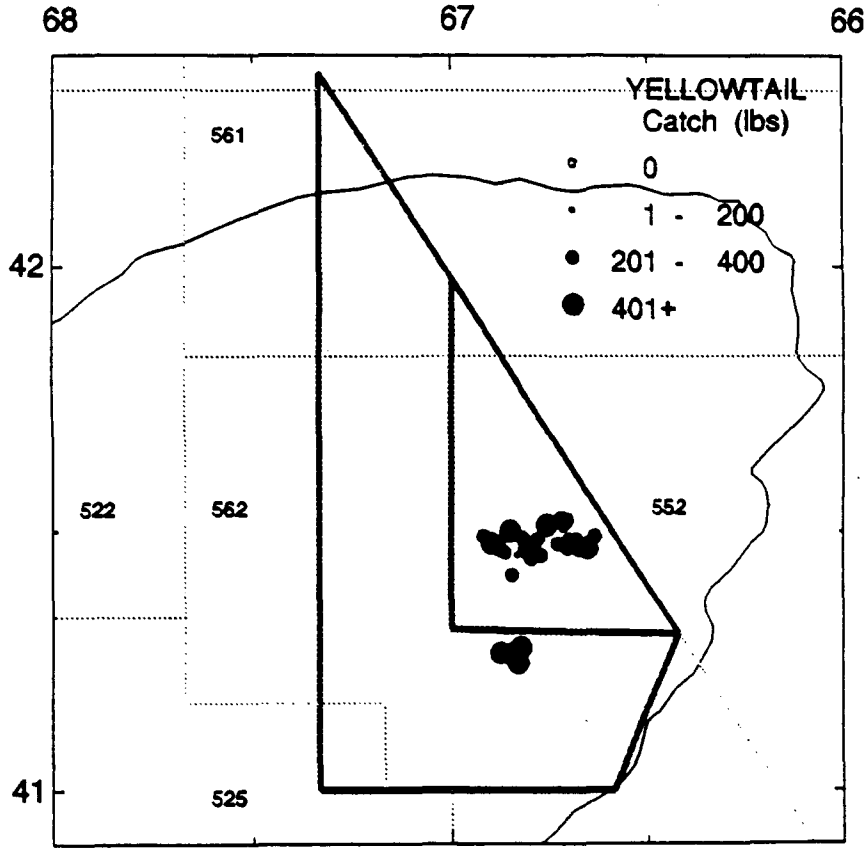
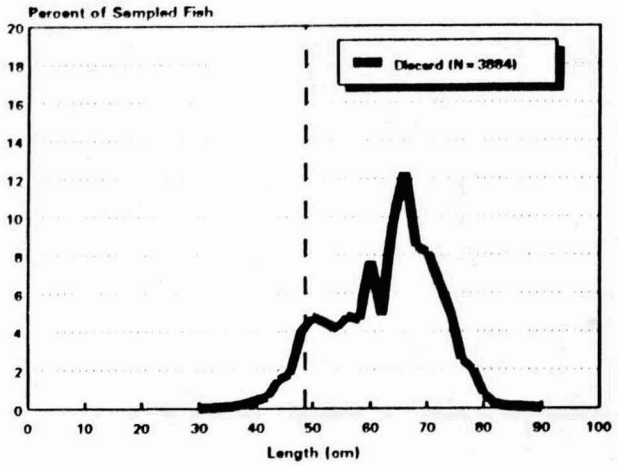
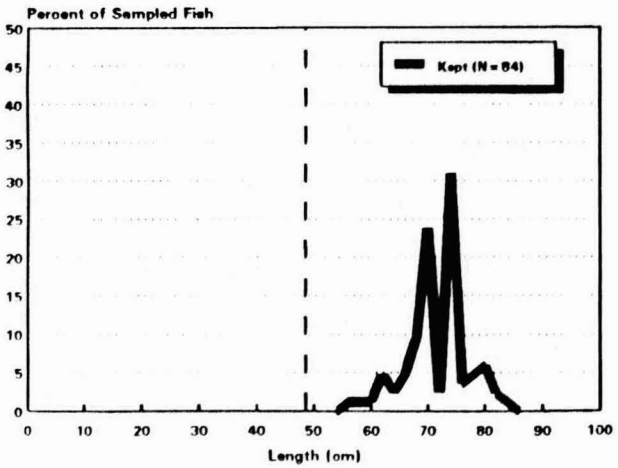


Figure 14. Distribution of yellowtail catches in Area II in July. Data are from observed tows.

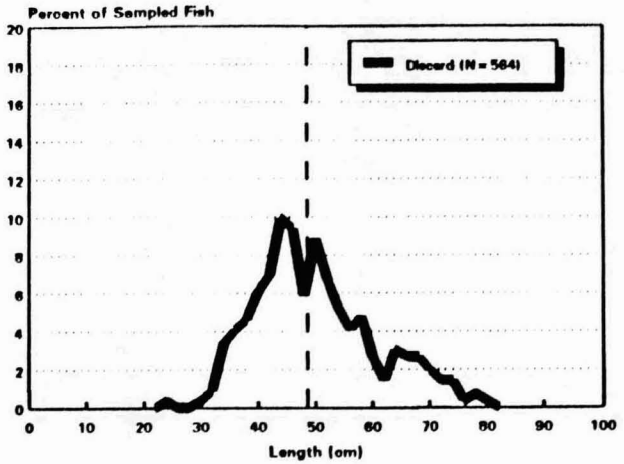
HADDOCK

AREA II





OUTSIDE AREA II



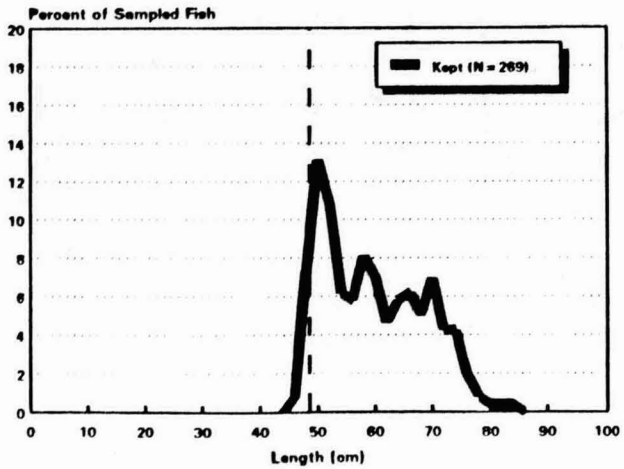
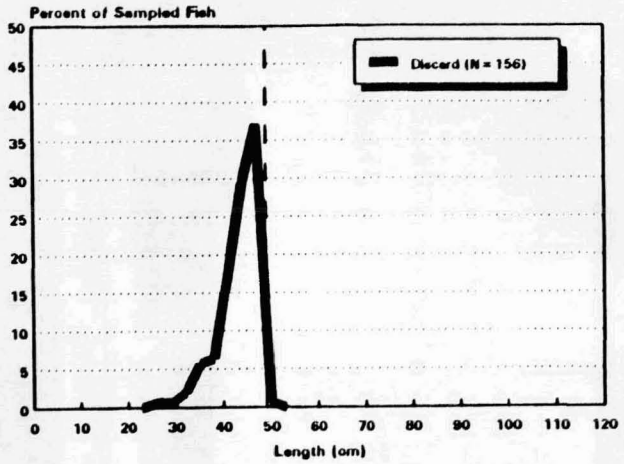
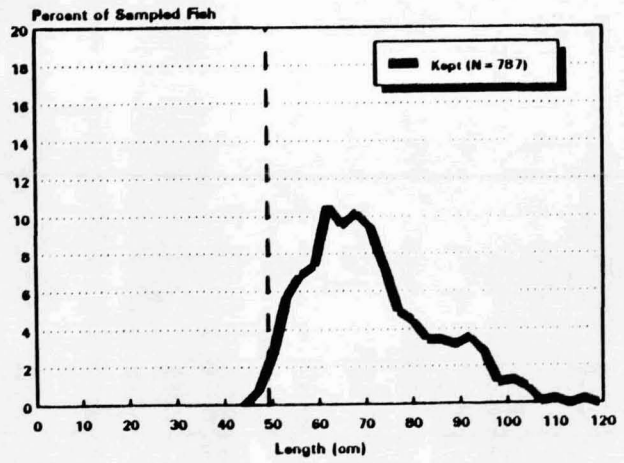


Figure 15. Size frequency distributions of haddock samples (discards and kept) in the 1994 Experimental Fishery (January-June). Data are from observed tows and are provided separately for samples taken inside and outside of Area II. The dotted line represents the minimum legal size for haddock of 48 cm.

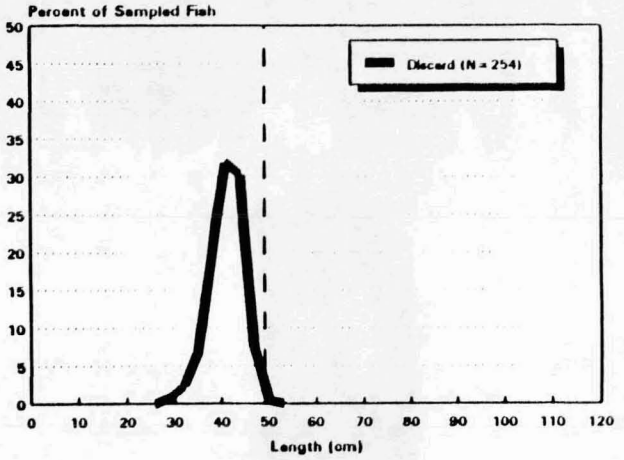
COD

AREA II





OUTSIDE AREA II



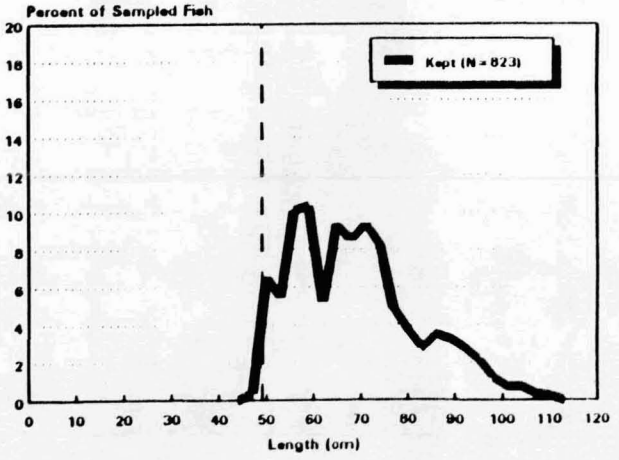
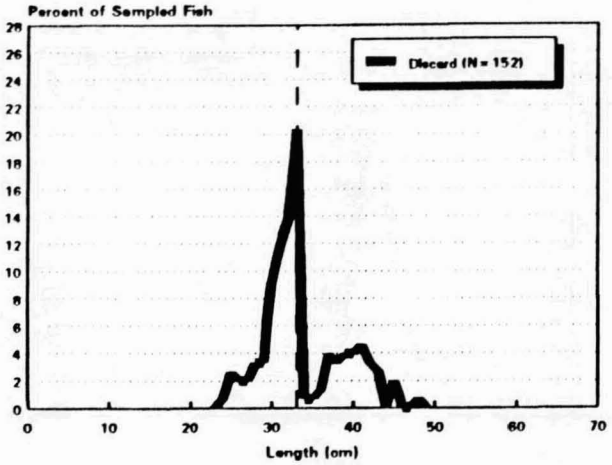
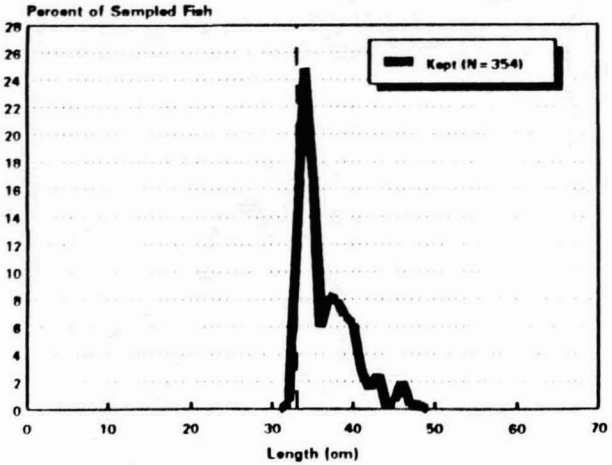


Figure 16. Size frequency distributions of cod samples (discards and kept) in the 1994 Experimental Fishery (January-June). Data are from observed tows and are provided separately for samples taken inside and outside of Area II. The dotted line represents the minimum legal size for cod of 48 cm.

YELLOWTAIL FLOUNDER

AREA II





OUTSIDE AREA II

Sampled only 2 discarded fish

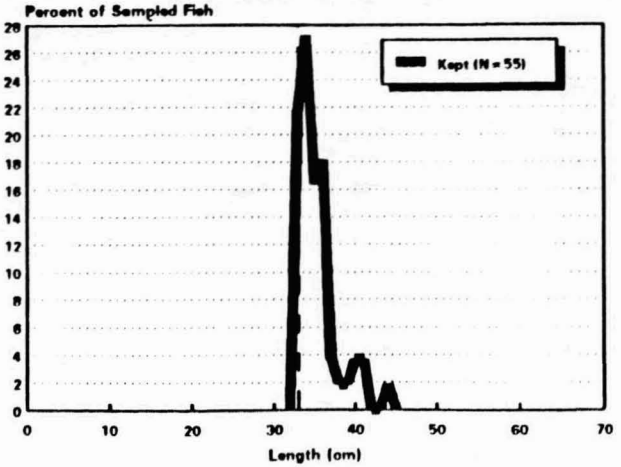
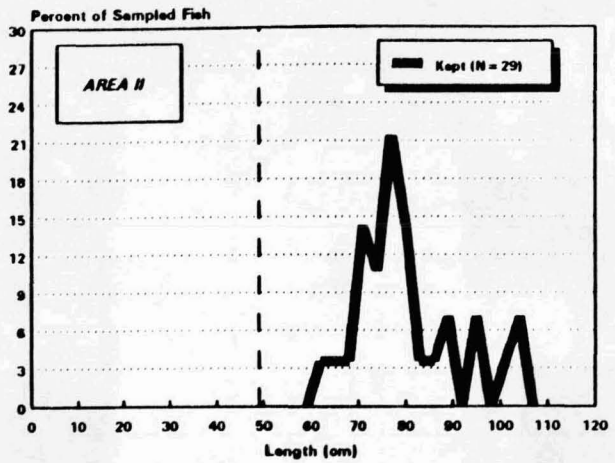
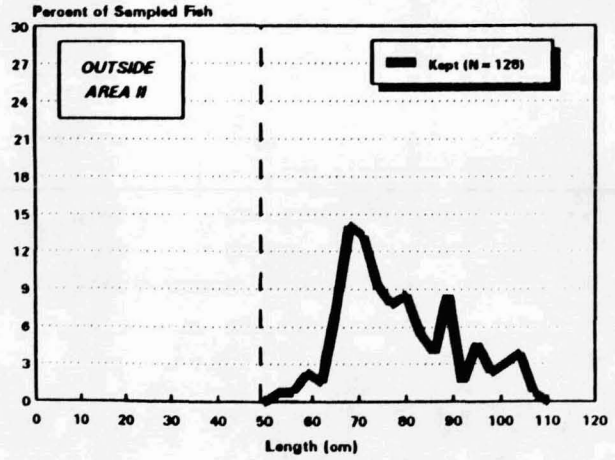


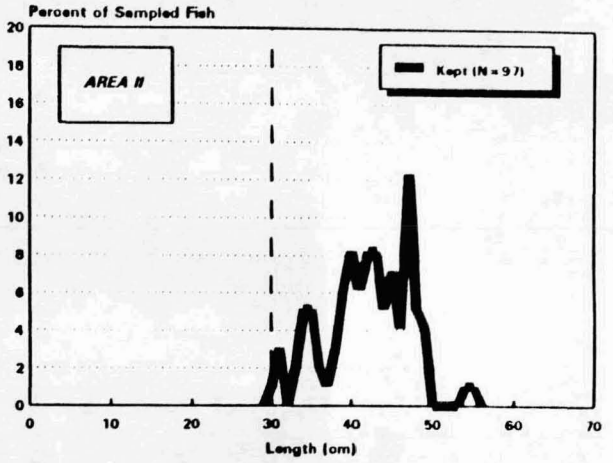
Figure 17. Size frequency distributions of yellowtail flounder samples (discards and kept) in the 1994 Experimental Fishery (January-June). Data are from observed tows and are provided separately for samples taken inside and outside of Area II. The dotted line represents the minimum legal size for yellowtail flounder of 33 cm.

POLLOCK





WINTER FLOUNDER



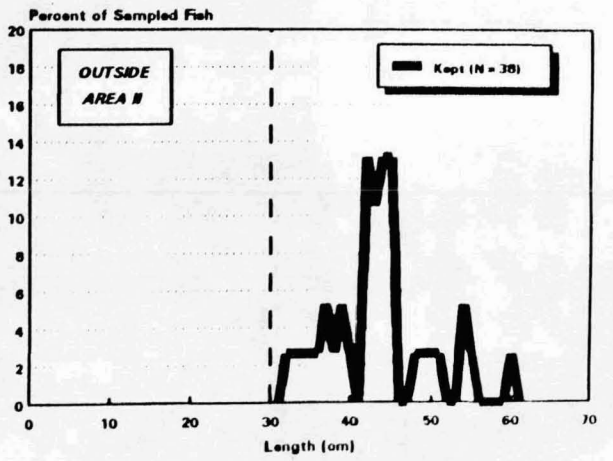
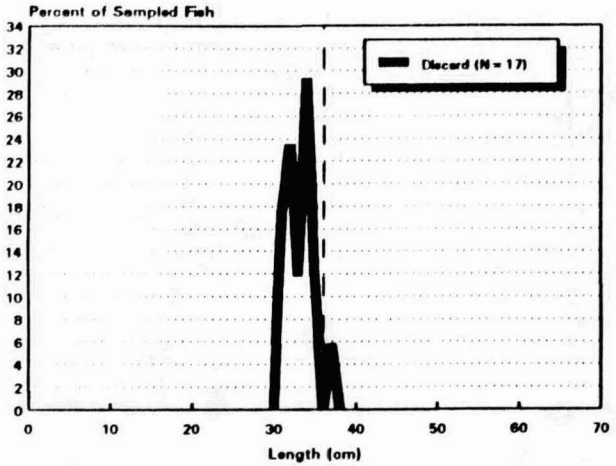
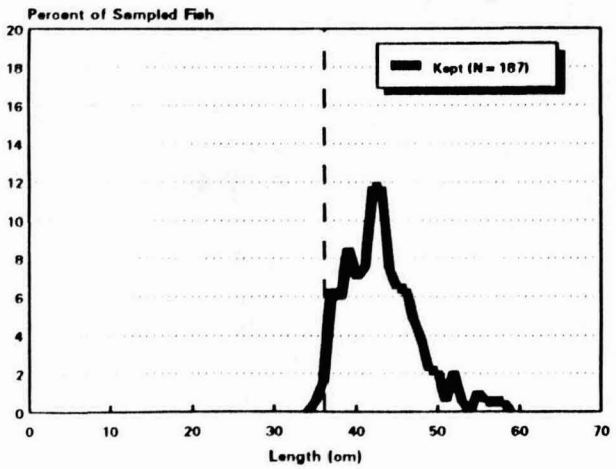


Figure 18. Size frequency distributions of pollock and winter flounder samples (kept) in the 1994 Experimental Fishery (January-June). Data are from observed tows and are provided separately for samples taken inside and outside of Area II. The dotted lines represent the minimum legal size for pollock of 48 cm and for winter flounder of 30 cm.

WITCH FLOUNDER

AREA II





OUTSIDE AREA II

Sampled only 1 discarded fish

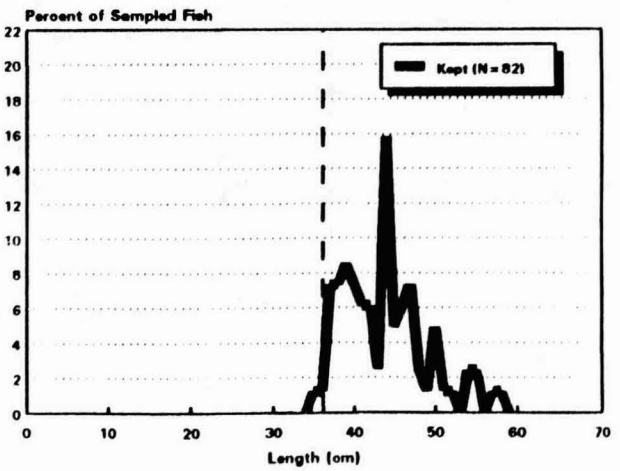
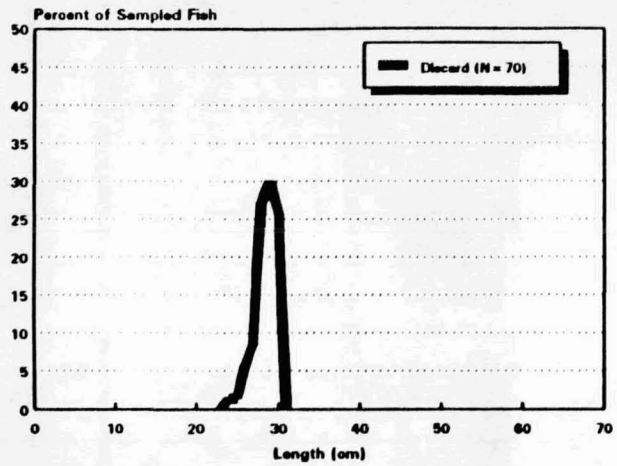
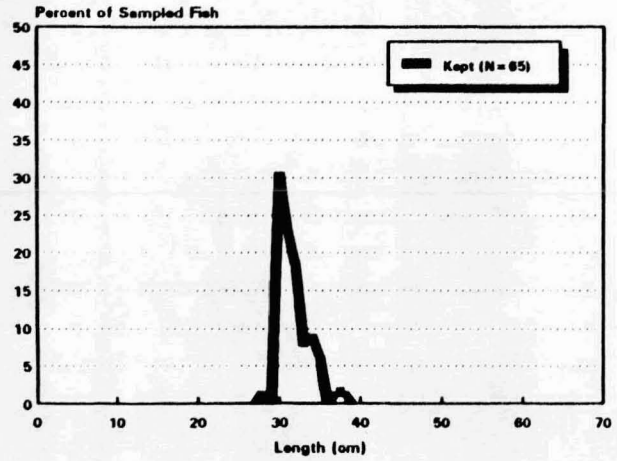


Figure 19. Size frequency distributions of witch flounder samples (discards and kept) in the 1994 Experimental Fishery (January-June). Data are from observed tows and are provided separately for samples taken inside and outside of Area II. The dotted line represents the minimum legal size for witch flounder of 36 cm.

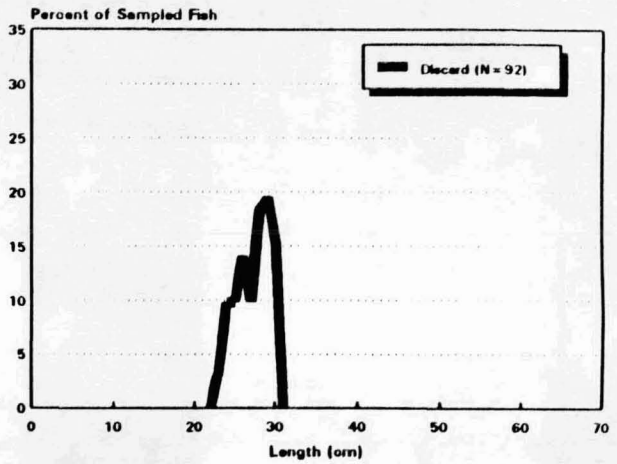
WINDOWPANE FLOUNDER

AREA II





OUTSIDE AREA II



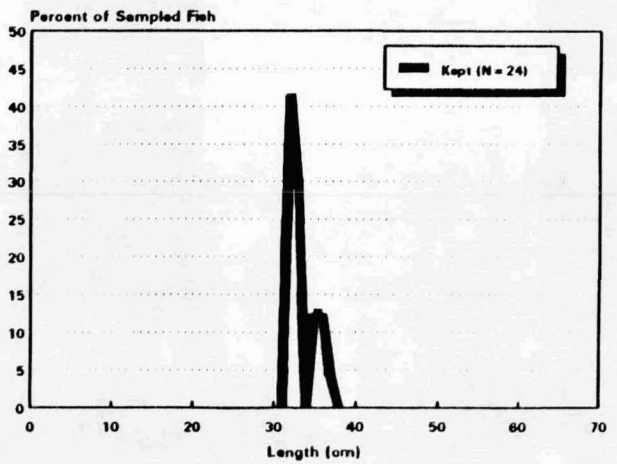
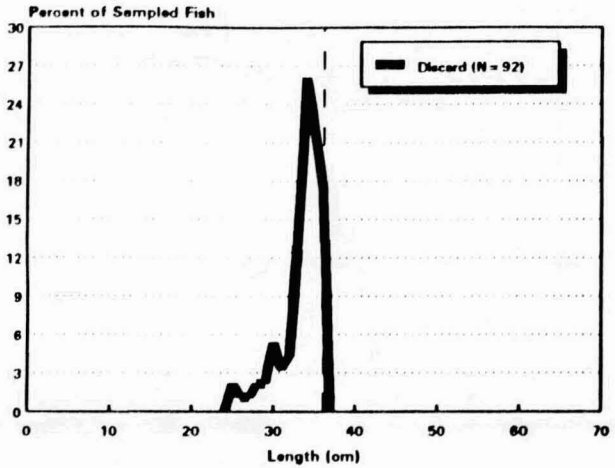
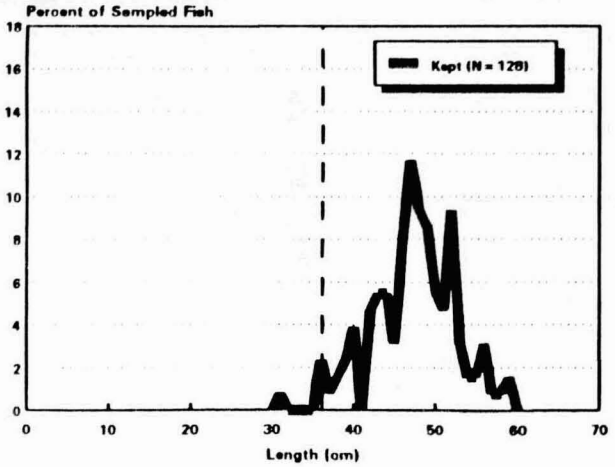


Figure 20. Size frequency distributions of windowpane flounder samples (discards and kept) in the 1994 Experimental Fishery (January-June). Data are from observed tows and are provided separately for samples taken inside and outside of Area II.

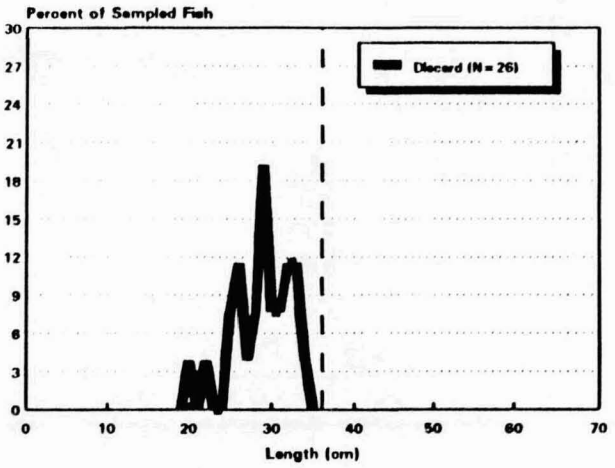
AMERICAN PLAICE

AREA II





OUTSIDE AREA II



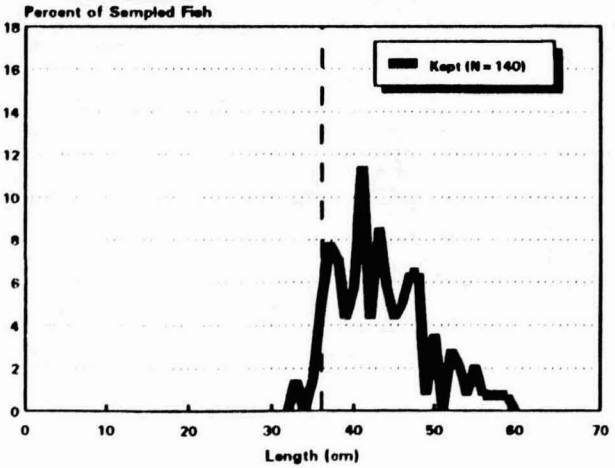
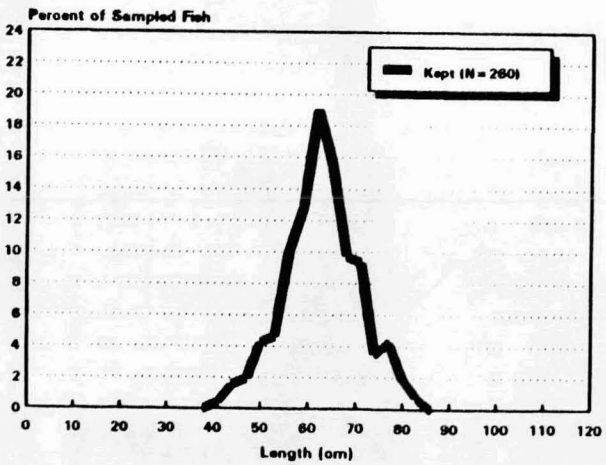


Figure 21. Size frequency distributions of American plaice samples (discards and kept) in the 1994 Experimental Fishery (January-June). Data are from observed tows and are provided separately for samples taken inside and outside of Area II. The dotted line represents the minimum legal size for American plaice of 36 cm.

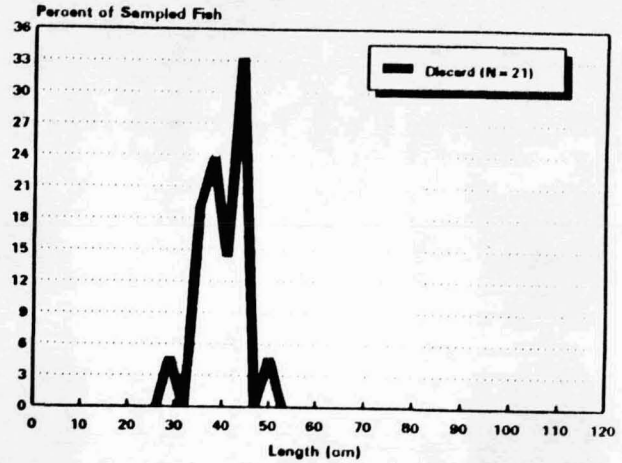
WHITE HAKE

AREA II

Sampled only 2 discarded fish



OUTSIDE AREA II



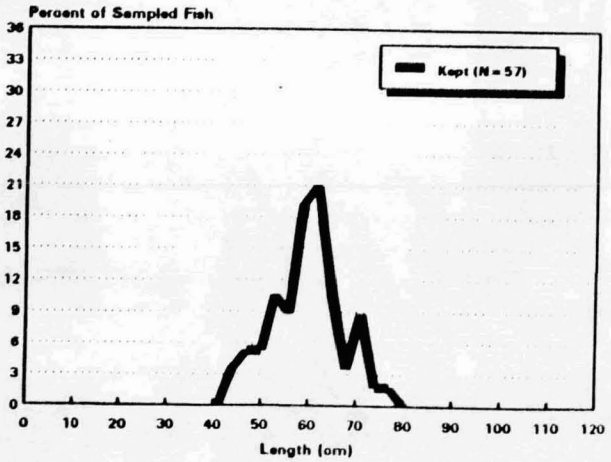
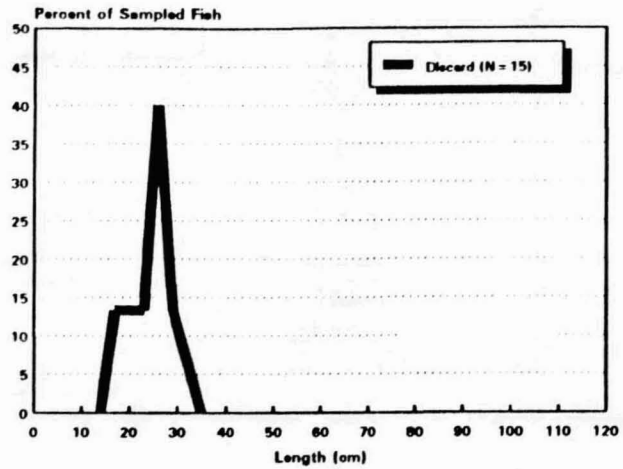
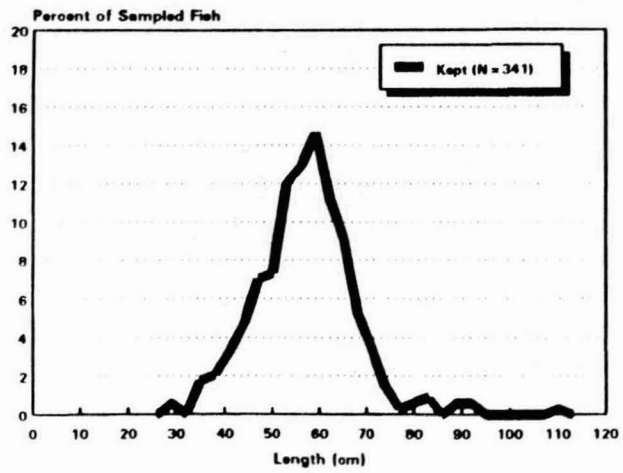


Figure 22. Size frequency distributions of white hake samples (discards and kept) in the 1994 Experimental Fishery (January-June). Data are from observed tows and are provided separately for samples taken inside and outside of Area II.

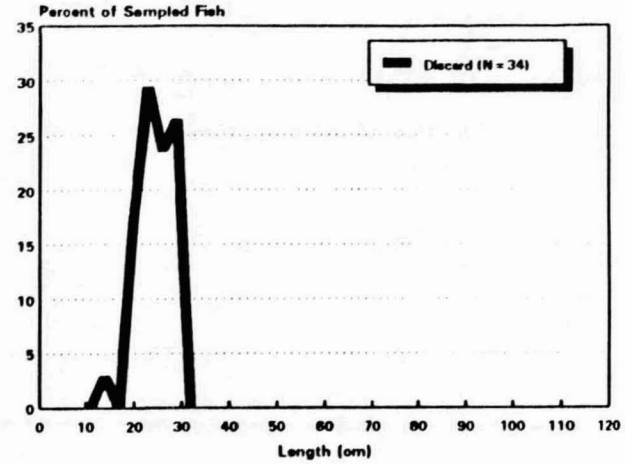
MONKFISH

AREA II





OUTSIDE AREA II



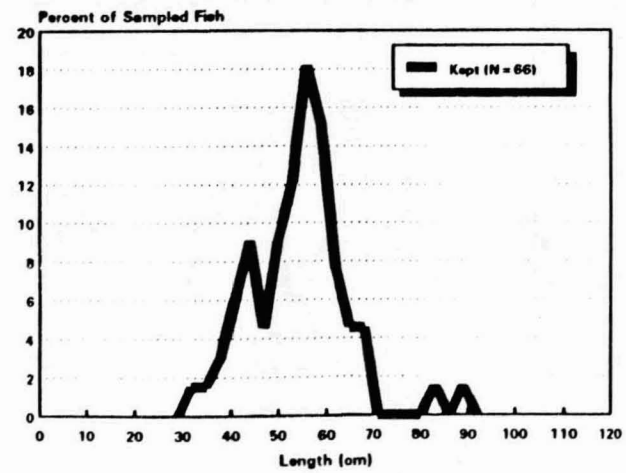


Figure 23. Size frequency distributions of monkfish samples (discards and kept) in the 1994 Experimental Fishery (January-June). Data are from observed tows and are provided separately for samples taken inside and outside of Area II.

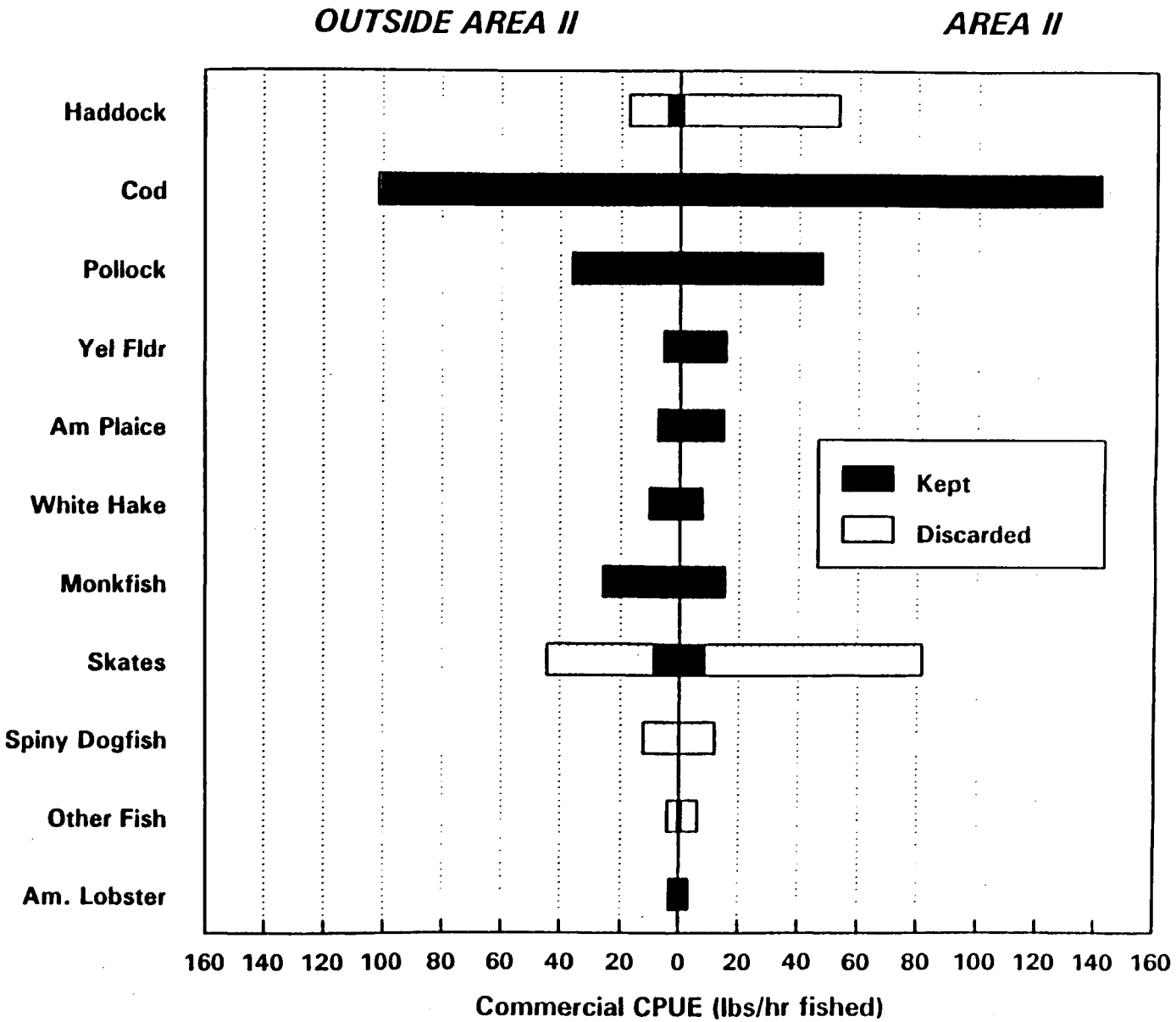


Figure 24. Catch per unit of effort (lbs/hr fished) of retained catches and discards for 11 different species taken in the 1994 Experimental Fishery (January-June). Data are from observed tows and are presently separately for Area II and outside of Area II.

Appendix Table 1. Scientific names of species caught in the 1994 Experimental Fishery.

Haddock	*Melanogrammus aeglefinus*
Cod	*Gadus morhua*
Pollock	*Pollachius virens*
Yellowtail Flounder	*Pleuronectes ferrugineus*
Winter Flounder	*Pseudopleuronectes americanus*
Witch Flounder	*Glyptocephalus cynoglossus*
Windowpane Flounder	*Scopthalmus aquosus*
American Plaice	*Hippoglossoides platessoides*
Redfish	*Sebastes fasciatus*
White Hake	*Urophycis tenuis*
Red Hake	*Urophycis chuss*
Silver Hake	*Merluccius bilinearis*
Ocean Pout	*Macrozoarces americanus*
Cusk	*Brosme brosme*
Wolffish	*Anarhichas lupus*
Monkfish	*Lophius americanus*
Skates	*Raja* spp.
Spiny Dogfish	*Squalus acanthias*
Other Fish	
Herring	*Clupea harengus*
Mackerel	*Scomber scombrus*
Shad	*Alosa sapidissima*
Alewife	*Alosa pseudoharengus*
Menhaden	*Brevoortia tyrannus*
Butterfish	*Peprilus triacanthus*
Scup	*Stenotomus chrysops*
Bluefish	*Pomatomus saltatrix*
Sculpins	*Myoxcephalus* spp.
Sea Raven	*Hemitripterus americanus*
Fourspot Flounder	*Paralichthys oblongus*
Summer Flounder	*Paralichthys dentatus*
Halibut	*Hippoglossus hippoglossus*
Lumpfish	*Cyclopterus lumpus*
Cunner	*Tautogolabus adspersus*
Tilefish	*Lopholatilus chamaeleonticeps*
Wrymouth	*Cryptacanthodes maculatus*
Buckler Dory (John Dory)	*Zenopsis conchifera*
Lamprey	*Petromyzon marinus*
Marlin-spike	*Nezumia bairdi*
Conger Eel	*Conger oceanicus*
Torpedo Ray	*Torpedo nobiliana*
Shark	*Carcharhinus* spp.
American Lobster	*Homarus americanus*
Other Invertebrates	
Long-finned Squid	*Loligo pealei*
Short-finned Squid	*Illex illecebrosus*
Sea Scallop	*Placopecten magellanicus*
Surfclam	*Spisula solidissima*
Rock Crab	*Cancer irroratus*
Jonah Crab	*Cancer borealis*
Red Crab	*Geryon quinquedens*
Octopus	*Octopus bairdii*