Technical Report

Massachusetts Division of Marine Fisheries
Technical Report TR-3

Southern Gulf of Maine Raised Footrope Trawl 1997 Experimental Whiting Fishery

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Massachusetts Division of Marine Fisheries
Department of Fisheries, Wildlife and Environmental Law Enforcement
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Massachusetts Division of Marine Fisheries
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I. EXECUTIVE SUMMARY

The 1997 Southern Gulf of Maine Experimental Fishery using a "raised footrope trawl" for whiting, red hake, and dogfish was a continuation of Massachusetts Division of Marine Fisheries (DMF) ongoing initiative to restore trawl fisheries for these species by reducing by-catch of regulated groundfish species. DMF sought to re-open northern Cape Cod Bay as well as other areas in federal waters including portions of Massachusetts Bay (west of Stellwagen Bank), and areas east of Cape Cod (so-called "Nauset" area) to traditional small-mesh fisheries for large whiting and red hake. Thirty-one vessels participated in the fishery.

DMF gave priority to those vessels with recent participation in whiting, red hake, or dogfish experimental fisheries and to those in the NMFS separator trawl experimental fishery during 1995-1997. A total of 651 trips were conducted in this fishery by the 31 participating vessels. Landings for this fishery totaled 2,333,135 lbs. of all species combined valued at $781,477. Whiting dominated landings at 1,793,448 lbs. and red hake was second at 450,964 lbs. These two species comprised 97% of the overall landings and 90% of the fishery's value. Fifty-one sea sampling trips were completed, representing 7.8% of all reported trips. The raised footrope trawl effectively mitigated flatfish by-catch. However, certain roundfish species (cod, white hake, and redfish) catches caused the 5% by-catch allowance to be exceeded in certain areas. Recommendations are made to create an exempted fishery in northern Cape Cod Bay and lower Massachusetts Bay and east of Cape Cod. However NMFS should continue experimental ("trial") fisheries in some other areas.

II. BACKGROUND

Since 1995, trawlers targeting whiting, red hake, and dogfish have been severely restricted by federal regulations designed to protect juvenile groundfish species in the Gulf of Maine. No direct controls (e.g. limits on effort or catch) have been placed on vessels targeting whiting, red hake, and dogfish. Instead, areas have been closed to small-mesh trawling where by-catch of the 10 regulated groundfish species exceeded 5% of the overall catch. (See federal regulations 50 CFR Part 648, Subpart F 648.80.)

The 1997 Southern Gulf of Maine Experimental Fishery using a "raised footrope trawl" for whiting, red hake and dogfish was a continuation of DMF's ongoing initiative to restore trawl fisheries for these species by reducing by-catch of regulated groundfish. This program began in 1989 when DMF began sea trials of an experimental trawl design to separate whiting and hakes from the regulated flatfish by-catch. Work progressed intermittently during 1990-1994.

In 1995, small-mesh trawling in Cape Cod Bay and most other areas in the southern Gulf of Maine was prohibited by federal regulation due to documented high by-catch levels of regulated species; most trips exceeded the 5% federal allowance standard. Despite Cape Cod Bay being state waters, most trawlers held federal permits so the federal prohibition on small-mesh trawling in Cape Cod Bay meant Massachusetts fishermen seeking to fish with small-mesh trawls in Cape Cod Bay needed federal exemptions or experimental fishery permits to operate.

Limited small-mesh trawling in areas closed to small-mesh for whiting and red hake was allowed through a federal experimental fishery using a separator grate from 1995 through 1997; however this program was unpopular among most Massachusetts trawlermen. The trawl design was similar to a shrimp trawl rigged with the "Nordmore Grate", a "finfish excluder device." The whiting trawl's grate consisted of parallel bars spaced 40 mm apart and prevented any fish or objects larger that 40 mm wide from being retained in the net. This configuration prevented retention of fish and invertebrates larger than 40 mm in width - including marketable-sized red hake and dogfish. The only marketable catch retained was small and medium-sized whiting, most under 12" in length. Most fish larger than 12" including "large" and "king"-sized whiting were excluded from the net.

In contrast DMF's "raised footrope trawl" is designed to fish about 1-2 ft. above the bottom and

retains larger sizes of whiting, red hake and dogfish. This design capitalizes on fishes' variable habitat preferences as well as swimming behaviors among target and non-target species; the net would retain those fishes that swim above the substrate, while passing over those that reside closer to it. The trawl's most innovative feature is a chain sweep longer than the footrope that contacts the bottom after the footrope has passed by. Slow-swimming demersal fishes (and most invertebrates), if disturbed by the sweep are not able to enter the mouth of the net since it already passed over them.

DMF has considered the raised footrope trawl as a by-catch solution for the Massachusetts whiting and hake fishery in Cape Cod Bay and lower Massachusetts Bay with its by-catch of juvenile flatfish: American plaice, yellowtail flounder, and winter flounder. DMF's sea sampling during 1992-1996 showed standard whiting trawls with heavy groundgear nearly always caught substantial amounts of juvenile flatfish and nearly all tows exceeded the 5% standard. Discard mortality of juvenile flounder and new-shelled lobsters (common during fall) was presumed to be substantial.

In late 1995 and the summer of 1996, DMF conducted a single-vessel federally-permitted experimental fishery with a "raised footrope trawl" and enlisted the F/V Charlotte G., a Provincetown trawler (McKiernan et al 1996). DMF supplied 100% observer coverage to document all trips. After considerable refinement, consistent catches below 5% were achieved.

In October 1996, NMFS granted DMF's request to open the fishery to 14 other local trawlers that had participated in Cape Cod Bay whiting fisheries. That fishery has been described in past reports to NMFS (McKiernan and Carr 1997). Sea sampling over 20 trips showed whiting, red hake, and dogfish at about 90% of the retained catch. About 28% of the overall catch was discarded; this contrasted with past years' sampling (when "normal" whiting nets were deployed) with 60-70% discarded. Catches of juvenile flounders dropped in 1996 to minimal levels and the fishery met the 5% standard - 19 of 20 sampled trips were below 5% regulated species by-catch. The early November departure of whiting and red hake from the small, approved fishing area prevented DMF from collecting further results, since the vessels were not permitted outside of the requested area in northern Cape Cod Bay/Massachusetts Bay. This abbreviated 4-week fishery landed an impressive 581,000 lbs. of whiting valued at $270,000.

During May and June of 1997, DMF continued this work with a small-scale experiment among six vessels. Vessels made paired tows where catches from a traditional whiting trawl and a raised footrope trawl were compared. With observers aboard each trip, three Gloucester vessels targeted whiting off Cape Ann and 3 Provincetown vessels targeted dogfish in waters adjacent to Cape Cod. Off Cape Ann, the results were dramatic: traditional whiting nets' regulated flatfish species catch averaged 171 lbs./hr but was lowered to 29 lbs./hr with the raised footrope trawl, a reduction of 83 %. However, even with the low by-catch, low whiting catches caused most tows to exceed the 5% allowance standard. Off Provincetown, the by-catch reduction results were similar with an 89% reduction in regulated flatfish (66.2 lbs./hr. to 7.1 lbs./hr) attributable to use of the raised footrope trawl (Carr and Milliken, 1998).

III. DESIGN AND CONDUCT OF THE EXPERIMENTAL FISHERY

This fall 1997 program was the largest undertaking to-date and was designed to increase the scope of the previous year's fisheries by broadening times and areas to federal waters adjacent to Massachusetts. DMF sought to re-open northern Cape Cod Bay, portions of Massachusetts Bay (west of Stellwagen Bank), and areas east of Cape Cod (so-called "Nauset" area) to traditional small-mesh fisheries for large whiting and red hake. Some of these areas had been requested for opening by industry in the past, but those requests were denied by NMFS after analyses showed by-catch of regulated species had - or was likely to - exceed 5% with an un-modified otter trawl (NMFS, 1995). Under existing policies, any amount of regulated species must be "covered" by non-regulated species at ratio of at least 19:1 - another way of viewing the 5% by-catch rule.

This experimental fishery was not a true "experiment." It was a "trial" fishery because there was no "control" for comparison. The "experiment" was originally accomplished in 1991 when DMF with New England Fishery Management Council funding performed a set of gear trials with a trouser-trawl fitted with a moveable panel in the net mouth, and determined that at a height of 1-2 feet "off-bottom", optimal trawl catches would result with most whiting retained and flatfish reduced by up to 95% (Carr and Caruso, 1993).

Further comparisons of net designs were accomplished during the limited research aboard the Charlotte G in 1995-1996, and among 6 contracted vessels (3 from Gloucester and 3 from Provincetown) during spring 1997. During these experiments, raised footrope trawls were compared to traditional whiting net. Consequently, this was simply a "trial" fishery - with fishermen attempting to prove the viability of a fishery in time, space, and gear design to target non-regulated groundfish, towing a single gear type: a raised footrope trawl.

(A) Industry Input

DMF met with prospective fishermen in Gloucester and Provincetown in early July 1997 to discuss developments in the experimental fishery. These fishermen were optimistic that the raised footrope trawl could solve by-catch problems, and they hoped to re-open certain areas during times when whiting and red hake catches historically have been productive.

DMF identified two key elements needed for success of the fishery: 1) educating fishermen about the gear's design and its proper use; and 2) promoting compliance through strict by-catch restrictions and strong penalties for non-compliance. Also, fishermen and dealers noted a market incentive for fishing the net as designed: soft-bodied whiting and hake are less likely to be damaged - and will fetch a higher price - when the catch is free of crabs, sculpins, lobster, and other hard-bodied or spiny organisms.

DMF solicited fishermen's opinions about the proposed conduct of the fishery, such as appropriate areas, trawl design specifications, by-catch limits, and other issues. At both meetings fishermen were satisfied with the permit conditions as established in 1995 and 1996. At the Provincetown meeting, fishermen voiced strong support for trip limits of target species (whiting and red hake). However, support wasn't universal among the three ports, so trip limits were not proposed as a permit condition.

In July, DMF formally petitioned NMFS to allow DMF to continue and expand the experimental fishery in 1997 with most of the previous year's permit conditions intact. (See 7/7/97 letter from Director Philip Coates to Dr. Andrew Rosenberg in Appendix B). The program's goals were:

1) Continue research on optimal gear configurations to reduce by-catch and allow "clean" fisheries that are allowable under the 5% rule where by-catch of regulated species totals less than 5% of the overall weight of the catch on a consistent basis.

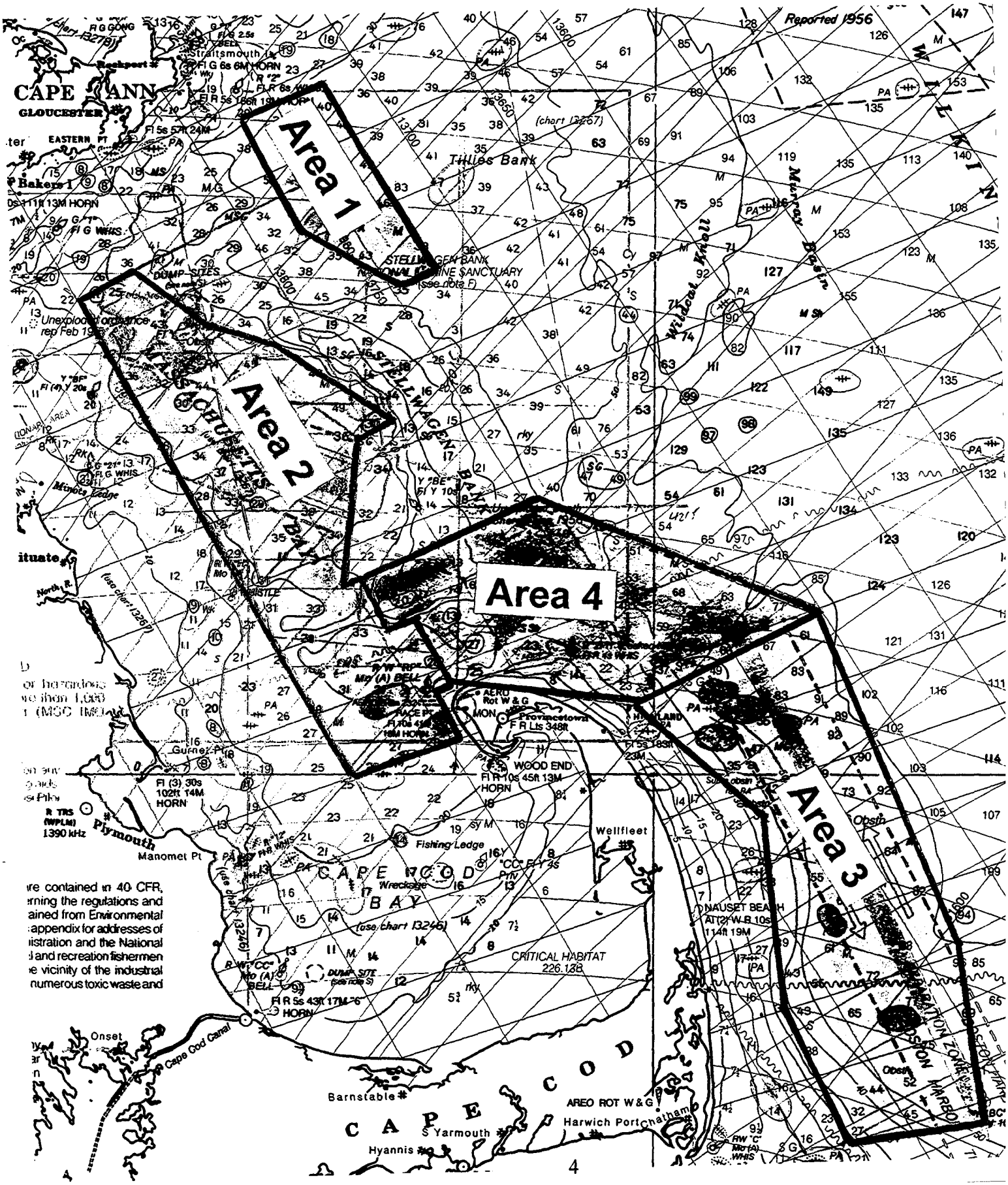
2) Identification - and verification through sea sampling and catch reports - of areas and times where viable fisheries for target species (whiting, red hake, dogfish) can be conducted.

Based on industry input, DMF's request to NMFS included four discrete fishing areas for the experimental fishery. (See Figure 1.) For most areas, fishermen requested the fishery be opened from July 1-December 31, except area 4 (southern Stellwagen Bank) would be opened on October 20 because fishermen did not expect whiting to be abundant on southern Stellwagen until mid-October.

(B) Vessel Participation and Eligibility Criteria.

DMF expected a high level of interest in the experimental fishery. More fishermen requested permits than could be monitored adequately. Interest was especially keen among those fishermen whose vessels are constrained by the federal groundfish Days-at-Sea program. When fishing in an "exempted" or "experimental" fishery, fishermen are not required to use any of their "groundfish days" and retention of regulated groundfish by-catch is prohibited.

Figure 1. Areas requested by industry for the 1997 Raised Footrope Trawl Experimental Fishery.



DMF requested guidance from NMFS about vessel eligibility and recommended common policies since requested areas were predominately in federal waters. However, NMFS responded that since this was a DMF-conducted experimental fishery, it would not be "appropriate for NMFS to be responsible for the identification of participating vessels." (See 8/29/97 letter from A. Rosenberg to Director Coates in Appendix B). NMFS re-iterated its long-standing policy to deny experimental fishery permits to vessels with outstanding violations, and NMFS officials approved the fishery for up to 40 vessels. Recognizing the limited sea sampling capabilities of DMF's small observer program, DMF requested permits for just 31 vessels.

DMF selected vessels based on their fishing history, and asked those fishermen who applied to DMF to list their vessels' whiting fishing history. DMF gave priority to those vessels with recent participation in whiting, red hake, or dogfish experimental fisheries or those in the NMFS separator trawl experimental fishery during 1995-1997. (See Appendix C for DMF's Notice to Fishermen and application to determine eligibility for participation in the experimental fishery.)

DMF re-enlisted 18 participants from past raised footrope trawl experimental fisheries: 15 vessels from Provincetown from the fall 1996 Cape Cod Bay whiting fishery and/or the limited spring 1997 fishery, and 3 vessels from Gloucester that participated in the limited spring 1997 fishery. The remaining 15 vessels were new participants to DMF's experimental fisheries from Gloucester (10), Chatham (3), and Provincetown (2). The list of participants is included in Table 1.

Table 1. The 33 vessels issued permits to participate in the fishery

Provincetown-based	Gloucester-based	Chatham-based
Alyssa & Zachary	Capt. Joe	Coming Home
Ancora Praia	Cathy C.	Honi-Do III
Antonio Jorge	Gloucesterman	Joanne A III
Blue Skies	Maryanne	
Carla Bee	Midnight Sun	
Charlotte G	Morning Star	
Chico & Jess	Padre Pio	
Joan & Tom	Razzo	
Kid-N-Me	Rose Marie	
Little Infant	Sailor's Choice*	
Little Natalia	Spray*	
North Star	St. Mary	
Pat Sea	Vincie N.	
Richard & Arnold		
Rock N Rollen		
Second Effort		
Silver Mink		

*never participated.

Twenty-one additional applicants applied to DMF but could not be accommodated. (These vessels are listed in Appendix C.) DMF received calls from other fishermen, but they opted not to apply after being told about the application process and DMF's desire to accommodate vessels with significant whiting fishing histories.

Some fishermen expressed concern to DMF that a bias toward smaller vessels was created by favoring past participants in state waters fisheries since state rules favor smaller trawlers. Only certain vessels

with overall length 72 feet or less have been eligible to fish in state waters since 1994. In the past few years, many vessels were not eligible for the annual Cape Cod Bay experimental fisheries since they did not have permits to trawl in state waters.

After approving DMF's list of applicants, NMFS sent vessels' federal experimental fishery authorizations to DMF. DMF then met with the captain or vessel owner to discuss permit conditions and to inspect the vessel's trawl for compliance with state specifications. After net inspections, those vessels and captains that participated in past DMF raised footrope trawl experimental fisheries were given their state and federal experimental permits. Vessels without prior experience using the experimental net were required to "earn" the permits by demonstrating proficiency with the design by taking a DMF observer and showing by-catch levels less than 5% of the overall catch.

DMF expected the fishery to be fully active beginning in early September, but progress was delayed. First, federal permit approvals were delayed; most vessels did not receive their permits or net inspections until mid-September. By August 27, NMFS officials had approved the fishery for just 20 vessels, but then decided in early September to allow up to 40 vessels. This delay in the decision to increase the fishery's scale was compounded by requisite investigations by NMFS officials regarding each vessel's enforcement history. On September 4, DMF submitted to NMFS a list of 23 vessels, and followed up with a requests for an additional 10 vessels by early October.

(C) Permit Conditions While fishing in the experimental fishery each captain or vessel owner agreed to the following permit conditions:

1. Fishing times and areas. The vessel could fish only at approved times and specific areas. However, the vessel was not obliged to remain in the experimental fishery for the entire season. If the captain opted to leave the experimental fishery and target regulated groundfish species, the small-mesh net had to be removed from the vessel, and federal groundfish rules applied (e.g. vessel would call-in to NMFS to report its activities).

2) Net configuration. The configuration of the net had to be maintained after inspection and permits issued. Any net changes would only be allowed after approval by DMF. Before state and federal permits, DMF inspected each vessel's trawl. Captain Henry Souza acting as DMF consultant assisted inspections. The mandated trawl design was similar to that refined by Captain Souza during the extensive sea trials in 1995 and 1996. Even if the vessel participated in the 1996 Cape Cod Bay fishery, DMF required the captain to display his net at the dock for inspection.

The following features were checked for compliance:

- Groundgear Construction:
  - Top and bottom legs of equal length;
  - Top legs of bare wire no larger than ½" diameter;
  - Bottom legs of bare wire no larger than 5/8" diameter;.
  - Ground cables of bare wire no larger than 3/4" diameter;
  - Ground cable length plus leg length not to exceed 40 fathoms measured from trawl door to net.
- Footrope:
  - Footrope length 20 feet longer than headrope length
- Chain Sweep:
  - Entire chain sweep comprised of only 5/16" chain;
  - chain sweep length to exceed footrope sweep length by at least 7 feet (3' 6" each side);
- "Dropper Chains":
  - Dropper connect the footrope to the chain sweep and are hung vertically;
  - Dropper chains at least 3' 6" (42") in length, and of 5/16" chain;
  - Spacing between dropper chain attachments on footrope identical to attachments on chain sweep;
  - Chains hung vertically, not at an angle;
  - One drop chain hung from center of the footrope to center of sweep;
  - Other dropper chains are hung at 8 foot intervals from net's center toward wing ends. (Spacing of the terminal dropper chains at wing ends may be less than 8' to accommodate variation in nets, but the chain

sweep must be at least 3'6" longer than footrope);

- Headrope floats:
  Headrope rigged with a minimum of 15 floats; float placement was not regulated.
- Minimum cod-end mesh size:
  Minimum cod-end mesh size of 2 ½"was added, as a condition of the DMF permit, after the fishery was opened. DMF re-considered the lack of a minimum cod-end mesh size in the original net specifications after fishermen complained about the use of liners used by some fishermen to retain more "small" whiting during late September. **DMF decided to mandate a minimum cod-end mesh size of 2 ½" as of October 1, 1997.** Replacement permits were issued to all participants to reflect this change.

3) Landings data collection: Catches were required to be logged by the Captain in the vessel's federal logbook. Captains were then required to forward "State Copies" (blue pages) of their trips from the logbooks to DMF on the same schedule required by NMFS.
4) By-catch restrictions: Possession or retention of all ten regulated groundfish species multispecies was prohibited. These are Atlantic cod, haddock, pollack, redfish, white hake, yellowtail flounder, winter flounder, windowpane flounder, American plaice and witch flounder. Also, other species unlikely to be caught when the net is fishing properly were prohibited to promote compliance with the net's purpose. These additional prohibited species were American lobster, crabs, monkfish, longhorn sculpin, sea raven, skates, fluke (summer flounder), and ocean pout. Some of these species have little or no market value but the restriction reinforced the concern that the net be used as designed.
5) Mandatory observer coverage: DMF observers must be accommodated upon request.

(D) At-Sea Data Collection Methods (Sea Sampling)

All sea sampling trips were performed by DMF's sea sampling program (Fisheries Dependent Investigations) or DMF's Conservation Engineering Program. Sea sampling was conducted on each "new" vessel on its initial trip with the net, and among experienced vessels the trips were conducted as randomly as possible. The sampler usually met the vessel's captain unannounced at the dock early in the morning and boarded the vessel to conduct sampling throughout the day-long trip.

Samplers recorded tow location, tow time, catches, discards, and gear characteristics. Sampling protocols were similar to those of the Northeast Fisheries Science Center Observer Program, as specified in the 1996 NMFS Observer Program Manual. Observers attempted to sample all tows whenever possible to obtain accurate estimates of catch, especially weights of regulated species by-catch. Fish lengths were recorded for most commercially important species.

DMF planned for 74 sea sampling trips, sufficient to enlist up to 19 vessels experienced with the trawl and another 12 vessels new to the experimental fishery.

Experienced vessels (19) X 2 trips/vessel = 38 trips
New participants (12) X 3 trips/vessels = 36 trips

At a minimum, DMF planned to sample the four areas over four months (September - December) that the fishery was expected to be active. The plan was to attempt to cover all four areas with at least four trips per month, as long as the areas had sufficient fishing activity. This proposed schedule depended on vessels fishing the areas. If areas were not fished, sea days would be diverted to areas where the fishery was active.

(E) Data Analysis Methods

Sea sampling trip logs were forwarded to DMF's Pocasset Office for review and audited. Data were keypunched and incorporated into the NMFS Sea Sampling Database at the Northeast Fisheries Science Center. Data were accessed by DMF staff utilizing ORACLE and SAS software. Tows were assigned to one of the experimental fishing areas if all or most of the tow occurred in that area. Catch and discards were summarized for all trips and tows within each designated experimental fishing area.

By-catch percentage statistics are presented in a variety of ways because there is no standard method to calculate regulated species percentage rates. Three different calculations are presented for each statistical

area: 1) aggregate trips percentage rate where all regulated species catches are summed and divided by summed weight of all species combined; 2) mean trips' percentage rate; and 3) mean tows' percentage rate among individual tows that were considered "valid", where the net was not obstructed or fouled.

Landings data for all trips were monitored by DMF in-season through the vessel's federal Vessel Trip Reports that were sent to DMF. These data were not keypunched. Instead, during the months following the fishery, DMF Statistics Program staff anticipated when all trips would be entered, and queried the NMFS database. When available in the federal system, landings data were summarized after considerable editing to resolve data-entry errors. For example, DMF detected some trips with quantities of prohibited species key-punched as "kept", when the fishermens' trip logs had entered them as discards. Corrections were made to a DMF database for these analyses.

Where a valid location was listed in each Vessel Trip Report, trips were assigned to the most appropriate 10-minute square. For trips where whiting or red hake were retained, catches were summed and divided by total towing hours, yielding catch-per-unit-effort.

(F) Enforcement Efforts and Compliance Monitoring

DMF worked closely with the state's Division of Environmental Law Enforcement to ensure compliance with permit conditions. Prior to opening the fishery, DMF held a training session with officers to explain the program and net design. Officers inspected nets, and they boarded vessels at-sea and dockside to monitor compliance. In Gloucester, 20 boardings were conducted with no violations. In Provincetown, 40 boardings were conducted, and one vessel was issued a warning for a non-compliant net; another vessel's permit was revoked for a non-complying net (shortened sweep) mid-way through the season in late October.

DMF staff conducted a thorough inspection of other vessel's nets after this incident. Non-complying features were found on two nets, and DMF ordered fishermen make changes. Sanctions were not taken against these other vessels because DMF could not determine if changes were made after the initial inspection. A meeting was convened with participating fishermen from Provincetown to discuss compliance issues.

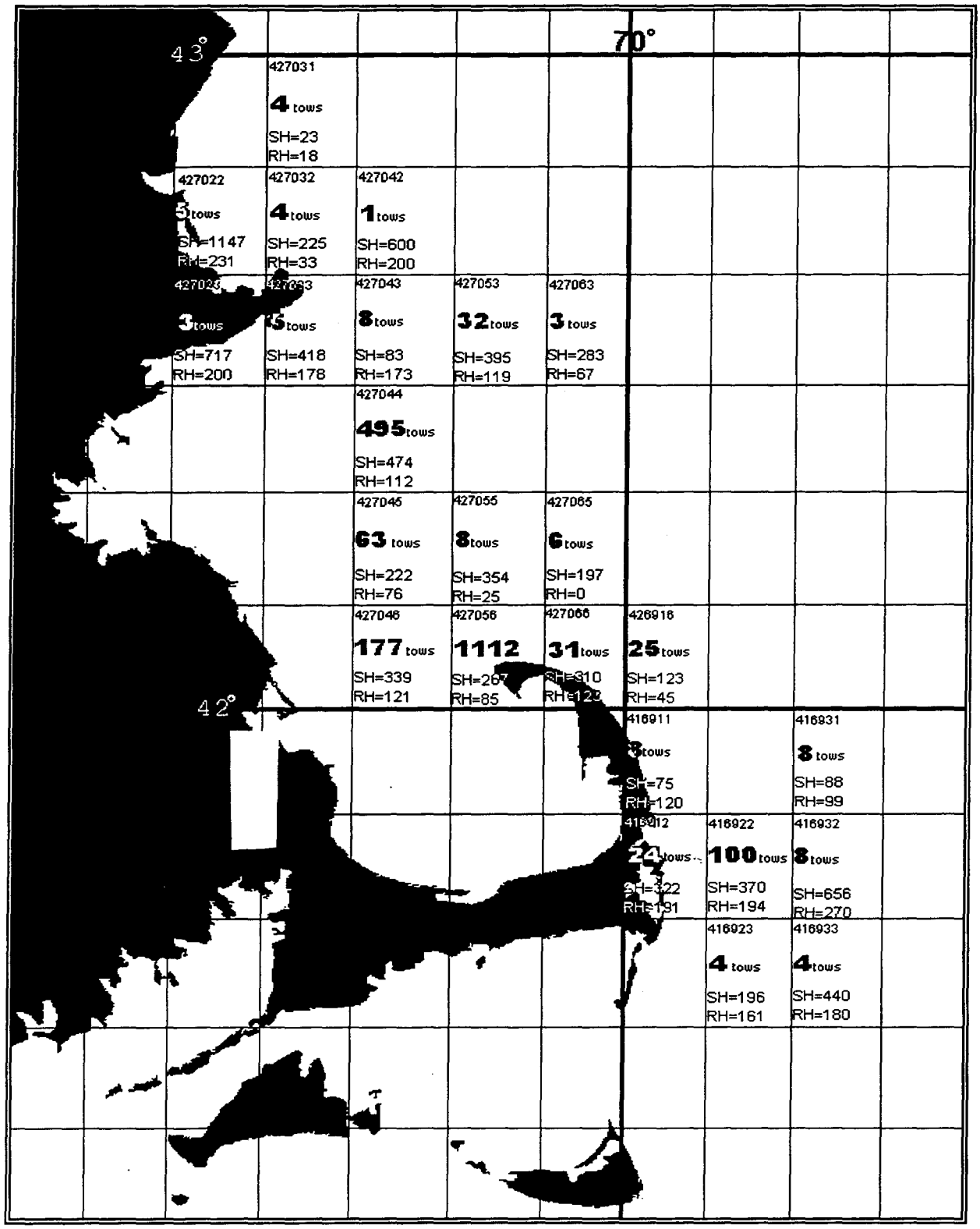
IV. FISHERY-WIDE TRIP RESULTS FROM LOGBOOKS

(A) Fishing Effort: the thirty one participating vessels reported a total of 651 trips were conducted in this fishery (Table 2). Despite industry's request to begin in July, DMF did not receive federal approval for most of the vessels until mid-September. Most vessels were active by late September, but fishing activity was lower than expected due to reported low whiting catches and low ex-vessel prices. Activity peaked in October with 61% of the overall trips. Effort waned during November due to reduced catches and deteriorating weather conditions. Most vessels later in November switched over to target groundfish with large-mesh nets. December saw very little effort (just 1% of the trips).

Table 2. Summary of trips conducted in the experimental fishery as reported through the federal Vessel Trip Reports

	Gloucester	Provincetown	Chatham	Totals
September	7	53	8	68 (10%)
October	149	226	23	398 (61%)
November	69	94	14	177 (27%)
December	7	1	0	8 (1%)
Totals	232 (36%)	374 (57%)	45 (7%)	651

Figure 2. Distribution of fishing effort by 10-minute square with calculated catch rates of retained whiting and red hake. Data from Vessel Trip Reports (logbooks).



Note: Each 10-minute square is identified in the upper left hand corner of each box.
Number of tows is listed in the middle of the box, and the CPUE for red hake and silver hake is in the lower left corner of each box.

Table 3.

Summary of landings by homeport for all reported trips in the experimental fishery.
Data obtained from federal Vessel Trip Report database.

	Port of Landing Gloucester		Provincetown		Chatham		Grand Total		Grand Total	
	Pounds	Value	Pounds	Value	Pounds	Value	Pounds	Percent	Value	Percent
Whiting	862,564	$350,694	860,393	$300,665	70,491	$35,990	**1,793,448**	76.9%	**$687,349**	88.0%
Red hake	170,502	$34,935	244,255	$39,740	36,207	$7,055	**450,964**	19.3%	**$81,730**	10.5%
Spiny Dogfish	2,750	$168	1,180	$166	36,498	$5,480	**40,428**	1.7%	**$5,814**	0.7%
Mackeral	4,284	$755	9,783	$2,727	93	$42	**14,160**	0.6%	**$3,524**	0.5%
Squid unspec.	2,345	$424	6,211	$934	158	$46	**8,714**	0.4%	**$1,404**	0.2%
Herring	7,300	$345	400	$20	0		**7,700**	0.3%	**$365**	0.0%
Butterfish	3,055	$150	3,463	$49	673	$9	**7,191**	0.3%	**$208**	0.0%
Squid, Loligo	1,115	$372	2,354	$619	250	$86	**3,719**	0.2%	**$1,077**	0.1%
Squid, Ilex	1,870	N/A	1,150	N/A	0		**3,020**	0.1%	**$0**	0.0%
Unid. Finfish	2,700	N/A	0		0		**2,700**	0.1%	**$0**	0.0%
Shad	0		880	N/A	0		**880**	0.0%	**$0**	0.0%
White Hake	60	N/A	67	N/A	21	N/A	**148**	0.0%	**$0**	0.0%
Scup	0		50	N/A	1	N/A	**51**	0.0%	**$0**	0.0%
Bluefish	0		0		10	$4	**10**	0.0%	**$4**	0.0%
John Dory	0		0		2	$2	**2**	0.0%	**$2**	0.0%
Grand Total	**1,058,545**	**$387,843**	**1,130,186**	**$344,920**	**144,404**	**$48,714**	**2,333,135**	100.0%	**$781,477**	100.0%
Trips	232		374		45		651			
Pounds/trip	4,563		3,022		3,209		3,584			

Landings value estimated by DMF Statistics Program staff using daily average port specific ex-vessel prices for each species.

Fishing effort was concentrated in fishing areas adjacent to homeports of Chatham and Provincetown, as well as along the western edge of Stellwagen Bank. Where possible, effort was attributed to appropriate 10-minute square locations (Figure 2).

(B) Landings and Ex-Vessel Value

Landing for this fishery were impressive: 2,333,135 lbs. of all species combined valued at $781, 469 (Table 3). Whiting dominated the landings at 1,793,448 lbs. (77% of total landings) and was valued at $687,349 (88% of the total value). Red hake ranked second with 450,964 lbs. (20% of landings) valued at $81,729 (10% of total). These two species comprised 97% of the overall landings and 90% of the fishery's value. Spiny dogfish comprised another 2% of the landings. Twelve other species comprised the remaining 2%.

Landings in Gloucester and Provincetown were similar with totals of 1.06 and 1.13 million lbs. respectively. However, fishing effort expended by Provincetown vessels (374 trips among 17 vessels) was 60% greater than effort of Gloucester vessels (232 trips among 11 vessels). Pounds landed per trip (calculated as total landings divided by number of trips) was 50% greater among Gloucester-based vessels (4,563 lbs./trips) than among the Provincetown vessels (3,022 lbs./trip). Pounds landed per trip for three Chatham vessels (3,209 lbs./hr) was similar to that seen for Provincetown vessels.

(C) Catch rates of retained whiting by 10-minute square

Among areas with concentrated fishing effort (with at least 10 tows or more) the highest whiting catch rate, 474 lbs./hr., was seen along the western edge of Stellwagen in square 427044 (Figure 2). This result reflects the elevated pounds-per trip rate seen above for Gloucester-based vessels. Gloucester vessels reported fishing primarily along the western edge of Stellwagen Bank. Catch rates were lower in the other heavily fished areas of upper Cape Cod Bay off Provincetown in squares #427046, #427045, and #427056, where whiting catch rates averaged 339, 222, and 267 lbs./hr respectively. Also east of Cape Cod off Chatham, whiting catch rates were intermediate (322 and 370 lbs./hr) in two ten-minute squares (#416912 and #416922) where most fishing was reported.

V. SEA SAMPLING RESULTS

(A) Trips Summary

In total, DMF observers accomplished 51 sea sampling trips in areas opened for the experimental fishery (Table 4), representing 7.8% of the total 651 trips. Nineteen of the 31 permitted vessels participated in previous DMF 1995-1997 experimental fisheries with the raised footrope trawl. The remaining 12 vessels had not previously participated in prior experimental fisheries so a DMF sampler was required on each first trip with the net. During these initial "qualifying" trips, the vessel's captain was required to demonstrate proficiency using the net as designed to "earn" the vessel's state and federal experimental fishery permits.

Ten of the 12 vessels demonstrated proficiency during the first trip and were issued permits at the end of those trips. However, two vessels' initial trips showed the net fishing improperly with high by-catch rates throughout the day, so a second trip was scheduled for the following day. Follow-up trips were conducted, and the net was modified slightly (usually headrope was slackened). By-catch on these vessels improved, so DMF samplers observers released the permits to the vessel. DMF samplers later selected these vessels for sampling trips from among all "qualified" vessels in the fleet.

Monthly sea sampling coverage reflected the overall fleet activity. Most sea sampling trips were accomplished in October with 27 (53%) and in November with 17 (33%). These months also had the largest number of reported fishing trips, 398 (61%), and 177 (27%) respectively (Table 4).

Table 4. Sea Sampling Trips listed by Experimental Fishing area and month

Month	1 (SEast of Cape Ann)	2A (West of Stellwagen)	2B (Cape Cod Bay)	3 East of Cape Cod)	4 (South Stellwagen)	Total
Sept	0	1	1 ½	2 ½	0	**5 (10%)**
Oct	1	13	11	1	1	**27* (53%)**
Nov		8	6	2	1	**17 (33%)**
Dec	1	1	0	0	0	**2 (4%)**
Total	**2 (4%)**	**23 (45%)**	**18 ½ (36%)**	**5 ½ (20%)**	**2 (4%)**	**51* (100%)**

*One additional trip conducted in October in Ipswich Bay for a Cape Ann vessel to qualify for the fishery.

Plots of observed tows showed discrete fishing areas adjacent to the three homeports (Figure 3). There was minimal intermingling of the fleets during sampled trips, except for a single trip by a Chatham-based vessel that occurred in Cape Cod Bay.

(B) Area Summaries

Area 1: Southeast of Cape Ann

Only two sea sampling trips with a total of six tows (Table 5) were accomplished in this area aboard Gloucester-based vessels. Blueback herring and red hake dominated the catches .

Trip catch rates for whiting and red hake (Table 6, Appendix Table 1A) were the lowest seen in any of the areas, averaging just 102 lbs./hr for whiting and 140 lbs./hr for red hake. Regulated species by-catch averaged 43 lbs./hr and was split between flatfish (mostly American plaice) at 21 lbs./hr and roundfish at 23 lbs./hr. Redfish dominated the roundfish catch with a mean catch rate of 21 lbs./hr. Redfish were present in four of the six tows, and most fish measured larger than the 9" minimum size. See Appendix D for size frequencies.

As for the 5% standard, all three statistics: Aggregate trips percentage, mean trips' percentage, and mean tows' percentage exceeded 5% (Tables 5,6). Regulated species by-catch for trips combined was 6.9%; mean percentage for the two trips was 8.3% and for the six tows was 8.6%. Three of the six tows exceeded 5% (Figure 4), and among the three tows that were at or below 5%, large catches of blueback herring (273-3,000 lbs./hr) lowered by-catch percentages. Some blueback herring were kept for bait sales, but most were discarded.

Area 2: West of Stellwagen including Cape Cod Bay For this analysis, we have divided this area into two sub-areas, a northern and southern component. A plot of all observed tows demonstrated discrete fishing areas for Gloucester and Provincetown-based fleets. There was no overlap within fishing areas (within Area 2) frequented by the two fleets during the sea sampling trips.

The northern sub-area (2A) and southern sub-area (2B) included all of Area 2 north of LORAN C 44160 line (see Figure 3). Subarea 2B includes all of Area 2 south of this line.

Table 5

1997 Experimental Whiting Fishery Sea Sampling Results
Summary of Retained and Discarded Catches by Fishing Area

	AREA 1			AREA 2A			AREA 2B			AREA 3			AREA 4			
	TRIPS = 2		TOWS = 6	TRIPS = 20		TOWS = 59	TRIPS = 21.5		TOWS = 71	TRIPS = 5.5		TOWS = 19	TRIPS = 2		TOWS = 6	
SPECIES	KEPT	DISCARD	TOTAL	KEPT	DISCARD	TOTAL	KEPT	DISCARD	TOTAL	KEPT	DISCARD	TOTAL	KEPT	DISCARD	TOTAL	COMBINED TOTAL
WHITING	966	0	966	60201	233	60434	32124	1002	33126	8575	13	8588	2993	0	2993	106107
RED HAKE	1491	0	1491	15583	2259	17842	9722	1410	11131	4425	2156	6580	65	238	303	37348
SPINY DOGFISH	360	40	400	950	2113	3063	0	16588	16588	610	414	1024	0	117	117	21192
ATL. HERRING	15	0	15	5676	4769	10445	0	709	709	0	1004	1004	0	1389	1389	13561
BLUE BACK HERRING	1300	2500	3800	3774	530	4304	0	3872	3872	0	0	0	0	0	0	11976
ALEWIFE	0	0	0	75	33	108	390	2143	2533	0	667	667	0	677	677	3985
AMERICAN PLAICE	0	183	183	0	2501	2501	0	1080	1080	0	131	131	0	2	2	3895
ATLANTIC COD	0	17	17	0	3074	3074	0	225	225	0	34	34	0	9	9	3360
WINTER FLOUNDER	0	8	8	0	24	24	0	1737	1737	0	101	101	0	1	1	1870
REDFISH	0	295	295	0	500	500	0	14	14	0	42	42	0	0	0	850
WHITE HAKE	0	0	0	0	165	165	0	197	197	0	423	423	0	0	0	785
YELLOWTAIL FLOUNDER	0	5	5	0	36	36	0	46	46	0	52	52	0	5	5	143
WITCH FLOUNDER	0	3	3	0	91	91	0	0	0	0	9	9	0	0	0	103
WINDOWPANE FLD.	0	0	0	0	2	2	0	91	91	0	0	0	0	0	0	93
POLLOCK	0	8	8	0	39	39	0	3	3	0	1	1	0	1	1	52
HADDOCK	0	0	0	0	3	3	0	3	3	0	6	6	0	1	1	13
ILLEX SQUID	7	8	15	1061	843	1904	224	933	1157	9	116	125	35	71	106	3306
AMERICAN LOBSTER	0	51	51	0	678	678	0	2124	2124	0	15	15	0	31	31	2899
LOLIGO SQUID	83	0	83	490	3	493	39	543	582	72	2	74	103	113	216	1447
LONG HORN SCULPIN	0	2	2	0	676	676	0	580	580	0	109	109	0	6	6	1372
ATL. MACKEREL	70	1	71	288	30	318	201	54	255	18	3	21	45	0	45	710
BUTTERFISH	0	1	1	200	11	211	102	190	292	166	11	177	8	5	13	694
MONKFISH	0	5	5	0	59	59	0	368	368	0	61	61	0	11	11	504
WRYMOUTH	0	0	0	0	310	310	0	0	0	0	0	0	0	0	0	310
OTHER *	0	67	67	230	334	564	449	2161	2610	2	260	262	0	220	220	3724
TOTAL	4292	3192	7484	88528	19315	107843	43250	36072	79322	13877	5628	19505	3249	2897	6145	220298
TOTAL REGULATED SPP.	0	517	517	0	6434	6434	0	3396	3396	0	798	798	0	19	19	11164
PERCENT REG. SPECIES			6.9%			6.0%			4.3%			4.1%			0.3%	5.1%

NOTE: Table includes all tows, including those obstructed tows excluded from later analyses. One trip with two tows accomplished in Ipswich Bay not presented.

* Includes catches of 40 species and species groups, such as ocean pout, skates, crabs, unsorted squid etc., making up 2.4% of the total catch observed from all sampled tows. See Appendix Table B for species list and total catches summed over all trips.

Figure 3. Generalized tow locations from sea sampling trips.

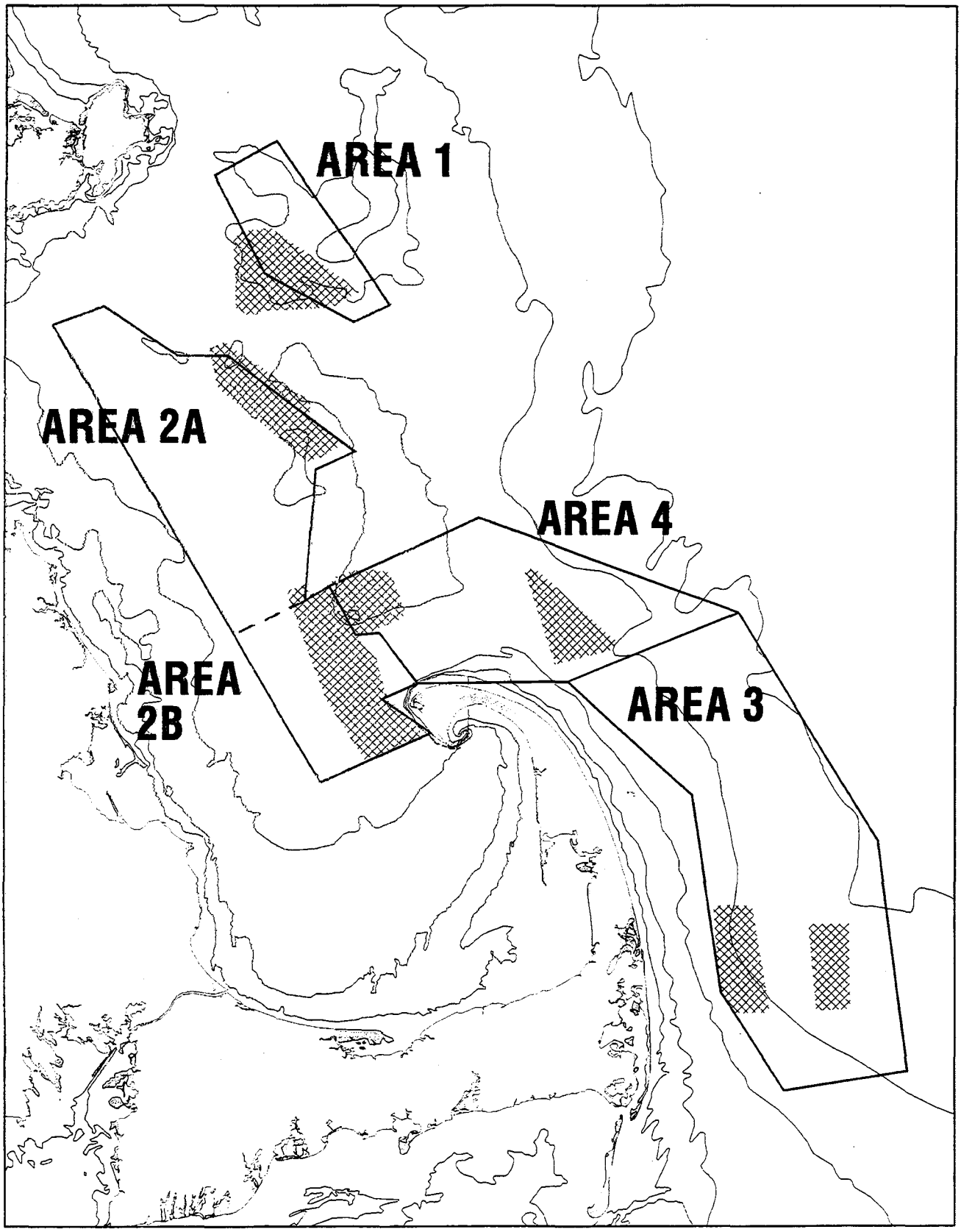
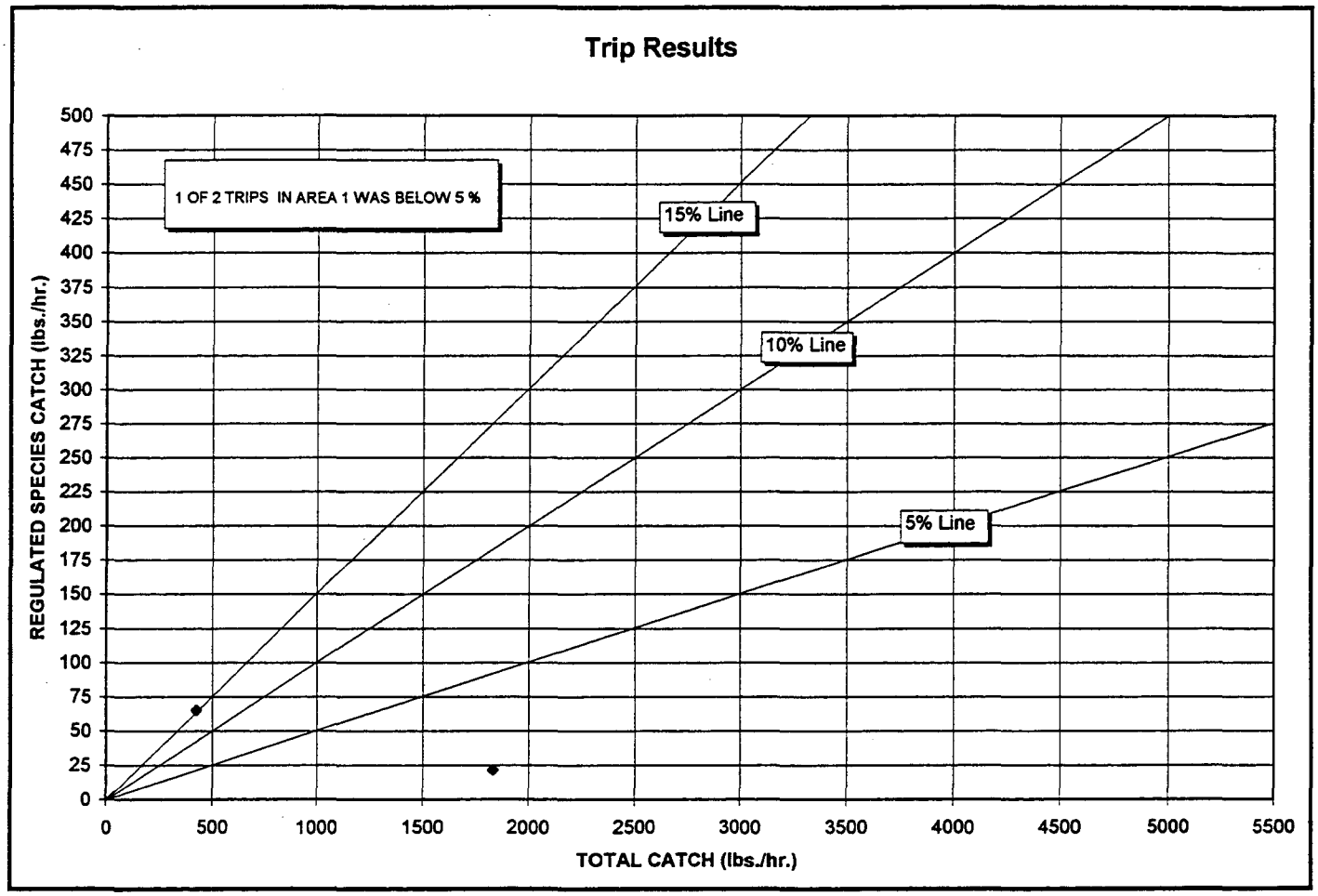
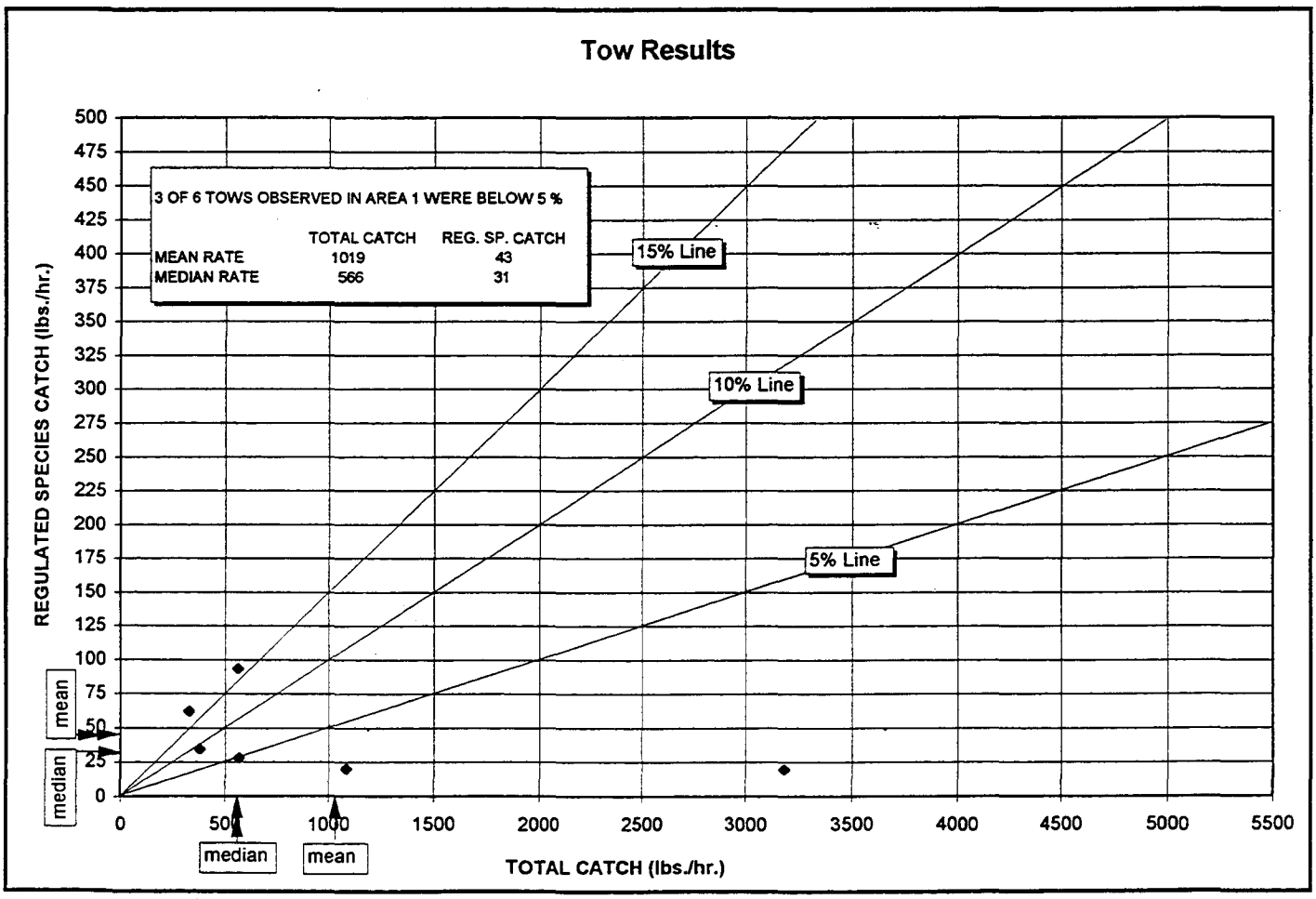


Table 6. Sea sampling summary statistics for each area.						
Area	**1**	**2A**	**2B**	**3**	**4**	**All Areas**
Sampling period	10/3 , 12/4	9/27-11/25	9/14-11/19	9/13-11/19	10/24-11/20	9/13-12/4
Total Catch (lbs.)	7,484	107,843	79,322	19,505	6,145	220,299
Reg. Species Catch	517	6,434	3,396	798	19	11,164
Percent Regulated Species	6.9%	6.0%	4.3%	4.1%	0.3%	5.1%
Trip Statistics:						
Total Number of Trips	2	20	21 1/2	5 1/2	2	51
Number of "Qualifying" Trips	1	6	3 1/2	2 1/2	0	13
Number of "Random" Trips	1	14	18	3	2	38
Avg. Pct. By-catch Among Trips	8.3%	6.6%	5.0%	4.7%	0.2%	5.5%
Number of Trips < 5%	1	10	13	3	2	29
Number of Trips > 5%	1	10	9	3	0	23
Avg. Catch Rates Among Trips (lbs./hr.):						
Whiting	102	679	268	528	219	416
Red Hake	140	198	87	373	22	160
Tow Statistics:						
Total Hours Towing	9.6	101.3	124.2	22.1	13.5	270.7
Total Number of Tows	6	59	71	19	6	161
Total Obstructed Tows	0	5	2	0	0	7
Total "Valid" Tows (unobstructed)	6	54	69	19	6	154
Valid Tows < 5%	3	31	50	12	6	102
Valid Tows > 5%	3	23	19	7	0	52
Avg. Pct By-catch for Valid Tows	8.6%	6.7%	4.7%	4.4%	0.3%	5.3%
Avg. Bycatch rates for Valid Tows (lbs./hr):						
(These rates from Appendix Table 1B)						
Winter Flounder	1	< 1	13	7	0	
American Plaice	19	25	9	7	0	
Yellowtail Flounder	1	1	< 1	4	< 1	
Witch Flounder	< 1	2	0	0	0	
Winowpane Flounder	0	0	1	0	0	
Total Flatfish Species	**21**	**29**	**24**	**18**	**<1**	
Atlantic Cod	1	37	2	1	1	
White Hake	0	1	2	20	0	
Redfish	21	5	0	1	0	
Haddock	0	< 1	0	< 1	0	
Pollock	1	1	0	0	0	
Total Roundfish Species:	**23**	**44**	**4**	**23**	**1**	
Total Regulated Species	***43**	**73**	**27**	**41**	**1**	
*Note: Column totals may be slightly off because of quotients rounding.						

Figure 4. Area 1 - Southeast of Cape Ann
Catch Rates: regulated species vs. all species combined, presented for all trips and tows.





Area 2B is primarily northern Cape Cod Bay and southern Massachusetts Bay, the site of DMF's 1996's federal experimental fishery and has been the site of DMF's past gear and sea sampling studies dating back to 1989. Analyzing Cape Cod Bay separately allows comparisons with previous years' sea sampling results in this area, including adjacent federal waters near the southwest corner of Stellwagen Bank.

Area 2A: West of Stellwagen Bank north of Cape Cod Bay.

Twenty trips were sampled in this area, all aboard Gloucester-based vessels. Unfortunately, coverage of this area was limited: all sampled trips were concentrated in the extreme eastern edge of the area (See Figure 3), near the western slope of Stellwagen Bank. Target species, whiting (60,434 lbs.) and red hake (17,842 lbs.), dominated catches by comprising 72% of overall total catch of 107,843 lbs. (Table 5). Mean trip catch rates for whiting and red hake were the highest seen of all the five statistical areas (Table 6). Also, mean trip catch rates for all species combined was the highest among areas at 1,093 lbs./hr. (Appendix Table 1A).

Among all "valid" tows regulated species by-catch averaged 73 lbs./hr (Table 6, Appendix Table 1B) and was dominated by roundfish at 44 lbs./hr, and flatfish averaged 29 lbs./hr. Atlantic cod was the single most common groundfish species (37 lbs./hr) followed by American plaice at 25 lbs./hr).

As for the 5% standard, all three statistics: aggregate trips percentage, mean trips' percentage, and mean tows' percentage (among "valid" tows) exceeded 5% (Table 6). Regulated species by-catch in aggregate among all trips, totaled 6,434 lbs., representing 6.0% of overall catch. Among trips, half (10 of 20) exceeded 5% (Figure 5), with a mean percentage of 6.6% .

Fifty-nine tows were completed during 20 trips, but 5 of 59 tows were observed obstructed with gear or debris, compromising the net's performance so have been excluded from further analysis. Obstructions included ghost gillnets, lobster gear, and anchors. Among valid (unobstructed) tows, a majority (31 of 54) fell below 5%. Mean tows' percentage was 6.7%. Among five obstructed tows, four exceeded 5%.

The predominant regulated groundfish species, Atlantic cod was present in 47 of the 54 valid tows (and in five of seven obstructed tows, dropped from the tows' analysis). Cod catch rates were highly variable: mean catch rate was 37 lbs./hr but median rate was much lower at 14 lbs. Mean catch rate was elevated by some large catches: four of the 54 tows exceeded 100 lbs./hr, with values of 500, 252, 184 and 164 lbs./hr. (See Appendix Table 1B.) Most cod measured smaller than the 19" minimum size with sublegal fish in the 30-48 cm range (12-19") predominating. See Figure D6 in Appendix D.

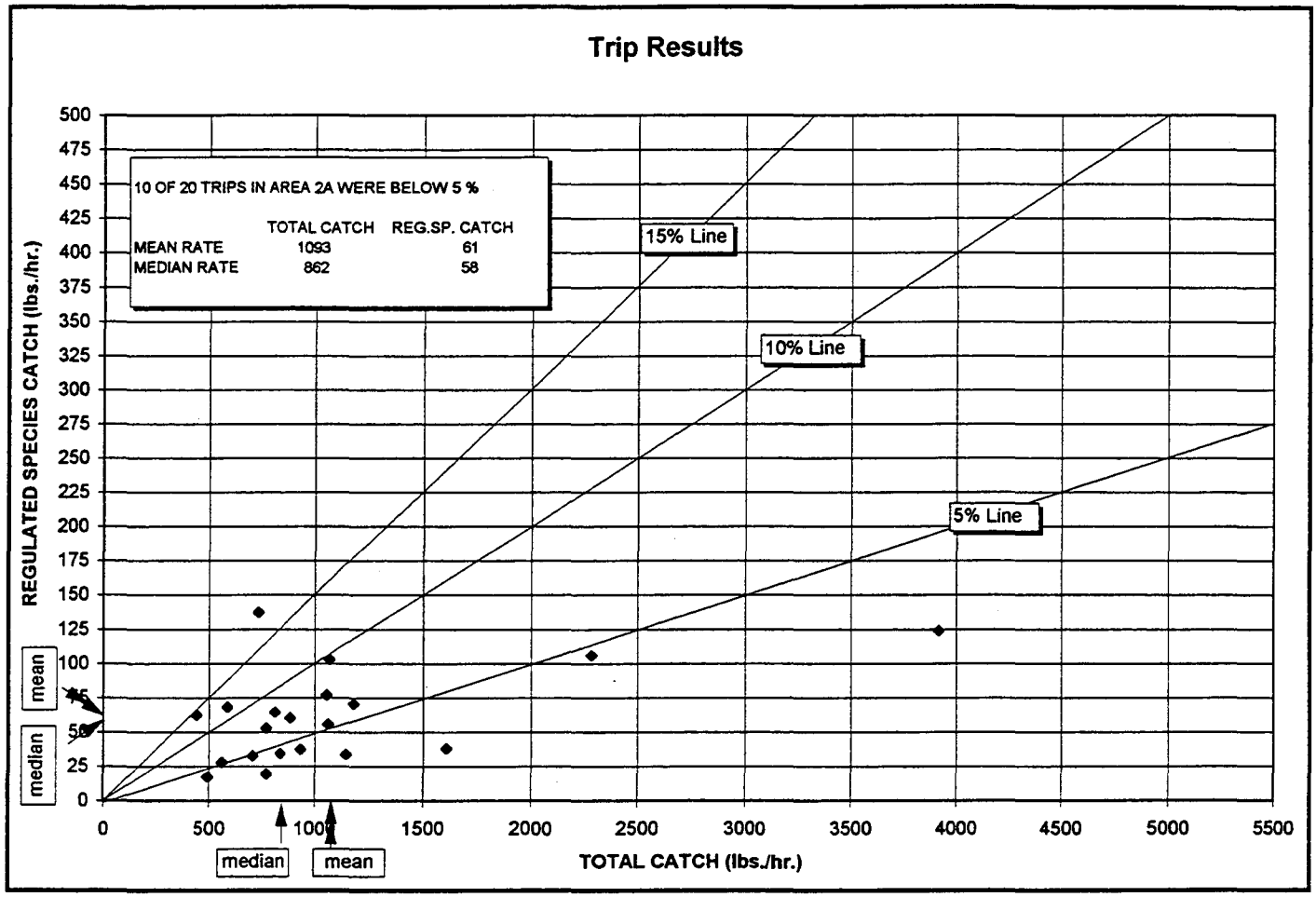
The second most prevalent regulated species was American plaice (dab), appearing in 53 of the 54 valid tows. Catch rates were less variable than seen for cod. Mean plaice catch rate was 25 lbs./hr while the median was similar at 19 lbs./hr. Most plaice measured below the 14" (35 cm) minimum size. See Appendix D for size frequencies.

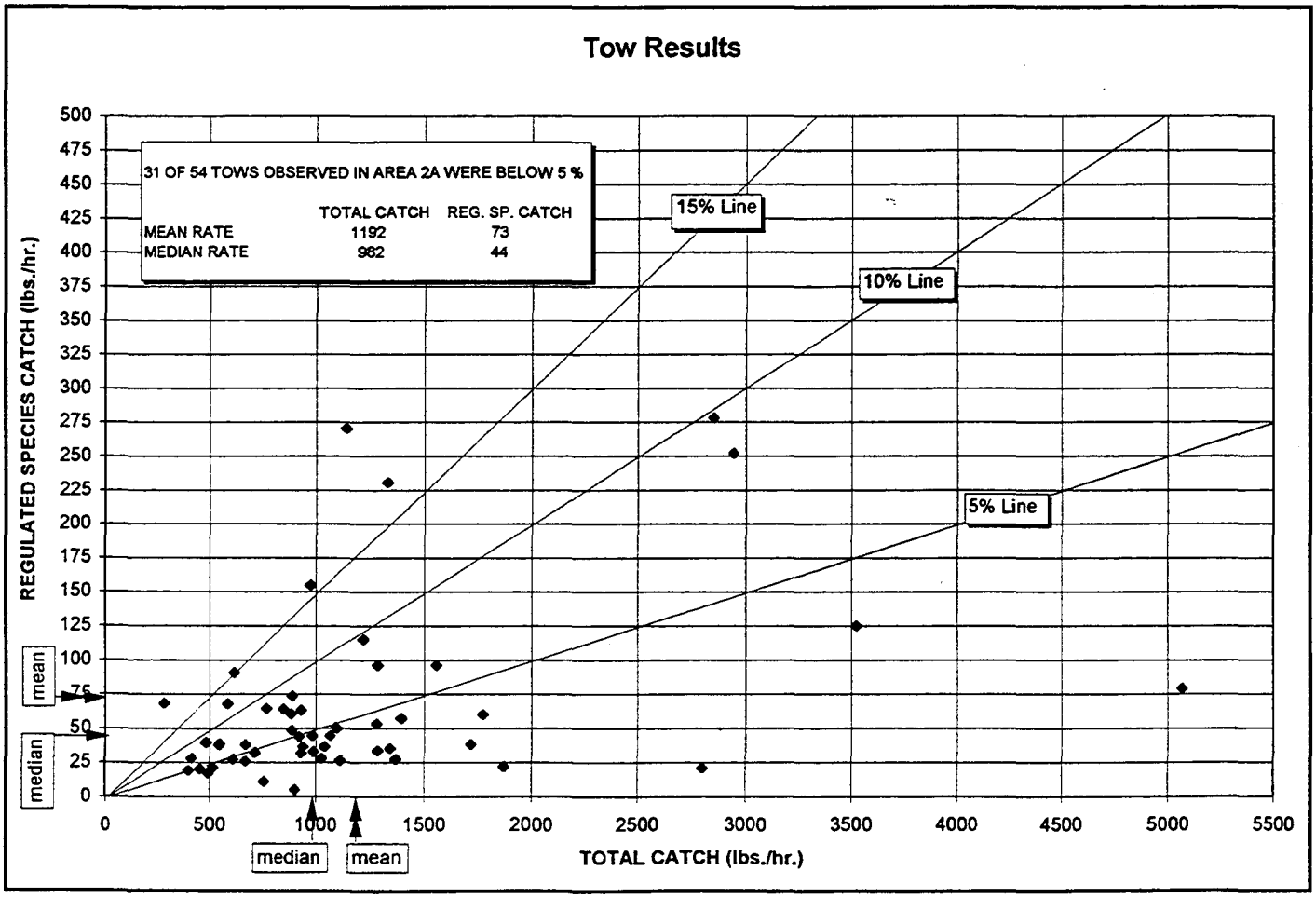
Area 2B: Cape Cod Bay.

Provincetown-based vessels fished almost exclusively in this area adjacent to their homeport. See figures 2 and 3. Nineteen sea sampling trips were accomplished in this area. Most (18) trips were aboard Provincetown vessels and were conducted in the eastern half of this region. Fixed gear (lobster trawls and gillnets) was present in the western half of the region. Also fixed gear was dense in adjacent areas.

DMF mediated "agreements" between mobile- and fixed-gear fishermen to provide gear-free towing areas in Cape Cod Bay, especially in the area off Provincetown for this directed whiting fishery. (See Appendix E.) Consequently, fixed gear was displaced to areas along the margins of this gear-free zone, that was modified during the fishing season. Gear along the margins of the area was dense, so vessels were often precluded from completing tows beyond the borders of the gear-free zone. DMF has documented an escalation of fixed gear in Cape Cod Bay (Pava et al. 1997) through the 1990's with increased lobster trap fishing effort and landings during fall months Also, since DMF's ban on night trawling in Massachusetts state waters was enacted in 1992, fixed gear fishermen reportedly have set more gear in "traditional" trawling areas.

Figure 5. Area 2A - West of Stellwagen Bank
Catch Rates: regulated species vs. all species combined, presented for all trips and tows.





The target species, whiting (33,126 lbs.) red hake (11,131 lbs.), and spiny dogfish (16,588 lbs.) dominated catches comprising 77% of an overall catch of 79,322 lbs. (Table 5). Mean trip catch rates for whiting and red hake were lower in Cape Cod Bay than seen in Area 2A (Table 6). Mean trip catch rates for all species combined was 600 lbs./hr, (Appendix Table 1A) with whiting catch rates averaging 268 lbs./hr - less than half the whiting catch rate seen in Area 2A. These catch rates are similar to calculated whiting catch rates from Vessel Trip Reports for areas adjacent to Provincetown (See Figure 2).

Seventy-one tows were completed during the 22 trips, but 2 tows were observed obstructed with ghost fishing gear or debris, compromising the net's performance so were excluded from the analysis of tows' data (Among the two obstructed tows, both exceeded 5% due to high catches of flatfish (Appendix Table B).

As for the 5% standard, two of the three statistics, aggregate trips percentage, 4.3%, and mean tows' percentage (among "valid" tows) 4.7%, were below 5%. Among trips, 13 of 22 fell below 5% (Figure 6) and mean trips' percentage was 5.0%. (Table 6, Appendix Table 1A). Among tows, most (50 of 69) fell below 5% (Figure 6).

Among tows, regulated species by-catch averaged 27 lbs./hr. (Table 6, Appendix Table 1B), and was mostly flatfish at 24 lbs./hr. Winter flounder was the single most common groundfish species averaging 13 lbs./hr followed by American plaice at 9 lbs./hr. These two species combined accounted for the vast majority of regulated species catch. Among the 69 valid tows, winter flounder were present in 61, while American plaice was present in 55. The majority of winter flounder were sublegal, and among American plaice, the percent sublegal was even higher. See Appendix D for size frequencies. Of the 69 tows, regulated species by-catch exceeded 5% in 19 tows, with 50 tows, less than 5%, resulting in a median rate of 3.3%.

These by-catch rates are similar to those seen in the 1996 raised footrope trawl experimental fishery in Cape Cod Bay during October 10 - November 7, 1996 (McKiernan and Carr, 1997). Among all tows, regulated species by-catch averaged 27 lbs./hr - the identical catch rate seen in the 1997 fishery in Cape Cod Bay. Also, 95 of 108 tows were below the 5% by-catch standard, and mean by-catch rate was 2.4%. By-catch percentages were lower in 1996 because, despite by-catch rates being identical during these two years, the overall catch rate (all species combined) was nearly twice as high in 1996 with 1,167 lbs./hr in 1996 compared to 600 lbs./hr in 1997. By-catch species composition was also similar in 1996 when flatfish dominated catch and was predominately winter flounder.

The tows with the highest by-catch rates (lbs./hr.) were examined to determine causes of the elevated rates. Of the 14 tows that exceeded 40 lbs./hr, all were dominated by flatfish. Ten of the top 14 tows might be explained by various gear design issues. Four tows occurred during "qualifying" trips where the fisherman was allowed to make slight alterations to the net to improve its efficiency. Another three tows were conducted during two trips with nets that were later checked by DMF samplers after the trip and discovered to be out of compliance with the chain sweep shortened. (After the completion of these trips, DMF samplers instructed the captains to re-configure the sweeps to bring the net into compliance.)

Another tow was conducted during a trip where the fisherman deployed a net that was evidently too large, and though the net appeared in compliance, the vessel was underpowered and unable to tow the net efficiently. This net was larger than the net that was used during the previous year's fishery (1996) when the vessel first joined the fishery (At the end of the trip the captain switched nets and deployed his older, smaller net. Follow-up sea sampling trips resulted in low by-catch rates.) Finally, two tows were done with an electronic device attached to the net's headrope that - the captain claimed - may have altered the net's performance resulting in higher by-catch.

Area 3: East of Cape Cod

Five sea sampling trips, totaling 19 tows were conducted in this region, aboard three Chatham-based vessels. A sixth trip had two tows east of Cape Cod and two in Cape Cod Bay. Coverage of this area was limited to the southern portion adjacent to Chatham. The three participating captains were disappointed by low whiting catches during this past fall's fishery in this area.

The target species, whiting (33,126 lbs.) red hake (11,131 lbs.), and spiny dogfish (16,588 lbs.) dominated catches comprising 77% of an overall catch of 79,322 lbs. (Table 5). Mean trip catch rates for whiting and red hake were lower in Cape Cod Bay than seen in Area 2A (Table 6). Mean trip catch rates for all species combined was 600 lbs./hr, (Appendix Table 1A) with whiting catch rates averaging 268 lbs./hr - less than half the whiting catch rate seen in Area 2A. These catch rates are similar to calculated whiting catch rates from Vessel Trip Reports for areas adjacent to Provincetown (See Figure 2).

Seventy-one tows were completed during the 22 trips, but 2 tows were observed obstructed with ghost fishing gear or debris, compromising the net's performance so were excluded from the analysis of tows' data (Among the two obstructed tows, both exceeded 5% due to high catches of flatfish (Appendix Table B).

As for the 5% standard, two of the three statistics, aggregate trips percentage, 4.3%, and mean tows' percentage (among "valid" tows) 4.7%, were below 5%. Among trips, 13 of 22 fell below 5% (Figure 6) and mean trips' percentage was 5.0%. (Table 6, Appendix Table 1A). Among tows, most (50 of 69) fell below 5% (Figure 6).

Among tows, regulated species by-catch averaged 27 lbs./hr. (Table 6, Appendix Table 1B), and was mostly flatfish at 24 lbs./hr. Winter flounder was the single most common groundfish species averaging 13 lbs./hr followed by American plaice at 9 lbs./hr. These two species combined accounted for the vast majority of regulated species catch. Among the 69 valid tows, winter flounder were present in 61, while American plaice was present in 55. The majority of winter flounder were sublegal, and among American plaice, the percent sublegal was even higher. See Appendix D for size frequencies. Of the 69 tows, regulated species by-catch exceeded 5% in 19 tows, with 50 tows, less than 5%, resulting in a median rate of 3.3%.

These by-catch rates are similar to those seen in the 1996 raised footrope trawl experimental fishery in Cape Cod Bay during October 10 - November 7, 1996 (McKiernan and Carr, 1997). Among all tows, regulated species by-catch averaged 27 lbs./hr - the identical catch rate seen in the 1997 fishery in Cape Cod Bay. Also, 95 of 108 tows were below the 5% by-catch standard, and mean by-catch rate was 2.4%. By-catch percentages were lower in 1996 because, despite by-catch rates being identical during these two years, the overall catch rate (all species combined) was nearly twice as high in 1996 with 1,167 lbs./hr in 1996 compared to 600 lbs./hr in 1997. By-catch species composition was also similar in 1996 when flatfish dominated catch and was predominately winter flounder.

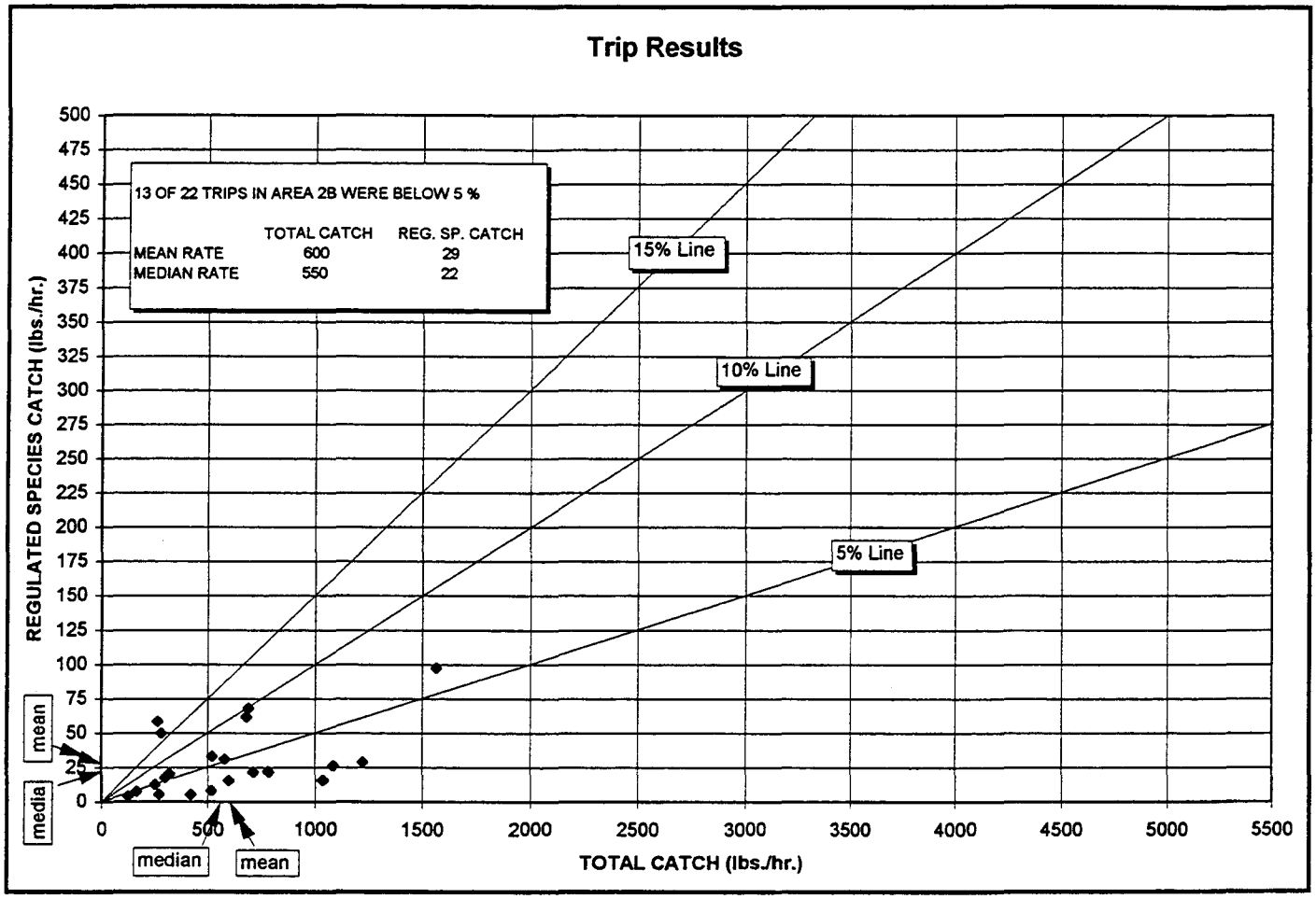
The tows with the highest by-catch rates (lbs./hr.) were examined to determine causes of the elevated rates. Of the 14 tows that exceeded 40 lbs./hr, all were dominated by flatfish. Ten of the top 14 tows might be explained by various gear design issues. Four tows occurred during "qualifying" trips where the fisherman was allowed to make slight alterations to the net to improve its efficiency. Another three tows were conducted during two trips with nets that were later checked by DMF samplers after the trip and discovered to be out of compliance with the chain sweep shortened. (After the completion of these trips, DMF samplers instructed the captains to re-configure the sweeps to bring the net into compliance.)

Another tow was conducted during a trip where the fisherman deployed a net that was evidently too large, and though the net appeared in compliance, the vessel was underpowered and unable to tow the net efficiently. This net was larger than the net that was used during the previous year's fishery (1996) when the vessel first joined the fishery (At the end of the trip the captain switched nets and deployed his older, smaller net. Follow-up sea sampling trips resulted in low by-catch rates.) Finally, two tows were done with an electronic device attached to the net's headrope that - the captain claimed - may have altered the net's performance resulting in higher by-catch.

Area 3: East of Cape Cod

Five sea sampling trips, totaling 19 tows were conducted in this region, aboard three Chatham-based vessels. A sixth trip had two tows east of Cape Cod and two in Cape Cod Bay. Coverage of this area was limited to the southern portion adjacent to Chatham. The three participating captains were disappointed by low whiting catches during this past fall's fishery in this area.

Figure 6. Area 2B - Cape Cod Bay
Catch Rates: regulated species vs. all species combined, presented for all trips and tows.



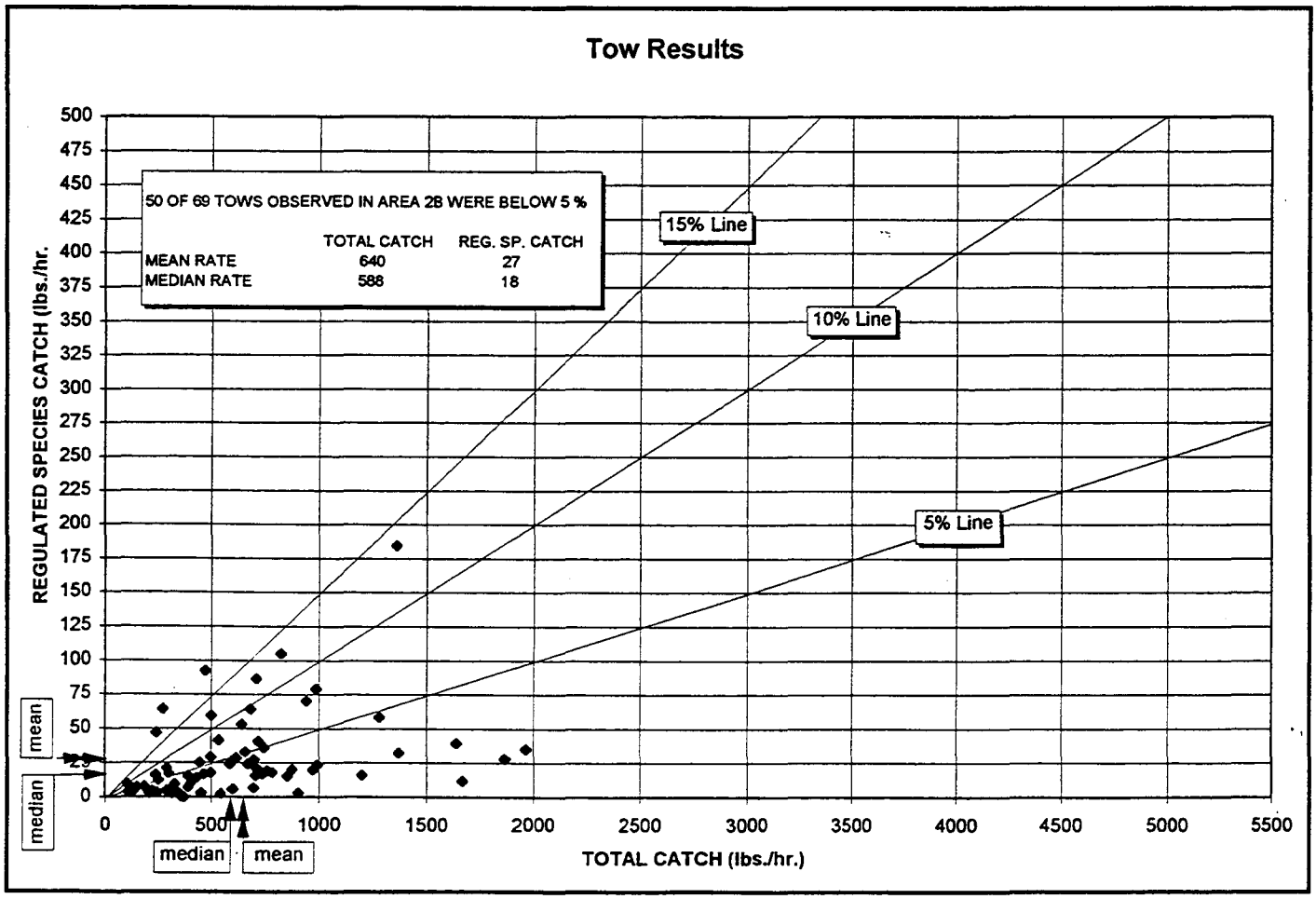
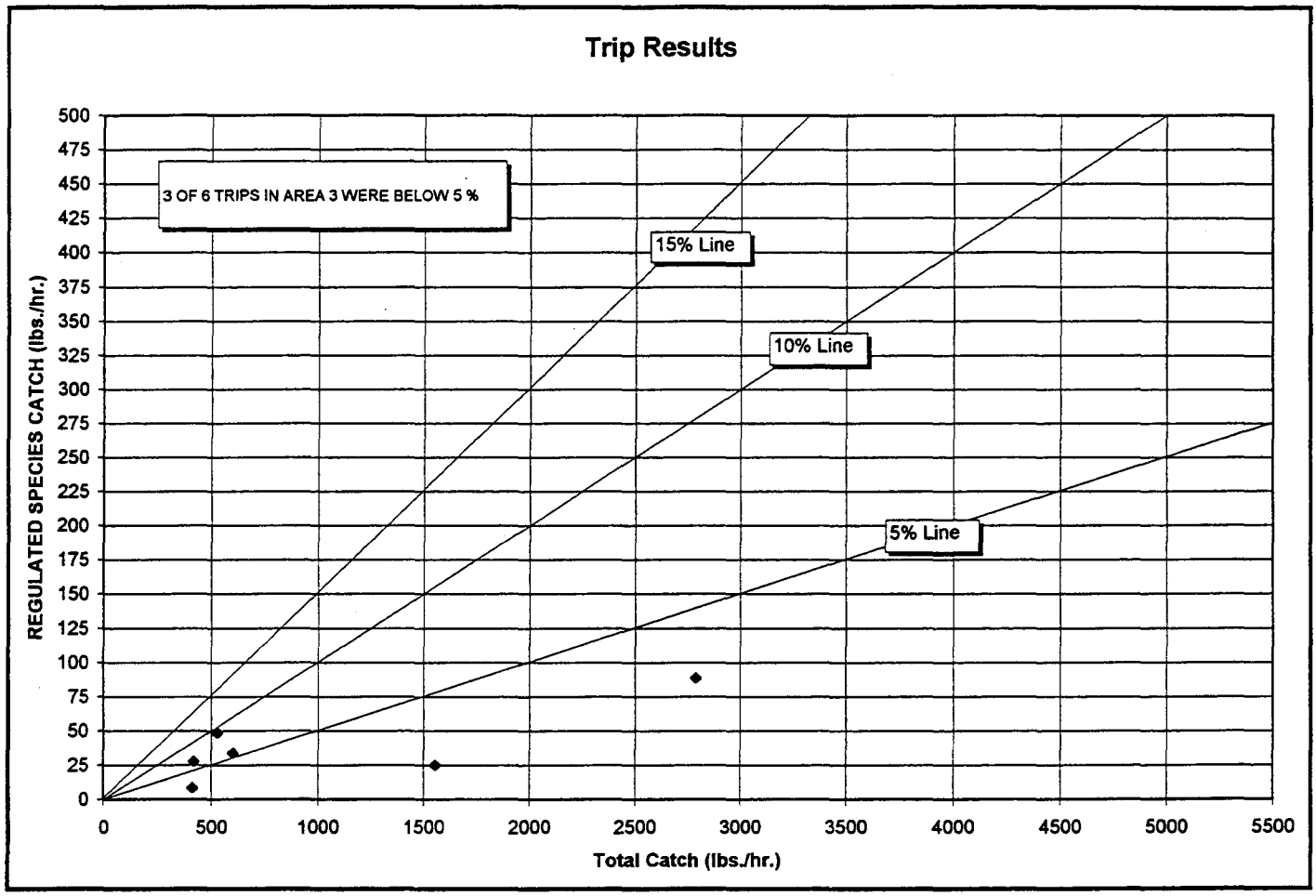


Figure 7. Area 3 - East of Cape Cod
Catch Rates: regulated species vs. all species combined, presented for all trips and tows.



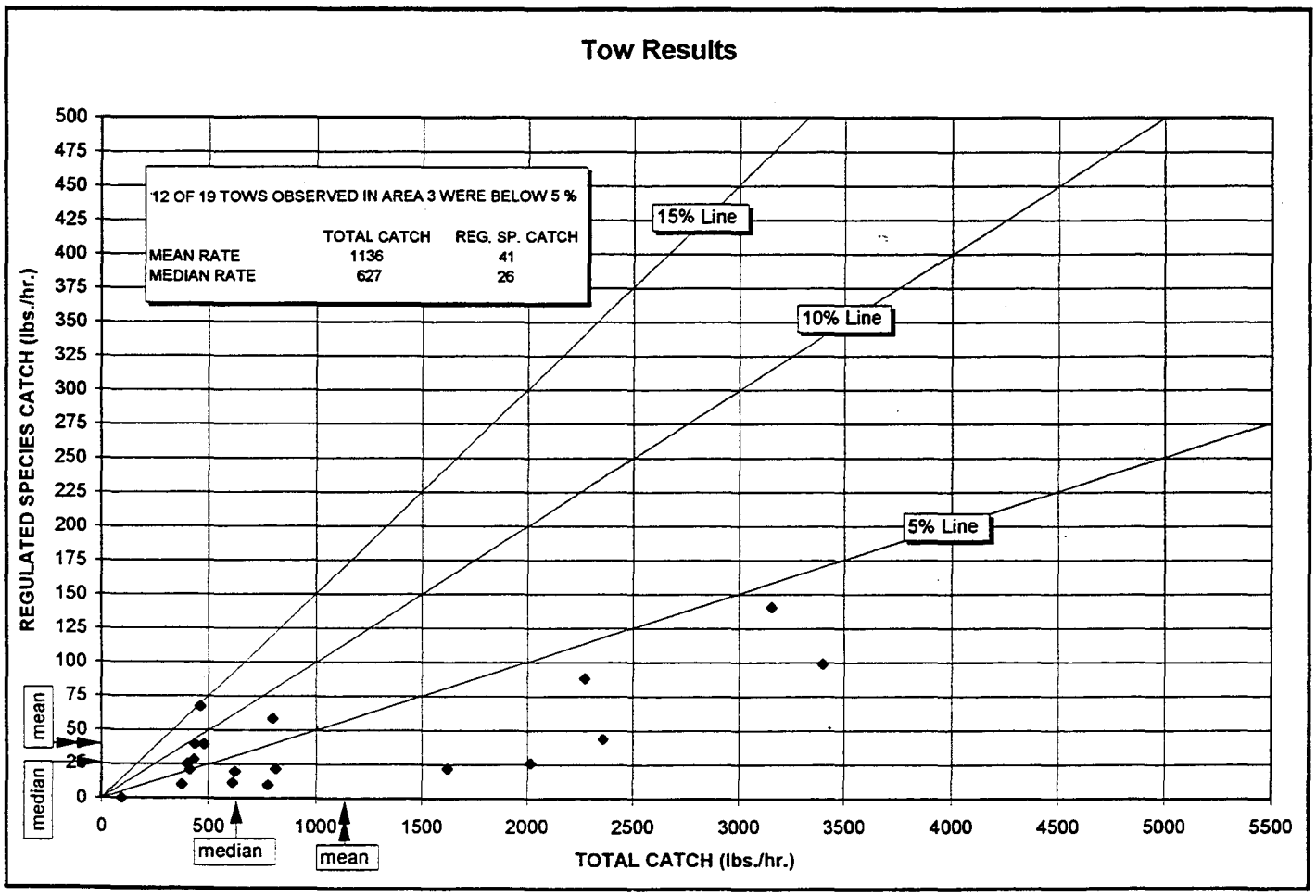
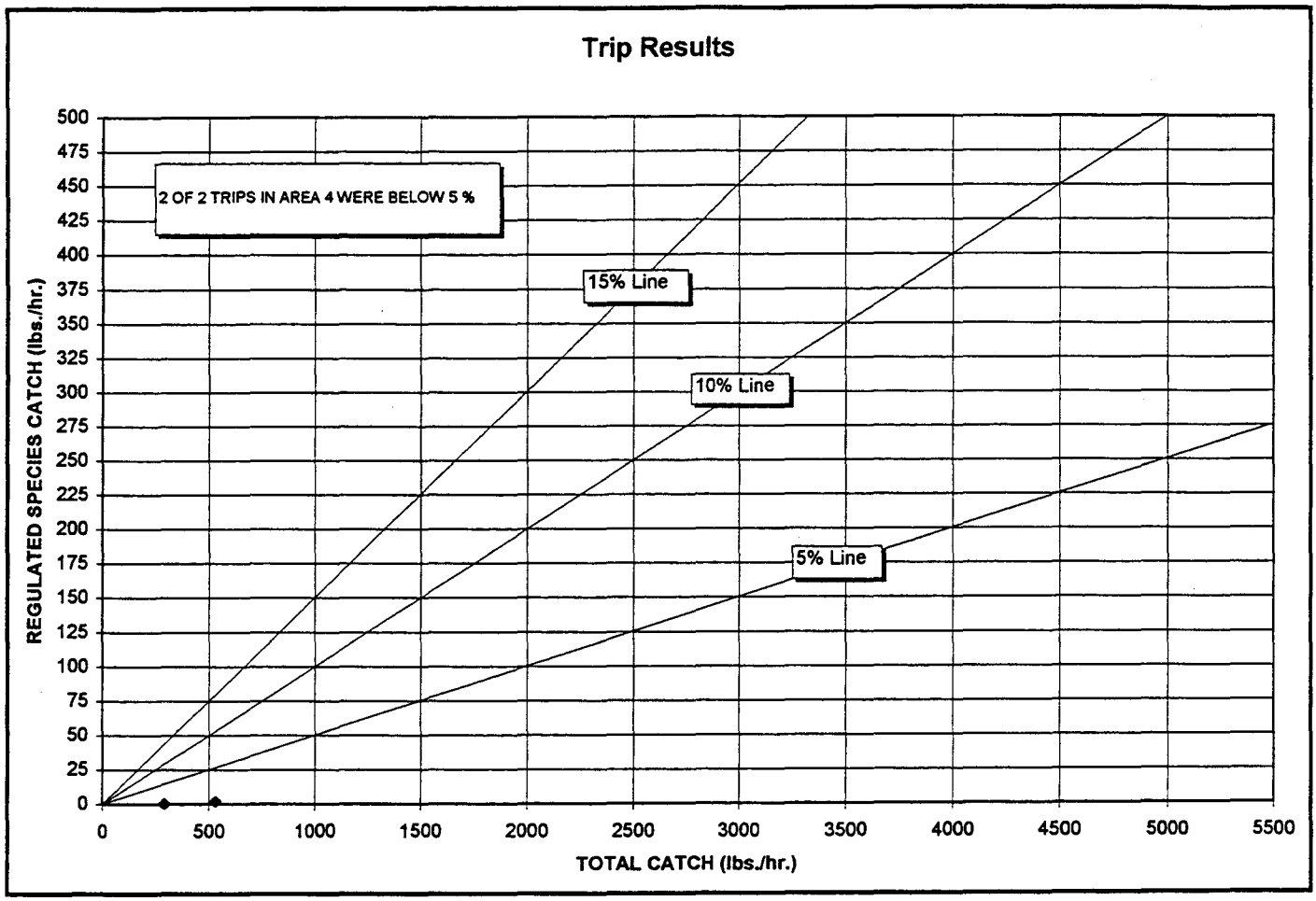
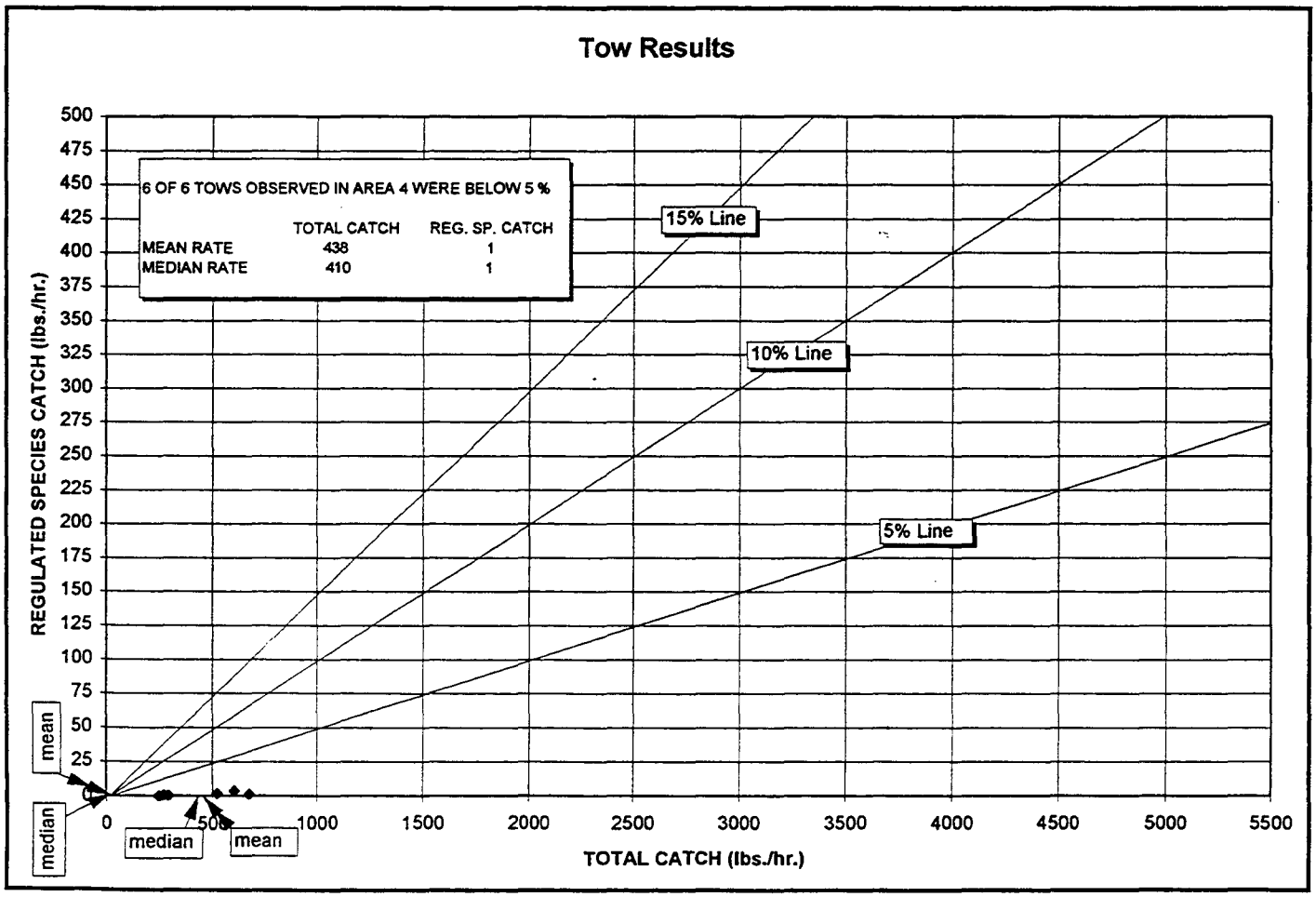


Figure 8. Area 4 - Southern Stellwagen Bank
Catch rates: regulated species vs. all species combined, presented for all trips and tows.





Catches in this region were highly variable. Most tows sampled in this region saw overall catches (all species combined) between 300 and 800 lbs./hr. However, 6 tows were between 1,600 and 3,400 lbs./hr., and these were all accomplished by the lone Scottish seiner participating in the experimental fishery. This gear type may be more efficient than a standard otter trawler.

For all trips, mean overall catch rate (all species combined) was 1,050 lbs. The predominant species were whiting and red hake averaging 528 and 373 lbs/hr. respectively. These rates ranked second for whiting and first for hake when compared to the other four areas. However, these rates were likely elevated by large catches observed aboard the Scottish seiner.

As for the 5% standard, all three statistics: aggregate trips' percentage (4.1%), mean trips' percentage (4.7%), and mean tows' percentage (4.4%), were below 5% (Table 6). Three of the six trips and 12 of the 19 tows were below 5%. (Figure 7).

By-catch of regulated species exceeded 5% of the overall catch in 7 of 19 tows. (No tows were obstructed, so all were considered "valid.") Regulated species by-catch among tows averaged 40 lbs./hr.: regulated flatfish species averaged 17 lbs./hr, but catch of roundfish (mostly white hake) was greater at 23 lbs./hr. See Appendix Table 1B.

Of the seven tows that exceeded the 5% regulated species by-catch standard, most were characterized by low overall catches of all species combined (under 500 lbs./hr) and low regulated species by-catch (under 40 lbs./hr.) (See Figure 7). Among the three tows with the highest catch rates of regulated species (above 75 lbs./hr), two were dominated by white hake while the third was dominated by two flounder species in combination (winter flounder and yellowtail, both over 50 lbs./hr.). All three of these tows were below the 5% by-catch standard because the overall catches of whiting were also high enough to "cover" regulated species catch.

The predominant regulated by-catch species was white hake that was present in 12 of 19 tows. White hake size frequency was dominated by fish measuring between 32 and 40 cm (11 to 16"). Of the 10 regulated species managed under the Multispecies Plan, white hake is the only species that has no minimum size. The flatfish species composition was a mixture of winter flounder, yellowtail, and American plaice.

Area 4: Southern Stellwagen Bank

Only two sea sampling trips totaling 6 tows were sampled aboard one Provincetown-based trawler. This trawler was not eligible to fish within state waters (Cape Cod Bay) since it was larger than 72' (overall length) and did not hold a Massachusetts Coastal Access Permit for trawling in state waters. Reports of low catches in this region appeared to discourage fishing effort.

Whiting (2,993 lbs.), was the primary species followed by sea herring (1,389 lbs.) and red hake (303 lbs.). These three species comprised 76% of the 6,145 lbs. overall catch (Table 5). Mean trip catch rates for whiting and red hake was among the lowest observed with whiting averaging 219 lbs./hr and red hake just 22 lbs./hr. (Table 6, Appendix Table 1A) Mean trip catch rate for all species combined was 413 lbs./hr., the lowest level seen among the five areas.

As for the 5% standard, all three statistics, aggregate trips' percentage (0.3%) mean trips' percentage (0.2%) and mean tows' percentage (0.3%) were well below 5%. Both trips and all six tows fell well below 5% (Figure 8).

Among tows, regulated species by-catch averaged only about 1 lb./hr., the lowest of all five areas (Table 6, Appendix Table 1B). Of the 19 lbs. of regulated species seen, 11 lbs. was roundfish (cod, haddock, pollock). Flounder species (yellowtail, winter flounder, and American plaice) comprised the rest.

VI. DISCUSSION

Successful conduct of this small-mesh trawl fishery with a raised footrope trawl depends on four factors: 1) fishermen finding target species in harvestable quantities in certain areas and times; 2) fishermen

avoiding areas where roundfish species (cod, pollock, haddock, redfish, and white hake) are abundant that the 5% standard might be exceeded, but more importantly, by-catches of these species would result in compromised conservation goals; 3) fishermen complying with net specifications to deploy the net as designed to minimize flatfish by-catch - future trawl modifications may exclude some roundfish species, but there's no successful gear modifications identified yet; and 4) fishermen avoiding gear conflicts.

Was this fishery successful? Each of the four aforementioned factors will be treated separately.

(A) Target Species Catch

During mid-September through mid-November, fishermen found economically viable quantities of whiting and red hake along the western edge of Stellwagen. These catch rates met or exceeded the fleet's expectations. Catches were lower in Cape Cod Bay and in most other areas were less than expected by the fleet with the exception of sporadically high catches east of Cape Cod. For any given location, whiting catches are known to fluctuate annually, and this is to be expected for this "predaceous wanderer" (Bigelow and Schroeder, 1953). .

A comparison of Cape Cod Bay's whiting catch rates with last year's rates demonstrates these annual fluctuations. Whiting catch rates for trips sampled by DMF observers in 1997 were only half the previous year's (268 lbs./hr for 1997 vs. 562 lbs./hr. for 1996).

Fortunately, the by-catch percentage rates for most trips and tows still were below the 5% standard. The lower whiting catches combined with red hake and dogfish among others were sufficient to "cover" the constant level of regulated species by-catch (27 lb./hr.), predominately American plaice and winter flounder, species endemic to this region.

Catches in other less-fished areas (Area 1-Southeast of Cape Ann, Area 4 - Southern Stellwagen, and Area 3- East of Cape Cod), were lower than expected by fishermen. Fishermen had identified these areas as seasonally productive in previous years, especially prior to 1994 when federal restrictions curtailed these fisheries. Provincetown and Chatham fishermen expected large yields from southern Stellwagen after the area was scheduled to open on October 20. Many even had argued for trip limits to prevent market gluts. However, these yields never materialized.

These data suggest it is inappropriate to manage these small-mesh fisheries by designating small areas with predictable catch rates of whiting, red hake, and dogfish. These three species' migrations will frustrate fishermen and managers if fishing is restricted to small areas. Furthermore, whiting fisheries have become increasingly recruitment-dependent, and catches will fluctuate with stock size depending on incoming year class strengths. In another year - or in another season - catches of whiting, red hake and dogfish that fell below expectations in Areas 1, 3 and 4 might be much higher.

(B) By-catch Avoidance

The raised footrope trawl as currently rigged reduces flatfish by-catch by about 80-90%. Where flatfish predominate the regulated species by-catch, the use of the raised footrope trawl will sufficiently mitigate the problem. Among the five areas, average flatfish catch rates ranged up to 29 lbs./hr, so as long as the catch of all species combined averaged at least 600 lbs./hr, the 5% by-catch allowance would not be exceeded for most tows - assuming the catch of the other regulated species, roundfish (cod, redfish, white hake, redfish, pollock, and haddock) is minimal. Where regulated roundfish species predominate, managers should exercise caution to ensure the fleet-wide by-catch levels do not threaten species' recovery. The net currently is not designed specifically to mitigate by-catches of roundfish, such as cod.

The three most common roundfish regulated species were cod, white hake, and redfish. Highest catch rates among regulated roundfish species were seen in area 2A (western edge of Stellwagen) where cod by-catches dominated regulated species catch compositions. Cod was seen in most (47 of 54 valid tows), but catches were highly variable: four tows exceeded 100 lbs./hr. with a maximum of 500 lbs./hr.

High cod catch rates surprised us and may not have been typical of by-catch species composition throughout the entire Area 2A. However, no data were collected in the rest of Area 2A to support this

speculation . These high cod catch rates may be a feature of the small portion of Area 2A where fishing was concentrated. As noted earlier, sea sampling coverage was limited to a small eastern portion of Area with no sea sampling observations in the central or western portions of the area (Figure 3). Trawlers fished primarily in this small area because whiting catches were high, but fixed gear also prevented trawlers from fishing elsewhere in 2A.

The cod-dominated by-catch species composition in Area 2A was inconsistent with previous federal sea sampling results (1989-1993) reviewed by NMFS staff that formed the basis for refusing fishermen's request to open some of this area in 1995 (NMFS NEFSC, 1995). In 1997, DMF re-analyzed the 1989-1993 tow data and found by-catch dominated by flounders (primarily American plaice) with 73% of regulated species by-catch as flatfish species. However, the 1995 analysis included tows scattered throughout the area. Comparisons between the 1997 results and previous sea sampling results are difficult because most tows sampled during 1997 were outside (east of) the area requested by industry in 1995.

DMF expected catch compositions in Area 2A to be similar to that seen in northern Cape Cod Bay where juvenile flounders (notably American plaice) predominate. The raised footrope trawl was expected to reduce by-catch to acceptable levels. These results are frustrating since they do not demonstrate whether this net design is suitable for most Area 2A.

By-catch of Gulf of Maine cod may be problematic given the dire condition of this stock. The 24th Northeast regional Stock Assessment Workshop declared Gulf of Maine cod on the verge of collapse and stated an immediate reduction in fishing mortality to levels approaching zero was warranted (SAW 24). Elevated primarily by cod catch rates, all three by-catch statistics (aggregate percentage, mean trip percentage, and mean tow percentage) for Area 2A came in above 5%.

Another regulated roundfish species, white hake, dominated by-catch east of Chatham in Area 3. This finding was consistent with past sea sampling results in the area where white hake was the predominant regulated species in the by-catch. A DMF analysis of federal sea sampling data (1997) showed white hake accounting for 88% (by weight) of regulated species by-catch seen in 47 tows over 13 trips. White hake by-catch east of Chatham was lower (20 lbs./hr) than that seen for cod west of Stellwagen. Furthermore, all three by-catch standards for Area 3 came in below 5% (Table 6).

In contrast to Gulf of Maine cod, white hake are not considered overfished. The last formal assessment was conducted back in 1994; the stock was considered "fully exploited" at the 1993 level of fishing and was at a medium level of biomass (NEFMC, Multispecies Monitoring Committee Report 1997).

Finally, redfish was the top ranking by-catch species (averaging 21 lbs./hr.) in Area 1, southeast of Cape Ann. This area saw very little fishing activity and only two sea sampling trips were conducted. Limited sampling in this area may be too low to determine whether this area would provide viable small-mesh fisheries in the future. However the preponderance of redfish in the regulated species by-catch may be problematic.

In Area 4, limited sampling accomplished in this area may be inadequate to conclude that this area would provide viable small-mesh fisheries for whiting in the future. However, the low occurrence of all regulated species in the catches (cod, haddock, white hake, pollock) is encouraging if economically viable concentrations of whiting are present during fall months.

(C) Compliance

The vast majority of vessels and trips sampled showed good compliance with by-catch restrictions and net specifications. Most participants worked diligently to ensure the fishery's success and saw their participation as a privilege that could be lost if cheating were detected. State Division of Law Enforcement officers cooperated with U.S. Coast Guard to monitor the fleets' activities at-sea and dockside.

Degree of compliance with net design may be the most difficult factor to measure. It is the most critical element of the program. DMF invested significant effort to inspect all vessels' nets dockside prior to their joining the fishery. Sea samplers scrutinized catches and nets for compliance. Also, a thorough DMF inspection was done on many vessels' nets midway through the season. Fishermen, regulators, and

especially law enforcement officials have found the net design to be complex with rules governing many features of the groundgear construction.

DMF's samplers found that certain changes to the net did compromise its performance. On two sea sampling trips a DMF sampler noted elevated by-catches of flounders, crabs, lobster, and sculpins. At the end of the trips, net inspections were conducted with DMF's gear experts and the captains. In both cases, the sweep's overall length was found to be too short, and the captain was ordered to reconfigure the net. DMF staff also found one vessel with a short sweep during routine dockside inspection.

As for the non-compliant sweeps, these three captains all claimed they made no changes to their nets after initial DMF inspection. DMF's original inspections were not sufficiently documented, so no enforcement action was taken against these vessels, as long as the changes were made. After these incidents, net inspections were more detailed and future inspections were well documented and each form signed by the captain.

DMF revoked the permit of one participant because his net was completely re-rigged without DMF approval and was out of compliance.

In summary, compliance was good regarding the stringent permit conditions because the participants recognized the privileges granted them and the financial benefits from the fishery. The net specifications are the most complex of the permit restrictions and these were the most difficult to monitor. However, we found most vessels' nets in compliance with the specifications.

The net design is still evolving and DMF expects modifications to improve its enforceability. DMF has received constructive recommendations from some of the participants that would improve the net's design, reduce its complexity, and further ensure compliance. (See letter from Captain Bill Amaru in Appendix F). Recent testing of the net in a flume tank at Memorial University, St. John's Newfoundland has provided insights into the net behavior and ways to improve its design. (See DMF news article and Boston Globe article in Appendix G)

(D) Gear conflicts

Finally, even the most precise creation of fishing zones by managers can be undermined by gear conflicts with fixed gear (lobster traps, gillnets). Increases in offshore lobster trap fishing effort by Massachusetts fishermen have been well documented with a 27% increase in traps fished during 1992-1996 (Pava et. al, 1997). Draggermen have complained that since Mass. Bay and Cape Cod Bay were closed to small-mesh trawling in 1995, fixed gear has proliferated in these areas. Gloucester-based trawlermen reported fixed gear in many areas west of Stellwagen. Also there was a gear conflict reported by a Beverly-based (north shore) lobsterman who set traps on southern Stellwagen.

DMF spent considerable effort in 1997 to ensure open fishing areas for the Provincetown-based trawlers by brokering agreements between lobstermen and trawlermen to create gear-free zones for the Provincetown fleet in state waters of northern Cape Cod Bay These negotiations resulted in fixed gear being displaced to the perimeter of the gear-free zone, creating what DMF observers described as a "wall of high flyers," essentially boxing in the trawlers. Frequent meetings were held during October and November and two changes were made to the informal agreements. (See Appendix E). Lobstermen, while accommodating draggermen's needs, were anxious to set their gear in the whiting area as soon as the whiting fishery subsided.

Cooperation was impressive among both sides in the Cape Cod Bay access negotiations. However, there would have been far less cooperation among lobstermen if normal whiting nets and large lobster catches were allowed. DMF has convinced lobstermen that the raised footrope trawl passes over most lobsters, so there's no longer direct competition for lobster. Furthermore, the ban on lobster possession for trawlers using the raised footrope trawl further helped ensure compliance with the net design, and was critical for lobstermen's cooperation. This area is renowned for high lobster catches as well as concentrations of new- and paper-shelled lobster that suffer high mortality from trawling.

VII. RECOMMENDATIONS

1) NMFS should establish an exempted fishery in Area 2B (Cape Cod Bay and lower Massachusetts Bay) and Area 3 (east of Chatham) with the same by-catch rules enacted in the 1997 experimental fishery. This is the third consecutive year with a successful fall experimental fishery in Cape Cod Bay. By-catch has been below 5% despite variable catch rates of whiting, the primary target species.

In Area 3 (east of Cape Cod), the by-catch rates and species composition appeared similar to past analyses. The only by-catch hurdle appears to be catches of white hake, but this species is not overfished. DMF recommends NMFS allow catch and retention of white hake to improve catch records for assessment purposes. Furthermore, allowing a limited seasonal exempted fishery in this region should not increase fishing effort in this area compared to pre-1994 levels of effort when the last assessment was conducted.

2) NMFS should continue the experimental fisheries in Areas 1 and 4, to gather more catch and by-catch data. NMFS should ensure these areas are sufficiently large to ensure the fleet can locate whiting, red hake, and dogfish if these species migrate beyond the areas' borders. Regular sea sampling (as was done in the 1997 fishery) should be continued in these three areas. Other permit restrictions should be continued as well.

3) DMF recommends a continuation of the experimental fishery for Area 2A to obtain data from tows throughout the area. DMF believes further sea sampling in raised footrope trawl fisheries in the main portion of Area 2A will prove that this area is probably worthy of an exemption. Past analyses of sea sampling data suggest that the net should succeed in this region for vessels targeting whiting, red hake, and dogfish, since American plaice has historically been the predominant regulated species. However, NMFS should consider keeping the fleet out of the area along the western edge of Stellwagen Bank that vessels frequented if sea sampling shows cod or other roundfish abundant.

4) NMFS should provide direct support for future phases of the experimental fishery because this fishery is primarily in federal waters and under NMFS jurisdiction. Sea sampling support is needed to continue the program either in the form of funds for DMF, or contracted observer sea days from the federal program.

5) To accelerate gear research to devise the best and most enforceable design, NMFS gear experts should participate actively in future gear trials and reviews. Also, industry input is critical and should be solicited to ensure the most efficient and enforceable design.

6) NMFS and the New England Fishery Management Council should take a lead role in determining eligibility and access to experimental fisheries. DMF was in an awkward position by having to determine eligibility in this past season's experimental fishery; most fishing occurred in federal waters. All vessels were federal permit holders, yet NMFS placed the onus on DMF to determine participants. Many fishermen who were denied participation, objected to the eligibility criteria. With the current limits on Days-At-Sea for trawlers, many fishermen argued they were desperate to enter this experimental or other exempted fisheries to replace lost groundfishing opportunities. If open access had been allowed, the number of participants would have included at least 50 vessels - and likely many more -especially trawlers constrained by groundfish Days-at-Sea restrictions. Consequently, NMFS and the Council should determine appropriate effort levels for these experimental - or if approved - exempted fisheries.

7) NMFS should amend the regulations regarding the establishment and conduct of experimental fisheries. First, policies on adequate sampler coverage levels should be established. This program produced less than 2 sea sampling trips per vessel among the 31 participants. Was this coverage level sufficient? DMF turned away vessels because of our inability to provide additional observer coverage. This became particularly awkward when fishermen denied from the fishery offered to pay for sampler coverage, but DMF was unable

to accommodate them.

8) NMFS and the Council should work to develop new policies and regulations regarding by-catch to minimize unwanted by-catch of all species, and proceed beyond the current 19:1 approach, where for every pound of regulated species fishermen must ensure at least 19 lbs. of non-regulated species are retained in the catch. Consistent with the new Sustainable Fisheries Act, all unwanted by-catch should be reduced, whether the species are among the 10 regulated groundfish species, other economically valuable species (e.g. monkfish and lobster), or even low valued species that may be important forage (sea herring and river herring).

VIII. LITERATURE CITED

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IX. ACKNOWLEDGMENTS

This work was accomplished with the cooperation of industry, other agencies, and many individuals within the Commonwealth.

Commonwealth of Massachusetts: DMF Director Philip G. Coates provided guidance and support during this past year's program and has been an ardent supporter of DMF's work reduce by-catch and establish a sustainable small-mesh fishery for whiting dating back to the 1980's.

Commissioner John Phillips and Executive Office of Environmental Affairs Secretary Trudy Coxe supported the program through grants to DMF's Conservation Engineering Program.

The Massachusetts Division of Law Enforcement has provided at-sea and dockside inspections during this and other experimental fisheries to ensure compliance. Other DMF staff also participated in the program. Sea sampling was also provided by Eric Waal, Dana Morse, Jeremy King, and Kevin Creighton.

Dorothy Graaskamp of the Department's GIS program provided technical support plotting areas and tow location data.

Captain Henry Souza, working as a consultant to DMF, was an invaluable asset to the program.

National Marine Fisheries Service: Fisheries Management staff have provided guidance and assistance securing experimental fisheries permits. Peter Christopher, Kathy Rodriguez, and Susan Murphy all have been extremely helpful to DMF during this program as well as prior experimental fisheries.

New England Fishery Management Council: The Council provided a grant to support this work. Also Staff member Phil Haring has provided advice and technical assistance.

Fishing Industry: Cooperation, sound advice, and moral support has come from all participating fishermen, seafood buyers, and fishermen's representatives. Special thanks to Raymond Duarte, Joe Venagre, Capt William Amaru, and Gloucester Fisheries Commission Executive Director Vito Calomo.

X. APPENDICES

Appendix A. **Sea Sampling Results Tables**
Appendix B: **Correspondence between DMF and NMFS regarding the application to conduct the experimental fishery**
Appendix C: **DMF's Notice to Fishermen with application and list of rejected vessels**
Appendix D: **Length-frequency histograms for various species by area**
Appendix E: **DMF's Notices to fishermen regarding the access agreements for Cape Cod Bay**
Appendix F: **Letter from Captain Bill Amaru regarding net design**
Appendix G: **News coverage of gear trials: DMF News article and Boston Globe article**

Appendix A. Sea Sampling Results Tables

- Appendix Table 1A: Sea Sampling Trip Summary by Fishing Area (2 pages)
- Appendix Table 1B: Sea Sampling Tow Summary by Fishing Area (5 pages)

Appendix Table 1A
1997 Experimental Whiting Fishery Sea Sampling Results
Trip Summary By Fishing Area

TRIP IDENTIFIER	AREA FISHED	TRIP TYPE *	NUMBER OF TOWS	TOW TIME (hrs.)	WHITING / HR.	RED HAKE / HR.	SPINY DOGFISH / HR.	ATLANTIC HERRING / HR.	BLUEBACK HERRING / HR.	ALEWIFE / HR.	AMERICAN PLAICE / HR.	ATLANTIC COD/ HR.	WINTER FLOUNDER / HR.	REDFISH / HR.	WHITE HAKE / HR.	YELLOWTAIL FLD. / HR.	WITCH FLOUNDER / HR.	WINDOWPANE FLD. / HR.	POLLOCK / HR.	HADDOCK / HR.	ILLEX SQUID / HR.	AMERICAN LOBSTER / HR.	LOLIGO SQUID / HR.	LONGHORN SCULPIN / HR.	MONKFISH / HR.	OTHER / HR. **	REG. FLATFISH / HR.	REG. ROUNDFISH / HR.	TOTAL REG. SPECIES / HR	PERCENT REG. SPP.	TOTAL CATCH / HR.
W97011	1	Q	3	2.4	103	109	16	0	1562	0	18	0	1	3	0	0	0	0	0	0	3	14	0	0	2	0	19	3	22	1.2	1832
W97052	1	R	3	7.2	100	171	50	2	0	0	19	2	1	40	0	1	0	0	1	0	1	3	12	0	0	19	21	44	65	15.3	423
Mean			3.0	4.8	102	140	33	1	781	0	19	1	1	21	0	0	0	0	1	0	2	8	6	0	1	10	20	23	43	8.3	1128
Median			3.0	4.8	102	140	33	1	781	0	19	1	1	21	0	0	0	0	1	0	2	8	6	0	1	10	20	23	43	8.3	1128
W97006	2a	Q	6	4.3	535	269	5	290	0	0	36	16	0	4	0	1	8	0	5	0	1	4	0	4	0	7	45	25	70	5.9	1185
W97008	2a	Q	3	2.4	2586	275	3	0	900	0	60	57	0	6	0	0	0	0	0	1	10	10	0	1	6	0	60	64	124	3.2	3914
W97014	2a	Q	4	4.6	633	73	1	27	0	0	9	5	0	5	0	0	1	0	0	0	11	2	0	0	0	5	10	10	20	2.6	772
W97015	2a	Q	4	6.1	757	149	1	0	68	0	19	28	0	5	0	0	2	0	0	0	26	1	0	1	0	4	21	34	56	5.2	1063
W97016	2a	Q	5	5.4	570	209	13	59	0	0	40	53	0	7	0	2	0	0	1	0	33	4	0	24	0	54	42	61	103	9.6	1070
W97017	2a	Q	4	5.5	1081	124	3	290	0	0	26	7	0	4	0	0	1	0	0	0	61	4	0	2	0	8	27	11	38	2.4	1611
W97021	2a	R	1	1.5	233	267	2	0	0	0	21	40	0	5	0	0	1	0	0	0	7	1	0	6	0	0	23	45	68	11.6	585
W97022	2a	R	4	7.3	1176	193	46	741	0	0	14	82	1	8	0	0	1	0	0	0	15	2	0	3	0	5	16	90	106	4.6	2286
W97026	2a	R	1	2.2	277	115	8	0	46	0	9	1	0	2	3	0	2	0	0	0	18	3	0	0	0	10	11	6	17	3.5	495
W97027	2a	R	2	4.2	408	199	90	36	0	0	27	30	0	3	3	0	1	0	0	0	6	5	0	1	0	2	28	36	64	7.9	811
W97028	2a	R	3	6.0	476	92	7	0	267	0	18	6	0	2	11	0	1	0	0	0	27	5	17	1	2	6	20	18	37	4.0	937
W97029	2a	R	3	6.1	485	129	4	119	0	0	8	21	0	1	4	0	0	0	0	0	62	4	0	4	0	0	8	26	35	4.1	840
W97033	2a	R	3	7.7	499	57	19	7	1	1	8	127	0	1	0	1	0	0	0	0	3	2	0	5	0	1	9	128	137	18.7	732
W97034	2a	R	2	4.1	369	86	10	31	0	1	21	3	0	2	0	1	1	0	0	0	17	8	0	0	0	9	23	5	28	5.0	559
W97036	2a	R	2	4.5	637	465	0	0	2	0	9	11	1	12	1	0	0	0	0	0	5	7	0	1	0	0	10	24	34	2.9	1151
W97038	2a	R	3	6.7	315	349	0	24	2	1	33	5	0	10	3	0	1	0	0	0	10	6	0	7	0	2	34	19	53	6.9	770
W97045	2a	R	1	2.8	269	424	42	35	0	9	28	19	1	11	0	0	0	0	0	0	23	0	1	11	0	11	30	31	60	6.8	885
W97046	2a	R	2	6.2	373	174	35	41	2	2	16	11	0	6	0	0	0	0	0	0	15	2	2	6	0	19	16	17	33	4.6	704
W97047	2a	R	3	5.9	191	73	28	0	0	0	31	28	0	2	0	0	0	0	0	0	8	16	3	8	1	53	31	31	62	14.1	442
W97051	2a	R	3	8.0	497	106	182	24	2	7	62	6	1	4	4	1	0	0	0	0	6	32	45	31	4	45	63	14	77	7.3	1058
Mean			3.0	5.1	618	191	25	86	65	1	25	28	0	5	1	0	1	0	0	0	18	6	3	6	1	12	26	35	61	6.6	1093
Median			3.0	5.5	491	161	7	25	0	0	21	18	0	5	0	0	1	0	0	0	13	4	0	3	0	6	23	26	58	5.1	862
W97001	2b	Q	2	1.5	81	80	11	4	0	0	56	0	3	0	0	0	0	0	0	0	11	16	1	1	0	4	58	0	58	21.8	268
W97002	2b	Q	2	1.6	96	31	0	5	0	0	6	0	0	0	1	0	0	0	0	0	18	3	1	0	3	1	6	1	8	4.6	167
W97005	2b	R	3	4.5	284	123	38	44	26	3	66	0	1	0	0	0	0	0	0	0	27	43	11	1	3	18	68	0	68	9.9	688
W97009	2b	R	2	4.4	84	9	1	0	0	11	4	0	0	0	0	0	0	0	0	0	11	6	2	0	0	1	4	0	4	3.3	130
W97010	2b	R	3	6.0	363	187	4	2	75	2	10	0	11	0	0	0	0	0	0	0	15	2	3	2	0	36	21	0	22	3.0	714
W97013	2b	Q	5	8.3	249	112	2	0	69	0	27	0	6	1	0	0	0	0	0	0	8	21	0	1	12	14	32	1	33	6.3	521
CONTINUED																															

Appendix Table 1A
1997 Experimental Whiting Fishery Sea Sampling Results
Trip Summary By Fishing Area

TRIP IDENTIFIER	AREA FISHED	TRIP TYPE *	NUMBER OF TOWS	TOW TIME (hrs.)	WHITING / HR.	RED HAKE / HR.	SPINY DOGFISH / HR.	ATLANTIC HERRING / HR.	BLUEBACK HERRING / HR.	ALEWIFE / HR.	AMERICAN PLAICE / HR.	ATLANTIC COD/ HR.	WINTER FLOUNDER / HR.	REDFISH / HR.	WHITE HAKE / HR.	YELLOWTAIL FLD. / HR.	WITCH FLOUNDER / HR.	WINDOWPANE FLD. / HR.	POLLOCK / HR.	HADDOCK / HR.	ILLEX SQUID / HR.	AMERICAN LOBSTER / HR.	LOLIGO SQUID / HR.	LONGHORN SCULPIN / HR.	MONKFISH / HR.	OTHER / HR. **	REG. FLATFISH / HR.	REG. ROUNDFISH / HR.	TOTAL REG. SPECIES / HR	PERCENT REG. SPP.	TOTAL CATCH / HR.
W97018	2b	R	1	1.7	149	102	2	0	0	2	4	0	13	0	1	0	0	0	0	0	11	0	3	3	0	15	16	1	17	5.7	304
W97019	2b	R	1	2.3	170	64	0	1	0	2	1	0	10	1	0	0	0	0	0	0	1	0	1	2	0	3	12	1	12	4.8	256
W97023	2b	R	4	8.5	261	190	225	6	1	17	9	0	11	0	0	0	0	1	0	0	19	6	7	6	4	19	22	0	22	2.9	783
W97024	2b	R	4	7.9	116	296	59	1	4	2	8	2	17	0	0	1	0	3	0	0	11	9	2	19	5	24	28	3	31	5.4	579
W97025	2b	R	3	6.7	244	146	91	6	0	0	3	0	4	0	0	0	0	0	0	0	0	3	0	3	0	15	8	0	8	1.6	516
W97030	2b	Q	2	3.2	294	266	28	0	70	0	11	2	8	0	0	0	0	0	0	0	76	10	0	0	0	18	20	2	22	2.7	785
W97031	2b	R	5	9.7	192	18	2	8	0	155	1	0	4	0	0	0	0	0	0	0	5	11	3	1	0	19	5	0	5	1.3	420
W97032	2b	R	5	9.2	317	25	15	0	194	0	0	3	12	0	0	0	0	1	0	0	2	11	0	3	3	12	13	3	15	2.6	597
W97035	2b	R	3	7.0	165	32	13	0	46	0	2	1	16	0	1	0	0	1	0	0	15	15	0	0	7	11	18	3	21	6.4	324
W97037	2b	R	4	8.6	161	24	15	0	34	0	1	0	4	0	0	0	0	0	0	0	0	15	0	3	0	17	5	0	5	2.0	275
W97039	2b	R	2	3.4	317	27	574	0	0	95	1	0	19	0	5	0	0	1	0	0	4	19	4	3	2	12	21	5	26	2.4	1084
W97040	2b	R	6	8.2	597	61	411	2	8	53	2	4	22	0	1	0	0	0	0	0	0	14	14	9	0	23	24	5	29	2.4	1221
W97041	2b	R	3	5.3	492	69	685	0	0	0	2	0	65	0	28	0	0	2	0	0	15	31	35	14	14	114	69	28	98	6.2	1566
W97043	2b	R	3	5.5	582	27	250	52	0	0	0	5	10	0	0	1	0	0	0	0	2	70	12	9	0	17	11	5	16	1.5	1036
W97048	2b	R	5	8.1	156	10	318	0	0	0	4	13	39	0	0	2	0	3	0	0	0	41	0	6	3	84	48	14	62	9.1	680
Mean			3.2	5.8	256	90	131	6	25	16	10	1	13	0	2	0	0	1	0	0	12	16	5	4	3	23	24	3	29	5.0	600
Median			3.0	6.0	244	64	15	1	0	0	4	0	10	0	0	0	0	0	0	0	11	11	2	3	0	17	20	1	22	3.3	550
W97001	3	Q	2	1.5	156	111	12	85	0	0	12	1	32	0	0	4	0	0	0	0	17	0	0	14	1	83	48	1	49	9.2	528
W97003	3	Q	3	2.5	94	112	111	52	0	0	6	1	0	0	0	0	1	0	0	0	21	0	0	1	4	7	8	1	9	2.1	411
W97004	3	Q	3	2.2	410	1015	1	63	0	2	21	2	1	0	0	0	0	0	0	0	5	0	0	3	5	27	22	3	25	1.6	1556
W97012	3	R	3	6.1	170	199	5	9	0	0	8	0	0	7	12	0	1	0	0	0	2	0	0	0	3	1	9	19	28	6.7	418
W97044	3	R	4	2.7	1829	513	240	0	0	11	1	0	15	0	58	14	0	0	0	0	2	0	0	29	7	66	31	58	89	3.2	2787
W97049	3	R	4	7.2	180	189	7	77	0	88	0	3	2	0	27	1	0	0	0	1	3	2	10	0	0	11	3	31	34	5.6	601
Mean			3.2	3.7	473	357	63	48	0	17	8	1	8	1	16	3	0	0	0	0	8	0	2	8	3	32	20	19	39	4.7	1050
Median			3.0	2.6	175	194	10	57	0	1	7	1	1	0	6	1	0	0	0	0	4	0	0	2	4	19	16	11	31	4.4	564
W97042	4	R	3	4.4	192	0	26	0	0	0	0	0	0	0	0	0	0	0	0	0	4	1	16	0	0	52	0	0	0	0.1	293
W97050	4	R	4	9.1	235	33	0	153	0	74	0	1	0	0	0	1	0	0	0	0	10	3	16	1	1	5	1	1	2	0.4	533
Mean			3.5	6.8	214	17	13	76	0	37	0	0	0	0	0	0	0	0	0	0	7	2	16	0	1	29	0	1	1	0.2	413
Median			3.5	6.8	214	17	13	76	0	37	0	0	0	0	0	0	0	0	0	0	7	2	16	0	1	29	0	1	1	0.2	413

NOTES: Analysis includes all tows. Catch rates(lbs./hr.) calculated as the summed catch for a particular species over all tows in the trip divided by the total tow time(hrs.) for the trip.

* Trip type: Q indicates the first or "qualifying" trip(s) aboard a vessel without prior experience with the experimental trawl, R indicates trips "randomly" chosen from the entire pool of permitted vessels.

** Other: Includes catches of 40 species and species groups such as ocean pout, skates, crabs, unsorted herring etc., making up 2.4% of the total catch observed from all tows.

Appendix Table 1B
1997 Experimental Whiting Fishery Sea Sampling Results
Tow Summary By Fishing Area

NOTE: Obstructed tows are excluded from this analysis and are presented at end of table.

TRIP IDENTIFIER	AREA FISHED	TRIP TYPE *	TOW NUMBER	WHITING / HR.	RED HAKE / HR.	SPINY DOGFISH / HR.	ATLANTIC HERR. / HR.	BLUEBACK HERR. / HR.	ALEWIFE / HR.	AM. PLAICE / HR.	ATLANTIC COD / HR.	WINTER FLOUNDER / HR	REDFISH / HR.	WHITE HAKE / HR.	YELLOWTAIL FLD. / HR.	WITCH FLD. / HR.	WINDOWPANE FLD. / HR	POLLOCK / HR.	HADDOCK / HR.	ILLEX SQUID / HR.	AM. LOBSTER / HR.	LOLIGO SQUID / HR.	LH SCULPIN / HR.	MONKFISH / HR.	OTHER / HR. **	REG. FLATFISH / HR.	REG. ROUNDFISH / HR.	TOTAL REG. SPP. / HR.	PERCENT REG. SPP.	TOTAL CATCH / HR.
W97011	1	Q	1	84	156	20	0	273	0	24	0	3	0	0	1	0	0	0	0	0	6	0	0	2	0	28	0	28	4.9	569
W97011	1	Q	2	154	105	32	0	736	0	20	0	0	0	0	0	0	0	0	0	9	22	0	1	5	1	20	0	20	1.8	1085
W97011	1	Q	3	68	88	0	0	3000	0	13	0	0	7	0	0	0	0	0	0	0	10	0	0	0	0	13	7	20	0.6	3186
W97052	1	R	1	104	177	125	0	0	0	29	3	1	55	0	1	0	0	3	0	1	8	14	0	0	43	31	62	93	16.5	564
W97052	1	R	2	80	145	7	5	0	0	19	3	1	39	0	0	1	0	0	0	1	0	17	0	0	11	20	42	62	18.8	330
W97052	1	R	3	123	200	20	0	0	0	9	0	1	25	0	1	0	0	0	0	1	0	2	0	0	2	10	25	35	9.1	382
Mean			2.0	102	145	34	1	668	0	19	1	1	21	0	1	0	0	1	0	2	8	5	0	1	10	21	23	43	8.6	1019
Median			2.0	94	151	20	0	136	0	19	0	1	16	0	0	0	0	0	0	1	7	1	0	0	2	20	16	31	7.0	566
W97006	2a	Q	1	360	255	0	150	0	0	180	24	0	0	0	6	60	0	0	0	6	24	0	18	0	60	246	24	270	23.6	1143
W97006	2a	Q	2	480	252	0	72	0	0	86	14	5	8	0	7	34	0	0	0	0	10	0	4	0	6	132	23	155	15.8	978
W97006	2a	Q	3	600	360	0	720	0	0	14	14	0	10	0	0	0	0	0	0	0	2	0	0	0	0	14	24	38	2.2	1721
W97006	2a	Q	4	382	245	18	355	0	0	20	16	0	0	0	0	0	0	1	0	0	2	0	4	0	1	20	17	37	3.6	1045
W97006	2a	Q	5	900	400	6	400	0	0	21	18	0	0	0	0	0	0	21	0	2	0	0	3	0	6	21	39	60	3.4	1777
W97006	2a	Q	6	400	160	0	120	0	0	10	13	0	9	0	0	0	0	0	0	0	0	0	2	0	1	10	22	32	4.5	715
W97008	2a	Q	1	1784	405	10	0	486	0	75	164	0	10	0	0	0	0	0	3	0	5	0	1	0	0	75	177	252	8.6	2943
W97008	2a	Q	2	2571	171	0	0	566	0	83	30	1	9	0	0	0	0	2	0	41	22	0	5	23	0	85	40	125	3.5	3526
W97014	2a	Q	1	647	203	0	4	0	0	35	12	0	12	0	0	4	0	0	0	7	4	0	0	0	4	39	24	63	6.8	933
W97014	2a	Q	2	294	117	0	2	0	0	10	21	0	7	0	0	1	0	0	0	13	0	1	1	0	17	11	29	40	8.2	485
W97014	2a	Q	3	820	43	0	22	0	0	4	0	0	1	0	0	0	0	0	0	12	1	0	0	0	0	4	1	5	0.6	904
W97014	2a	Q	4	642	47	1	40	0	0	6	0	0	4	1	0	0	0	0	0	11	2	0	0	0	4	6	6	11	1.5	759
W97015	2a	Q	1	727	364	0	0	0	0	32	184	0	12	0	0	3	0	0	0	0	1	0	0	0	9	35	196	231	17.3	1332
W97015	2a	Q	2	651	169	7	0	8	0	20	8	0	6	0	1	2	0	1	0	56	1	0	4	0	8	22	15	37	3.9	941
W97015	2a	Q	3	770	100	0	0	150	0	16	24	0	6	0	1	3	1	0	0	30	1	0	0	0	0	20	30	50	4.5	1101
W97015	2a	Q	4	807	129	0	0	43	0	18	6	0	4	0	0	1	0	0	0	13	2	0	1	0	5	19	9	28	2.8	1029
W97016	2a	Q	1	560	20	20	60	0	0	2	500	0	0	0	8	0	0	0	0	80	0	0	197	0	7	10	500	510	35.1	1454
W97016	2a	Q	2	1200	220	110	84	0	0	0	14	0	4	0	2	0	0	2	0	200	0	0	22	0	18	2	20	22	1.2	1876
W97016	2a	Q	3	373	89	0	21	0	0	11	5	0	6	0	0	0	0	0	0	0	2	0	1	1	9	11	11	21	4.1	518
W97016	2a	Q	4	380	31	5	71	0	0	11	18	0	3	0	3	0	0	3	0	0	1	0	14	0	9	14	24	38	6.9	548
W97016	2a	Q	5	609	386	0	59	0	0	84	0	0	12	0	0	0	0	0	0	17	9	0	0	0	113	84	12	96	7.5	1287
W97017	2a	Q	1	933	419	21	16	0	0	27	53	0	9	0	1	5	0	1	0	27	8	0	12	0	25	33	63	96	6.2	1557
W97017	2a	Q	2	720	250	0	32	0	0	34	0	0	10	0	0	1	0	0	0	0	12	0	2	0	8	35	10	44	4.2	1068
W97017	2a	Q	3	2191	111	0	339	0	0	21	0	0	0	0	0	0	0	0	0	127	0	0	0	0	11	21	0	21	0.8	2800
W97017	2a	Q	4	841	17	0	417	0	0	26	0	0	2	0	0	0	0	0	0	65	2	0	0	0	2	26	2	27	2.0	1371
W97021	2a	R	1	233	267	2	0	0	0	21	40	0	5	0	0	1	0	0	0	7	1	0	6	0	0	23	45	68	11.6	585
W97022	2a	R	1	1596	248	11	655	0	0	15	252	0	4	0	3	4	0	0	0	55	0	0	5	0	2	22	256	278	9.8	2849
W97022	2a	R	2	2968	379	87	1516	0	0	23	45	0	11	0	0	0	0	0	0	38	2	0	0	0	0	23	57	79	1.6	5069
W97022	2a	R	3	658	145	31	387	0	0	10	40	0	2	0	0	0	0	0	0	0	3	0	3	0	2	11	42	53	4.2	1284
W97022	2a	R	4	318	91	47	636	0	0	12	87	1	14	0	0	0	0	1	0	0	0	0	2	0	13	13	102	115	9.4	1223

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Appendix Table 1B
1997 Experimental Whiting Fishery Sea Sampling Results
Tow Summary By Fishing Area

NOTE: Obstructed tows are excluded from this analysis and are presented at end of table.

TRIP IDENTIFIER	AREA FISHED	TRIP TYPE*	TOW NUMBER	WHITING / HR.	RED HAKE / HR.	SPINY DOGFISH / HR.	ATLANTIC HERR. / HR.	BLUEBACK HERR. / HR.	ALEWIFE / HR.	AM. PLAICE / HR.	ATLANTIC COD / HR.	WINTER FLOUNDER / HR	REDFISH / HR.	WHITE HAKE / HR.	YELLOWTAIL FLD. / HR.	WITCH FLD. / HR.	WINDOWPANE FLD. / HR	POLLOCK / HR.	HADDOCK / HR.	ILLEX SQUID / HR.	AM. LOBSTER / HR.	LOLIGO SQUID / HR.	LH SCULPIN / HR.	MONKFISH / HR.	OTHER / HR. **	REG. FLATFISH / HR.	REG. ROUNDFISH / HR.	TOTAL REG. SPP. / HR.	PERCENT REG. SPP.	TOTAL CATCH / HR.
W97026	2a	R	1	277	115	8	0	46	0	9	1	0	2	3	0	2	0	0	0	18	3	0	0	0	10	11	6	17	3.5	495
W97027	2a	R	1	392	198	162	23	0	0	30	26	0	4	0	0	3	0	0	0	0	6	0	1	0	4	33	31	64	8	850.6
W97027	2a	R	2	425	200	13	50	0	0	23	35	0	2	5	0	0	0	0	0	13	3	0	1	0	1	23	42	65	8.4	769
W97028	2a	R	1	484	73	12	0	484	0	15	2	0	2	7	0	0	0	0	0	29	2	0	0	5	0	16	11	27	2.4	1117
W97028	2a	R	2	364	86	6	0	129	0	20	6	0	2	9	0	1	0	0	0	43	3	0	1	0	2	20	18	38	5.7	672
W97028	2a	R	3	632	126	0	0	189	0	21	10	1	1	17	0	1	0	0	0	0	13	63	0	0	20	23	28	51	4.6	1094
W97029	2a	R	1	525	175	12	150	0	0	15	27	0	3	0	0	1	0	0	0	75	3	0	1	0	0	16	29	45	4.5	985
W97029	2a	R	2	600	139	0	75	0	0	6	13	0	0	13	0	0	0	0	0	83	4	0	1	0	0	6	26	32	3.4	933
W97029	2a	R	3	336	74	0	130	0	0	3	23	0	1	0	0	0	0	0	0	29	5	0	10	0	0	3	24	27	4.5	611
W97033	2a	R	1	689	116	0	13	0	0	18	26	0	5	0	0	0	0	0	0	0	10	0	13	0	0	18	31	49	5.5	889
W97033	2a	R	2	680	60	60	12	2	2	2	69	0	0	0	2	1	0	0	0	2	0	0	2	0	0	5	69	74	8.3	892
W97034	2a	R	2	254	50	0	38	0	2	15	2	0	2	0	1	1	0	0	0	30	7	0	0	0	3	17	3	20	4.8	403
W97036	2a	R	1	541	762	0	0	5	0	11	4	2	15	1	0	0	0	1	0	0	3	0	1	0	0	13	22	35	2.6	1348
W97036	2a	R	2	716	221	0	0	0	0	8	16	0	9	0	0	0	0	0	0	9	10	0	0	0	0	8	25	33	3.3	989
W97038	2a	R	1	400	925	0	0	0	0	25	4	0	18	10	0	1	0	0	0	0	5	0	5	0	3	26	32	58	4.1	1395
W97038	2a	R	2	320	110	0	52	2	0	26	3	0	8	0	0	2	0	0	0	14	1	0	12	0	0	28	11	39	7.0	550
W97045	2a	R	1	269	424	42	35	0	9	28	19	1	11	0	0	0	0	0	0	23	0	1	11	0	11	30	31	60	6.8	885
W97046	2a	R	1	206	161	5	34	0	0	6	12	0	3	0	0	0	0	0	0	7	1	5	3	0	14	6	15	21	4.5	457
W97046	2a	R	2	523	185	62	48	5	3	25	9	0	9	0	0	0	0	0	0	22	3	0	9	0	23	25	18	44	4.7	925
W97047	2a	R	1	250	65	10	0	0	0	14	13	0	1	0	0	0	0	0	0	8	0	2	13	2	40	14	14	28	6.7	418
W97047	2a	R	2	250	100	73	0	0	0	40	47	0	3	0	0	0	0	1	0	13	15	2	6	1	65	40	51	91	14.8	615
W97047	2a	R	3	68	52	0	0	0	0	39	25	0	2	0	0	0	0	1	1	5	32	4	3	0	54	40	29	68	23.8	287
W97051	2a	R	1	267	97	143	18	3	8	17	8	0	0	0	0	0	0	0	0	7	6	43	0	0	52	18	9	26	3.9	670
W97051	2a	R	3	780	105	282	0	0	0	31	0	0	3	0	0	0	0	0	0	10	21	35	0	0	24	31	3	34	2.6	1291
Mean			2.2	679	198	23	127	39	0	25	37	0	5	1	1	2	0	1	0	23	5	3	7	1	12	29	44	73	6.7	1192
Median			2.0	550	153	2	28	0	0	19	14	0	4	0	0	0	0	0	0	10	3	0	2	0	4	20	24	44	4.5	982
W97001	2b	Q	3	81	89	12	2	0	0	61	0	3	0	0	0	0	0	0	0	7	17	1	2	0	5	64	0	64	23.0	279
W97001	2b	Q	4	82	62	10	8	0	0	46	0	1	0	0	0	0	0	0	0	21	15	0	0	0	3	47	0	47	19.0	248
W97002	2b	Q	1	97	50	0	9	0	0	5	0	0	0	3	0	0	0	0	0	17	7	2	0	0	1	5	3	8	4.1	190
W97002	2b	Q	2	96	22	0	4	0	0	7	0	0	0	0	0	0	0	0	0	19	1	0	0	4	1	7	0	8	4.9	156
W97005	2b	R	1	451	162	12	13	0	4	16	0	4	0	0	0	0	0	0	0	12	19	10	1	4	10	20	0	20	2.8	718
W97005	2b	R	3	260	116	50	81	59	0	104	0	1	0	0	0	0	0	0	0	45	67	9	0	5	32	105	0	105	12.7	827
W97009	2b	R	1	78	8	0	0	0	8	4	0	0	0	0	0	0	0	0	0	10	5	2	0	0	1	4	0	4	3.1	116
W97009	2b	R	2	91	10	2	0	0	13	4	0	0	0	0	0	0	0	0	0	11	8	2	0	0	1	5	0	5	3.4	143
W97010	2b	R	1	248	121	10	2	0	0	6	0	10	1	0	0	0	0	0	0	6	1	1	1	0	90	17	1	18	3.5	497
W97010	2b	R	2	314	261	0	2	37	3	12	0	11	0	0	0	0	1	0	0	16	0	3	2	0	8	24	0	24	3.6	669
W97010	2b	R	3	537	185	0	4	196	4	12	0	11	0	0	0	0	0	0	0	25	6	5	4	0	5	23	0	23	2.3	993

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Appendix Table 1B
1997 Experimental Whiting Fishery Sea Sampling Results
Tow Summary By Fishing Area

NOTE: Obstructed tows are excluded from this analysis and are presented at end of table.

TRIP IDENTIFIER	AREA FISHED	TRIP TYPE *	TOW NUMBER	WHITING / HR.	RED HAKE / HR.	SPINY DOGFISH / HR.	ATLANTIC HERR. / HR.	BLUEBACK HERR. / HR.	ALEWIFE / HR.	AM. PLAICE / HR.	ATLANTIC COD / HR.	WINTER FLOUNDER / HR	REDFISH / HR.	WHITE HAKE / HR.	YELLOWTAIL FLD. / HR.	WITCH FLD. / HR.	WINDOWPANE FLD. / HR	POLLOCK / HR.	HADDOCK / HR.	ILLEX SQUID / HR.	AM. LOBSTER / HR.	LOLIGO SQUID / HR.	LH SCULPIN / HR.	MONKFISH / HR.	OTHER / HR. **	REG. FLATFISH / HR.	REG. ROUNDFISH / HR.	TOTAL REG. SPP. / HR.	PERCENT REG. SPP.	TOTAL CATCH / HR.
W97013	2b	Q	1	139	81	0	0	174	0	6	0	7	1	0	0	0	0	0	0	6	9	0	0	8	1	13	1	14	3.3	432
W97013	2b	Q	2	198	65	0	0	78	0	1	0	14	1	0	0	0	0	0	0	6	6	0	4	0	24	15	1	15	3.9	395
W97013	2b	Q	3	247	225	7	0	66	0	62	0	2	1	0	0	0	0	0	0	11	47	0	0	0	15	64	1	64	9.4	683
W97013	2b	Q	4	573	158	0	0	19	0	67	0	1	2	0	0	0	0	0	0	11	40	0	0	70	0	68	2	70	7.5	943
W97013	2b	Q	5	159	17	0	0	0	0	2	0	1	0	0	0	0	0	0	0	7	1	0	0	0	25	3	0	3	1.4	213
W97018	2b	R	1	149	102	2	0	0	2	4	0	13	0	1	0	0	0	0	0	11	0	3	3	0	15	16	1	17	5.7	304
W97019	2b	R	1	170	64	0	1	0	2	1	0	10	1	0	0	0	0	0	0	1	0	1	2	0	3	12	1	12	4.8	256
W97020	2b	R	1	40	21	7	1	1	0	1	1	6	0	1	0	0	0	0	0	0	12	0	1	0	18	7	3	10	8.7	111
W97020	2b	R	2	183	138	0	1	0	21	66	0	20	0	4	1	0	0	0	0	6	0	1	4	0	25	88	4	92	19.6	472
W97023	2b	R	1	222	250	609	4	1	19	13	0	0	0	1	0	0	1	0	0	8	12	3	17	3	37	14	2	16	1.3	1201
W97023	2b	R	2	233	256	116	15	2	26	10	0	6	0	0	0	0	0	0	0	18	0	8	5	14	29	16	0	16	2.2	738
W97023	2b	R	3	195	80	131	2	0	13	7	0	19	0	0	0	0	3	0	0	26	5	9	2	0	8	29	0	29	5.9	500
W97023	2b	R	4	405	181	31	2	1	9	7	0	20	0	0	0	0	1	0	0	23	5	11	2	0	3	28	0	28	3.9	699
W97024	2b	R	1	79	242	72	1	2	1	1	0	15	0	0	1	0	0	0	0	3	4	2	23	2	18	17	0	17	3.6	464
W97024	2b	R	2	121	237	149	1	7	2	21	0	4	1	0	1	0	0	0	0	9	18	0	15	0	13	26	1	26	4.4	597
W97024	2b	R	3	126	439	12	2	6	2	7	8	18	0	0	2	0	7	0	0	26	6	4	18	0	39	33	8	41	5.7	719
W97024	2b	R	4	141	265	0	1	2	2	3	2	31	0	0	2	0	4	0	0	6	9	3	22	17	25	40	2	41	7.7	535
W97025	2b	R	1	325	200	273	0	0	0	9	0	6	0	0	0	0	1	0	0	0	8	0	6	0	26	15	0	15	1.8	853
W97025	2b	R	2	231	115	24	4	0	0	1	0	6	0	0	0	0	0	0	0	0	1	0	2	0	9	7	0	7	1.9	394
W97025	2b	R	3	190	130	4	11	0	0	1	0	2	0	0	0	0	0	0	0	0	1	0	1	0	12	3	0	3	0.8	352
W97030	2b	Q	1	236	236	23	0	69	0	10	3	9	0	0	1	0	0	0	0	78	6	0	0	0	26	20	3	22	3.2	698
W97030	2b	Q	2	421	329	40	0	73	0	13	0	7	0	0	0	0	0	0	0	73	18	0	0	0	1	20	0	20	2.0	974
W97031	2b	R	1	380	22	2	16	0	204	1	0	6	0	0	0	0	0	0	0	10	8	2	0	0	45	7	0	7	1.0	695
W97031	2b	R	2	105	16	4	3	0	129	1	0	6	0	0	0	0	0	0	0	6	12	3	1	0	40	7	0	7	2.3	325
W97031	2b	R	3	144	5	0	10	0	189	0	0	0	0	0	0	0	0	0	0	2	10	0	1	0	1	0	0	0	0.1	363
W97031	2b	R	4	130	19	5	7	0	130	1	0	2	0	0	0	0	0	0	0	3	10	9	1	0	3	3	0	3	0.9	320
W97031	2b	R	5	206	30	0	6	0	121	3	0	7	0	0	0	0	0	0	0	6	17	3	1	0	6	10	0	10	2.4	406
W97032	2b	R	1	648	74	15	0	0	0	0	0	18	0	0	0	0	0	0	0	0	8	3	1	5	12	18	0	18	2.3	785
W97032	2b	R	2	225	0	11	0	194	0	1	0	2	0	0	0	0	0	0	0	0	10	0	1	0	9	3	0	3	0.7	453
W97032	2b	R	3	261	5	5	0	235	0	0	0	2	0	0	0	0	0	0	0	0	14	0	2	10	10	3	0	3	0.5	545
W97032	2b	R	4	248	16	15	0	252	0	0	9	15	0	0	0	0	1	0	0	6	10	0	3	0	13	16	9	24	4.1	588
W97032	2b	R	5	347	64	39	0	224	0	0	3	30	0	0	0	0	4	0	0	0	9	0	9	0	17	33	3	36	4.8	746
W97035	2b	R	1	224	45	30	0	45	0	0	2	23	0	0	0	0	0	0	0	13	19	0	1	15	30	23	2	25	5.6	446
W97035	2b	R	2	157	27	11	0	31	0	2	3	13	0	3	0	0	1	0	0	18	29	0	0	0	1	15	6	21	7.1	295
W97035	2b	R	3	120	24	0	0	60	0	3	0	12	0	0	0	0	1	0	0	14	0	0	0	6	2	16	0	16	6.7	242
W97037	2b	R	1	165	33	25	0	50	0	0	0	9	0	0	0	0	0	0	0	0	19	0	3	0	28	10	0	10	2.9	333
W97037	2b	R	2	164	20	11	0	56	0	1	1	2	0	0	0	0	0	0	0	0	18	0	0	0	20	4	1	5	1.6	294
W97037	2b	R	3	139	38	18	0	0	0	1	0	4	0	0	0	0	0	0	0	0	13	0	7	1	5	5	0	5	2.2	227
W97037	2b	R	4	174	5	9	0	30	0	1	0	2	0	0	0	0	0	0	0	0	12	0	1	0	15	3	0	3	1.3	249

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Appendix Table 1B
1997 Experimental Whiting Fishery Sea Sampling Results
Tow Summary By Fishing Area

NOTE: Obstructed tows are excluded from this analysis and are presented at end of table.

TRIP IDENTIFIER	AREA FISHED	TRIP TYPE *	TOW NUMBER	WHITING / HR.	RED HAKE / HR.	SPINY DOGFISH / HR.	ATLANTIC HERR. / HR.	BLUEBACK HERR. / HR.	ALEWIFE / HR.	AM. PLAICE / HR.	ATLANTIC COD / HR.	WINTER FLOUNDER / HR.	REDFISH / HR.	WHITE HAKE / HR.	YELLOWTAIL FLD. / HR.	WITCH FLD. / HR.	WINDOWPANE FLD. / HR.	POLLOCK / HR.	HADDOCK / HR.	ILLEX SQUID / HR.	AM. LOBSTER / HR.	LOLIGO SQUID / HR.	LH SCULPIN / HR.	MONKFISH / HR.	OTHER / HR. **	REG. FLATFISH / HR.	REG. ROUNDFISH / HR.	TOTAL REG. SPP. / HR.	PERCENT REG. SPP.	TOTAL CATCH / HR.
W97039	2b	R	1	272	28	270	0	0	131	1	0	11	0	6	0	0	1	0	0	6	12	9	2	0	8	13	6	19	2.6	759
W97039	2b	R	2	357	27	844	0	0	62	1	0	25	0	4	1	0	1	1	0	1	25	0	4	3	16	28	5	32	2.4	1372
W97040	2b	R	2	736	12	750	0	0	100	2	4	6	0	0	0	0	0	0	0	0	5	12	8	0	33	8	4	12	0.7	1668
W97040	2b	R	3	518	25	1000	0	0	19	2	11	25	0	0	1	0	0	0	0	0	9	14	0	0	17	28	11	39	2.4	1641
W97040	2b	R	4	292	96	80	0	0	22	6	5	16	0	0	1	0	0	0	0	0	44	11	22	0	20	23	5	28	4.6	615
W97040	2b	R	5	490	52	221	10	0	107	1	0	0	0	1	0	0	0	0	0	0	8	9	3	0	2	2	1	3	0.3	906
W97040	2b	R	6	605	54	100	1	0	42	1	0	15	0	4	0	0	0	0	0	0	7	20	13	0	14	16	4	20	2.3	876
W97041	2b	R	1	625	80	143	0	0	0	4	0	101	0	75	0	0	4	0	0	14	75	45	30	30	134	110	75	185	13.6	1359
W97041	2b	R	2	496	33	1242	0	0	0	0	0	33	0	0	0	0	2	0	0	14	0	21	6	6	113	35	0	35	1.8	1967
W97041	2b	R	3	282	105	677	0	0	0	0	0	58	0	0	0	0	0	0	0	16	10	43	4	0	86	58	0	58	4.6	1281
W97042	2b	R	1	240	0	40	0	0	0	0	0	0	0	0	0	0	0	0	0	6	2	18	0	0	67	0	0	0	0.0	375
W97043	2b	R	1	857	0	686	114	0	0	1	5	19	0	0	4	0	0	0	0	6	91	19	23	0	45	23	5	28	1.5	1870
W97043	2b	R	2	384	29	62	41	0	0	0	0	5	0	0	1	0	0	0	0	0	62	10	2	0	5	6	0	6	1.0	600
W97043	2b	R	3	540	54	27	0	0	0	0	10	6	0	0	0	0	0	0	0	0	56	7	2	0	3	6	10	16	2.2	705
W97048	2b	R	1	25	15	469	0	0	0	0	9	68	0	0	4	0	5	0	0	0	41	0	0	0	74	77	10	87	12.2	710
W97048	2b	R	2	30	15	396	0	0	0	0	7	33	0	0	6	0	7	0	0	0	30	0	8	0	110	46	7	53	8.3	641
W97048	2b	R	3	429	11	334	0	0	0	7	34	36	0	0	0	0	2	0	0	0	25	0	4	0	109	44	35	79	8.0	990
W97048	2b	R	4	250	5	224	0	0	0	3	13	15	0	0	1	0	1	0	0	0	46	0	10	6	84	20	13	33	5.0	659
W97048	2b	R	5	95	7	208	0	0	0	9	9	38	0	0	1	0	2	0	0	0	50	0	9	5	67	50	9	60	11.9	501
Mean			2.4	268	87	139	5	29	20	9	2	13	0	2	0	0	1	0	0	10	17	5	5	3	26	24	4	27	4.7	640
Median			2.0	225	52	15	0	0	0	2	0	7	0	0	0	0	0	0	0	6	10	1	2	0	15	16	1	18	3.3	588
W97001	3	Q	1	137	238	9	206	0	0	15	2	3	0	0	0	0	0	0	0	15	0	0	2	0	0	18	2	20	3.1	627
W97001	3	Q	2	168	28	15	7	0	0	10	1	50	0	0	7	0	0	0	0	18	0	0	23	2	136	67	1	67	14.5	464
W97003	3	Q	1	39	22	0	23	0	0	0	0	0	0	0	0	0	0	0	0	14	0	0	0	0	2	0	0	0	0.0	100
W97003	3	Q	2	84	196	0	31	0	0	9	1	0	0	0	0	1	0	0	0	44	0	0	2	6	7	10	1	11	2.8	379
W97003	3	Q	3	134	74	289	89	0	0	7	1	1	0	0	0	2	0	0	0	0	0	0	1	5	10	11	1	11	1.9	614
W97004	3	Q	1	131	528	0	95	0	1	9	0	0	0	0	0	1	0	0	0	4	0	0	1	1	8	10	0	10	1.3	778
W97004	3	Q	2	266	1216	0	71	0	3	17	3	2	0	0	0	0	0	0	0	10	0	0	5	6	24	19	3	22	1.4	1623
W97004	3	Q	3	849	1381	4	20	0	1	38	4	0	0	0	1	0	0	0	1	2	0	0	3	7	52	39	5	44	1.9	2364
W97012	3	R	1	171	176	11	15	0	0	8	0	0	8	8	0	1	0	0	0	2	2	0	0	1	0	9	16	25	6.2	402
W97012	3	R	2	189	202	5	0	0	0	8	0	0	7	24	0	0	0	0	1	2	0	0	0	0	1	8	31	39	9.0	438
W97012	3	R	3	152	217	1	13	0	0	8	0	0	6	6	0	1	0	0	0	2	0	0	0	8	1	9	12	21	5.0	415
W97044	3	R	1	1571	362	75	2	0	55	3	0	0	0	85	0	0	0	0	0	8	0	0	11	4	100	3	85	88	3.9	2275
W97044	3	R	2	2734	496	32	0	0	0	1	0	6	0	91	2	0	0	0	0	0	0	0	9	0	32	8	91	99	2.9	3402
W97044	3	R	3	1492	454	876	0	0	0	3	1	54	0	31	52	0	0	0	0	0	0	0	91	28	78	108	32	140	4.4	3158
W97044	3	R	4	1121	726	55	0	0	0	0	0	3	0	16	7	0	0	0	0	0	0	0	14	1	71	10	16	26	1.3	2015
W97049	3	R	1	310	209	31	103	0	41	0	3	1	0	54	0	0	0	0	1	10	1	17	0	1	19	1	57	58	7.3	801

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Appendix Table 1B
1997 Experimental Whiting Fishery Sea Sampling Results
Tow Summary By Fishing Area

NOTE: Obstructed tows are excluded from this analysis and are presented at end of table.

TRIP IDENTIFIER	AREA FISHED	TRIP TYPE *	TOW NUMBER	WHITING / HR.	RED HAKE / HR.	SPINY DOGFISH / HR.	ATLANTIC HERR. / HR.	BLUEBACK HERR. / HR.	ALEWIFE / HR.	AM. PLAICE / HR.	ATLANTIC COD / HR.	WINTER FLOUNDER / HR	REDFISH / HR.	WHITE HAKE / HR.	YELLOWTAIL FLD. / HR.	WITCH FLD. / HR.	WINDOWPANE FLD. / HR	POLLOCK / HR.	HADDOCK / HR.	ILLEX SQUID / HR.	AM. LOBSTER / HR.	LOLIGO SQUID / HR.	LH SCULPIN / HR.	MONKFISH / HR.	OTHER / HR. **	REG. FLATFISH / HR.	REG. ROUNDFISH / HR.	TOTAL REG. SPP. / HR.	PERCENT REG. SPP.	TOTAL CATCH / HR.
W97049	3	R	2	125	291	5	189	0	150	1	2	1	0	16	1	0	0	0	2	3	2	13	0	0	14	2	20	22	2.7	813
W97049	3	R	3	175	176	0	18	0	51	0	8	3	0	28	0	0	0	0	1	0	2	9	0	1	11	3	37	39	8.2	481
W97049	3	R	4	178	101	4	19	0	85	0	1	2	0	24	1	0	0	0	0	3	2	7	0	0	6	3	25	28	6.5	433
Mean			2.2	528	373	74	47	0	20	7	1	7	1	20	4	0	0	0	0	7	0	2	8	4	30	18	23	41	4.4	1136
Median			2.0	175	217	5	19	0	0	7	1	1	0	8	0	0	0	0	0	3	0	0	1	1	11	9	16	26	3.1	627
W97042	4	R	2	176	0	23	0	0	0	0	0	1	0	0	0	0	0	0	0	4	1	16	0	0	53	1	0	1	0.3	274
W97042	4	R	3	171	1	19	0	0	0	0	0	0	0	0	0	0	0	0	0	2	1	16	0	0	41	0	0	0	0.0	251
W97050	4	R	1	468	73	0	31	0	76	0	0	0	0	0	1	0	0	1	0	12	2	11	0	0	3	1	1	1	0.2	678
W97050	4	R	2	109	20	0	117	0	26	0	0	0	0	0	0	0	0	0	0	7	3	8	1	0	5	0	0	0	0.2	296
W97050	4	R	3	94	20	0	309	0	124	0	3	0	0	0	0	0	0	0	0	7	3	36	0	0	7	0	3	4	0.6	605
W97050	4	R	4	295	19	0	119	0	57	1	0	0	0	0	1	0	0	0	0	13	3	2	1	5	6	2	0	2	0.3	523
Mean			2.5	219	22	7	96	0	47	0	1	0	0	0	0	0	0	0	0	8	2	15	0	1	19	1	1	1	0.3	438
Median			2.5	174	20	0	74	0	42	0	0	0	0	0	0	0	0	0	0	7	3	13	0	0	7	1	0	1	0.2	410
OBSTRUCTED TOWS																														
W97008***	2a	Q	3	3017	257	0	0	1286	0	40	13	0	3	0	0	0	0	0	0	0	6	0	0	0	0	40	16	56	1.2	4622
W97033***	2a	R	3	235	18	0	0	0	0	6	237	0	0	0	0	0	0	0	0	5	0	0	2	0	3	6	237	243	48.0	507
W97034***	2a	R	1	480	120	19	24	0	0	26	5	0	2	0	1	1	0	0	0	5	10	0	0	0	15	29	7	36	5.1	709
W97038***	2a	R	3	231	92	0	14	5	5	50	9	0	6	0	0	0	0	0	0	14	12	0	4	0	5	50	15	65	14.6	445
W97051***	2a	R	2	538	117	153	44	3	10	128	7	1	8	11	2	0	0	0	0	3	65	53	83	10	53	131	26	157	12.2	1290
W97005***	2b	R	2	205	108	40	15	0	5	49	0	0	0	1	0	0	0	0	0	12	27	13	1	1	6	49	1	51	10.5	485
W97040***	2b	R	1	938	137	135	0	50	14	0	0	71	0	2	0	0	1	0	0	0	14	18	14	0	55	72	2	74	5.1	1448

NOTES: Target species are presented in the first three species columns, followd by the 10 regulated species in order of their dominance by weight summed for all sampled tows.
The remaining 5 species columns represent the dominant species,ranked by weight, except that unsorted herrings and unsorted squid, ranked 9th and 12th respectively, have been included in the "other" column.

* Trip type: Q indicates the first or "qualifying" trip(s) aboard a vessel without prior experience with the experimental trawl, R indicates trips "randomly" chosen from the entire pool of permitted vessels.

** Other: Includes the weights of the remaining 40 species and species groups, such as mackerel, skates, unsorted herring, butterfish etc., not represented elsewhere in the table, making up 2.4% of the total catch for all tows sampled.

*** These 7 tows have been identified as having "significant obstructions" such as fixed gear, boulders etc., at haulback and have been excluded from higher level analyses.

Appendix B: **Correspondence between DMF and NMFS regarding the application to conduct the experimental fishery.**

- DMF request to approve the experimental fishery dated 7/7/97 (attachments not included) (6 pages).
- DMF request to establish eligibility criteria and establish a cap on the number of participants dated 8/25/97 (4 pages).
- NMFS Regional Director response to DMF regarding the eligibility criteria and number of participants dated 8/27/97 (1 page).

The Commonwealth of Massachusetts
Division of Marine Fisheries
Leverett Saltonstall State Office Building
100 Cambridge Street
Boston, Massachusetts 02202
727-3193

PHILIP G. COATES
DIRECTOR

July 7, 1997

Dr. Andrew Rosenberg, Regional Administrator
National Marine Fisheries Service
One Blackburn Drive
Gloucester, MA 01930

Dear Andy,

Please consider this request for DMF to manage and oversee an expanded experimental small-mesh trawl fishery for whiting, red hake, and spiny dogfish using DMF's "raised footrope trawl". Our success to-date convinces us that this design is the best solution available to restore historic trawl fisheries, especially those that targeted large whiting and red hake. See attached report dated 6/24/97 (Attachment 1). Small-mesh trawl fisheries are currently very limited under the existing groundfish (multispecies) regulations that mandate areas be closed unless proven clean, where by-catch of regulated species falls below 5% of the overall catch.

Background: The success of last year's experimental fishery is now well-known and presented in the attached report. We believe that a clean fishery in Cape Cod Bay was probably the highest hurdle that this net will need to clear. Cape Cod Bay is a well documented nursery area for juvenile flounders (American plaice, yellowtail flounder, and winter flounder). DMF's past sea sampling during 1992-1996 showed standard whiting trawls with heavy groundgear nearly always catch substantial amounts of juvenile flatfish as well as new-shelled lobsters, all likely to suffer high rates of mortality when discarded. You may recall in 1995, DMF helped your staff document high by-catch rates in Cape Cod Bay and Mass. Bay and consequently small-mesh trawling in the area (including state waters) was banned as a means to conserve regulated groundfish. Furthermore DMF has been working since 1989 conducting intensive sea sampling as well as various conservation engineering projects to mitigate the by-catch problem.

Your office permitted fifteen vessels to participate in the Cape Cod Bay fishery for about four weeks during mid-October through-mid-November. Whiting catches totaled over 581,000 lbs. and were valued at $270,000. Sea sampling over twenty trips showed the results where whiting, red hake, and dogfish accounted for about 90% of the overall catch.. Also just 28% of the overall catch was discarded, and this contrasts with past years (when "normal" whiting nets were deployed) when 60-70% was discarded. Catches of juvenile flounders dropped to minimal levels and the fishery met the 5% standard - with 19 of the 20 sampled trips below 5% regulated species by-catch. The seasonal departure of whiting and red hake from the small approved fishing area prevented DMF from collecting further results, since the vessels were not permitted

in the experimental fishery to fish outside of the requested "postage stamp" area of northern Cape Cod Bay/Massachusetts Bay.

We identified two key elements needed for success of the fishery: educating fishermen about the gear design and proper use of the net, and promoting compliance through strict by-catch restrictions and strong penalties for non-compliance. . We encountered many fishermen who were initially skeptical that the net's design is flawed and they argued that the groundgear (cables, legs, and sweep) needs to be heavier to catch whiting and hake. Sea sampling aboard their vessels', filming nets underwater, and the seeing the success of fellow fishermen have all contributed to the acceptance of the net among those skeptics.

Fishermen and dealers have also discovered a market incentive for fishing the net as designed: whiting and hake are soft-bodied fish and are less likely to be damaged - and will fetch a higher price - when the catch is free of crabs, sculpins, lobster, and certain other spiny organisms, that are typically caught when the nets are fished hard on the bottom.

DMF has conducted further sea trials this spring with the raised footrope trawl for vessels primarily targeting dogfish in Cape Cod Bay, and also some Gloucester-based vessels that have utilized the net for whiting, hake or dogfish in three discrete areas: east of Jeffreys, west of Stellwagen, as well as east of Cape Cod . This work was supported through a state grant that terminated on July 1 and was approved by your office. Consequently, over twenty captains have already re-rigged their small-mesh trawls with the raised footrope design and all have been monitored through sea sampling. The participating fishermen are anxious to continue the progress with the net raised footrope trawl during the seasons when whiting and hake are more available, summer-fall.. Furthermore, other fishermen have seen the results and seek to join the fishery, including many who have well-documented histories of trawling for whiting, red hake, and dogfish.

We've met with your staff to discuss last year's fishery and the potential of this season's upcoming fishery. They've explained the federal regulations regarding the application for experimental fisheries, especially the 60 day advance notice requirement. Also they requested we describe the scope of the experimental fishery as well as its potential impacts.

Specifics of the Proposal for the 1997 Fishery

We recommend an expansion of last year's Cape Cod Bay fishery in both area and time to include areas north to Cape Ann as well as east of Cape Cod, all traditional whiting areas. We urge most of last year's restrictions be maintained.

Number of Vessels: We propose the number of participants be limited to about 40 due to our manpower limitations to provide sufficient sea sampling oversight. To-date, about twenty vessels have already participated in experimental fisheries with the raised footrope trawl last fall or past spring. We propose another 20 be permitted this year. Unless additional funds are available - or unless NMFS provides contracted observer coverage, DMF expects to be able to provide only about 8-10 sea sampling trips per month during August-November. Depending on the intensity of sampling expected by NMFS, we suggest this fishery be maintained at the level of 40 vessels, but we would consider NMFS advice on this issue.

Gear specifications: We propose last year's gear specifications be maintained this year as well.

However for certain smaller or larger vessels, we can amend the gear specifications if needed, but will maintain the basic design of the net.

Mandatory Observer Coverage: We propose all vessels entering the experimental fishery be required to carry an observer to ensure the captain's proficiency with the net design. Only after the catches are documented "clean" should the state and/or federal permits be issued. If more sea sampling trips are warranted, then alternate funding sources and or other observer programs will be required to cover additional trips.

Data Collection: We propose all vessels participating in the fishery submit "State Copies" of their trips logs. DMF will monitor the reports and summarize them at year's end.

By-catch restrictions: Since no net can be guaranteed tamper-proof, we propose to maintain the existing by-catch restrictions as an indirect method of promoting compliance. In addition to the existing ban on retention of the ten regulated multispecies, other species likely to be caught when the net is fishing properly should be prohibited to ensure the net is fishing as designed. We propose maintaining the prohibition on lobster, crabs, monkfish, sculpin, sea raven, skates, fluke, and ocean pout. Some of these species have little or no market value but it helps reinforce our concern that the net be used as designed.

Participation: We recommend against fishermen being forced to remain in the experimental fishery for any period of time. Instead, fishermen should be allowed to switch from this experimental fishery to large mesh trawling, by simply removing the small mesh net from the vessel.

Gear possession: Fishermen should be allowed to possess either the small mesh trawl or a 6" mesh trawl for groundfish. If small-mesh is aboard the vessel, then the restrictions on possession of the ten regulated species and the other prohibited species (lobster, monkfish, crab, etc) would apply.

Areas requested for trawling: As for the areas we seek for expanded fishing, first a note of concern. NMFS should consider the difficulty placed on the industry and DMF to definitively identify exact areas and times that are appropriate. Catch levels of the target species (whiting, hake, dogfish) vary seasonally in certain areas as these species migrate. We saw this last November when whiting departed the approved Cape Cod Bay experimental area and moved onto Stellwagen Bank and off Nauset. Fishermen were denied the opportunity to pursue these migrating stocks on Stellwagen and east of Cape Cod off Nauset since these were not approved as part of the original experimental fishery. In summary, the longer the season, the larger the area will need to be.

Fishermen have begged for real-time monitoring of catch and by-catch with consequent openings of productive areas (and closing unproductive areas) But what agency can afford such a program? While fishermen have offered to pay for an observer program, no such mechanism has ever been established. Simply put, the longer the season, the larger the areas need to be to accommodate the expected shift in abundance and availability. NMFS should also be mindful that catch rates of the by-catch species may change as well and vary annually with year class strengths. In short, making conclusions about any area based on dated sea sampling data is tenuous. Furthermore, we don't believe fishery independent trawl surveys can be relied upon to predict by-catch levels of vessels deploying a raised footrope trawl since the research vessels use trawls designed to maximize groundfish species, typically rigged with heavy groundgear.

Under the existing policies, to meet the 5% test we must identify areas that will produce sufficient non-regulated species (whiting, hake, etc) to sufficiently cover any amount of regulated species that might occur, at ratio of 19:1 ! (Another way of viewing the 5% by-catch rule). Continued sea sampling may be required to verify that documented species catch compositions persist with minimal change. While we realize that NMFS has devoted much of its sea sampling to "science-based" questions instead of "management-based" questions, the 5% rule may require constant monitoring if it is meant to be a somewhat precise tool used to protect juvenile groundfish, not a blunt tool that results in huge area closures (to small mesh) and threatens the viability and future of entire fleets such as those in Provincetown, Chatham and Gloucester.
As for the area requested, we suggest one of two options.

Option 1: Allow this limited experimental fishery on a wide scale basis without limiting the vessels to pre-determined small zones. All areas within the old small-mesh exemption area could be opened with restrictions applied to some areas within Stellwagen and Jeffreys Ledge. The currently approved separator (grate) trawl fishery is not limited to small times and areas. This "approved" experimental fishery is allowed in most waters of the western Gulf of Maine in the former small-mesh exemption area. However, fishing with the separator trawl is currently prohibited in the two square mesh exemption areas. Fishermen we've met with have asked for portions of the Stellwagen square mesh area be opened to the use of this net. Note that last fall's Cape Cod Bay experimental fishery was conducted in parts of the southwest portion of the Stellwagen square mesh area.

Generally speaking, we seek to re-open upper Cape Cod Bay, portions of Massachusetts Bay, and areas east of Cape Cod (so-called Nauset area). Fishermen we've met from Gloucester, Provincetown and Chatham have identified certain areas and times when whiting and hake catches have historically been productive. Some of these areas have been identified in the past but were denied by NMFS after analyses showed the by-catch of regulated species had - or was likely to - exceed 5% with an un-modified otter trawl . The requested times will vary depending on the area - since these species migrate seasonally - but overall the season requested late summer through December. Since NMFS requires a 60 day review period, the start date for the 1997 fisheries would be early September and the ending date would be late December unless closed earlier based on evidence of unacceptable by-catch.

Option 2: Establish pre-determined zones based on fishermen's input. After two meetings with trawlermen from Gloucester, Provincetown, and Chatham, we've defined areas and times where the fishery is likely to be successful. See Attachment 2. These areas have been highlighted on attached charts. But are these areas too complex? Will these convoluted areas be difficult to enforce?

Projected Impacts: Whiting fisheries have historically been characterized by high by-catches of juvenile flounders. This net design effectively reduces the catch of all juvenile and most adult flounders. As for roundfish by-catch we seen very few instances of regulated roundfish (specifically cod, pollock, and haddock) co-occurring with concentrations of whiting and red hake.

In upper Cape Cod Bay, we have sufficiently documented the catch and by-catch

composition and feel that opening this area is warranted for the period mid-September through November.

As for Mass. Bay, we've re-examined the regulated species by-catch composition that NMFS staff used to justify denying small-fishing and our results revealed American plaice and other regulated flounders dominated the by-catch. See Attachment #3. So we feel opening some area in this region is warranted as long as harvestable quantities of whiting and hake can be found. We are confident that these areas would be appropriate for use with the raised footrope trawl since plaice and other juvenile flounder catches have been reduced by over 90% by this trawl design. Fishermen have argued vehemently that they need access to portions of the Stellwagen square mesh area that have historically produced large whiting catches. Last year's Cape Cod Bay experimental area included the southwest corner of the square mesh area.

For the area east Cape Cod, we've re-examined the sea sampling data from this region. See Attachment #4. White hake dominated the by-catch during four of the 12 trips sampled the requested area. While the design of the raised footrope trawl is not expected to greatly reduce white hake by-catch, we urge NMFS to consider allowing it experimentally in this area for three reasons: 1) the catch actually may have been RED hake and the species misidentified. Small (less than 30 cm) red vs. white hake are difficult to separate by the most seasoned observer; 2) fishermen report that recently the red hake catches predominate in the area and doubt if trips conducted in the area this summer/fall will produce much white hake. And finally 3)white hake are not over-fished, rather they are fully exploited at the 1993 level of fishing (much higher than current levels). If fishermen are denied access to whiting fishing in the area and are forced to target and groundfish (because of white hake catches) will conservation be served - despite the use of large mesh?

Penalties for non-compliance: Any violation of the permit conditions should be dealt with severely. We recommend revoking the privilege of participating in the federal and/or state experimental fisheries. Also DMF will review the case as well and consider suspending the vessel's state Coastal Access Permit for trawling in state waters.

Benefits: This program will help restore the "king" whiting and red hake fishery that has been nearly lost in the shuffle of groundfish conservation. Annual landings of whiting alone in Provincetown could be expected to reach historical levels in the range of 1 to 4 million lbs. Benefits will be seen for other fish and invertebrate species. Video footage shows the net hardly disturbing the bottom sediments. Surely this will have positive but probably unmeasurable benefits. Finally, the raised footrope design reduces retention and discard mortality for many other species (pout, raven, monkfish, lobster, crab, sculpin, skate, fluke, etc.).

Risks: We believe the opening of this fishery will pose no risk to regulated groundfish species, as long as by-catch of these regulated species remains minimal. Without this fishery, the participating vessels will be forced to target groundfish, fully using their allotted 88 days-at sea. Many of the participating trawlers fish day-trips (each trip about 0.5 DAS) and also target shrimp, fluke and squid in state waters, and may not be using all of their annual 88 days-at-sea.

If you have any questions about these proposals contact Dan McKiernan or Arne Carr at DMF.

In summary, we thank you and your staff for maintaining an open door to us to help tackle the problems of by-catch reduction. The 5% rule is a good rule if it motivates the industry and fishery managers to recognize by-catch problems and find solutions. Let's use it as a means to improve our fisheries, not as a tool to remove certain vessels or fleets from our historic fisheries through bankruptcies.

Sincerely,

Philip G. Coates,
Director

cc: Paul Howard, NEFMC
Mass. Marine Fisheries Commission

The Commonwealth of Massachusetts
Division of Marine Fisheries
Leverett Saltonstall State Office Building
100 Cambridge Street
Boston, Massachusetts 02202
727-3193

PHILIP G. COATES
DIRECTOR

August 25, 1997

Dr. Andrew Rosenberg, Regional Administrator
National Marine Fisheries Service
One Blackburn Drive
Gloucester, MA 01930

Dear Andy,

DMF has requested NMFS to approve a limited experimental fishery for whiting, red hake, and dogfish for trawlers deploying the DMF raised footrope trawl in certain requested areas off the Massachusetts coast. This fishery would be an expansion of last year's fishery that was conducted with 15 vessels in an area of upper Cape Cod Bay during mid-October through mid November. Please consider this request that provides further details regarding vessel participation. Furthermore, we recommend policies be established jointly between NMFS and DMF regarding qualifications for participation. The intense level of interest in this fishery may exceed the number of vessels that we felt we could adequately monitor.

DMF's goal is to restore the fishery for large whiting and red hake that was regulated out of existence in 1995 in most areas of the Gulf of Maine when federal groundfish rules were adopted in 1995 that curtailed most small-mesh fishing. This upcoming experimental fishery will allow:

1) Continued research on optimal gear configurations that will reduce by-catch and allow "clean" fisheries that are allowable under the 5% rule where by-catch of regulated species totals less than 5% of the overall weight of the catch on a consistent basis.
2) Identification - and verification through sea sampling and catch reports - of areas and times where this net design is appropriate. With fishermen's input, DMF has identified areas and times where the target species (whiting, red hake, dogfish) are expected in abundance and where regulated species by-catch is predominately flatfish, a problem that can be solved with the raised footrope design. Areas where roundfish (cod, pollock, haddock, white hake) predominate are probably inappropriate for small-mesh trawling with this trawl design.

In the July 7 letter to NMFS, DMF requested up to 40 vessels be allowed to participate, with plans to conduct 8-10 sea sampling trips per month during September - December. This number would have included the 19 vessels that have already participated in "raised footrope" trawl experimental fisheries this past spring or last fall, as well as a set of new participants.

Among the new participants, DMF intended to enlist vessels with significant recent participation in whiting, red hake or dogfish fisheries, but DMF did not provide clear policies or guidelines for determine a vessel's eligibility. Unfortunately, DMF now needs to establish guidelines to determine which vessels would be allowed to participate because the number of interested vessels will likely exceed that which DMF can sample adequately - even with a slightly expanded sea sampling program.

DMF planned to select vessels based on their participation in last year's raised footrope trawl fishery during fall 1996 and spring 1997, and then expand the fleet to include those who have enlisted in the NMFS separator trawl experimental fishery. Also DMF had hoped to include fishermen who had participated in the federal exempted fisheries program prior to 1995, and/or participation in state waters whiting fisheries during fall off Cape Ann or in Cape Cod Bay.

I understand that NMFS enforcement officials expressed concerns about compliance and enforcement oversight, and recommended the fishery be approved for just 20 vessels, with the potential for more vessels if additional sea sampling effort were committed. DMF finds the number 20 unacceptably low to accomplish the program's goals. The areas and times were drafted by a group of fishermen from Cape Ann, Provincetown and Chatham. Additional vessels are needed to adequately document the additional areas and times where the fishery should be expanded.

In addition to the 16 vessels from Provincetown and the three Gloucester vessels who've fished with the raised footrope trawl, we feel we need to enlist additional trawlers from Cape Ann and Chatham. The areas requested were drafted by a group of fishermen that included three from Gloucester who've already participated in raised footrope trawl experimental fisheries last spring as well as some who have not. We hope that once this net is shown to be successful, then NMFS can consider requiring the raised footrope trawl in Small-mesh Exemption Area 1 (Ipswich Bay) to further conserve juvenile monkfish and regulated flatfish species. Also, there are three Chatham trawlers that seek to join this experimental fishery instead of the NMFS separator trawl fishery that they'd been involved in during the past two years. Their involvement will ensure data collection east of Cape Cod off Nauset during the 4-month season.

Consequently, we are seeking permits for those same vessels that participated in the fishery last year from Provincetown and Gloucester totaling 19. Also we seek 3 vessels from Chatham that participated in the separator grate fishery east of Cape Cod bringing the total to 22. Additional vessels from Cape Ann (as noted above), various Cape Cod ports, and even New Bedford will be seeking to participate.

We request guidance from NMFS about which additional vessels should be granted experimental fishery permits. NMFS should recognize that last year's Cape Cod Bay effort was biased in favor of smaller trawlers that were eligible to fish in state waters (overall vessel length less than 72 feet). However, most of the requested areas for 1997 (see map) are in federal waters. Some of the vessels that might seek to fish with this net were not eligible to fish last year since they do not have permits to trawl in state waters. There are vessels that have participated in the separator grate fishery that seek to use the raised footrope trawl instead of the separator grate trawl. Should these vessels be given priority? I suggest they should, especially if they have a documented history of small-mesh trawling for whiting.

As vessels apply to DMF and NMFS we should have clear policies. I recommend the

following in order:
1) Any vessel will be eligible that participated in DMF supervised experimental raised footrope trawl fisheries in 1996 or 1997 (N=19);

For any additional vessels, choose from those that meet the following:
2) Any vessel that participated in the NMFS whiting separator grate fishery in 1995 or 1996 and can documented participation in state or federal permitted whiting fisheries prior to 1995 be eligible; First consideration should be given to the three Chatham trawlers.

Finally, additional vessels can be chosen based on #3:
3) Any vessel that participated in state or federal permitted whiting fisheries prior to 1995 but did not participate in the experimental federal separator trawl be eligible;

Also, we are aware of your position of not permitting vessels with outstanding violations to participate in experimental fisheries.

Consideration will not be given to vessels in 1997 without documentable histories of small-mesh fishing for whiting. The final list of participants should be determined by DMF and NMFS and should not exceed a maximum number that NMFS decides. DMF proposed a limit of 40 vessels, and you should consider the sea sampling limitations, especially if two to three sea sampling trips should be conducted per vessel, as well as intensive enforcement oversight. Also consideration should be given to ensure participation by certain vessels that fish in specific areas (off Cape Ann, and off Chatham) to ensure data collection in these areas.

If you agree with the above criteria we will submit a list of vessels to your office for consideration.

Our investigations will include both sea sampling by DMF staff and cooperative enforcement missions with Massachusetts Division of Environmental Law Enforcement and US Coast Guard.

Sea sampling: We will target each vessel with two to three sea sampling trips. Two trips aboard each vessel that has already shown proficiency with the net design and an additional trip for each vessel that has not yet used the net when they first deploy the gear. If 30 vessels are approved this will result in up to 72 sea sampling trips:

Experienced vessels (18) X 2 trips/vessel = 36 trips
New participants (12) X 3 trips/vessels = 36 trips

We plan to target all four requested areas with at least four trips per month as long as the areas have sufficient fishing effort. The proposed Area 2 that encompasses Mass. Bay and Cape Cod Bay will be subdivided and some effort will be maintained in Cape Cod Bay where fishing

and sampling has been done consistently since 1992. Separate sea days will target the remainder of the area, notably Mass. Bay west of Stellwagen, since this is a new area.

Areas	Sept.	Oct.	Nov.	Dec.
1: North of Stellwagen	4	4	4	4
2: Mass. Bay, W of Stellwagen	4	4	4	4
2: Cape Cod Bay	3	3	3	3
3: Nauset, E of Cape Cod	4	4	4	4
4: So. Stellwagen & off Truro	N/A	4	4	4
Totals	**15**	**19**	**19**	**19**

This proposed schedule will be dependent on vessels fishing the above areas, and if areas are not being utilized seasonally, sea days will be diverted to areas where the fishery is active.

At-sea compliance checks: DMF will coordinate with state and federal enforcement personnel to periodically board participating vessels and document catch composition to determine if by-catch composition reveals the net is not being fished as designed. However, we maintain that the by-catch prohibition that includes the long list of species will reduce the incentive to compromise the net.

Thank you for considering these issues.

Sincerely,

Philip G. Coates, Director

AUG 27 1997

UNITED STATES DEPARTMENT OF COMMERCE
National Oceanic and Atmospheric Administration
NATIONAL MARINE FISHERIES SERVICE
NORTHEAST REGION
One Blackburn Drive
Gloucester, MA 01930

Philip G. Coates, Director
Massachusetts Division of Marine Fisheries
Leverett Saltonstall State Office Building
100 Cambridge Street
Boston, MA 02202

Dear Phil:

I have received your letter dated August 25, 1997 pertaining to the MADMF's raised footrope whiting trawl experimental fishery. I am proceeding with the review of the request for a maximum of 40 participating vessels and have requested that NOAA Law Enforcement and General Counsel provide comments. I will notify you as soon as possible as to the decision on whether or not additional vessels will be allowed. I do not expect this to be a lengthy process.

Currently, however, my staff will proceed with permit issuance for the initial 20 vessels. They have received the list of vessels that was faxed to this office and will check them for eligibility based on enforcement histories. Permits will be issued to those vessels that have no such histories.

You have also requested that I provide input on your proposed criteria to accept or deny additional participation in the fishery. I understand that your goal is to identify a fishery conducted predominantly in Federal waters that may be exempted under the Northeast Multispecies Fishery Management Plan. As an experimental fishery, however, participation is under the direction of the MADMF. While I support the experimental fishery, I do not feel that it is appropriate for NMFS to be responsible for the identification of participating vessels. I would hope that vessels having significant state enforcement histories would not qualify. Should additional vessels be approved, the MADMF should provide a list of vessels. My staff would continue to determine eligibility of such vessels based on enforcement histories.

Sincerely,

Andrew A. Rosenberg, Ph.D.
Regional Administrator

Appendix C: **DMF's Notice to Fishermen with application and list of rejected vessels.**

- DMF notice to fishermen and application to determine eligibility for participation in the Experimental Fishery (3 pages).

- List of vessels that formally applied to DMF but were not be accommodated (1 page).

The Commonwealth of Massachusetts
Division of Marine Fisheries
Leverett Saltonstall State Office Building
100 Cambridge Street
Boston, Massachusetts 02202
727-3193

PHILIP G. COATES
DIRECTOR

August 29, 1997

To those interested in the upcoming experimental small-mesh trawl fishery,

Thank you for your interest in the upcoming DMF conducted experimental fishery. DMF has received approval from the National Marine Fisheries Service to conduct another "raised footrope trawl" experimental fishery for whiting, dogfish and red hake beyond Cape Cod Bay to include adjacent waters in Massachusetts Bay and east of Cape Cod through the end of the year. This fishery will be an expansion of last year's fishery that was conducted with just 15 vessels in an area of upper Cape Cod Bay during mid-October through mid November.

The intense level of interest in this fishery has exceeded the number of vessels that DMF can adequately monitor. NMFS officials have expressed concerns about the level of oversight through sea sampling and enforcement so they decided to limit the fishery to a number less than the number 40 requested, so not all fishermen who have contacted us will be eligible to participate.

DMF's goal is to restore the fishery for large whiting and red hake that was regulated out of existence in 1995 in most areas of the Gulf of Maine when federal groundfish rules were adopted in 1995 that curtailed most small-mesh fishing. This upcoming experimental fishery will allow:

1) DMF to continue research on optimal gear configurations that will reduce by-catch and allow "clean" fisheries that are allowable under the 5% rule where by-catch of regulated species totals less than 5% of the overall weight of the catch on a consistent basis.
2) DMF to identify - and verify through sea sampling and fishermen's catch reports - areas and times where this net design is appropriate.

DMF hopes this "trial" fishery will succeed by demonstrating areas and times the net could be used to catch large whiting, red hake, and dogfish. In addition to the 16 vessels from Provincetown and the three Gloucester vessels who've fished with the raised footrope trawl, we feel we need to enlist additional trawlers from Cape Ann and Chatham. By enlisting vessels from these wide areas, we will improve the areal coverage of sea sampling and observe the net's conservation benefits in these diverse areas: Ipswich Bay, off Cape Ann, off Stellwagen, Mass. Bay, Cape Cod Bay, and east of Cape Cod off Nauset.

Consequently, DMF will give priority to vessels with significant participation in the whiting fishery. We plan to include vessels from Cape Ann as well as a few Chatham vessels

that participated in the separator grate fishery east of Cape Cod; these Chatham fishermen participated in the federal experimental (separator grate) fishery for whiting in federal waters and they seek to switch over to this net design.

DMF will use the following guidelines to determine eligibility:
1) Any vessel will be eligible that participated in DMF supervised experimental raised footrope trawl fisheries in 1996 or 1997 (N=19);

For any additional vessels, choose from those that meet the following:
2) Any vessel that participated in the NMFS whiting separator grate fishery and landed whiting for the foodfish market (not the bait markets) in 1995 or 1996 and can document participation in state or federal permitted whiting fisheries prior to 1995 may be eligible;

Finally, additional vessels may be chosen based on #3:
3) Any vessel that participated in state or federal permitted whiting fisheries prior to 1995 but did not participate in the experimental federal separator trawl fishery may be eligible;

To ensure areal representation is sufficient to meet the goals of the study, priority will be given to Cape Ann and Chatham vessels as well as those that have fished traditionally in Cape Cod Bay.

If you are still interested in participating, please provide us with a description of your history of whiting fishing during the past five years. We will compare your application to the others we receive and consider your application in light of the number of vessels we can accomodate. The ultimate number of vessels in the fishery will be determined by NMFS, not DMF. Thank you for your cooperation.

Name:

Address:

Phone: **Fax:**

Vessel Name:

State Permit Number: **Federal Permit Number:**

Please list your whiting fishing history and approximate the number of days fished.

	1992	1993	1994	1995	1996	1997
Was your vessel permitted for state small-mesh fisheries for whiting and hake? List days fished for whiting.					N/A	N/A
Was your vessel enrolled in the federal Exempted Fisheries Program for whiting during '92-'94? List days fished for whiting.				N/A	N/A	N/A
Did you fish for whiting in the Ipswich Bay Exempted Fishing Area opened since '95. List days fished for whiting.	N/A	N/A	N/A			
Was the vessel enrolled in the federal experimental separator grate fishery begun in '95? List days fished for whiting.	N/A	N/A	N/A			

If you have questions call DMF at 617 727-3193
Return this form to DMF at 100 Cambridge St., Boston MA 02202 or fax to 617 727-7988

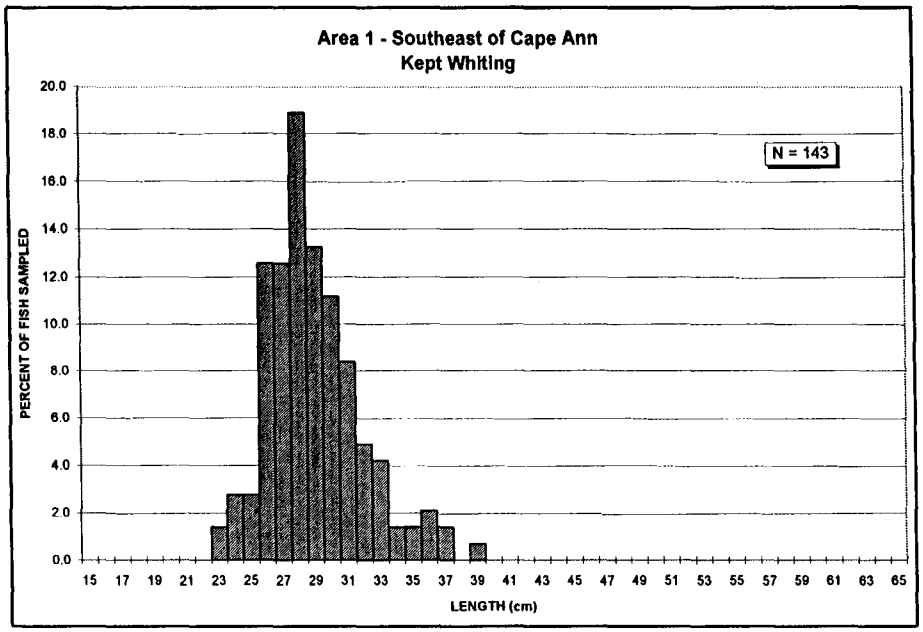
List of vessels that formally applied to DMF but could not be accomodated. DMF prioritized vessels based on past participation in whiting fisheries as well as considered their homeport/fishing area to ensure the experimental fishery program would collect adequate data from the various open fishing areas.

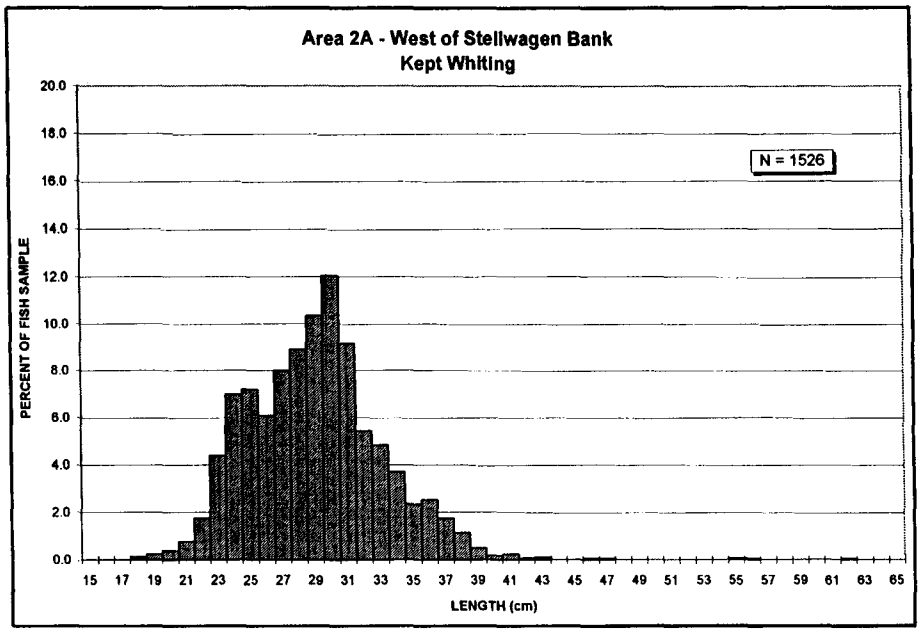
North Star (Gloucester)
Odessa(Gloucester)
Little Sandra(Gloucester)
Captain Dutch(Gloucester)
Sea Rover(Gloucester)
Skimmer(Gloucester)
Giannina G. (Gloucester)
Susan B (Gloucester)
Caterina G. (Gloucester)
Christina Eleni (Gloucester)
Maureen (Gloucester)
Jenaya and Joseph (Gloucester)
Nauset (Provincetown)
Jessica and Susan (Hyannis)
Shelli Rose (Plymouth)
Survival (Green Harbor)
Alosa (Plymouth)
Angennete (Plymouth)
Sao Jacinto (New Bedford)
Irene Maria (New Bedford)

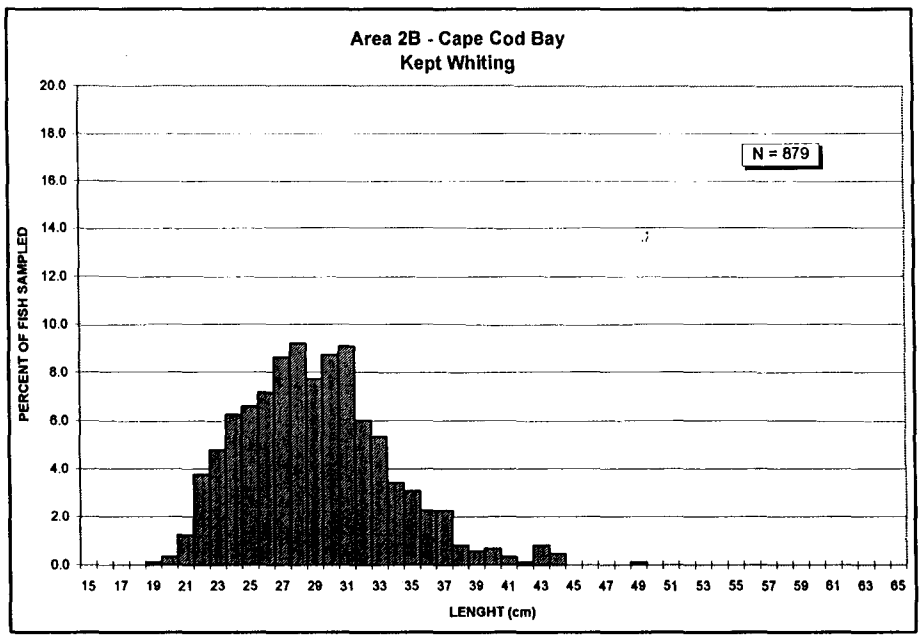
Appendix D: Length-frequency histograms for various species by area:

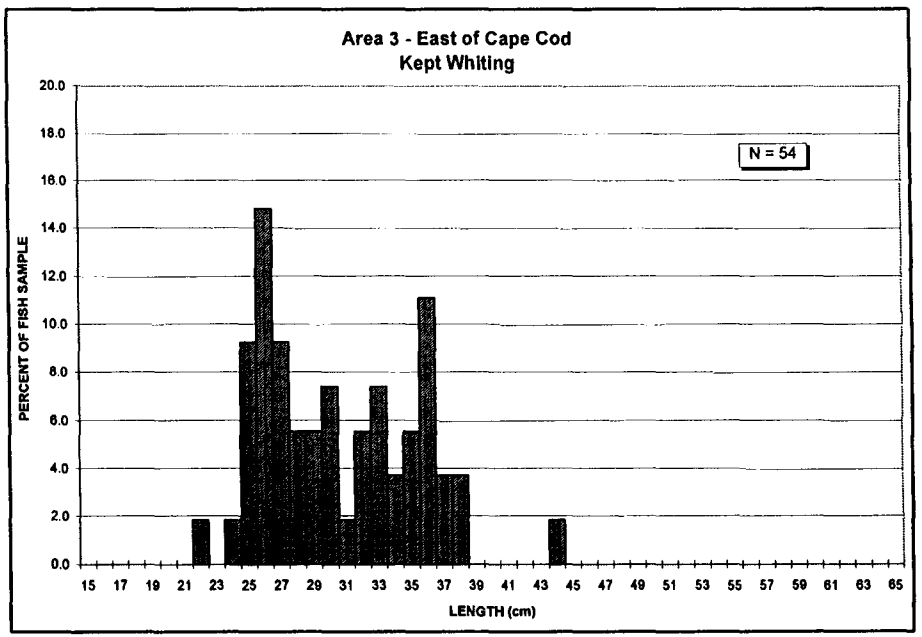
- Figure D1. Kept whiting length frequencies from Areas 1, 2A, 2B, and 3
- Figure D2. Kept red hake length frequencies from Areas 2A and 2B
- Figure D3. American plaice length frequencies from Areas 1, 2A, 2B, and 3
- Figure D4. Redfish length frequencies from Areas 1, 2A, and 3
- Figure D5. White hake length frequencies from Areas 2A and 3
- Figure D6. Cod length frequency from Area 2A
- Figure D7. Winter flounder length frequency from Area 2B

Figure D1. Kept whiting length frequencies from Areas 1, 2A, 2B, and 3



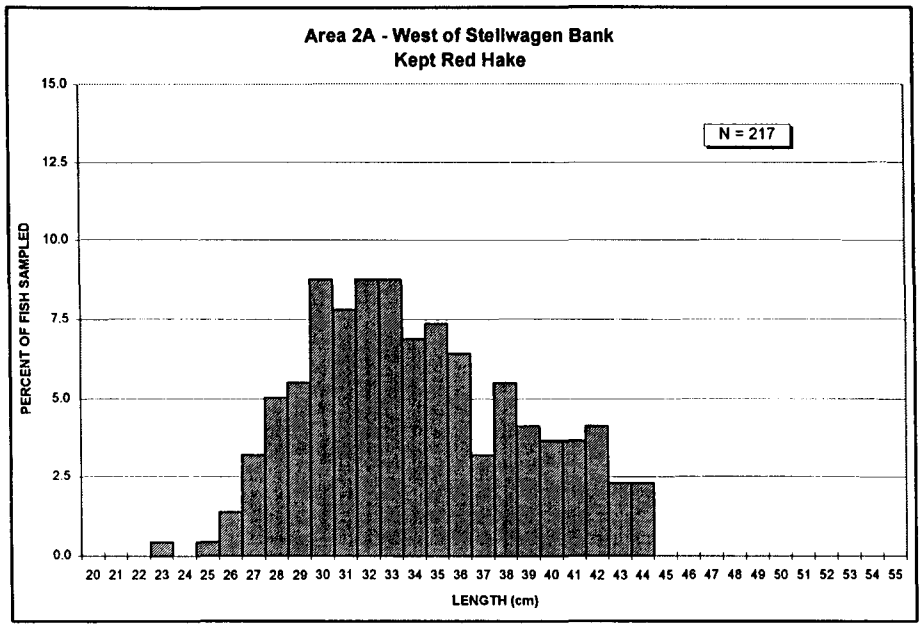


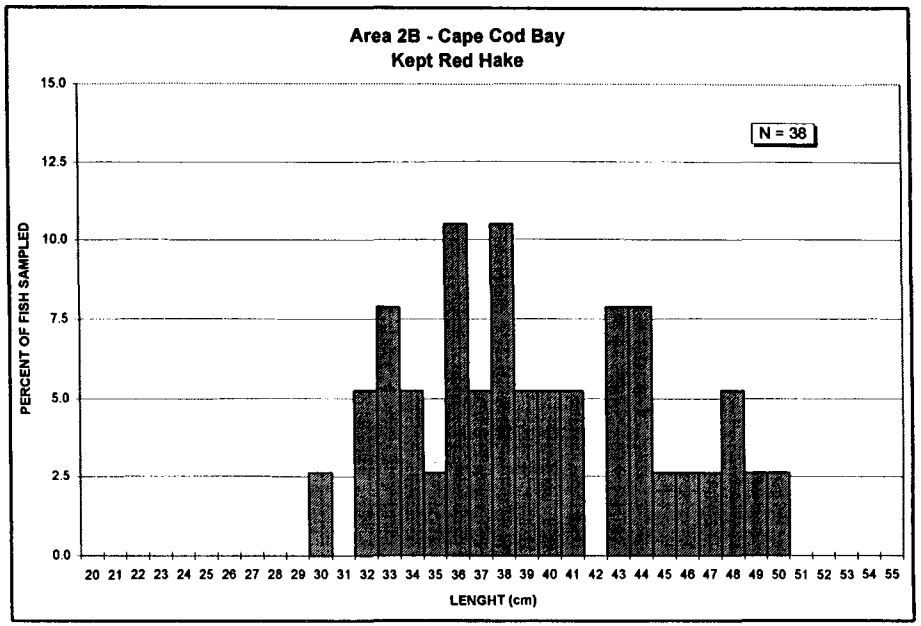




No whiting measured in Area 4

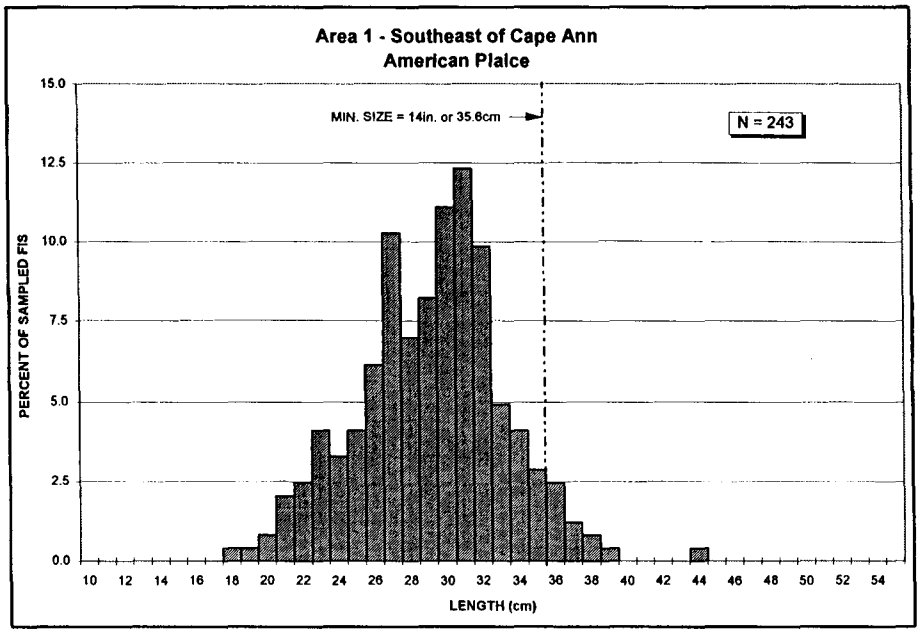
Figure D2. Kept red hake length frequencies from Areas 2A and 2B

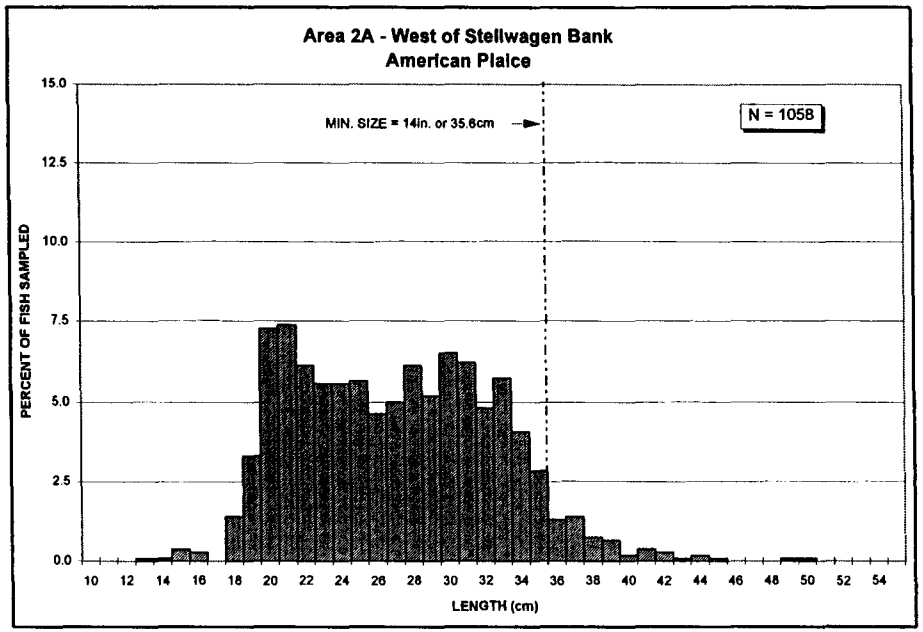


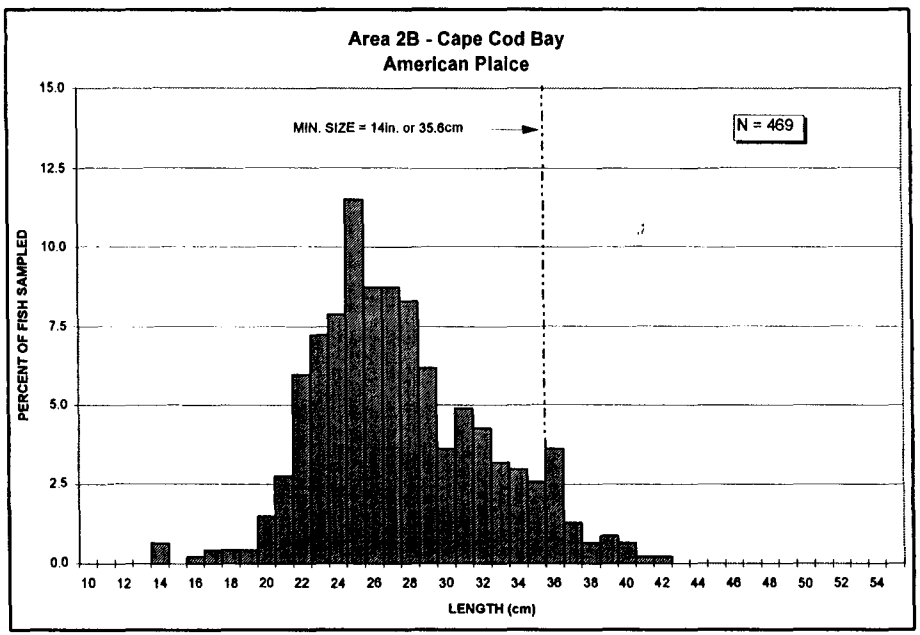


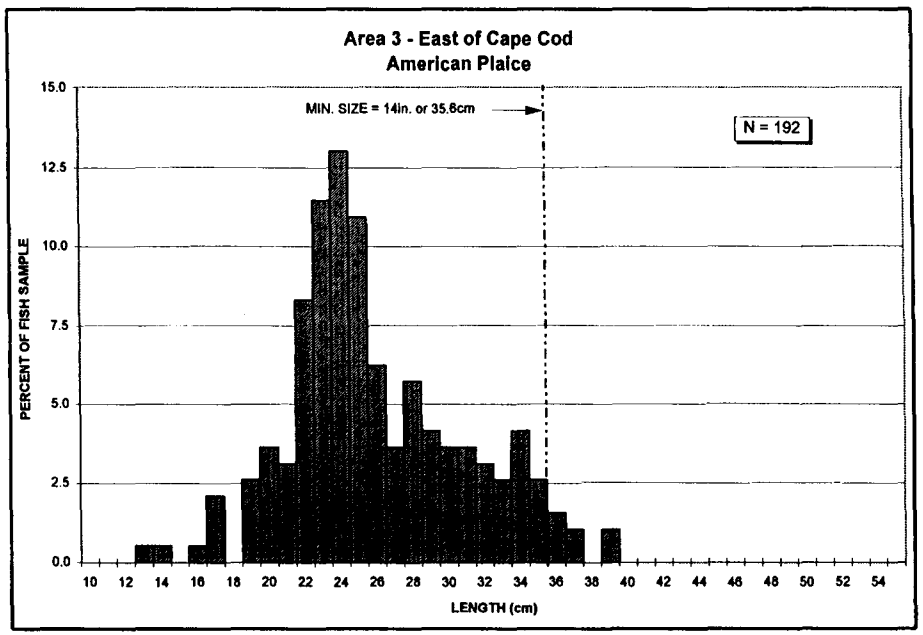
No red hake measured in Areas 1, 3, or 4

Figure D3. American plaice length frequencies from Areas 1, 2A, 2B and 3.



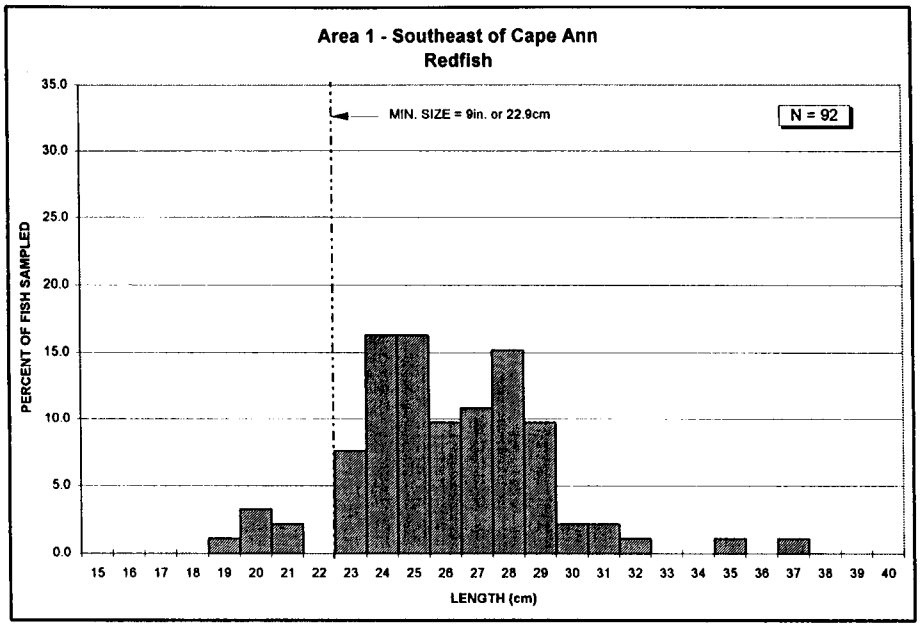


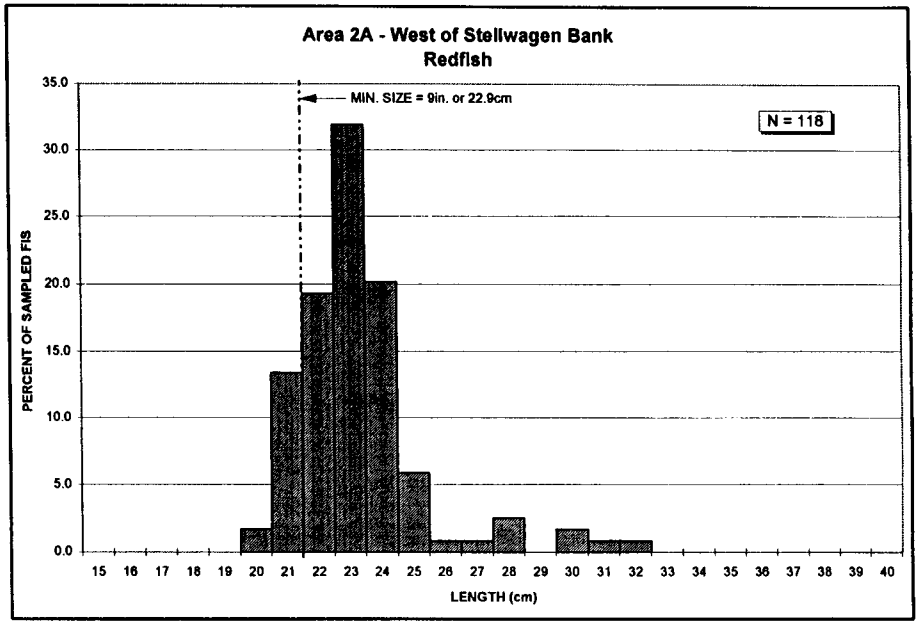


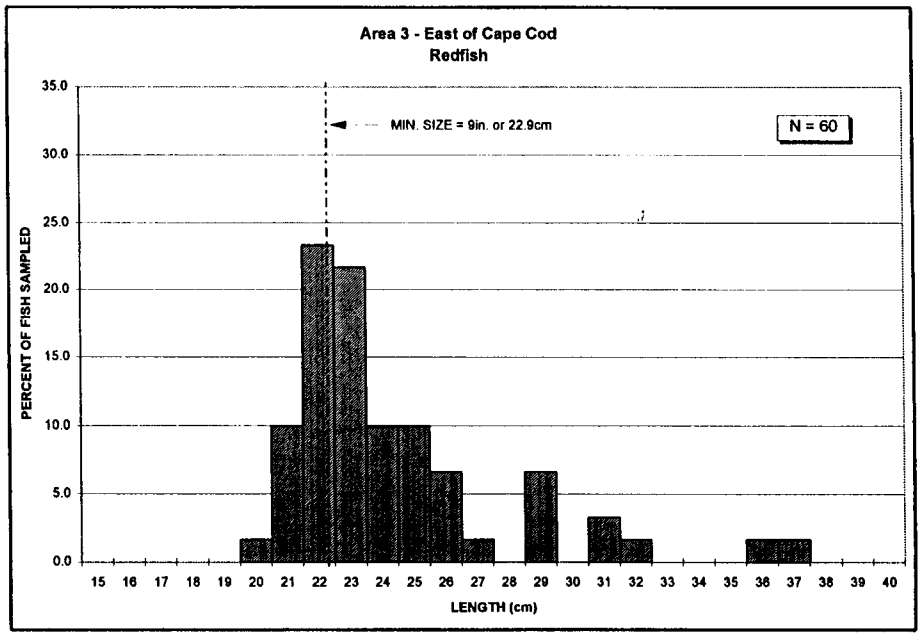


Insufficient sampling in Area 4

Figure D4. Redfish length frequencies from Areas 1,2A, and 3



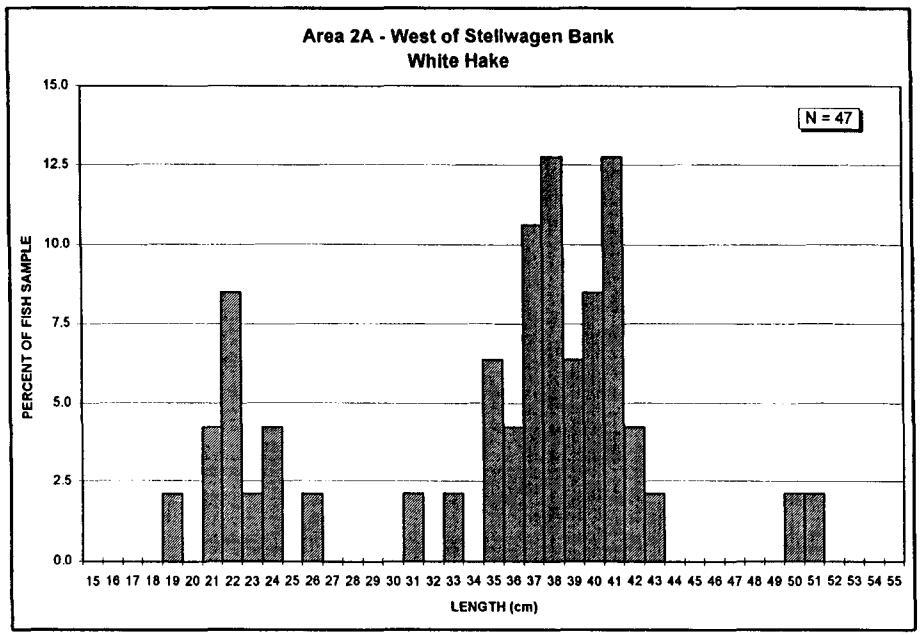


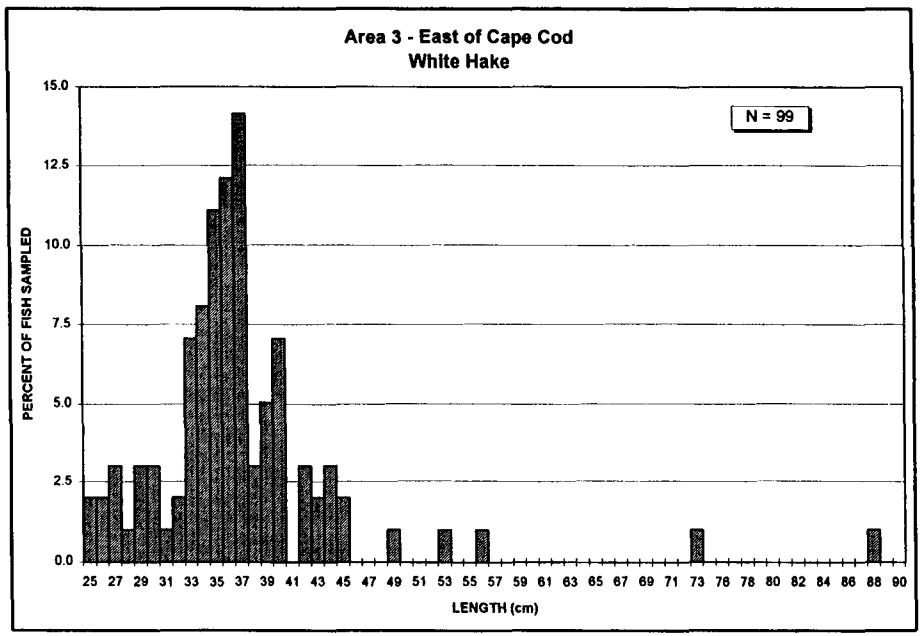


Insufficient sampling in
Areas 2B and 4

Figure D5. White hake length frequencies from Areas 2A and 3

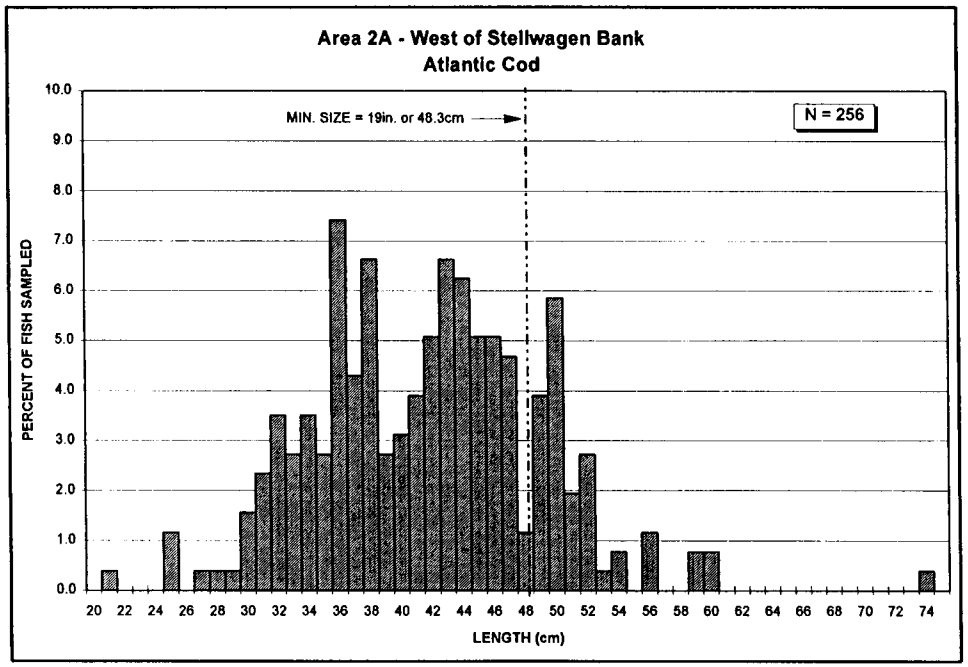
Please note different length scales





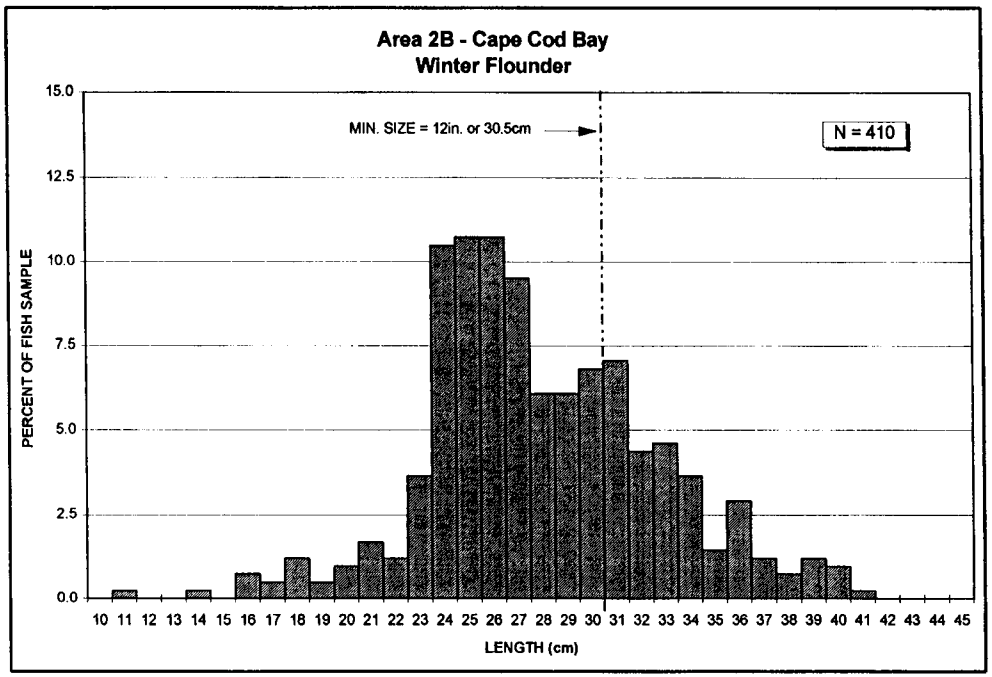
Insufficient sampling in Area 2B, and no samples taken in Areas 1 and 4

Figure D6. Cod length frequency from Area 2A



Insufficient sampling in Areas 2B, and 3, and no samples taken in Areas 1 and 4

Figure D7. Winter flounder length frequency from Area 2B



Insufficient sampling in Area 3, and no samples taken in Areas 1 2A, and 4

Appendix E: **DMF's Notices to fishermen regarding the access agreements for Cape Cod Bay (6 pages).**

NOTICE TO FIXED GEAR AND MOBILE GEAR FISHERMEN
August 21, 1997

Agreements to Share Access to Cape Cod Bay Established

★★★CAN YOU MAKE THESE AGREEMENTS WORK?!★★★

Fishermen's competition for Cape Cod Bay is severe and continues to worsen. Consider these facts:

- Lobstermen have increased the number of pots fished in October in deeper waters of the Bay (areas 7 and 8) 5-fold since 1990. At least half this increased amount of gear is due to fishermen who have received permit transfers.
- At certain times of the year, lobstermen have little room in the Bay to maneuver to move their gear (800 pots maximum) to other areas due to competition between themselves.
- There are 220 lobstermen who fish areas 6, 7, and 8 with pots.
- Late summer and fall fishing has become more important to lobstermen.
- Draggermen have lost many of their traditional "tows" in the Bay to fixed gear fishermen.
- Draggermen, represented by the Mass. Commercial Fishermen's Association, frustrated by their continuing loss of access, petitioned DMF and the Marine Fisheries Commission for specific areas to be set aside for mobile gear fishing only at certain times of the year (June hearings).
- Draggermen must avoid fixed gear at all times since by law they are prohibited from having fixed gear in possession without permission of the owner.
- Draggermen have regained their late summer/fall Cape Cod Bay whiting fishery through their work with DMF to develop an off-bottom trawl that has drastically reduced bycatch of groundfish and lobster catch.
- Whiting fishermen using this new net design in September and October in upper Cape Cod Bay in an area designated by DMF as the sole area for use of the net in the Bay, have lost much of this area to fixed gear fishermen.
- About 14 gillnetters pursue dogfish throughout the Bay into the fall.
- Fishermen of all types would rather work together to resolve their differences or develop compromises instead of having the government implement regulations.
- While the great majority of fishermen are willing to cooperate with each other, some put their own interests above those of others and will not subscribe to agreements for share access.
- <u>Agreements have been developed by Cape Cod Bay fishermen to provide mobile gear fishermen with access to Cape Cod Bay and lower Massachusetts Bay in state waters.</u>
- <u>Agreements start on September 1.</u>

With the above facts in mind, DMF and the Commission urge fishermen competing for access to Cape Cod Bay to make these agreements work. Regulations forcing separation are the option of last resort. No one wants more regulations, if at all possible. These agreements:

(1) were developed during August by a group of about 30 different fishermen representing lobstermen, draggermen, and gillnetters. A DMF representative provided some assistance without interfering;
(2) are dynamic because they are not fixed in stone. They're flexible and can change with time as fishermen communicate, cooperate, and decide how to improve shared access; and
(3) are not perfect solutions. They are the group's best attempt to avoid conflicts especially this

September and October, and to prevent DMF and the Commission from having to step in and regulate access.

This Cape Cod Bay working group of fishermen understood that not everyone would be completely satisfied with the agreements. It's impossible for 30 fishermen to speak for the many fishermen who fish Cape Cod Bay. Nevertheless, these fishermen with knowledge of the Bay and who consulted with many of their fellow fishermen in their respective ports, made every effort to be fair and representative. They recognized the seriousness of competition in the Bay and DMF's insistence that draggermen have access to the area reserved for use of the off-bottom trawl. This net has allowed draggermen, especially from Provincetown, to regain the valuable whiting fishery they had lost in recent years due to state and federal groundfish regulations.

For those of you who might feel the agreements are not yours since you weren't part of their development, please consider this:

(1) Be part of the solution and not part of the problem;
(2) Whatever sacrifice there might be on your part, it's only temporary;
(3) Your participation can help mend fences (and avoid fences); and
(4) You don't want to be one of those responsible for regulations impacting yourself as well as your neighbors who will know it was you that contributed towards failure of the agreements and new restrictions, if you ignore the agreements.

For draggermen fishing outside the areas set aside for your access, DMF/Commission message is this: "It's in your own best interests to do everything possible to avoid gear conflicts." We recognize you're hard-pressed to find bottom free of fixed gear, especially in traditional tows. We recognize that you're no longer able to fish at night in state waters; fishing at night probably did prevent some fixed gear fishermen from thinking twice about expanding their gear to areas where trawlers towed. Nonetheless, it's important for you to:

(1) continue to demonstrate to lobstermen and gillnetters that their property is respected, and
(2) realize that these agreements are flexible and a good first step towards more cooperation, communication, and increased access in future months.

DMF and the Commission support these agreements as an alternative to regulations. So does MLA. So does MCFA. We all consider these agreements to be great accomplishments and well worth the effort. They're steps in the right direction.

The attached chart shows the areas and times when fixed gear is to be set elsewhere. Loran coordinates are provided. These charts are being mailed to fishermen who have reported to DMF that they fish in Cape Cod Bay. MLA and MCFA will distribute the charts as well. The Division of Law Enforcement (DLE) will assist our efforts to contact fishermen.

Any fixed gear set in these areas of the agreements will be reported to DMF/DLE. To confirm these reports, DMF/DLE will survey the areas to identify the gears' owners. DMF will:

(1) contact these fishermen to inform them that they have broken the spirit of the agreements;
(2) report the names of these fishermen to the Cape Cod Bay Fishermen's Working Group, MLA, and MCFA;
(3) immediately condition these fishermen's permits: "It is prohibited for any fixed gear to be set in the

areas defined in the agreements." If these fishermen's gear is found in the area(s) again in violation of this permit condition, an adjudicatory hearing in Boston could be scheduled with a possible outcome being permit suspension; and
(4) publish in its quarterly newsletter the names of these fishermen whose gear is fished in violation of the permit condition. DMF's newsletter is received by the fishing industry and others interested in marine fisheries goings-on.

DMF will periodically sample draggermen's catches in the areas subject to these agreements to document their catches.

Furthermore, mobile gear fishermen fishing outside the areas in other Cape Cod Bay locations who tow up or damage fixed gear (but not ghost gear), could face an adjudicatory hearing with a possible outcome being suspension of the Coastal Access Permit (CAP).

Remember: (1) These areas of agreement are not meant as a substutite for fixed gear and mobile gear fishermen continuing to work together outside these areas to share access; (2) These areas defined in the agreements are not the only areas in Cape Cod Bay and lower Mass. Bay where draggermen can fish; and (3) These agreed-upon areas represent an amount of bottom less than requested by draggermen in their petition aired by DMF and the Commission in June.

★Please cooperate with this approach. As noted above, fishermen working together to share access to Cape Cod Bay is a far better approach than regulations forcing separation.

★While we favor these cooperative agreements, we give everyone advance warning that if there is wholesale disregard of these agreements, especially in DMF's whiting area off Provincetown, DMF will be forced to consider an emergency action closing these areas to fixed gear fishing.

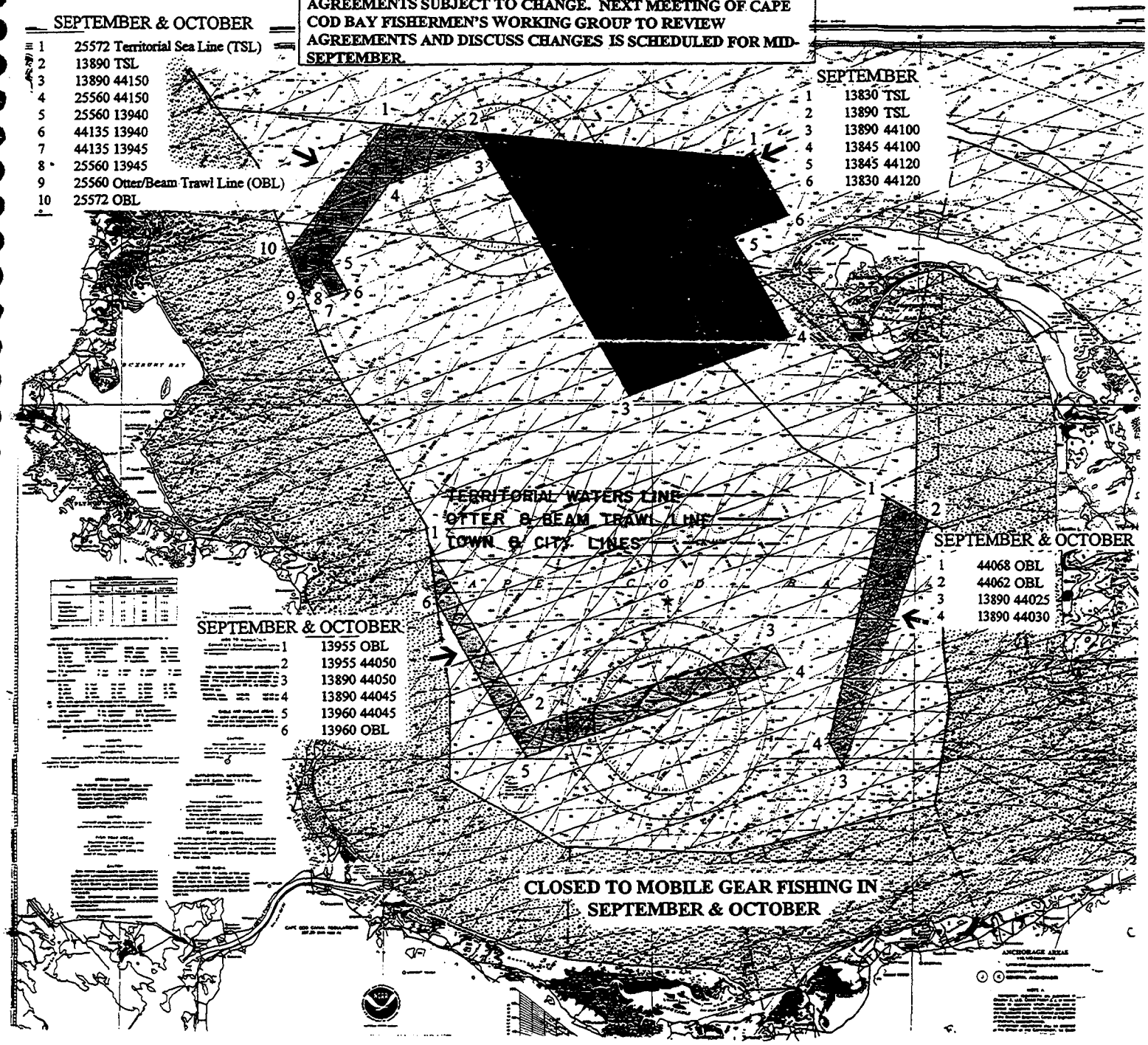
★ Also, remember to comply with the following DMF fixed gear requirements:
Pot Trawl: *East end* must be marked with a double buoy, consisting of any combination of two 7" by 7" or 5" by 11" buoys and one or more 3-foot sticks. *West end* must be marked with a single 7" by 7" or 5" by 11" buoy with a 3-foot stick and a flag.
Single Pots must be marked with a single 7" by 7" or 5" by 11" buoy. Sticks are optional, but if used, must not have a flag attached.
Permit Numbers: All buoys, pots, and traps must be marked with the permit number assigned by the Director which must be burned or cut into the surface thereof. Permit numbers must not be less than ½" in height nor less than 1/8" in thickness or width of line. In the case of non-wooden traps (steel, plastic, wire mesh, vinyl covered metal, etc.) numbers must be burned or cut into a wooden lath or a plate made of durable synthetic material, which must be permanently secured to the inside of the trap.
Pot Trawl Maximum Length: no greater than 2,000' from end to end.
Gillnets: *East end* must be marked with a high flyer and standard 12-inch tetrahedral corner radar reflector. *West end* must be marked with a high flyer with flag and a standard 12-inch tetrahedral corner radar reflector.
Gillnet Buoys must be permanently and visibly marked or branded with the permit number of the owner.
Gillnet Maximum Length: strings of gillnets must be no greater than 2,400 feet from end to end.

For more information, contact David Pierce or Dan McKiernan at DMF's Boston office (617-727-3193).

ACCESS AGREEMENTS FOR SEPTEMBER AND OCTOBER:

NO FIXED GEAR FISHING IN THESE AREAS DURING THE MONTHS SHOWN FOR EACH AREA.

AGREEMENTS SUBJECT TO CHANGE. NEXT MEETING OF CAPE COD BAY FISHERMEN'S WORKING GROUP TO REVIEW AGREEMENTS AND DISCUSS CHANGES IS SCHEDULED FOR MID-SEPTEMBER.



The Commonwealth of Massachusetts
Division of Marine Fisheries
Leverett Saltonstall State Office Building
100 Cambridge Street
Boston, Massachusetts 02202
727-3193

PHILIP G. COATES
DIRECTOR

NOTICE TO CAPE COD BAY LOBSTERMEN AND DRAGGERMEN

Western Boundary of Fishermen's Access Agreement for Cape Cod Bay Whiting Area Moved to the East to 13880.

Effective Friday October 10

After meeting Monday night to discuss the access agreement for the Cape Cod Bay "Whiting Area," lobstermen and draggermen agreed that the western boundary of the area should be moved 10 microseconds to the east to Loran C line 13880. For now, the other three boundaries of the area remain the same until further notice.

Another meeting has been scheduled for October 20 at the Hyannis Airport Conference room from 7:30 P.M. to 9:00 P.M. to discuss further shifts in the boundaries. Anyone wanting to participate in the discussions and decision should attend the meeting. Otherwise, DMF can be called at 617-727-3193, ext. 366 or 371 to find out if the boundaries have changed.

The boundaries of the other three areas with access agreements will not change. Except for the Whiting Area agreement that extends through November, unless changed before then, no agreements have been developed after October. Nevertheless, all fishermen working in Cape Cod Bay are encouraged to continue to work together to fish the Bay without conflict.

So far, most fishermen feel that the agreements are working well, although there's room for some improvements. To their credit, lobstermen have honored the agreements.

For those very few fishermen who consistently have not honored the agreements, DMF will follow through with the approach supported by fishermen who developed the agreements (Cape Cod Bay Fishermen's Working Group). That approach was described in DMF's August 21 notice describing the agreements to share access to Cape Cod Bay. DMF will condition the permits of these fishermen so that if they are found in the areas again, an adjudicatory hearing will be scheduled in Boston with a possible outcome being permit suspension.

For further information contact David Pierce at DMF's Boston office.

The Commonwealth of Massachusetts
Division of Marine Fisheries
Leverett Saltonstall State Office Building
100 Cambridge Street
Boston, Massachusetts 02202
727-3193

PHILIP G. COATES
DIRECTOR

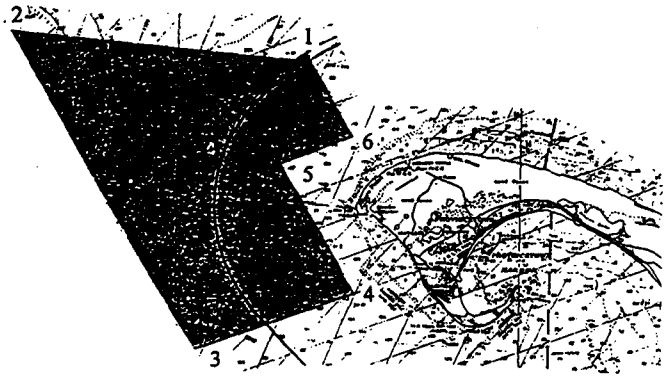
October 28, 1997

NOTICE TO CAPE COD BAY LOBSTERMEN AND DRAGGERMEN

Fishermen's Access Agreement for Cape Cod Bay Whiting Area

On October 27 the Cape Cod Bay Working Group met to continue discussions on the access agreement for the Cape Cod Bay "Whiting Area." Everyone agreed that the boundaries should remain the same for now because whiting catches are peaking, whiting prices are high, and most participants are fishing for whiting. Furthermore, whiting catches in federal waters north of the area are still low, and draggermen's access to those waters has been reduced due to fixed gear.

The area has been modified once already (October 10). The western boundary was moved 10 microseconds to the east to Loran C line 13880. The other boundaries remained the same.



1	13830 Territorial Sea Line (TSL)
2	13880 TSL
3	13880 44100
4	13845 44100
5	13845 44120
6	13830 44120

Another meeting is scheduled for Monday, November 3 from 7:30 P.M. to 9:00 P.M. at the Hyannis Airport Conference Room. At that time the Group will determine if conditions have changed enough to warrant new boundaries to the Whiting Area. For whatever reason, perhaps water temperature, the whiting fishery is lasting longer in Cape Cod Bay than last year.

Anyone wanting to participate in the discussions and decision should attend the meeting. Otherwise, DMF can be called after 9:00 P.M. on Monday until Tuesday evening to find out if the boundaries have changed. Our number is 617-727-3193. Listen to the message at extension 369.

If there is a change, it will be effective on Wednesday, November 5.

If necessary, the Working Group will meet each Monday in November to determine if changes to the Area are necessary. As with this first go-around, call DMF's office and listen to the message. Any change will be effective that Wednesday.

For further information contact David Pierce at DMF's Boston office.

Appendix F: **Letter from Captain Bill Amaru regarding net design (3 pages).**

Production / Conservation

WILLIAM H. AMARU

Fisheries Research & Conservation

(508) 255-0619
FAX (508) 255-0188

Fisheries Production Through Conservation Research

Dan Mckiernan
Mass. Division of Marine Fisheries
100 Cambridge Street
Boston, MA 02202
November 1, 1997

Dear Dan:

This letter comes as a follow-up to our conversation regarding the raised footrope whiting trawl experiment. These comments are for the benefit of the Division to insure the experimental fishery has the best chance for a positive outcome. The suggestions are based on my knowledge and use of the traditional trawl used in the fishery, my recently completed Saltonstall-Kennedy research project to test square mesh and knowledge gained through the use of the MDMF raised footrope trawl design.

First, I want to thank you and your colleagues for your dedication to the project. Your belief that there can be a clean fishery for whiting in Mass. and nearby waters has given this project a chance. Second, please take the time necessary to work out all the "bugs" before bringing your work forward for exemption. Towards that end, I would suggest the following.

Using this net system can be a real pleasure. It can also be a real pain. There is a tendency for fishermen to feel "there is something wrong with the net" when they catch what they consider too few fish. This is partly because the recent prohibition on small mesh fishing has created a "there must be plenty of whiting, since I haven't caught any lately" myth. As we know, someone else has been catching quite a few whiting and there may not be quite the robust stock we would like to see. In other words, it's a challenge not to tinker. This tendency becomes less a factor as the fisherman starts to catch fish in good numbers. The strength of the resource plays an important role in the effective use of this gear.

POST OFFICE BOX 1019, SOUTH ORLEANS, MASSACHUSETTS 02662

This net requires great faith on the part of the user. It is very easy to make it just as dirty as any other net can be. That is your number one challenge. You need to build into this net additional safeguards to prevent it from being adjusted too easily, especially when a fisherman is doubting himself. To this end I would encourage you to require a mandatory set-back of 12" to 16" for the top legs. This can be accomplished by requiring equal length top and bottom legs and a rope extension at the hook up to the top wing connector. The reason this should be required is that despite the long drop chains, the footrope will not rise sufficiently without extending the top legs. I have found the foot rope will rise proportionately to the top leg extension. Footrope rise is approximately 1/2 the top leg extensions. The ratio is also dependent on the net being floated to nearly neutral. Without the set back, the footrope will follow exactly behind the sweep, negating the major benefit the long drop chains provide.

Along this same line of thinking, the use of a large mesh panel in the forward portion of the bottom belly would be helpful. You may remember this type of panel was required before the Nordmore grate was mandated. It has a limited effect on reducing the catch of small flounder and may also reduce lobster and sculpins in the catch. My experience has proven to me it is not necessary when the net is set up correctly (with the top leg extensions and proper floatation), but it can only be removed or altered with difficulty. A square mesh codend should be tested as part of the experiment. Square mesh has been proven to allow improved escapement for juvenile whiting and herring and needs to be thoroughly field tested in a directed fishery. I cannot think of a better place to learn more about the benefits this mesh can offer.

While I have learned this net can fish quite clean on flats and other species in close contact with the sea bed, as noted above, it can be made to fish very close to the bottom with minimal adjustment. Fishermen who are approved for participation in the experiment (and ultimately the exemption) will have a considerable responsibility to fish the net as it is intended. <u>It is absolutely incumbent for the success of this experiment that substantial risk be attached to the decision to violate the net specifications.</u>

Fishermen, like everyone, learn through example. If the belief becomes accepted that violations will be tolerated, this experiment will fail. If fishermen believe they will lose their privilege and very real financial benefits associated with participation, they will think twice before taking the chance to violate the rules (I hate to say it, but getting hit in the pocket book is more effective than relying on conscience). While I believe the majority of fishermen will try very hard to fish as clean as possible, I also know they will not be made to feel foolish by violators who are allowed to continue to fish without heavy penalties. The abundance of willing fishermen to participate in the experiment should remind everyone how lucky we are to be in the program and that there are others just waiting for a chance to fish in their place.

Finally, how to allow for fair entry of additional participants as space becomes available? I do not envy the Division trying to perform this thankless task. Once the selections are made for the needs of the experiment pool, additional participants could be selected through the luck of the draw. Those who make up this pool must be screened for violations, as is now the case as well. However, you must decide whether a violator who has "paid his debt to society" belongs in the same pool as someone who has never faced a fishery charge. Should a fisherman whom you must assume has a clean record because he followed the rules be given the same chance as one who has a violation from, say, three years ago? It is definitely a tough choice. As chairman of the Professional Standards Committee, I will recommend to the New England Council that individual fishermen with no history of fishery infractions be placed at the highest qualifying level for the advantages of limited participation fisheries. Once regional and historical participants are chosen from this block, a lottery process could be used to continue to offer a chance to participate, free of selection bias. But at no time would a violator be given an advantage over someone with no violations.

Accurate and timely reporting should be a requirement to continue in the program. Also, perhaps fisherman should write their comments, concerns and general impressions for ways the experiment could be improved. You could also hold an end of season meeting; let them know there thoughts matter.

Thanks for the opportunity to participate. I have enjoyed getting to know and working with Rob Johnson and Henry Souza; quality individuals, both of them. I hope we, the fishermen and the Division of Marine Fisheries, can make the experiment a success. It is the kind of win/win project that could really "bring home the fish". Now, if we do our work on the Council, we can even bring it home sustainably.

Sincerely,

Bill Amaru

Bill Amaru

Appendix G: News coverage of gear trials: DMF News article and Boston Globe article

- Second Quarter '98 DMF News article describing recent testing of raised footrope trawl in a flume tank at Memorial University, St. John's Newfoundland (1 page).

- Boston Globe article (5/24/98) describing Henry Souza's efforts in the experimental fisheries (6 pages).

DMF Goes International with the Raised Footrope Trawl

Flume tank study reveals net behavior and potential for improvements

DMF's gear experts got a crystal clear view of DMF's off-bottom trawl in action in an experimental flume tank in Newfoundland. A better understanding of the net's behavior was needed as well as clear film footage to teach fishermen to deploy the net properly.

DMF's "raised footrope trawl" has already solved some significant by-catch problems by reducing the catch of juvenile flounders and other bottom-dwelling finfish and crustaceans in trawls targeting whiting, dogfish and red hake. However, this work progressed slowly over the past few years as various net configurations were tested. DMF biologists would usually measure the effect of any modification to the net indirectly - by enumerating the species composition when the net's contents were dumped on deck. Whiting catches associated with sculpins, crabs, lobster, and small flounders usually meant the net was "digging" into the substrate while the absence of these species meant the net was fishing properly. This work was tedious, often imprecise, and expensive. Furthermore, filming the net on productive whiting grounds was difficult due to low light levels and poor visibility.

DMF's Conservation Engineering staff traveled in March to St. John's, Newfoundland, to the flume tank facility at Memorial University. Project Leader Arne Carr, Henry Milliken and Dana Morse were joined by Provincetown fisherman Henry Souza, and Chris Glass, a gear and fish behavior expert from Scotland currently working with the Manomet Bird Observatory.

Their objective was to examine the effects of rigging and water speed on a model trawl equipped with a raised footrope, such as is used in the fall experimental fishery for whiting in Provincetown and Gloucester. Fishermen are presently mandated to use the raised footrope trawl because of the bycatch-reducing properties of the net. In addition, the researchers hoped to develop videotape, detailing the effects of changes to the rigging, which would be used as an educational tool to help fishermen fish their nets most efficiently — to maximize the target species with minimal by-catch.

DMF's Arne Carr and fisherman Henry Souza testing the raised footrope trawl in various configurations.

Photo by Henry Milliken

The flume tank at the Fishing Technology Unit of Memorial University is a world-class facility: its working section alone is 70 feet in length and 26 feet wide, and it carries 400,000 gallons of water. It is fully equipped with submersible video and still cameras, and can replicate water speeds scalable to 5 knots. With a movable belt on the bottom of the tank, it can even replicate the movement of a trawl over the seabed.

The investigators spent five days at the facility, varying such things as water speed, flotation, headrope length, sweep length, and arrangement of the 'dropper' chains which connect the sweep to the footrope. In addition, the model was modified to fish without a sweep, leaving only the drop chains to keep the net weighted. Some time was spent examining the effects of placing a tube of canvas-like material inside the webbing of the extension of the net; a modification referred to by the group as the 'black hole.' The black hole is a modification which, if used in conjunction with a large mesh panel ahead of it, may induce cod escapement. Scinetists theorize that the black hole resembles the open mouth of a large predator. [Yikes!]

The results surpassed expectations, and were made all the more valuable by their capture on videotape and photographs. The group was able to see which speeds and methods of rigging maximized the vertical opening of the model, while maintaining the height of the footrope "off-bottom." Generally, increases in headrope length resulted in increased headrope height, while a reduction of headline length caused the net to flatten out, and the footrope to fish closer to the bottom.

The group discovered that it was fairly easy to rig the net to fish without a sweep of any sort. Instead, the right number of drop chains and floats could be used and the net would perform properly "off-bottom." This is an important development since the net would be easier to rig — and easier to enforce for Coast Guard and the Environmental Police.

This work is seen as an important tool to help fishermen understand how their gear is fishing, and to improve DMF's ability to communicate with fishermen about the raised footrope trawl. Additionally, the link with Memorial University will be a continuing asset, given their capability and experience for any future gear tests.

Personnel from the Canadian Department of Fisheries and Oceans(DFO) viewed the net and the testing with interest. They have a new shrimp fishery north of Newfoundland that has a flatfish bycatch problem. As a result of viewing the gear in the flume tank and discussions with DMF staff, DFO intends to test this gear in that fishery.

Individuals interested in learning more about the results of this project are encouraged to contact members of DMF 's Conservation Engineering Project: Arne Carr, Henry Milliken or Dana Morse, at the DMF Office in Pocasset, (508)563-1779.

by Dana Morse

Net profits

Henry Souza, a Provincetown fisherman, has been working on a trawling net that's better for the environment than traditional gear. And that might make it better for fishermen, too.

By Seth Rolbein

Two miles off Provincetown, in calm Cape Cod Bay, a little thump beneath his hand on the tiller tells commercial fisherman Henry Souza that he has a big problem. He jumps to the controls, throws the boat's engine into neutral, and uses his hydraulics to begin hauling back the thick metal wires that link his fishing net to his boat.

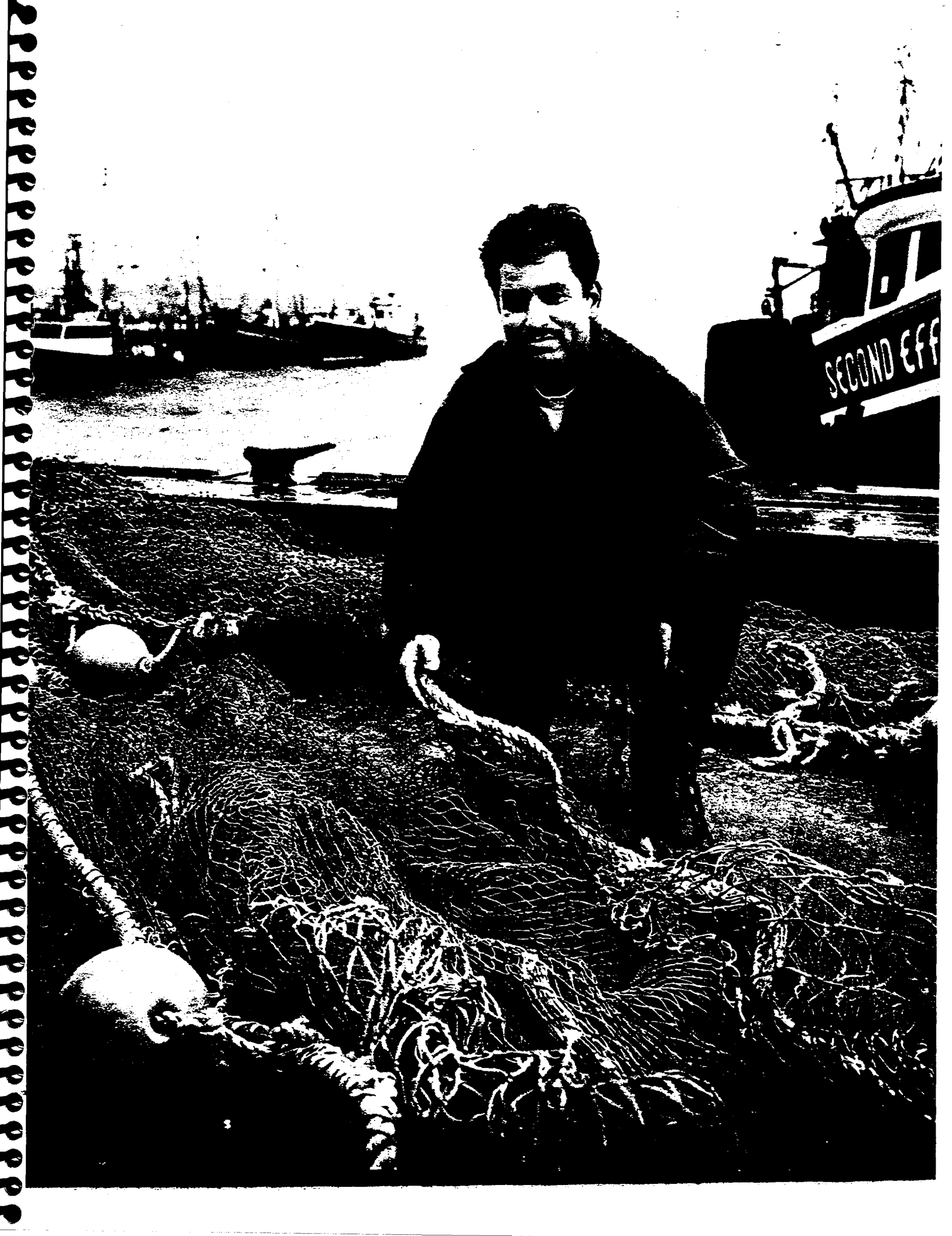
Anxiously, he watches as the cables wrap around a steel drum nearly 10 feet in diameter that slowly rotates, creaking and groaning. Five minutes pass, enough time to haul up hundreds of feet of cable. There is nothing attached: The lines have snapped, and the $3,000 net they had held has gone to the bottom.

"This is the first time that's happened to me in 16 years of fishing," says Souza quietly, holding his frustration in check, staring at the frayed ends of the cables. "The net hit something down there." Something big enough to hold it fast, heavy enough to snap thick, braided metal wire.

Souza knows these waters; he has fished them for years. His boat, the *Charlotte G*, belonged to his grandfather and has been dragging its big nets along this bottom since 1952, 11 years before Souza was born. Less than a week earlier, Souza's partner had taken the *Charlotte G* dragging over the same sandy bottom without a problem.

Looking east, Souza believes he sees the cause of this disaster: a large, modern boat

Seth Rolbein's last article for the Globe Magazine *was on the Marine Biological Laboratory, at Woods Hole.*


SECOND EFF

dredging for scallops. Like the *Charlotte G*, this scalloper scrapes its gear along the ocean floor. But because its engines are much more powerful, it can drag large underwater objects with it, dumping them in new places. It can also rake the sea floor so heavily that it disrupts the places where the fish Souza is after – yellowtail and other flounder – live and breed. Souza can't prove it, but he is sure that the scalloper dragged a boulder into these grounds. Discouraged, he heads for home.

MUCH LIKE SOUZA'S NET, the Provincetown fleet is in tatters. In trawling's heyday, more than 50 boats tied up at Provincetown's piers. Today, there are 16. None of them is new, and many bear family names. Tethered side by side, they look like respected but aged relatives, rocking gently, worn and weathered, their best days long behind them.

The way commercial operators fish – particularly draggers – is changing the undersea environment. Modern trawling is wiping out the enclaves fish need to breed and is killing tomorrow's stocks, along with today's catch. Some scientists compare dragging to the clear-cutting of forests or the strip mining of hillsides in its destructive impact.

If the fleet is to survive, its salvation may lie with one of Souza's nets. Not the conventional net ripped from its cables and rippling along the floor of Cape Cod Bay but an experimental net Souza has been tinkering with in his back yard for three years. Already, his stubborn inventiveness has produced a new kind of trawling gear that nets fewer small fish; many credit him with singlehandedly keeping the fleets in Provincetown and Gloucester on the water last fall. Later this year, he hopes to build a net that treats the seabed much more gently. Not because he's a committed environmentalist but because he wants to give the fishermen of his generation the ability to continue to make a living the way their grandfathers did.

TRAWLING WAS CONTROVERSIAL from the moment it first appeared in this country. The *Spray*, the first trawler in the United States, was built in Boston and launched from here in 1905. It used reliable engine power to transform the ancient craft of netting fish. Put simply, the technique involves laying out a huge cone-shaped net behind the boat, weighing it down to keep it on the bottom, and propelling the boat ahead for an hour or so. Everything in its path is forced into the open mouth of the net. Fishermen could then haul up, pick out what they wanted to sell, and toss the rest back.

The catches were phenomenal, and the idea was soon imitated up and down the coast. Early reports say that often more than 100,000 pounds of fish were harvested in a single haul. With gears and winches helping fishermen muscle the nets out of the sea, draggers landed a hundred times the amount of fish the old dorymen could. But in the process, fishermen did two things they had never done before: They killed and wasted tons of immature fish – their future catch – in the crush of the net. And they scoured acres of the sea bottom, raking it clean of vegetation.

Those who would not take up trawling were both appalled and threatened by it. "If no check is put upon these sea scavengers, Gloucester and all that now remains of the New England fisheries will soon be a thing of the past," predicted a Gloucester fisherman named Lemuel Spinney at the 26th Annual Master Mariners' Banquet and Ball in Gloucester in 1913.

Yet, as the plaque on many a fishing boat reads, "Oh, Lord, the sea is so very big, and my boat is so very small." To many, the ocean's abundance seemed infinite. Trawling became the dominant form of fishing not only in New England but around the world.

It took nearly a century, but the doomsayers were finally proved right. For decades, New England fishermen landed roughly 80 million pounds of haddock annually; by 1995, there were so few haddock in the Gulf of Maine that they were termed "commercially extinct." Yellowtail flounder catches, which once averaged 40 million pounds a year, are now limited to 6.5 million pounds annually; otherwise, the federal government says, the stocks will crash. Cod, the potatoes of the sea, are now so scarce that large sections of Georges Bank have been closed. Port by port, boat by boat, the fishing industry is shrinking, so that, like the fish, it has itself become endangered.

Technology made the big sea small and the small boats big. Satellites now pinpoint potential catches with such precision that fertile spots no larger than a living room can be targeted and dragged over and over again. Onboard gear known as fish finders can display individual fish as blips on a sonar screen.

But no piece of equipment has changed as dramatically as the dragging gear. For many decades, draggermen were limited to trawling across soft and sandy bottoms; they could not fish where the bottom was rocky and jagged, because their nets would catch and tear. But in the late 1980s, new trawling gear with descriptive names such as "rockhopper" and "streetsweeper" was introduced. Nets equipped with large rollers – tires, in essence – could bounce along the bottom without snagging. Outfitted with much more powerful engines to pull heavy gear around, the boats became the nautical equivalent of all-terrain vehicles, with the size, power, and capacity of tractor-trailers.

"My feeling is that the final collapse of the fishery was the advent of gear that allowed people to go anywhere," says Les Watling, a professor of oceanography at the University of Maine's Darling Marine Center. Watling used a submersible craft to dive down and study rough areas of the ocean bottom in 1984, and he was amazed at how many fish lived in these havens. "I've come to believe that those nurseries functioned for a very long time and kept the fishery going," he says. "Now those refuges are gone."

Provincetown's draggermen saw the newer, bigger trawlers clean out their neighborhood. For decades, an area off the town's "back

shore" yielded a solid spring harvest of flounder. Huge boulders across the bottom made large areas of the back shore off-limits. "But three or four years ago," Henry Souza recalls, "a guy showed up with big horsepower and this heavy roller gear. He got 20, 30 buckets of flounder in one tow. Suddenly, there were 10 of his buddies there, and they're taking historic catches of flounder." Since then, the fishery has disappeared. "That was our breeding stock," Souza says in frustration, "and they took it."

This is not only New England's problem. The University of Maine's Watling makes an upland comparison: Roughly 100,000 square kilometers of forest are clear-cut each year, he says. Although it's harder to know what's going on underwater, Watling believes that as much as 14 million square kilometers of seabed are dragged regularly – the equivalent of half of the world's continental shelf.

People could see what was happening. Yet it is the nature of the fishing industry to grab what you can, when you can, until there aren't enough fish left to make money. Then you move on and do the same thing in another area, or to another species – while there still is another area and another species. Romance of the sea aside, fishing is an adversarial, aggressive business.

ARNE CARR, OF THE Massachusetts Division of Marine Fisheries, knew how bad things had gotten along the state's historic waterfronts. For several years, he had been tinkering with new nets that might be more selective, catching the fish for market while killing fewer of the fish that can't be sold. He called a Provincetown fish buyer he knew named Ray Duarte, wondering if there was a fisherman in town who had the head and heart to experiment with new gear. Duarte sent Carr to his nephew, Henry Souza.

"Arne brought over a net, something like a prototype he had been working on, and spread it out in the back yard," Souza recalls. "I looked at it, and didn't think it could possibly work. I even brought my grandfather up to look at it. He said, 'Jeez, you don't expect to catch anything with that, do you?' "

The problem was, the federal government was telling fishermen that, in effect, their conventional nets were no longer legal. In 1995, tough federal guidelines on bycatch took effect. Bycatch is the unintended fish the draggers tow up and kill as they scour the bottom for their target fish. The new regulations prohibited draggers from landing any fish at all if their bycatch amounted to more than 5 percent of the target.

The rules sounded like a death knell for the struggling Provincetown fleet. The port relies on a fish called whiting, also known as silver hake, about 12 inches long. It is Provincetown's staple; in the early 1990s, this one small port landed an average of 1.2 million pounds of whiting a year. Yet as draggers haul back with whiting, many bottom-dwelling fish like flounder and monkfish are scraped up and killed in the process. Some of them can be sold. Most of them can't – including many lobsters. When the whiting arrive in the fall, many lobsters are molting, shedding their hard shells. Hundreds of pounds of soft lobsters are disgorged from the nets among the whiting, crushed and useless.

The net that Arne Carr dumped in Souza's back yard was meant to reduce the bycatch around whiting and get Provincetown's fleet back on the water. Carr promised that the state was willing to support the effort and cut through federal red tape to get an experiment going, if Souza would be willing to work with the new net. The port was desperate; in the fall of 1995, instead of going after whiting, Provincetown's boats stayed tied up at the pier. Fifty percent of the fleet's annual income was lost. With that much at stake, Souza agreed.

For Souza, the challenge was also personal. His grandfather had been a fisherman in Portugal long before he arrived in Provincetown, 50 years ago. Souza, who was named after him, became the only one in the family to take up the business. After high school and a few years of fishing out of Woods Hole, he fished with his grandfather until 1992, when the older Souza retired. The younger Souza inherited his grandfather's stubbornness, a trait that comes in handy for a fisherman hoping to survive the worst crisis in the industry's history.

He outfitted the *Charlotte G* with the new net, went to sea, and towed. Anxiously, he checked the first haul; the net was empty. The second tow wasn't much better: Souza pulled out three or four dabs – a flounderlike flatfish – and maybe a handful of whiting.

But he didn't quit. For three months, he worked on the gear, while the state paid for a portion of his fuel and allowed him to sell whatever little he was catching. Souza focused on raising the "foot rope," a thick line at the mouth of the net that dragged on the sea floor. Fishermen had always assumed that if the foot rope was elevated, the fish would scurry through the open space between the foot rope and the ocean floor. But Souza and Carr were becoming convinced that if the rope were raised a foot or two in the water – using floats on the surface and drop chains on the bottom to hold the net in place – then lobster and flounder could slip under the net and escape, while the whiting that schooled higher up would still be caught. And the gear would do less damage to the bottom.

When Souza got the net to a point where it seemed to be working, he made his first big test. "I brought out an old net that caught every living thing in the water," he says. "We made a tow with that, and then compared it with the new net." The old net caught 260 pounds of dabs, mostly juveniles, and 300 pounds of whiting; the bycatch was nearly equal to the target. The new net caught 20 pounds of dabs and 100 pounds of whiting. Souza was headed in the right direction, but he was still taking too much bycatch and missing too many whiting.

With fish money short, Souza took another job in 1996, as captain of one of Provincetown's whale-watch boats. But all summer, he kept refining his gear in his spare time, fooling with floats and chain, raising and lowering the foot rope. As he worked, skeptical fishermen passed by, taunting him with calls like, "Hey, stupid, that'll never work" – though not always worded that politely.

When the whiting returned that fall, Souza was ready to prove his critics wrong. With an experimental permit in hand, he steamed offshore and towed. The first day, instead of looking at an empty net, he caught so many fish that he ran out of packing boxes. With almost no bycatch, he was pulling in 5,000, 7,000, 10,000 pounds of whiting a day. With the old net, the whiting came up on deck covered in mud and goo from the bottom, beat up and raw. But these fish were clean and silvery, superior quality, some of them still alive. They fetched top prices at the market in New York, about 50 cents a pound.

For two weeks, Souza had the fishery to himself, and the money he made paid for a lot of the time and sweat and risk he had put into the gear. But it didn't take long for the rest of the fleet to notice; 13 of Provincetown's 16 boats got experimental permits and took up the new gear. By the end of a shortened season, 500,000 pounds of whiting, worth $250,000, had been landed. The fleet was back in business.

ALMOST IMMEDIATELY, Arne Carr began getting phone calls from Gloucester. What is this with Provincetown? How did the boats get back on the water? Carr sent Souza north to work with the Gloucester fleet to prepare for 1997. "There were a lot of skeptics, just like here," Souza says. "But after the first few tows, people were saying that it was just great. And the crews love it, because there's no dirt and mud all over everything."

Environmentalists approved as well, though with reservations. "It's great, in terms of reducing the bycatch of flatfish," says Eleanor Dorsey, senior scientist with the Conservation Law Foundation, based in Boston. "But in terms of what it's doing to the bottom, that hasn't really been studied." Souza's design continued to employ a "sweep-chain" that dragged along the seabed, damaging the bottom.

Andrew Rosenberg, regional director of the National Marine Fisheries Service, has raised concerns about cheating. By relaxing the tension on certain lines, he says, fishermen can adjust the new net and drop the foot rope to the ocean floor. A quick look on board any dragger would reveal the alteration, but with only 25 enforcement agents from Canada to Cape Hatteras, North Carolina, Rosenberg says he couldn't possibly monitor every boat. So he has issued a stern warning: "If we catch people messing with the gear, I will close that experiment."

"It's true, it's easy to cheat," Souza says. "Too easy." So he has returned to the drawing board, with an even more radical notion: to eliminate the sweepchain. With no chain, it becomes virtually impossible to cheat. But would the mouth remain open if the net were weighted only at each end?

In March, Henry Souza and Arne Carr flew to Newfoundland, where they tested the net in a sophisticated laboratory flume tank, which simulates ocean conditions. Sure enough, the new gear seemed to work. "We had guys from the Canadian government coming over – I'm talking about some of the world's experts on gear," Carr says. "One of them saw what Henry was doing and said, 'Wow, I had no idea the net would still spread without that horizontal sweep.' It was a revelation to everybody."

Souza is not certain his idea will fish in the real world. He's going to experiment this summer much as he experimented with the first gear, back in 1995 and 1996. If all goes well, and the fleet takes up the new rig in the fall, then the last piece of chain that drags across the bottom behind a draggerboat in search of whiting will have been removed. "This new gear would be really light on the bottom," he says. "But to be honest, the reason I'm trying it isn't because of the environment. It's to stop the cheating."

Henry Souza's new gear is not going to make him rich. There is no patent he can claim, no market share, no money from the state other than a consultant's fee when he is working on the gear or helping other fishermen. Even if the new net works, Souza still may need to resort to taking tourists whale watching to keep himself on the water, which is by no means his first choice. Neither will it solve all the problems of the industry, although Souza's stubbornness and inventiveness may tide the fleets over in Provincetown and Gloucester while the fish stocks recover.

But in a certain way, Souza's work represents a dramatic, almost revolutionary change. Since humans first began to fish, the challenge has always been to catch more. Fishermen are now confronting the idea that more is not

necessarily better. The infinite ocean has become finite; to sustain the stocks, fishermen need to become shepherds as well as hunters.

Environmentalists and scientists have accepted the change, but they are not the ones who, in the end, matter most. If the New England fishery is to be saved, it will be because fishermen like Henry Souza, working on the decks of aging boats like the *Charlotte G*, adapt and adopt new ways of practicing their ancient craft. ▭