Expanding the Use of the Sweepless Raised Footrope Trawl in Small-Mesh Whiting Fisheries

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Abstract
The purpose of this study was to monitor the exempted small-mesh raised-footrope trawl (RFT) fishery and to improve adoption of the sweepless RFT in the exempted fishery through net modification at sea and production of a video documenting the fishing procedures and performance of the sweepless trawl. Eighteen sampling trips were conducted from September 13 – December 19, 2002; 7 trips in which the standard whiting RFT or Scottish seine were used and eight trips in which the sweepless RFT design was used. In addition, three trips in which nets were converted from a standard RFT to a sweepless RFT (changeovers) were conducted. Biological data (catch composition, catch and discard rates, and length frequencies of whiting and regulated groundfish species) were collected and analyzed for short and long-term monitoring.

Monitoring of the fishery was successful, redirecting effort away from cod concentrations, establishing fairer regulations, and verifying overall low bycatch. The sweepless net appeared to perform comparably to the standard RFT, although tuning in the form of headrope extensions was usually required. The sweepless net appeared stable during fishing, although more net mensuration data under varying towing conditions would be helpful to achieve optimum performance of this design. Changeover trips helped convince two of three fishermen to use the sweepless RFT. An edited video distributed to all fishery participants received positive feedback.

These limited trial results and the video and outreach efforts will help support the adoption of the sweepless trawl, and based on these and past observations, will benefit groundfish rebuilding in several ways.

Introduction
Federal regulations implemented in 1995 prohibited small-mesh trawls in the southern Gulf of Maine and in Cape Cod Bay to protect juvenile groundfish species. Although these regulations allowed some small-mesh fisheries to be exempted from mesh requirements if bycatch levels were low (NEFMC 2000), trawling for whiting *Merluccius bilinearis* in Cape Cod Bay was not allowed, based on evidence of high by-catch rates during 1992-1994 (McKiernan et al. 1996).

These prohibitions had a severe impact on fishing fleets from Gloucester, Chatham, and Provincetown, Massachusetts that relied on small-mesh trawls to target whiting, red hake *Urophycis chuss*, and other species. Although Cape Cod Bay is managed under Commonwealth jurisdiction, nearly all trawlers hold Federal permits and are subject to Federal regulations. Therefore, most Massachusetts fishermen could not fish with small-mesh trawls in Cape Cod Bay (McKiernan et al. 1998, 1999).

The Division of Marine Fisheries (DMF) began in 1989 to investigate this fishery and to develop gear-based solutions to high bycatch levels (Pierce and McKiernan 1990; Pol 2003). Specifically, the goal of that research was to decrease bycatch of regulated species (Atlantic cod *Gadus morhua*, witch flounder *Glyptocephalus cynoglossus*, American plaice *Hippoglossoides platessoides*, yellowtail flounder *Limanda ferruginea*, haddock *Melanogrammus aeglefinus*, pollock *Pollachius virens*, winter flounder *Pseudopleuronectes americanus*, windowpane flounder *Scophthalmus aquosus*, redfish *Sebastes fasciatus*, and white hake *Urophycis tenuis*). Trials involving a trouser-trawl fitted with a removable horizontal separator panel determined that optimum catches of whiting could be obtained with a 90% reduction of regulated flatfish species at a height of 1-2 feet off the bottom (Carr and

Caruso 1993). This result inspired Robert Bruce, a former draggerman working for DMF, to develop the raised footrope trawl (RFT), a net that fishes 1-2 feet off the bottom. Reportedly, this design was adapted from a shrimp trawl seen on the US Northwest coast (Richard Taylor, pers. comm.).

Additionally, a separator grate, based on the Nordmøre shrimp grate, was tested during a limited experimental fishery from 1995 – 1997 by the Maine Department of Marine Resources. This device was eventually adopted for small-mesh whiting fisheries in the northern Gulf of Maine. Although results indicated a substantial reduction in regulated species, the grate was never popular with Massachusetts fishermen in part because large (or "king" (> 12 in)) whiting were excluded by the grate along with regulated species (Amaru 1996).

Results using the RFT were promising. Initial testing of the RFT in 1995 on one vessel resulted in catches of regulated groundfish species comprising less than 5% of the total (McKiernan and King 1996; McKiernan et al. 1996). In spring 1997, extensive paired tows comparing the RFT to a standard small-mesh whiting net demonstrated that the RFT could reduce catch of regulated species by 70% and of regulated flatfish by 83% with no significant reduction in whiting catch (DMF, unpubl. data).

RFT design and modifications (including a sweepless version of the RFT) were also tested in a flume tank in Newfoundland, Canada by DMF in March 1998. The flume tank testing was used to refine the RFT (and sweepless RFT), and to define the exact rigging necessary for the design to fish cleanly. The crucial aspect of the RFT is the height of the footrope off the bottom. By raising the footrope 1-2 feet above the bottom, the net exploits differences in habitat preferences and swimming behaviors between target and non-target species. At this height, the RFT retains whiting, red hake and dogfish, that swim above the substrate, while passing over non-target species such as flatfish, which stay close to the bottom. To raise the footrope, a chain sweep longer than the footrope is attached to the footrope using "drop chains" that are 42 inches long (Figure 1a). The weight of the chain keeps the net mouth open, while the drop chains allow the footrope to fish 1 – 2 feet off the bottom. The sweep is longer than the footrope to prevent it acting as a "tickler chain" and thereby encouraging demersal species to enter the net. A fuller description of the RFT is provided by NEFMC (2000).

Modifications of the RFT continued to be tested. The sweepless design (Figure 1b) is identical to the RFT except that the chain sweep is removed and the dropper chains are made heavier. It was flume tank tested and field tested in the 1998 fishery (McKiernan et al. 1999) on a limited basis (Figure 2). In 1999, field testing of the sweepless trawl continued and demonstrated that the sweepless trawl was a viable alternative to the RFT. However, comparisons of catch rates of whiting and red hake were inconclusive (Pol 2000). Power analysis showed that the number of tows necessary to detect true differences was unreasonably high (Pol 2000).

DMF's RFT research efforts culminated in Framework Adjustment 35 to the Northeast Multispecies Fishery Management Plan (Multispecies Plan) (NEFMC 2000). Framework 35 created an exempted whiting fishery in Upper Cape Cod Bay and Southern Stellwagen Bank. The New England Fishery Management Council (NEFMC) and the National Marine Fisheries Service (NMFS) approved this exemption based on observed bycatch levels below 5% for 111 of 130 observed trips. Under Framework 35, the use of the raised footrope trawl (RFT) or the sweepless RFT was mandated in the Provincetown-area exempted whiting fishery.

The seasonal RFT whiting fishery in upper Cape Cod Bay thus joined two other small-mesh whiting exempted fisheries off New England. The Cultivator Shoal fishery was established in

the early 1990's under an earlier exemption program, and was continued after the passage of Amendment 5 to the Multispecies Plan (NEFMC 2000). The Ipswich Bay (Area I) and Jeffries Ledge (Area II) fisheries were established in 1994. The new RFT fishery was the first exempted fishery established based on an experimental fishery conducted by a conservation engineering program. The different origins of these fisheries contributed to differences in bycatch retention limits. For example, monkfish *Lophius americanus* and lobster *Homarus americanus* could be retained, within limits, when fishing in Areas I, II and on Cultivator Shoals. No retention of these species was permitted in the new RFT fishery. The differences in the bycatch allowance for different regions in effect at the beginning of this study are summarized in Appendix A.

The successful creation of an exempted RFT whiting fishery was the result of more than nine years of testing (Pol 2003). Over that time, the RFT gained acceptance throughout the fleet, partly because its use was mandatory and partly because reductions in bycatch were dramatic. Additionally, DMF conducted substantial outreach by working with individual vessels. While the RFT is a popular and successful net design, several problems arose that led DMF to prefer the sweepless version. Because the regulations are so specific, it can be difficult to rig properly (see Appendix B for specifications). This specificity was necessary to ensure the net fished cleanly. This complexity also makes the net difficult to enforce. Finally, the chain sweep of the RFT can get hung up on ghost fishing gear or other debris, causing the net to fish closer to the bottom and incur higher bycatch. In fact, many of the tows and trips with bycatch levels above 5% were the result of interaction with other gear. For these reasons, DMF sought to encourage voluntary industry adoption of the sweepless RFT.

DMF conducted several forms of outreach to encourage use of the sweepless net. Conservation Engineering personnel offered gear inspections, presented results from fishermen who used the sweepless net, and displayed raw footage of net testing. While both versions of the RFT were written into the exempted fishery, interest in and adoption of the sweepless version remained rare. DMF's experience with video presentations showed that a video extolling the virtues of the sweepless net might be effective and persuasive.

At the time of the grant application, an experimental fishery along the eastern coast of Cape Cod was in existence and was intended to expand the boundaries of the Upper Cape Cod Bay fishery established by Framework 35. To augment DMF monitoring resources, and to encourage the use of the sweepless net, DMF developed a dual-purpose project that was funded by NMFS Cooperative Research Partners Initiative (CRPI). The initial objectives of this project were to monitor in "real-time" the small-mesh experimental raised-footrope trawl fishery in waters east of Cape Cod, and to improve adoption of the sweepless RFT in both the experimental fishery and the exempted Seasonal Whiting RFT Fishery. The experimental fishery was not implemented, and a formal request was submitted to NEFMC to open the area east of Cape Cod as an exempted fishery. Consequently, the experimental fishery was not opened during September and October of 2002. As DMF and fishermen awaited the approval of the exempted fishery, DMF requested a revision to the goals and objectives of the project. This request was approved by NMFS; the revised goals were to monitor the exempted small-mesh RFT fishery, and to improve adoption of the sweepless RFT including the production of an edited video.

Methods

The exempted fishery was monitored "real-time" (during the fishery) by deployment of DMF sea samplers on participating vessels. Additional data were obtained from routine sea-

sampling by NMFS observers (although these trips were not supported by the funding from this grant.) Also, some analysis of RFT and SRFT catches was attempted because data comparing these two gear types are limited. In addition, this study offered an opportunity to compare net geometry and some catch results.

Monitoring and data collection occurred during the exempted whiting fishery (September 1 – November 20, 2002) in upper Cape Cod Bay (UCC) and southern Stellwagen Bank, and in Ipswich Bay (Area I). Data were also collected during the exempted whiting fishery (November 21 – December 31, 2002) in waters east of Cape Cod. Sampling was performed on vessels hailing from Chatham, Gloucester, Provincetown and Scituate, Massachusetts.

Sea sampling was carried out following protocols established by the NMFS-NEFSC observer program. Sea samplers selected vessels in the whiting fleet, collected catch information on landings and discards, length frequencies of whiting and certain bycatch species, tow location, duration, depth, net characteristics and other conditions.

The second goal of this study was to encourage fishermen to adopt the sweepless RFT. Adoption of the sweepless RFT was encouraged in two ways: "changeover" trips, and the production of a videotape. The purpose of these "changeover" trips was to encourage adoption of the sweepless design by re-rigging and tuning a vessel's net during fishing operations. A contracted fisherman (who has demonstrated proficiency using the sweepless RFT) performed the gear modifications, accompanied by DMF personnel. Letters (Appendix C) were sent to 33 previous fishery participants (Appendix D) explaining the project and soliciting interest. Vessels were offered a small amount of compensation for lost income due to reduced fishing time during the trip. Trips were arranged with vessels from Gloucester, Provincetown and Scituate. On vessels using the standard RFT, the sweep was removed and additional chains were added when necessary to keep the net mouth open. If high bycatch levels were observed, extensions ((1, 1.5, 2.0 ft) (0.3, 0.5, or 0.6 meters) were added to the top of each wing to increase headrope length (Figure 3). Extensions would therefore increase headrope length twice the length of the extension and raise the footrope further off the bottom. Other adjustments were made based on the contracted fisherman's experience. Catches were monitored and recorded (using the same sampling protocol) by tow for each modification.

An edited video documenting at-sea modifications of the RFT was produced. Filming was performed on vessels hailing from Gloucester and Provincetown. Trawl nets were deployed using an underwater video camera attached to the headrope with live feed to a monitor inside the vessel wheelhouse. Footage of whiting and other species interactions to the trawl were observed and recorded. Additionally, remote sensors were attached to trawl doors, headrope and wings to record data on net geometry. Information on door spread, wing spread, headrope and footrope height were recorded by sensors and transmitted to a wheelhouse computer.

Data Analysis

For monitoring purposes, all catch and gear information were recorded using NMFS sea sampling logs and subsequently entered into the NMFS Observer Database (OBDBS). Catch and gear information on trips sampled by NMFS observers were accessed from the OBDBS by DMF staff. Landings and discard data for all species were summarized for gear types (RFT, SRFT, Scottish seine) and modification (changeover trips), and for all areas combined. Catch-per-unit-effort (CPUE) scores for all species landed and discarded were generated by dividing the total catch by total towing hours to allow comparisons among tows of different lengths. Bycatch percentages (by tow and by trip) for all regulated species were calculated as the sum of all regulated species caught divided by the summed weight of all species combined. Mean

percentage of regulated species caught were generated for each sampling trip (Table 2). Length frequencies were expanded to the total catch of each trip.

Net mensuration data collected from Netmind software were recorded into Excel spreadsheets and audited to exclude outlier measurements (periods where accurate net geometry measurements could not be determined). In addition to net mensuration parameters collected, distances between headrope and footrope were calculated for each tow. To measure the distance between footrope and the seafloor, data measuring headrope height from the seafloor and distance between headrope and footrope were audited and cross-referenced based on the time in which the data point was collected for both parameters. Differences were generated for each pair of data points and basic statistical variables (mean, variance, standard deviation, standard error and 95% confidence limits) were calculated for each parameter measured.

Results

A total of eighteen sampling trips (Table 1) were conducted by DMF (N = 15) and NMFS (N = 3) personnel from September 13 – December 19, 2002 for all gear types and areas fished (Figure 4). Fourteen sampling trips were conducted in the whiting small-mesh exempted area of Upper Cape Cod Bay (UCC) (September 1 – November 20, 2002) and 41 tows were observed. Three trips and five tows were observed in Area I (Ipswich Bay). One trip (3 tows) was observed in the small-mesh exempted area east of Cape Cod which was opened from November 21 – December 31, 2002. Seven additional trips were attempted but prevented by weather.

The fifteen trips conducted under this study by DMF consisted of 6 sea sampling trips onboard vessels using the standard RFT, 5 onboard vessels using the sweepless RFT, 3 trips onboard vessels undergoing modifications (changeovers), and 1 trip onboard a Scottish seine vessel. The three trips conducted by NMFS observers were performed onboard vessels using standard RFT. Sea sampling results for all observed trips are presented in Table 2 with CPUE (lbs/hr) for all trips in Table 3.

Nine trips and twenty-eight tows were observed on vessels fishing with the standard RFT from September 13 – November 4, 2002 for a total of 49 hours towing. Eight trips were observed in Upper Cape Cod Bay and one trip was observed in Area I (Ipswich Bay). Whiting dominated the total catch (31,223 lb caught; 23,800 landed) using the standard RFT. Total catch of regulated species (1,214 lb) accounted for 2.3% of the total catch (53,711 lbs). Catch composition is summarized in Table 4.

One trip was conducted onboard a Scottish seine fishing vessel in the small-mesh exempted area east of Cape Cod on December 19, 2002. Scottish seiners use a net similar in shape and design to an otter trawl; however, in Scottish seining the net is set in the water and slowly hauled to the boat, without the use of trawl doors (Sainsbury 1971). Three tows were conducted for 4.5 hours of fishing time. Whiting (840 lb) dominated the catch with regulated species (30 lb) comprising 3.1% by weight of the total catch.

Five sampling trips were conducted aboard fishing vessels using the sweepless RFT from September 13 – November 4, 2002. Twelve tows were observed for a total of 22 hours towing. Four trips were prosecuted in Upper Cape Cod Bay and one trip in Area I (Table 5). Spiny dogfish (16,902 lb) and whiting (7,477 lb) comprised the majority of the catch with whiting (6,939 lb) dominating the landings. Total catch of regulated species (1,208 lb) constituted 4.3% of the total catch (28,209 lbs).

Length frequencies were constructed from whiting catches to compare mean sizes by gear design (Figure 6). Mean size (cm TL) of whiting caught using the standard RFT (26 ± 0.03 (10.2 ± 0.01 in), N = 91,916) was lower than catches using the SRFT (28 ± 0.07 (11.0 ± 0.03 in), N = 20,216). Length frequencies of regulated species were constructed for plaice (Figure 7), winter flounder (Figure 8) and yellowtail flounder (Figure 9); all other species were collected in numbers too small for any comparative analyses between gear types. Visual analysis of length frequency histograms suggest that mean size for plaice in the sweepless RFT (29 ± 0.6 (11.4 ± 0.24 in), N = 412) were larger than catches using the standard RFT (27 ± 0.5 (10.6 ± 0.02 in), N = 727). Mean size for yellowtail flounder (32 ± 1.0 cm (12.6 ± 0.4 in)) were similar for both the RFT (N = 58) and SRFT (N = 139). In addition, mean size of winter flounder (30 ± 1.0 cm (11.8 ± 0.4 in)) were similar for both standard (N = 212) and sweepless (N = 370) trawl designs.

Three vessels (one each from Gloucester, Provincetown and Scituate) responded to the solicitation for interest in participating in changeover trips. Complete catch results separated by individual modifications (headrope extensions) are presented in Appendix E. Catches of whiting and regulated species by modification are summarized in Table 6. The sweepless modification incurred the largest catch of whiting (2,663 lb) and the highest CPUE (507.24 lbs/hr). CPUE scores for cod (44 lbs/hr) and winter flounder (27 lbs/hr) were highest when using the standard RFT.

Filming was limited by weather conditions and water clarity. Two filming trips, during which 5 tows were performed, were conducted on October 9, 2002 and October 10, 2002. One tow was filmed and measured with the sweepless RFT, two tows were filmed using a 1 ft extension on the headrope, one tow using a 1.5 ft extension on the headrope, and one tow using a 2 ft extension on the headrope to the sweepless RFT. Net mensuration data were collected during these two filming trips. Measurements of headrope height, footrope height, wing spread and door spread for each modification are summarized in Table 7, and shown in Figure 10. Mean height (± SE) from seafloor was lowest during the two tows when the 1-ft extension was added (0.26 ± 0.2 ft (N_{obs} = 20) and 1.44 ± 0.52 ft (N_{obs} = 26). For the rigging without extensions, the footrope was further off the bottom (6.8 ± 0.36 ft, N_{obs} = 101). The addition of the 1.5 and 2-ft extensions raised the footrope further, to 8.4 ± 0.36 ft (N_{obs} = 112) and 8.63 ± 0.36 ft (N_{obs} = 114).

A 12 minute video tape (Szymanski 2003) was produced and distributed to 67 participants in the 2002 whiting fishery and other interested parties, including the New England Fishery Management Council (Appendix F, G). Footage collected from both sea-sampling trips, and scale-model testing at the flume tank from the Marine Institute at Memorial University in Newfoundland, show how this net design became management's new tool which helped re-establish this fishery. The video then discusses advantages of a sweepless RFT over a standard RFT. The source for the regulations surrounding small mesh fishery exemptions was also presented. The end of the video shows the potential of the improved design in other fisheries. This video is catalogued in the DMF Conservation Engineering Program's video library as 03MADMF845 and is available upon request.

Discussion

The results show that monitoring of the fishery was effective both in the short-term and in the long-term. For example, sea sampling was used during the project (11/4/02) to redirect effort from the top of Stellwagen Bank to avoid high cod bycatch, meeting one of our objectives.

This redirection helped keep the overall percentage of regulated species bycatch for all observed trips during the 2002 season low (< 5%) (Table 2).

A long-term effect resulting from monitoring of the fishery was a change in the bycatch regulations for Areas I and II. A trip in the Area I fishery on 13-14 September highlighted differences in lobster and monkfish possession limits between exempted small-mesh fisheries (Appendix A). In DMF's view, these differences in possession limits provided an incentive for fishermen to rig the RFT improperly to increase bottom contact, and increase the catch of these bottom-tending organisms. This trip provided evidence that improper rigging was taking place in this area to capitalize on the bycatch allowance. DMF contacted NEFMC staff to rectify the inconsistencies between bycatch limits in different small-mesh whiting areas. Consequently, uniform bycatch allowances were proposed through Framework 38 (NEFMC 2003).

The substantial number of observer trips that were conducted also allowed monitoring of the exempted fishery in a longer term. As observed in previous years, additional trips were limited by adverse weather conditions in the months of November and December as well as the size of vessels in the fleet (larger vessels being able to tolerate more severe weather). A principal use of the observer data was to determine the level of bycatch of regulated species. Tremendous effort is often put into establishing the effectiveness of a gear modification. However, measurements of its effectiveness once widely implemented are rarer. This overall "fleet selectivity" expresses the fleet's geographical and seasonal utilization of the gear (Danish Institute for Fisheries Research 2003) and the resulting variability. This study offered an opportunity to quantify the effectiveness of the RFT and sweepless RFT on a variety of vessels under true fishing conditions, and not in the context of an experiment.

Overall, the measured fleet selectivity was low, closely matching experimental results. Bycatch levels of regulated species from this fishery in 2002, compared to sea sampling data from previous years (McKiernan et. al. 1998, 1999, NEFMC 2000), continue to remain low (3.5% (2002) v. 3% (1999)), despite two trips with unusually high bycatch. In both of those trips, lobster pots were captured by the gear thereby causing the footrope to fish closer to the bottom. The tendency of the standard RFT to capture pots and other passive or abandoned gear or debris helps explain the increased amounts of lobster, winter flounder and American plaice in the catches, and strengthens the support for the sweepless net, which when fished properly, cannot hang up in this manner. Overall, these results are consistent with or better than those measured in the years of the experimental fishery and indicate the exempted fishery is in good shape in avoiding bycatch.

Cod present a special concern with the exempted fishery. Cod stocks were low during prior testing, and have increased in size over recent years, but fishing mortality for cod must still be kept at low levels. Cod catches with the RFT have been controlled through temporal closure of the fishery and through short-term monitoring, as described above. The presence of cod was responsible, in one case, for bycatch levels above 5% in individual tows using the sweepless RFT (Table 2). This occurrence has been observed in previous years as well, and further demonstrates that although the sweepless and standard RFT modifications to standard trawls are effective in reducing bycatch levels of regulated flatfish species, they do not minimize the bycatch of cod. In fact, results from paired testing of the RFT and a standard net showed no effect on the catch of cod (DMF, unpublished data). We have observed a rising behavior of cod as they are overtaken by the trawl, where they ascend above the footrope and are caught. Possible net modifications to reduce cod catches include avoiding areas where cod are present

or further net modifications such as large square-mesh panels in the tops of nets or removing the top panels in nets (thereby moving the headrope further back in the trawl).

These types of trawl modifications may someday allow whiting trawlers to fish in areas where cod may be present. In addition, current conservation measures are resulting in increasing numbers of cod in the Gulf of Maine. Cod bycatch may become more prevalent in small-mesh fisheries as these stock rebuildings occur. Our observations that the RFT and SRFT continue to have low bycatch bodes well for this fishery. Some regulations require periodic renewal of exempted fisheries. If bycatch levels observed here continue, the exempted RFT fishery should be maintained.

A combination of observer data and catch information from changeover trips was used to assess effects of sweepless net tuning using insertions, and to compare the sweepless RFT to the standard RFT. While insufficient numbers of tows were conducted to establish true differences in performance between the sweepless RFT and the standard RFT, the data bear examination. The sweepless modification incurred the largest catch of whiting (2,663 lb) and the highest CPUE (507.24 lbs/hr). The standard RFT trial incurred the highest CPUE scores for cod (44 lbs/hr) and winter flounder (27 lbs/hr). These limited data show the sweepless and standard versions of the RFT performing somewhat similarly.

The differences in sizes as shown by the length frequencies show no simple pattern. The sweepless RFT caught whiting that were slightly larger, in general, although the mean size difference was only 2 cm (about 0.75 in). This size difference may not matter to fishermen, as there is no regulated size limit. The difference in plaice size, and in whiting size, may be a result of footrope height. Some have suggested that schools of whiting can be structured by fish size, and that different flatfish have slight differences in behavior in front of nets. The relationship between footrope height and size or species selectivity needs further examination and clarification.

Interestingly, overall mean percentage of regulated species bycatch (4.3% by weight of total catch per trip) was higher for trips using the sweepless RFT. A level of 5% was exceeded in three of the five trips; however, noticeable causes were observed in two of these trips. Gear was out of compliance for one trip (9/13/02), and this problem was determined after the trip was completed. Improper dimensions of the lower leg cables created direct contact between the footrope and the seafloor as evidenced by underwater video taken during these trips. The vessel captain was notified of this situation. Another trip (11/4/02), in which the sweepless RFT was deployed for all tows, was prosecuted along the southwest edge of Stellwagen Bank and cod were present (Table 2). The proximity of this area to the Bank (a prime seasonal habitat for cod) has been problematic for trawlers in the past, and action has been taken to direct fishing outside of this area when cod are present in the area in previous years. The third trip (9/26/02) did not have any noticeable cause for exceeding of the 5% regulated species bycatch limit.

Use of the insertions had a noticeable effect on catch (Appendix E). In one trip (10/24/02), extensions were added to the lower legs of the sweepless RFT to demonstrate the results of fishing the footrope closer to the seafloor. The presence of mud and a lobster trap as well as increased volumes of skates, flatfish, monkfish and lobster was observed in the catch as a result of this modification, indicating, as expected, that lengthening the footrope lowers the net and increases bycatch. An elevated level of bycatch was also observed on a changeover trip conducted on November 1, 2002. In this case, extensions were added to the headrope of the net with the purpose of raising the footrope off the bottom. However, increased levels of flatfish

and lobsters were observed in the tow. These results indicate that "tuning" of the net, within the confines of regulated limits, is necessary to optimize bycatch reduction and net performance.

Net mensuration data supported the need for tuning when initially using the sweepless net. Our measurements indicated that the footrope unexpectedly stayed closer to the seafloor when 1-ft headrope extensions were applied. Insertion of longer extensions did increase the footrope height although the measured heights were somewhat greater than expected for the sweepless RFT and the addition of the 1.5 ft and 2.0 ft extensions (over six feet from headrope to seafloor). This height is not consistent with observations of shine on the 42-in dropper chains. This shine indicated that the net was fishing on the bottom at the presumed optimal height of 1-2 ft. These results emphasize the need for tuning and for further underwater at sea measurement of nets, as the number of observations under this study was small, including some measurements when our underwater camera system was deployed, which may have affected net performance.

The results of the net comparisons and insertions provided a small amount of evidence that the sweepless and standard RFT gear types perform similarly with respect to species capture size and that differences observed between nets may be more attributable to mesh size and fishing technique than footrope. The small confidence intervals in the measurement data indicate stability in the net designs. In short, we did not observe any results to discount the assumption that the sweepless RFT performs acceptably compared to the standard RFT, and that the sweepless net continues to have the advantages of simplicity of rigging, enforcement, and lower susceptibility to entanglement.

The primary purpose of the changeover trips and the production of the video were focused on encouraging voluntary adoption of the sweepless RFT. Two of the vessels which participated in the changeover trips plan to use the sweepless RFT during the 2003 fishing season, an encouraging sign. Participation was limited both by lack of response, and because of weather and the delay in opening of the Chatham area fishery.

Video documentaries are a valuable tool which can encourage fishermen to adopt changes to traditional fishing gear through photographic evidence. The project video (03MADMF845) shows fishermen the advantages of a sweepless RFT over a standard RFT. The video starts with a historical account of the importance of the whiting fishery for Massachusetts small fishing vessels, the reasons why the fishery was closed, and the re-opening of this fishery in the advent of the standard RFT.

After the persuasive argument was presented to the viewer, the video then explained how to change a standard net to a sweepless version. During a trip with the help of a fisherman, the sweep was cut away from the drop chains, measurements were taken after a completed tow, and further adjustments were made to a net while staying within the federal regulations. As the distribution of this video occurred shortly before this report, we cannot measure its impact yet. However, early responses have been favorable from fishermen and others.

DMF's strategy for the SRFT will continue to be to work cooperatively with fishermen in a manner that encourages them to adopt gear modifications voluntarily before, or instead of, incorporating them into regulations. If DMF seeks eventually to mandate the use of the sweepless net, the cooperative work funded by this project will pave the way for higher compliance because fishermen will have been introduced to the sweepless net before it was required.

Future Research

Future work with the sweepless DMF must include at-sea demonstration and tuning, as well as continued measurement of net geometry. We believe that demonstration of the practical use of this lower-impact gear will continue to be essential to further industry acceptance of the sweepless RFT.

DMF plans to further continue research into other modifications of the sweepless RFT. The proposed research aims at testing of two modifications to the sweepless RFT: replacement of the drop chains with weights attached directly to the footrope; and addition of cookies to the ground cables of the RFT (Pol et al. 2003). These modifications result in a semi-pelagic trawl net that has no contact with the seafloor.

The replacement of drop chains with weights will accomplish two important improvements: increased safety; and decreased bottom contact. The drop chains of a sweepless RFT may swing around the net reel and could strike crewmembers. This modification seeks to eliminate this hazard. It also seeks to have even less impact on bottom habitat than the both the standard and sweepless designs as only the doors and ground cables will be in contact with the seafloor.

The second modification we propose testing is the addition of cookies to the ground cables. The regulations for the RFT are very specific, limiting ground cables to “all bare wire not larger than ¾-inch diameter” (NEFMC 2000). However, fishermen allege that this restriction makes fishing in areas of with mud bottom difficult because the bare wire digs into the mud, thereby causing the net to fill with mud and fish closer to the bottom. The addition of cookies (1.5 – 2 inch diameter rubber discs) makes the ground cable much less likely to dig into mud, allowing whiting to be caught cleanly in areas of mud bottom.

Further improvement of the RFT is important because the northern stock of whiting is fully rebuilt (NEFMC 2003) and offers opportunity for redirection of groundfishing effort. The proposed research seeks to keep the fishermen safer and their catch even cleaner than earlier versions of the RFT.

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Table 1: Summary report of the number and type of sampling trips prosecuted for the whiting sweepless raised footrope trawl project.

Date	Trip type	Sampler	Vessel	Port	Results
9/13/2002	Regular	BH	Lady Jane	Gloucester	Success
9/14/2002	Change/Film	VM/MS/RJ	Lady Jane	Gloucester	Success
9/23/2002	Regular	BK	Blue Ocean	Provincetown	Success
9/25/2002	Regular	BK	Antonio Jorge	Provincetown	Success
9/26/2002	Regular	BK	Blue Ocean	Provincetown	Success
9/26/2002	Regular	BH	Rose Marie	Gloucester	Success - Shortened due to gear damage
10/2/2002	Regular	JS	Richard & Arnold	Provincetown	Failure - Weather
10/8/2002	Change/Film	JS/MS	Blue Skies	Provincetown	Failure - Weather
10/9/2002	Change/Film	JS/MS	Blue Skies	Provincetown	Success
10/10/2002	Change/Film	JS/MP	Blue Skies	Provincetown	Success
10/22/2002	Regular	BK	Ancora Praia	Provincetown	Success
10/23/2002	Regular	BK	Sao Jacinto	Provincetown	Success
10/24/2002	Regular	BK		Provincetown	Failure - Weather
10/24/2002	Changeover	JS	Christopher Andrew	Scituate	Success
10/28/2002	Regular	BK		Provincetown	Failure - Weather
10/29/2002	Changeover	JS	Ancora Praia	Provincetown	Failure - Weather
10/31/2002	Regular	BH	Lady Jane	Gloucester	Success
11/1/2002	Regular	BH	Lady Jane	Gloucester	Success
11/1/2002	Changeover	JS	Ancora Praia	Provincetown	Success
11/4/2002	Regular	JS	Blue Skies	Provincetown	Success
11/8/2002	Changeover	JS	Midnight Sun	Gloucester	Failure - Weather & boat repairs
11/14/2002	Film	JS/MS	Blue Skies	Provincetown	Failure - Weather
11/19/2002	Film	MS	Blue Skies	Provincetown	Success
12/19/2002	Regular	BK	Coming Home	Chatham	Success

Trip Types:

1. Regular - Regular sea sampling conducted in accordance with NMFS sampling protocol.
2. Changeover - Modifications made to trawl nets and catch data recorded for each haul.
3. Film - Underwater camera and sensors fitted to trawl net to record gear performance.

Table 2: 2002 Exempted whiting fishery sea sampling results trip summary - total catch from all observed trips (weights in pounds).

TRIP DATE	AREA(S) FISHED	TRIP TYPE	NO. TOWS	TOW TIME (HRS.)	WHITING	SPINY DOGFISH	RED HAKE	ALEWIFE	ATLANTIC HERRING	ATLANTIC COD	WINTER FLOUNDER	AMERICAN PLAICE	YELLOWTAIL FLOUNDER	WINDOWPANE	WITCH FLOUNDER	POLLOCK	HADDOCK	WHITE HAKE	REDFISH	LOLIGO SQUID	AMERICAN LOBSTER	ILLEX SQUID	LONGHORN SCULPIN	MONKFISH	OTHER	REG. FLATFISH	REG. ROUNDFISH	TOTAL REG. SPECIES	PERCENT REG. SPECIES	TOTAL CATCH
9/13	1	SRFT	1	4	232	0	16	75	42	0	16	17	1	0	0	0	6	1	0	0	103	0	3	16	51	34	7	41	7.1%	579
9/14	1	*SRFT	2	4.25	1,938	40	628	0	765	0	14	49	4	0	5	1	0	7	0	0	61	1	1	164	14	72	8	80	2.2%	3,692
9/23	UCC	SRFT	1	0.5	203	1,200	2	0	3	0	0	0	0	0	0	0	0	0	0	0	0	1	0	2	0	0	0	0	0.0%	1,411
9/25	UCC	RFT	4	6.8	5,088	4	689	145	15	1	36	19	2	0	1	1	0	0	0	24	6	25	12	6	30	58	2	60	1.0%	6,104
9/26	UCC	RFT	2	1	180	6,480	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	4	0	0	2	0	0	0	0.0%	6,666
9/26	UCC	SRFT	4	7.3	2,800	10	456	80	3	0	151	161	18	0	5	0	0	2	0	18	43	88	19	15	127	335	2	337	8.4%	3,996
9/30	UCC	RFT	4	5.8	3,350	715	2,380	0	100	85	205	25	21	0	0	0	0	0	0	10	0	65	20	15	588	251	85	336	4.4%	7,579
10/2	UCC	RFT	4	8.9	3,800	41	1,120	0	35	21	49	8	0	120	0	1	0	0	0	12	0	25	3	12	30	177	22	199	3.8%	5,277
10/3	UCC	RFT	3	6.2	1,435	62	250	0	0	0	18	0	0	0	1	0	0	0	0	68	9	14	5	7	66	19	0	19	1.0%	1,935
10/9	UCC	SRFT	2	3.5	142	15,132	21	0	20	15	14	6	2	0	1	0	0	0	0	5	11	5	0	14	2	23	15	38	0.2%	15,390
10/22	UCC	RFT	3	4.5	1,012	1,041	174	23	0	3	43	28	3	3	1	0	0	0	0	0	54	19	5	2	95	78	3	81	3.2%	2,506
10/23	UCC	RFT	4	7.5	2,001	665	279	128	10	34	20	94	4	0	2	0	0	0	0	42	37	2	5	15	82	120	34	154	4.5%	3,420
10/24	UCC	*SRFT	2	3	1,150	194	191	0	60	15	36	1	5	5	0	0	0	0	0	19	19	17	22	0	463	47	15	62	2.8%	2,197
10/31	UCC	RFT	2	3	5,657	110	1,267	600	23	104	21	42	11	2	2	1	1	0	0	162	30	50	69	13	137	78	106	184	2.2%	8,302
11/1	UCC	*SRFT	3	5.25	2,350	65	165	0	360	101	130	10	1	7	0	0	0	0	0	40	215	0	50	1	360	148	101	249	6.5%	3,855
11/1	UCC	RFT	2	5	8,700	45	1,151	1,280	11	65	44	50	6	8	0	8	0	0	0	278	15	50	64	2	229	108	73	181	1.5%	12,006
11/4	UCC	SRFT	4	6.5	4,100	560	190	0	850	554	143	28	61	7	0	2	0	0	0	85	36	0	46	5	173	239	556	795	11.6%	6,840
12/19	3	**SCS	3	4.5	840	57	28	0	0	26	0	0	0	0	0	0	4	0	0	4	0	0	5	0	5	0	30	30	3.1%	969
Totals			50	87.52	44,978	26,421	9,007	2,331	2,297	1,024	940	538	139	152	18	14	11	10	0	767	639	366	329	289	2,454	1,787	1,059	2,846		92,724
Mean			3	4.862	2,499	1,468	500	130	128	57	52	30	8	8	1	1	1	0.556	0	43	36	20	18	16	136	99	59	158	3.5%	5,151
Median			3	4.75	1,970	88	221	0	18	15	29	18	3	0	0	0	0	0	0	15	17	10	5	7	74	75	15	81	3.0%	3,926

UCC - Upper Cape Cod Bay Exempted Raised Footrope Fishery

*SRFT - trips in which vessels participated in net modifications (changeovers).

**SCS - Scottish seine

Table 3: 2002 Exempted whiting fishery sea sampling results CPUE scores (lb/hr) per trip.

TRIP DATE	AREA(S) FISHED	TRIP TYPE	NO. TOWS	TOW TIME (HRS.)	WHITING/HR.	SPINY DOGFISH/HR.	RED HAKE/HR.	ALEWIFE/HR.	ATLANTIC HERRING/HR.	ATLANTIC COD/HR.	WINTER FLOUNDER/HR.	AMERICAN PLAICE/HR.	YELLOWTAIL FLOUNDER/HR.	WINDOWPANE/HR.	WITCH FLOUNDER/HR.	POLLOCK/HR.	HADDOCK/HR.	WHITE HAKE/HR.	REDFISH/HR.	LOLIGO SQUID/HR.	AMERICAN LOBSTER/HR.	ILLEX SQUID/HR.	LONGHORN SCULPIN/HR.	MONKFISH/HR.	OTHER/HR.	REG. FLATFISH/HR.	REG. ROUNDFISH/HR.	TOTAL REG. SPECIES/HR.	PERCENT REG. SPECIES	TOTAL CATCH/HR.
9/13	1	SRFT	1	4	58	0	4	19	11	0	4	4	0	0	0	0	2	0	0	0	26	0	1	4	13	9	2	10	7.1%	145
9/14	1	*SRFT	2	4.25	456	9	148	0	180	0	3	12	1	0	1	0	0	2	0	0	14	0	0	39	3	17	2	19	2.2%	869
9/23	UCC	SRFT	1	0.5	406	2,400	4	0	6	0	0	0	0	0	0	0	0	0	0	0	0	2	0	4	0	0	0	0	0.0%	2,822
9/25	UCC	RFT	4	6.8	748	1	101	21	2	0	5	3	0	0	0	0	0	0	0	4	1	4	2	1	4	9	0	9	1.0%	898
9/26	UCC	RFT	2	1	180	6,480	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	4	0	0	2	0	0	0	0.0%	6,666
9/26	UCC	SRFT	4	7.3	384	1	62	11	0	0	21	22	2	0	1	0	0	0	0	2	6	12	3	2	17	46	0	46	8.4%	547
9/30	UCC	RFT	4	5.8	578	123	410	0	17	15	35	4	4	0	0	0	0	0	0	2	0	11	3	3	101	43	15	58	4.4%	1,307
10/2	UCC	RFT	4	8.92	426	5	126	0	4	2	5	1	0	13	0	0	0	0	0	1	0	3	0	1	3	20	2	22	3.8%	592
10/3	UCC	RFT	3	6.2	231	10	40	0	0	0	3	0	0	0	0	0	0	0	0	11	1	2	1	1	11	3	0	3	1.0%	312
10/9	UCC	SRFT	2	3.5	41	4,323	6	0	6	4	4	2	1	0	0	0	0	0	0	1	3	1	0	4	1	7	4	11	0.2%	4,397
10/22	UCC	RFT	3	4.5	225	231	39	5	0	1	10	6	1	1	0	0	0	0	0	0	12	4	1	0	21	17	1	18	3.2%	557
10/23	UCC	RFT	4	7.5	267	89	37	17	1	5	3	13	1	0	0	0	0	0	0	6	5	0	1	2	11	16	5	21	4.5%	456
10/24	UCC	*SRFT	2	3	383	65	64	0	20	5	12	0	2	2	0	0	0	0	0	6	6	6	7	0	154	16	5	21	2.8%	732
10/31	UCC	RFT	2	3	1,886	37	422	200	8	35	7	14	4	1	1	0	0	0	0	54	10	17	23	4	46	26	35	61	2.2%	2,767
11/1	UCC	*SRFT	3	5.25	448	12	31	0	69	19	25	2	0	1	0	0	0	0	0	8	41	0	10	0	69	28	19	47	6.5%	734
11/1	UCC	RFT	2	5	1,740	9	230	256	2	13	9	10	1	2	0	2	0	0	0	56	3	10	13	0	46	22	15	36	1.5%	2,401
11/4	UCC	SRFT	4	6.5	631	86	29	0	131	85	22	4	9	1	0	0	0	0	0	13	6	0	7	1	27	37	86	122	11.6%	1,052
12/19	3	SCS	3	4.5	187	13	6	0	0	6	0	0	0	0	0	0	1	0	0	1	0	0	1	0	1	0	7	7	3.1%	215
Totals			50	88	9,273	13,894	1,761	529	457	190	168	97	25	20	4	2.74	3	2	0	165	134	76	73	67	530	314	197	511		
Mean			3	5	515	772	98	29	25	11	9	5	1	1.14	0.2	0.2	0.2	0.1	0	9	7	4	4	4	29	17	11	28	3.5%	1,526
Median			3	5	395	25	39	0	5	3	5	4	1	0	0	0	0	0	0	2	4	3	1	1	12	16	3	20	2.9%	801

UCC - Upper Cape Cod Bay Exempted Raised Footrope Fishery

*SRFT - trips in which vessels participated in net modifications (changeovers).

**SCS - Scottish seine

Table 4: Summary of landings and discards from sea sampling by state and federal observers of standard RFT trips (weights in pounds).

Area(s) Fished:	Upper Cape Cod Bay/Area 1 (Ipswich Bay)
N trips	8 (UCC) / 1 (Area 1)
N tows	26 (UCC) / 2 (Area 1)
Hours fished	49

Species	Landed	Discarded	Total
Whiting	23,800	7,423	31,223
Atlantic herring	0	59	59
American lobster	0	151	151
Monkfish	0	72	72
American shad	0	114	114
Alewife	0	2,176	2,176
Red hake	5,609	1,701	7,310
Sea scallop	0	2	2
Butterfish	107	205	312
Hake, NK	0	0	0
Loligo squid	449	166	615
Atlantic mackerel	44	0	44
Illex squid	129	106	235
Spiny dogfish	6,000	3,163	9,163
Black sea bass	7	0	7
Bluefish	9	30	39
Longhorn sculpin	0	183	183
Little skate	0	116	116
Sea raven	0	9	9
Summer flounder	0	1	1
Fourspot flounder	0	87	87
Rock crab	0	6	6
Jonah crab	0	0	0
Ocean pout	0	12	12
Menhaden	0	7	7
Blueback herring	0	17	17
Wrymouth	0	0	0
Blueback herring	0	12	12
Winter skate	0	514	514
Northern sea robin	0	10	10
Cusk	0	1	1
Atlantic cod	0	313	313
Pollock	0	11	11
Yellowtail flounder	0	47	47
White hake	0	0	0
Haddock	0	1	1
Winter flounder	0	436	436
American plaice	0	266	266
Witch flounder	0	7	7
Windowpane	0	133	133
Redfish	0	0	0
Total Catch	36,154	17,557	53,711
Total Reg. Species			1,214
Percent Reg. Species			**2.26%**

Table 5: Summary of landings and discards of all species in trips using the sweepless RFT (All areas combined; weights in pounds).

N trips	4 (UCC) / 1 (Area 1)
N tows	10 (UCC) / 2 (Area 1)
Hours fished	22

Species	Landed	Discarded	Total
Whiting	6,939	538	7,477
Atlantic herring	42	876	918
American lobster	38	155	193
Monkfish	0	52	52
American shad	9	0	9
Alewife	75	80	155
Red hake	415	270	685
Sea scallop	10	0	10
Butterfish	73	21	94
Loligo squid	106	2	108
Atlantic mackerel	3	0	3
Illex squid	5	89	94
**Spiny dogfish	100	16,802	16,902
Black sea bass	2	0	2
Bluefish	0	0	0
Scup	4	0	4
Sea Raven	0	10	10
Longhorn sculpin	0	68	68
Jonah crab	0	20	20
Little skate	0	119	119
Ocean pout	0	20	20
Winter skate	0	50	50
Fourspot flounder	0	10	10
Summer flounder	0	2	2
Striped bass	0	0	0
Smooth dogfish	0	0	0
Striped sea robin	0	0	0
*Atlantic cod	0	569	569
Yellowtail flounder	0	81	81
Winter flounder	0	323	323
Windowpane	0	7	7
Witch flounder	0	6	6
White hake	0	3	3
Haddock	0	6	6
American plaice	0	211	211
Redfish	0	0	0
Pollock	0	2	2
Total Catch	7,819	20,390	28,209
Total Reg. Species			1,208
Percent Reg. Species			**4.3%**

*Area fished: SW ledge Stellwagen and into the Bank (tow 3).
* 1 tow (11/4/02) into Stellwagen Bank (10 min duration) yielded 400 lbs cod.

Table 6: Catch results of whiting and regulated species from changeover trips using RFT modifications (all areas, trips, and tows combined; weights in pounds).

	Landings (lbs)			CPUE (lbs/hr)		
Treatment	RFT	SWRFT	*EXT	RFT	SWRFT	*EXT
No. Trials	1	3	3	1	3	3
Fishing time (hrs)	1.5	5.25	5.75	1.5	5.25	5.75
Species						
Whiting (total catch)	650	2,663	2,125	433.33	507.24	369.57
Whiting (landed)	600	2,563	2,075	400	488.19	360.87
Winter flounder	40	61	79	26.67	11.62	13.74
Atlantic cod	66	35	15	44	6.67	2.61
American plaice	5	26	29	3.33	4.95	5.04
Yellowtail flounder	0	9	7	0	1.71	1.22
Windowpane	3	4	5	2	0.76	0.87
Witch flounder	0	4	1	0	0.76	0.17
Pollock	0	0	1	0	0	0.17
Redfish	0	0	0	0	0	0

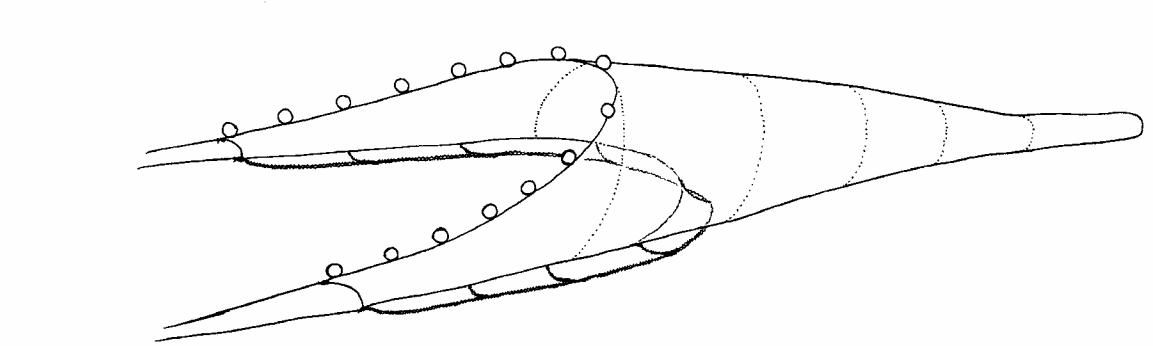
* EXT – “tuning tows” in which extensions were applied to the net to increase footrope height from the seafloor.

Table 7: Summary of statistical variables calculated (by modification) for each parameter measured using Netmind software. Measurements in meters. CI = confidence interval, 1.96*SE

Treatment	EXT 1*								
Net Measurement	Date	Tow No.	Tow Time (Hrs)	No. Observations	Mean	s^2	s	SE	CI
Doorspread	10/9/02	1	1.67	310	60.9	73.2	8.6	0.5	1.0
Wingspread				357	12.9	23.9	4.9	0.3	0.5
Headrope - Seafloor				233	2.6	3.8	1.9	0.1	0.2
Headrope - Footrope				30	2.3	0.0	0.2	0.0	0.1
Footrope - Seafloor				20	0.08	0.06	0.25	0.06	0.11
Treatment	EXT 1								
Net Measurement	Date	Tow No.	Tow Time (Hrs)	No. Observations	Mean	s^2	s	SE	CI
Doorspread	10/9/02	2	2.08	304	37.5	98.3	9.9	0.6	1.1
Wingspread				443	10.5	4.3	2.1	0.1	0.2
Headrope - Seafloor				233	2.8	4.5	2.1	0.1	0.3
Headrope - Footrope				37	2.3	0.02	0.1	0.02	0.04
Footrope - Seafloor				26	0.44	0.69	0.83	0.16	0.32
Treatment	SWRFT								
Net Measurement	Date	Tow No.	Tow Time (Hrs)	No. Observations	Mean	s^2	s	SE	CI
Doorspread	10/10/02	3	1.0	188	41.7	281.9	16.8	1.2	2.4
Wingspread				224	10.4	6.4	2.5	0.2	0.3
Headrope - Seafloor				155	4.3	2.7	1.7	0.1	0.3
Headrope - Footrope				109	2.5	0.1	0.3	0.03	0.1
Footrope - Seafloor				101	2.07	1.23	1.11	0.11	0.22
Treatment	EXT 1.5								
Net Measurement	Date	Tow No.	Tow Time (Hrs)	No. Observations	Mean	s^2	s	SE	CI
Doorspread	10/10/02	4	0.83	131	43.9	254.4	15.9	1.4	2.7
Wingspread				206	10.9	6.0	2.5	0.2	0.3
Headrope - Seafloor				146	5.2	2.5	1.6	0.1	0.3
Headrope - Footrope				121	2.9	0.3	0.5	0.05	0.1
Footrope - Seafloor				112	2.58	1.32	1.15	0.11	0.21
Treatment	EXT 2								
Net Measurement	Date	Tow No.	Tow Time (Hrs)	No. Observations	Mean	s^2	s	SE	CI
Doorspread	10/10/02	5	0.67	137	38.9	191.7	13.8	1.2	2.3
Wingspread				212	9.8	9.5	3.1	0.2	0.4
Headrope - Seafloor				138	5.4	3.6	1.9	0.2	0.3
Headrope - Footrope				123	3.1	0.3	0.5	0.05	0.1
Footrope - Seafloor				114	2.63	1.31	1.14	0.11	0.21

* Variable lengths of towing wire during this tow may have affected net geometry.

A. Standard Raised Footrope Trawl (RFT)



B. Sweepless Raised Footrope Trawl (SRFT)

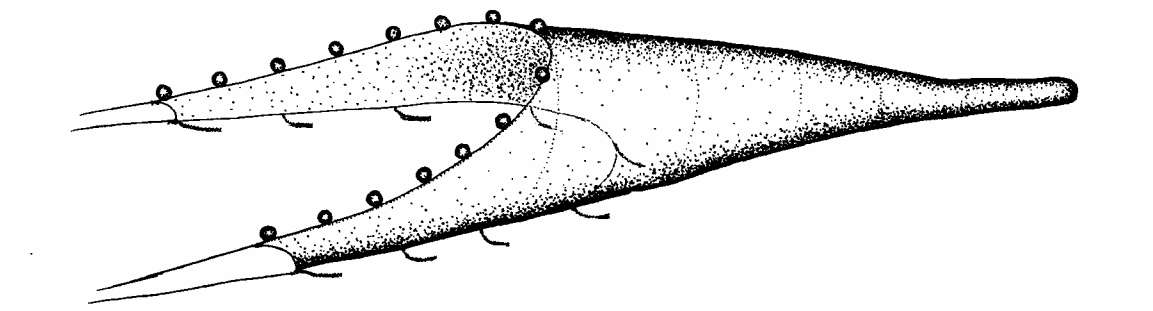


Figure 1: Drawings of the standard raised footrope trawl (A), and sweepless raised footrope trawl (B).

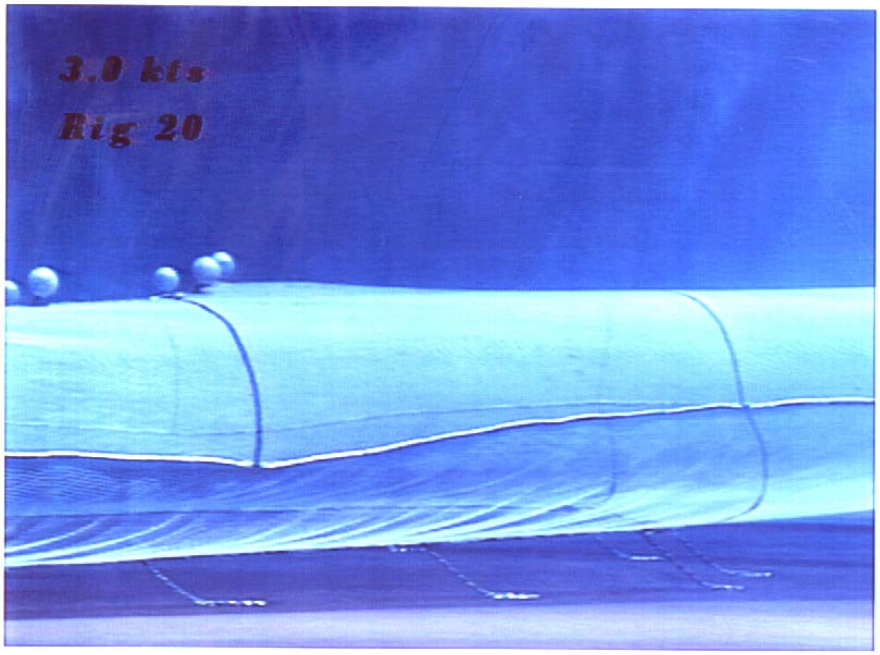


Figure 2: Flume tank model of the sweepless RFT undergoing a towing simulation (3 knots).

Figure 3: Extension piece added to the headrope during at sea modification of the sweepless RFT to raise the footrope off the seafloor.

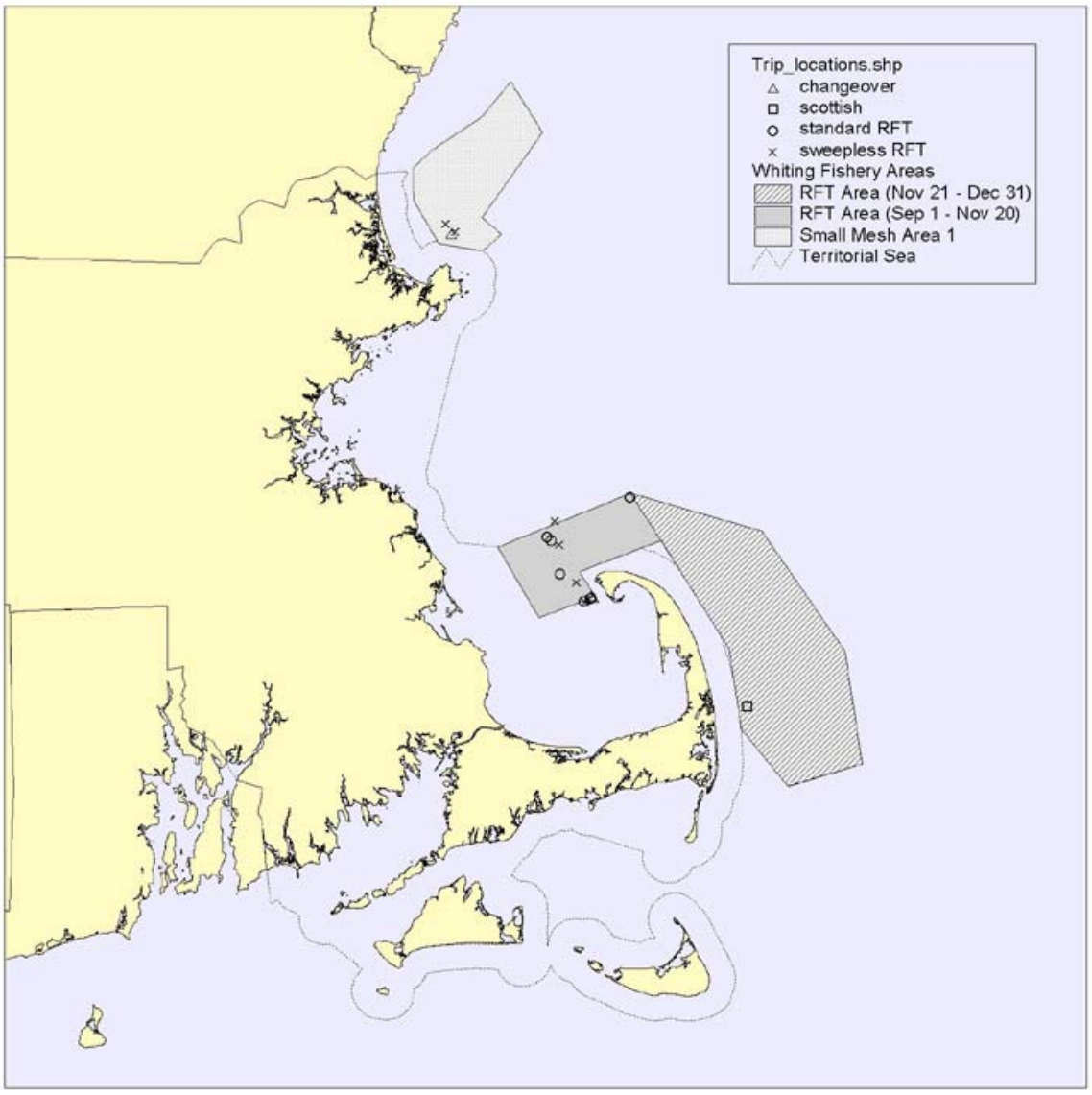


Figure 4: Locations of sea-sampling trips and RFT experiments by small-mesh area (SMA).

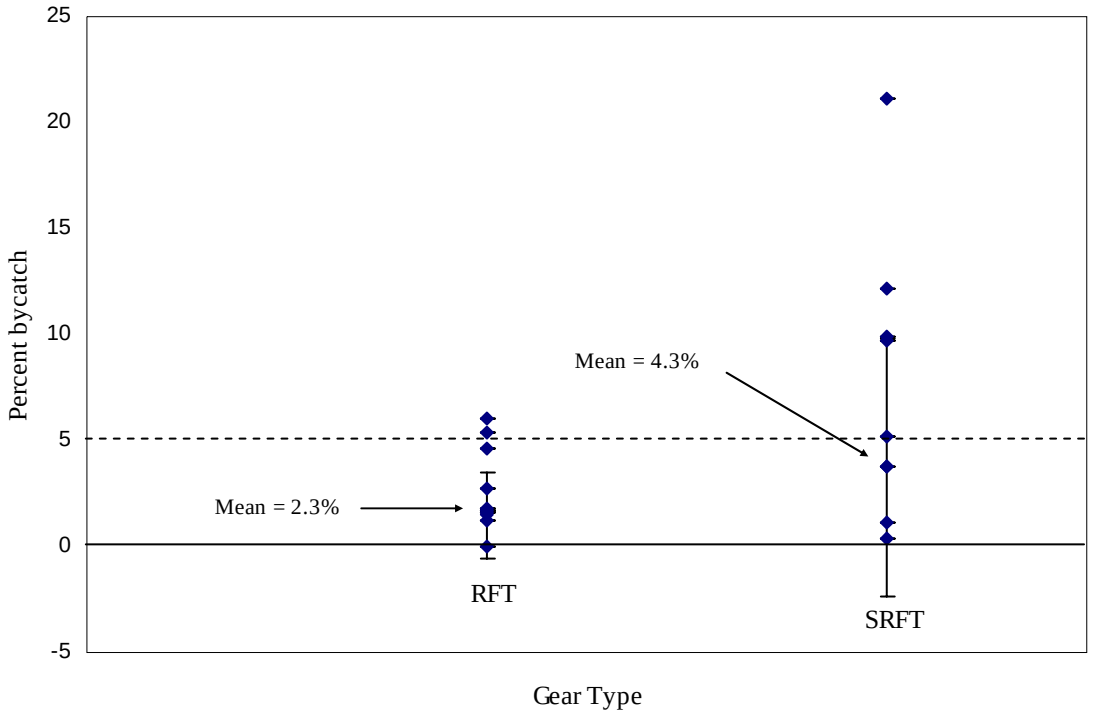


Figure 5: Percent bycatch of regulated species per trip by gear type (RFT vs. SRFT) from sea sampling and changeover trips during the 2002 exempted whiting fishery. Error bars are confidence intervals derived from 95% t-values.

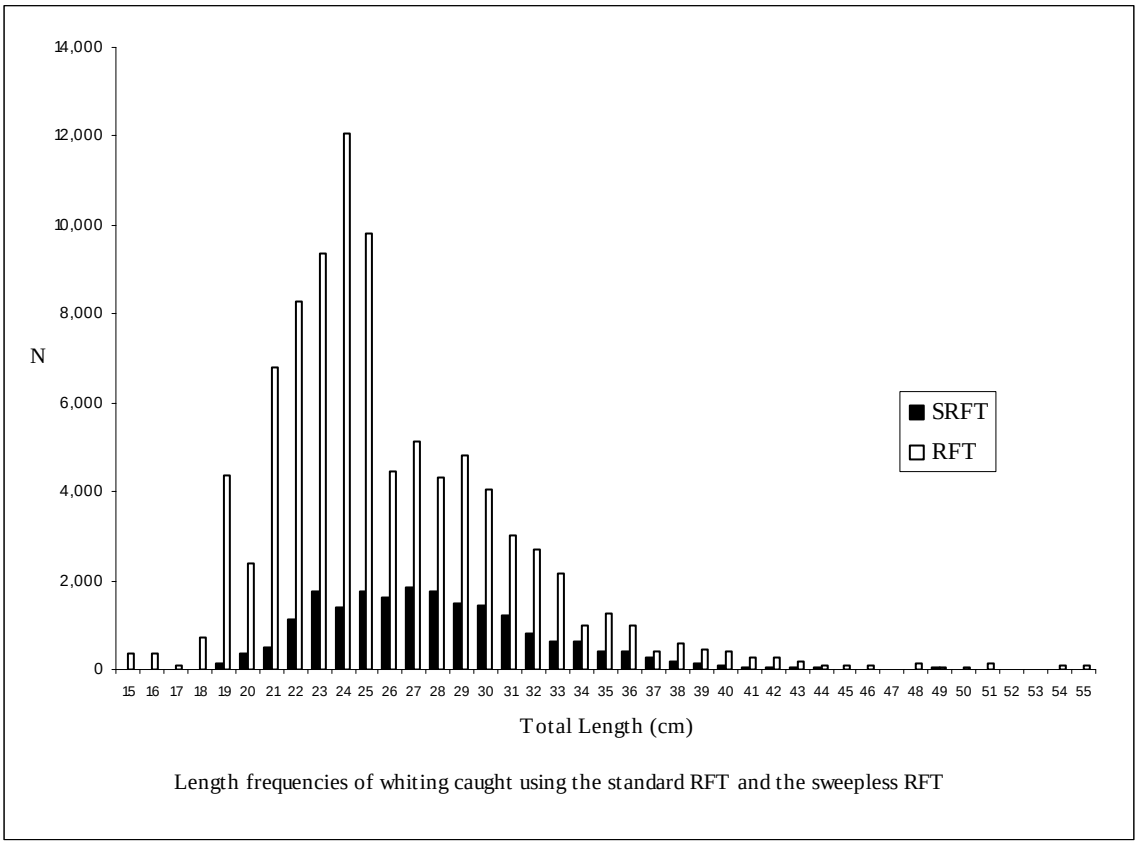


Figure 6: Length frequency of whiting by gear type.

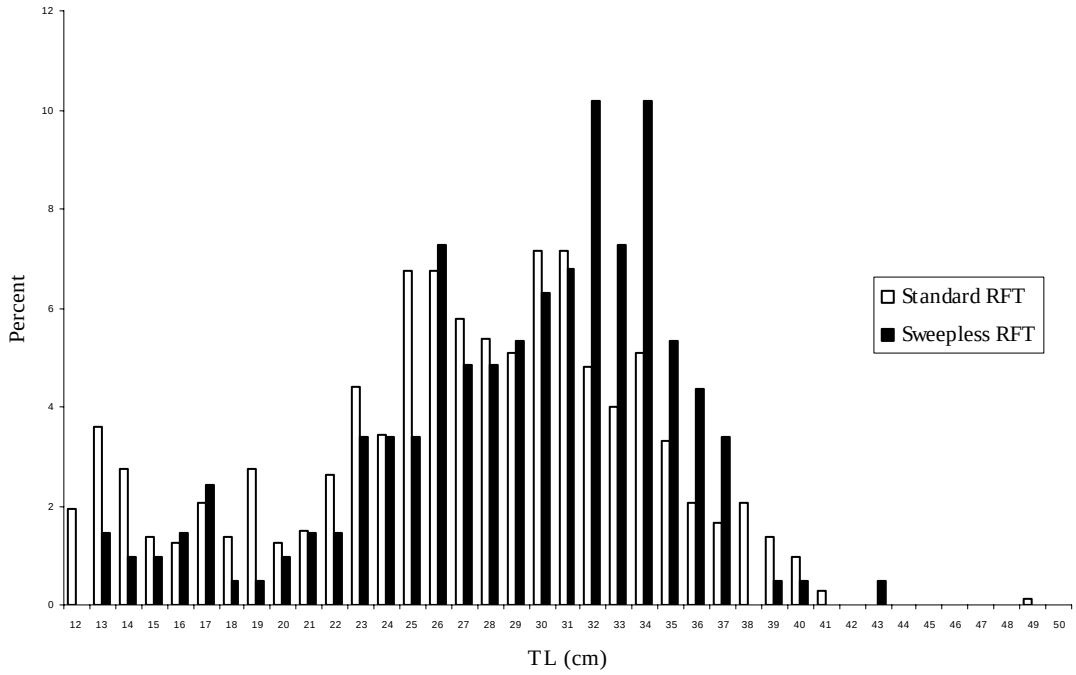


Figure 7: Length frequency of American plaice caught in sea trials using the standard and sweepless RFT.

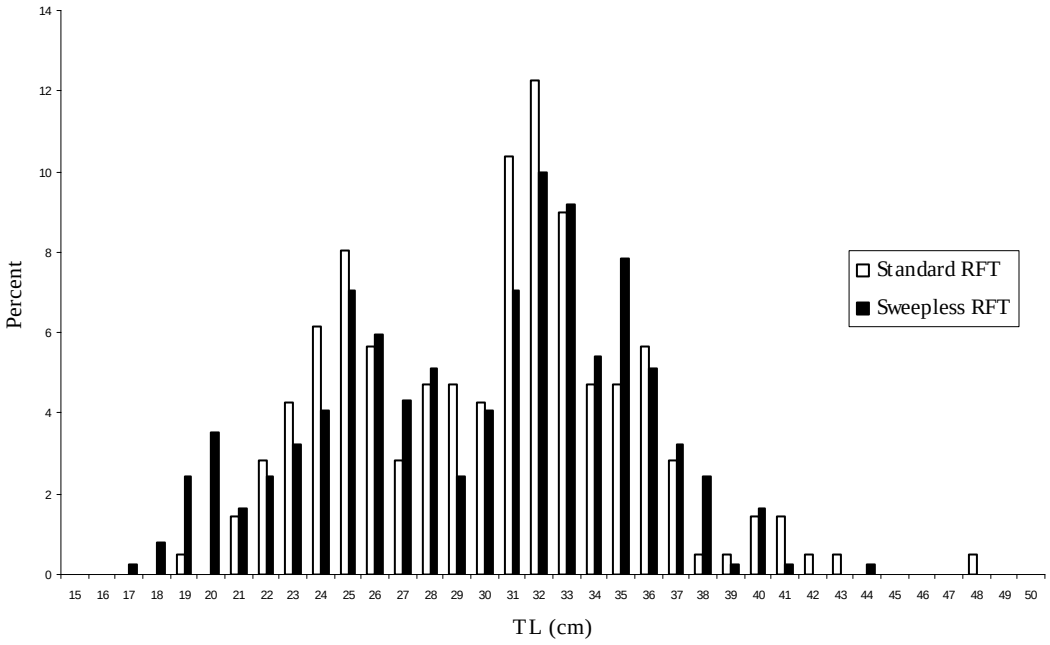


Figure 8: Length frequency of winter flounder caught in sea trials using the standard and sweepless RFT.

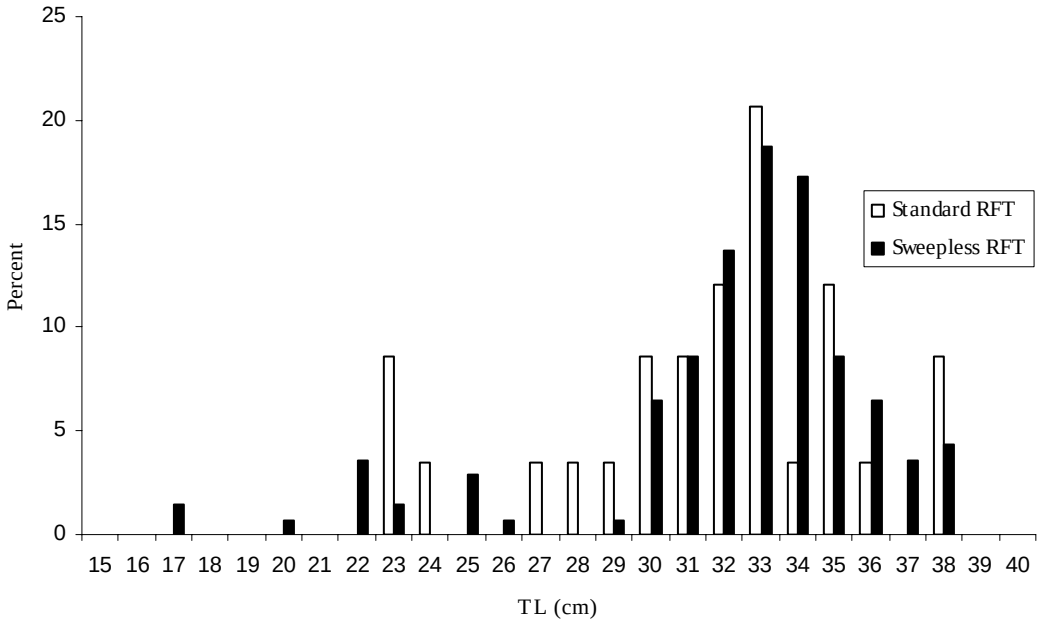


Figure 9: Length frequency of yellowtail flounder caught in sea trials using the standard and sweepless RFT.

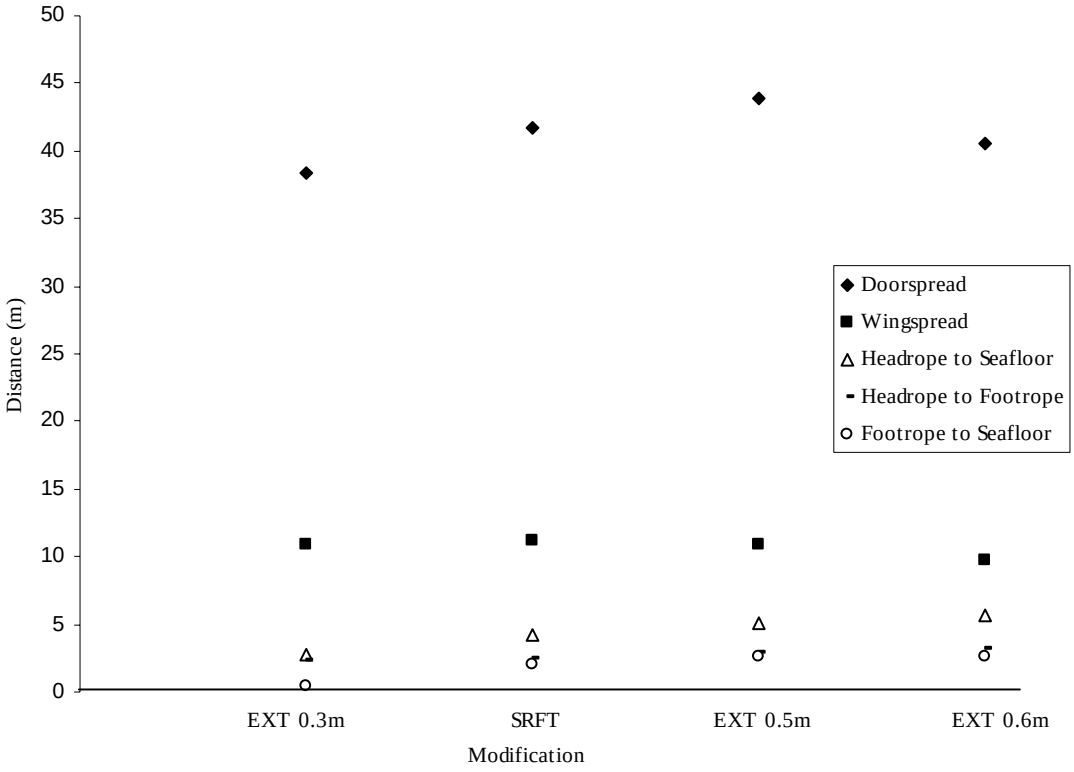


Figure 10: Net mensuration data generated from the Netmind system during filming trips (10/9/02 – 10/10/02) on the F/V Blue Skies. Net dimensions recorded in meters.

Appendix A: Summary of incidental catch allowances in exempted fisheries for small-mesh multispecies at the start of the grant (source: NEFMC 2002).

Exempted Fishery	Season	Gear Requirements	Allowable Incidental Catch
Small Mesh Area I	6/15 – 11/15	RFT	Herring, Sculpin, Squid, Butterfish, Mackerel, Dogfish, Ocean pout, Scup, Red hake, *Monkfish, **Lobster
Small Mesh Area II	1/1 – 6/30	RFT	Herring, Sculpin, Squid, Butterfish, Mackerel, Dogfish, Ocean pout, Scup, Red hake, *Monkfish, **Lobster
Raised Footrope Trawl Cape Cod Bay	9/1 – 11/20 Cape Cod Bay; 11/21 – 12/31 eastern area only	Minimum 2.5-inch mesh RFT	Red Hake, Squid, Butterfish, Mackerel, Dogfish, Herring, Scup
Cultivator Shoal Whiting Fishery	6/15 – 9/30	Minimum 3-inch mesh	Herring, Sculpin, Squid, Butterfish, Mackerel, Dogfish (up to 10% by weight), Ocean pout, Scup, Red hake, *Monkfish, **Lobster

Incidental catch amounts limited only by the regulations for that species (i.e. dogfish is limited to 600 lb May 1 – Oct. 31 and 300 lb 11/1 – 4/30, or zero lb if quota closes.
* Monkfish can be retained up to 10% by weight OR 50 lb tail/166 lb whole, whichever is less.
** Lobster can be retained up to 10% by weight OR 200 lobsters, whichever is less.

Appendix B: Raised footrope trawl gear specifications for use in small mesh whiting fishery.

Net Characteristic	Specifications
*Codend mesh size	Minimum 2.5-inches square or diamond counting from terminus of the net, the first 50 meshes or first 100 bars with square mesh (vessels up to 60 feet in length). Minimum 2.5-inches square or diamond counting from the terminus of the net, the first 100 meshes or first 200 bars with square mesh (vessels greater than 60 feet in length).
*Outside net strengtheners	Prohibited along with liners and codend covers.
Headrope	Floats minimum diameter 8-inch attached along entire headrope length; 4 feet maximum spacing between floats.
Ground gear	All bare wire not larger than ½-inch diameter (top leg), 5/8-inch diameter (bottom leg), ¾-inch diameter (ground cables). Top and bottom legs must be equal in length with no extensions. Total length of ground cables and legs must not be greater than 40 fathoms (73 m) from the doors to wing ends.
Footrope	Must be longer than headrope, not more than 20 feet longer than headrope; must be rigged so that it does not contact the bottom.
Drop chains	42 inches in length or greater, 5/16-inch maximum stock (with sweep); 3/8-inch maximum stock (sweepless). Additional weights and cookies prohibited. Must be hung from center and each corner of footrope; must be hung at 8-foot intervals along footrope from corners to wing ends.
Sweep	Must be bare chain the same length as footrope. Maximum size is 5/16-inch stock chain and must be attached to ends of drop chains. Center of sweep must be attached to the drop chain from the center of footrope. Ends of sweep must be attached to drop chains at the end of footrope.

* Gear specifications apply only to vessels fishing in all small-mesh whiting areas except Areas I and II.

Appendix C: Letter sent to small-mesh whiting participants to solicit changeover trips.

9 September, 2002
F/V Anne Example
9 Saltwater Road
Nor'easter MA 02468

Dear Captain,

This letter is an invitation to participate in a program to modify your raised footrope trawl to a "sweepless" version. You are receiving this letter because you have fished in past Whiting Raised Footrope Trawl Exempted or Experimental fisheries.

The Conservation Engineering Program of the Division of Marine Fisheries has been awarded limited research funds to continue monitoring the fishery and encourage the use of the "sweepless" raised footrope trawl. As you probably know, the sweepless net is a raised footrope trawl with the chain sweep removed. It was developed at the Newfoundland flume-tank by Arne Carr and Henry Souza in 1997. This modification, including the option of using heavier dropper chains, is permitted under existing regulations.

We consider the sweepless net to be an improvement over the raised footrope trawl for several reasons. The fishermen who use this net agree that it is simpler and easier to rig than the raised footrope trawl. It is less likely to get hung up on ghost gear and result in tows with high by-catch of bottom tending species (e.g. flatfish). It has less contact with the bottom, and is also easier to check for compliance. Instead of proposing to make this design mandatory, we are encouraging fishermen like yourself to experiment with this design on a voluntary basis. We encourage you to adopt the sweepless trawl. The modification is easily done by simply removing the chain sweep, and increasing the dropper chains' weight which can then be changed to 3/8 inch stock.

We have budgeted to work with about 10 vessels to rigging over with DMF assistance. This opportunity will be available on a first-come, first served basis. If you request, and your vessel meets certain basic safety requirements, DMF may schedule a trip to assist you on your vessel. Capt. Luis Ribas, who has used the sweepless net for three years, has been contracted by DMF to assist the rigging over and to make modifications to your net as necessary. Catch data will be collected by DMF's Vincent Manfredi.

Use of the sweepless net may result in a small reduction in whiting and red hake catch rates. However, we believe that the benefits of reduced by-catch and reduced "hangs" outweigh the costs. If you are interested in having Capt. Ribas and Vincent Manfredi onboard your vessel to work with you and your crew, contact Vincent Manfredi at DMF's South Shore Field Station in Pocasset and request a "switchover" trip.

You should be aware that a switchover trip would not be the same as a day of fishing. Your first set may be delayed due to the time required to modify your net. Catches, especially the first ones, will probably have less whiting and red hake than usual until your net is properly tuned. It will require some patience on your part while your net is tuned to fish efficiently. Due to the expected loss of catch during the first tow(s), DMF can provide a limited amount of compensation to you. At this time, the amount of compensation has not yet been determined.

We hope you will take part in this effort to improve the whiting fishery. Please contact us if you have any questions, and please contact Vincent Manfredi (508-563-1779 x140) if you are willing to work with us.

Sincerely,

Michael Pol
Conservation Engineering Program

Appendix D: List of Participants Solicited for Changeover Trips.

F/V Alyssa & Zachary
114 Macarthur Drive
New Bedford, MA 02740

F/V Antonia Jorge
PO Box 723
2 Somerset Road
Provincetown, MA 02657

F/V Ancora Praia
15 Jerome Smith Road
Provincetown, MA 02657

F/V Blue Skies
7 Sandy Hill Lane Ap#A
Provincetown, MA 02657

F/V Brenda Louise
PO Box 287
Kenyon RI 02836

F/V Lady Jane
Capt. Russel Sherman
95 Concord Street
Gloucester,MA 01930

F/V Carla Bee
Race Point Road
PO Box 480
Provincetown, MA 02657

F/V Chico-Jess
3 Fishburn Court
Provincetown, MA 02657

F/V Christopher Andrew
67 Creelman Drive
Scituate,MA 02066-2026

F/V Columbus
2 Sterling Avenue
PO Box 749
Greenport NY 11944

F/V Coming Home
37 Aunt Zilpas Road
West Chatham MA 02669

F/V Frankie Joe
190 Old Centre Street
Middleboro MA 02346

F/V Honi-Do III
C/O Mark Farnham
19 Wilford Road
Chatham MA 02633-1876

F/V Iberia II
84 Front Street
New Bedford, MA 02740

F/V Janaya & Joseph
10 Magnolia Avenue
Gloucester MA 01930

F/V Jersey Princess II
PO Box 1453
Provincetown, MA 02657

F/V Joan & Tom
PO Box 534
North Truro MA 02652

F/V Joanne A III
25 Portanimicut Road
PO Box 1019
South Orleans MA 02662

F/V Josephine
279 Western Avenue
Gloucester MA 01930

F/V Kathryn V
10 Highview Road
Rockport MA 01966

Appendix D (cont.): List of Participants Solicited for Changeover Trips

F/V Mary And Josephine
279 Western Avenue
Gloucester MA 01930

F/V Midnight Sun
38 Mansfield Street
Gloucester MA 01930

F/V Pat-Sea
476 Commercial Street
Provincetown, MA 02657

F/V Meridian
113 Macarthur Drive
New Bedford, MA 02740

F/V Rose Marie
5 Jacques Lane
Gloucester MA 01930

F/V Santa Luzia
15 Nelson Avenue
PO Box 836
Provincetown, MA 02657

F/V Sao Jacinto
84 Front Street
New Bedford, MA 02740

F/V Sarajen
113 Macarthur Drive
New Bedford, MA 02740

F/V Second Effort
PO Box 259
Provincetown, MA 02657

F/V Silver Mink
PO Box 202
36b Courst Street
Provincetown, MA 02657

F/V Terra Nova
PO Box 714
5 Sylvan Lane
Truro MA 02666

F/V United States
114 Macarthur Drive
New Bedford, MA 02740

F/V Vincie N
9 Seaview Road
Gloucester MA 01930

Appendix E: Sea sampling results of vessels undergoing modifications using the sweepless raised footrope trawl (autumn 2002). All landings and discards in pounds.

Treatment: SWRFT					
Date	9/14/02	10/24/02	11/1/02		
Area fished	Area 1	UCC	UCC		
N tows	1	1	1	N tows	3
Hours fished	2.25	1.5	1.5	Hrs fished	5.25
Species Landed				Combined Total Landings	
Whiting	1,338	325	900	Whiting	2,563
Atlantic herring	315	60	0	Atlantic herring	375
Red hake	311	10	0	Red hake	321
Butterfish	1	25	0	Butterfish	26
Loligo squid	0	12	10	Loligo squid	22
Atlantic mackerel	0	2	0	Atlantic mackerel	2
Illex squid	1	11	0	Illex squid	12
Black sea bass	0	0	4	Black sea bass	4
Scup	0	0	1	Scup	1
American lobster	20	0	0	American lobster	20
Monkfish	65	0	0	Monkfish	65
White hake	4	0	0	White hake	4
				Totals	**3,415**
Speices Discarded				Combined Total Discards	
Whiting	0	0	100	Whiting	100
Atlantic herring	0	0	250	Atlantic herring	250
Red hake	0	0	100	Red hake	100
Sea scallop	4	1	0	Sea scallop	5
Butterfish	0	0	8	Butterfish	8
Atlantic mackerel	0	0	2	Atlantic mackerel	2
Spiny dogfish	24	51	10	Spiny dogfish	85
Black sea bass	0	18	0	Black sea bass	18
Bluefish	0	0	1	Bluefish	1
American lobster	25	1	60	American lobster	86
Sea Raven	0	0	2	Sea Raven	2
Longhorn sculpin	1	0	40	Longhorn sculpin	41
Little skate	1	0	50	Little skate	51
Ocean pout	1	0	0	Ocean pout	1
Winter skate	0	0	20	Winter skate	20
Monkfish	85	0	1	Monkfish	86
Atlantic cod	0	0	35	Atlantic cod	35
Yellowtail flounder	3	0	0	Yellowtail flounder	3
Winter flounder	10	1	50	Winter flounder	61
Windowpane	0	0	4	Windowpane	4
Fourspot flounder	1	0	8	Fourspot flounder	9
Witch flounder	4	0	0	Witch flounder	4
American plaice	21	1	4	American plaice	26
Summer flounder	0	0	4	Summer flounder	4
Wrymouth	2	0	0	Wrymouth	2
Smooth dogfish	0	0	5	Smooth dogfish	5
				Totals	**1,009**

Appendix E (cont.): Sea sampling results of vessels undergoing modifications using the sweepless raised footrope trawl (autumn 2002). All landings and discards in pounds.

Treatment: EXT					
Date	9/14/02	10/24/02	11/1/02		
Area fished	Area 1	UCC	UCC		
N tows	1	1	1	N tows	3
Hours fished	2	1.5	2.25	Hrs fished	5.75
Species Landed				Combined Total Landings	
Whiting	600	825	650	Whiting	2075
Atlantic herring	450	0	0	Atlantic herring	450
Red hake	317	181	0	Red hake	498
Butterfish	0	52	0	Butterfish	52
Loligo squid	0	7	5	Loligo squid	12
Atlantic mackerel	0	1	0	Atlantic mackerel	1
Illex squid	0	6	0	Illex squid	6
Black sea bass	0	0	56	Black sea bass	56
Bluefish	0	13	0	Bluefish	13
American lobster	12	0	0	American lobster	12
Monkfish	7	0	0	Monkfish	7
White hake	3	0	0	White hake	3
Menhaden	0	2	0	Menhaden	2
				Totals	3187
Speices Discarded				Combined Total Discards	
Whiting	0	0	50	Whiting	50
Atlantic herring	0	0	100	Atlantic herring	100
Red hake	0	0	50	Red hake	50
Butterfish	0	0	10	Butterfish	10
Spiny dogfish	16	143	50	Spiny dogfish	209
Black sea bass	0	16	0	Black sea bass	16
American lobster	4	18	75	American lobster	97
Sea Raven	0	2	0	Sea Raven	2
Longhorn sculpin	0	22	5	Longhorn sculpin	27
Little skate	0	235	25	Little skate	260
Ocean pout	1	6	0	Ocean pout	7
Winter skate	0	26	0	Winter skate	26
Monkfish	7	0	0	Monkfish	7
Atlantic cod	0	15	0	*Atlantic cod	15
Yellowtail flounder	1	5	1	Yellowtail flounder	7
Winter flounder	4	35	40	Winter flounder	79
Windowpane	0	5	0	Windowpane	5
Fourspot flounder	0	18	0	Fourspot flounder	18
Witch flounder	1	0	0	Witch flounder	1
American plaice	28	0	1	American plaice	29
Pollock	1	0	0	Pollock	1
Summer flounder	0	11	0	Summer flounder	11
Rock crab	1	16	0	Rock crab	17
Striped bass	0	15	0	Striped bass	15
Smooth dogfish	0	4	0	Smooth dogfish	4
* (10/24) Lobster trap caught				Total Discards	**1,066**

Appendix E (cont.): Sea sampling results of vessels undergoing treatments using the sweepless raised footrope trawl (autumn 2002). All landings and discards in pounds.

Treatment: RFT

Date	11/1/02
Vessel	AP
Area fished	UCC
N tows	1
Hours fished	1.5

Species	Landings (lbs)	Discards (lbs)	Total Catch (lbs)
Whiting	600	50	650
Atlantic herring	0	10	10
American shad	0	0	0
Alewife	0	0	0
Red hake	0	15	15
Sea scallop	0	0	0
Butterfish	0	15	15
Loligo squid	25	0	25
Atlantic mackerel	0	10	10
Illex squid	0	0	0
Spiny dogfish	0	5	5
Black sea bass	21	0	21
Bluefish	0	0	0
Scup	1	0	1
American lobster	0	80	80
Sea Raven	0	0	0
Longhorn sculpin	0	5	5
Jonah crab	0	0	0
Little skate	0	100	100
Ocean pout	0	0	0
Winter skate	0	0	0
Monkfish	0	0	0
Atlantic cod	0	66	66
Yellowtail flounder	0	0	0
Winter flounder	0	40	40
Windowpane	0	3	3
Fourspot flounder	0	3	3
Witch flounder	0	0	0
White hake	0	0	0
Haddock	0	0	0
American plaice	0	5	5
Pollock	0	0	0
Redfish	0	0	0
Summer flounder	0	9	9
Rock crab	0	0	0
Smooth dogfish	0	2	2
Striped sea robin	0	1	1
Totals			**1,066**

Appendix F: Cover letter sent along with project video.

9 September, 2003
««AddressBlock»»
Dear Captain,

The enclosed video is a description of the development of the sweepless raised footrope trawl. It was produced under a grant awarded to the Conservation Engineering Program of the Division of Marine Fisheries by the National Marine Fisheries Service (NMFS) Cooperative Research Partners Initiative (CRPI). One goal of that grant was to encourage voluntary use of the "sweepless" raised footrope trawl.

The 12-minute video includes descriptions of the rigging of both the raised footrope trawl and the sweepless version. We consider the sweepless net to be an improvement over the raised footrope trawl because it is simpler and easier to rig than the raised footrope trawl, it is less likely to get hung up on ghost gear and result in tows with high by-catch, and it has less contact with the bottom.

We hope you will watch the video and consider modifying your raised footrope trawl. The modification to a sweepless design is easily done by removing the chain sweep, and increasing the dropper chains' weight by changing them to 3/8 inch stock.

Please contact us with any feedback about the video. Further copies, and DVD or CD versions, are available upon request.
Sincerely,

Michael Pol
Conservation Engineering Program

Appendix G: List of Video Recipients, Based on Cultivator Shoals and Exempted RFT Fishery Participants

F/V Ancora Praia
Sandia Fishing Corp
15 Jerome Smith Road
Provincetown, MA 02657

F/V Antonio Jorge
Antonio Jorge Inc
PO Box 723
2 Somerset Road
Provincetown, MA 02657

F/V Atlantic Queen
Alda Gentile
PO Box 703
Speonk, NY 11972

F/V Baltic
Mitura Fishing Corp
84 Front Street
New Bedford, MA 02740

F/V Black Sheep
Black Sheep Fisheries Inc
434 Klondike Road
Charlestown, RI 02813

F/V Blue Ocean
Blue Ocean Fisheries Corp
7 Sandy Hill Lane
Provincetown, MA 02657

F/V Blue Skies
Barrosa Fishing Corp
7 Sandy Hill Lane Apt A
Provincetown, MA 02657

F/V Capt Novello
Vincie N Inc
9 Seaview Road
Gloucester, MA 01930

F/V Casa Blanca
Blanca Casa Fishing Corp
113 Macarthur Drive
New Bedford, MA 02740

F/V Charlie's Pride
Seafarer Ent Inc
26 Shannon Road
Wakefield, RI 02879

F/V Chico-Jess
Chico-Jess Inc
PO Box 1892
Provincetown, MA 02657

F/V Christina Eleni
Sal & Sons Inc
108-110 Commercial Street
Gloucester, MA 01930

F/V Christopher Andrew
Boat Kathleen A Mirarchi Inc
67 Creelman Drive
Scituate, MA 02066

F/V Columbus
Long Island Fishery LLC
PO Box 8934
New Bedford, MA 02740

F/V Coming Home
Christopher F Davis
37 Aunt Zilpas Road
West Chatham, MA 02669

F/V David James
David James Inc
7 Burroughs Road
North Reading, MA 01864

F/V Dona Maria
Clark A Reposa
336 Main Street
Wakefield, RI 02879

F/V Excalibur
Renaissance Trawling Corp
136 Post Road
Wakefield, RI 02879

F/V Frankie Joe
John A Phaneuf
190 Old Centre Street
Middleboro, MA 02346

F/V Glacier Bay
Glacier Bay Inc
PO Box 135
Wakefield, RI 02880

F/V Green Acres
C & D Fishing Corp
114 Macarthur Drive
New Bedford, MA 02740

F/V Honi-Do III
Honi-Do Corp
C/O M G Farnham
19 Wilfred Road
Chatham, MA 02633

F/V Janaya & Joseph
S S Fisheries Corp
10 Magnolia Avenue
Gloucester, MA 01930

F/V Jason & Danielle
L & G Fisheries LLC
34 Madison Hill Drive
Montauk, NY 11954

F/V Jersey Princess II
Jersey Princess Fishing Corp
PO Box 1453
Provincetown, MA 02657

F/V Joan & Tom
Joan & Tom Fish Inc
PO Box 534
North Truro, MA 02652

F/V Joanne A III
William H Amaru
25 Portanimicut Road
Box 1019
South Orleans, MA 02662

F/V Kate & Sean
New England Fisheries Inc
PO Box 1071
Charlestown, RI 02813

F/V Katrina Lee
CPR Fishing Inc
336 Main Street
Wakefield, RI 02879

F/V Lady Dee
Andrew E Lang
PO Box 118
25 Shaw Circle
New Castle, NH 03854

Appendix G (cont.): List of Video Recipients, Based on Cultivator Shoals and Exempted RFT Fishery Participants

F/V Lady Jane
F/V SCM Inc
95 Concord Street
Gloucester, MA 01930

F/V Lady Lynn
New Horizon Fishpacking Inc
23 Old Mill Road
Clinton, CT 06413

F/V Liberty
Jacques R Macara
21A Brewster Street
Provincetown, MA 02657

F/V Lily Jean
Lily Jean Corporation
14 St Anthonys Lane
Gloucester, MA 01930

F/V Lophius
Muckler Fisheries Inc
90 Hawthorn Street
New Bedford, MA 02740

F/V Matthew & Lisa
Valente Fishing Corp
84 Front Street
New Bedford, MA 02740

F/V Megan-Marie
Blue Water Fisheries Inc
PO Box 2242
Montauk, NY 11954

F/V Melissa Jayne
Mal De Mer Fisheries Inc
113 Macarthur Drive
New Bedford, MA 02740

F/V Meridian
Meridian Seafood Corp
113 Macarthur Drive
New Bedford, MA 02740

F/V Midnight Sun
Lisa T Corp
222 Magnolia Avenue
Gloucester, MA 01930

F/V Mystic Way
Mystic Way Fisheries Inc
114 Smith Street
New London, CT 06320

F/V Northern Linn
Fish Hawks Inc
PO Box 1347
Southampton, NY 11969

F/V Pat-Sea
Fortune Fishing Corp
476 Commercial Street
Provincetown, MA 02657

F/V Perseverance
PMS Fisheries Inc
17 Alexander Drive
Narragansett, RI 02882

F/V Predator
Mark S Phillips
210 Atlantic Avenue
Greenport, NY 11944

F/V Prima Donna
F/V Prima Donna Inc
21 Rampasture Road
Hampton Bays, NY 11946

F/V Princess
Andrew M Porter
PO Box 233
Provincetown, MA 02657

F/V Provider
Good Shepherd Fisheries Inc
85 Auburn Drive
Charlestown, RI 02813

F/V Rayda Cheramie
K & D Fisheries Inc
PO Box 579
336 Klondike Road
Charlestown, RI 02813

F/V Rebecca
A J LLC
2 Portland Fish Pier
Portland, ME 04101

F/V Richard & Arnold
David W Dutra
PO Box 326
43 Shore Road
North Truro, MA 02652

F/V Rose Marie
Rose Marie Inc
250 Jackson Street
PO Box 5296
Englewood, NJ 07631

F/V Sao Jacinto
Karen Maria Trawling Corp
84 Front Street
New Bedford, MA 02740

F/V Sao Paulo
Cura & Borges Fish Corp
84 Front Street
New Bedford, MA 02740

F/V Sarajen
La Gata Fisheries Inc
113 Macarthur Drive
New Bedford, MA 02740

F/V Sasha Lee
Sasha Lee Inc
114 Macarthur Drive
New Bedford, MA 02740

F/V Sea Breeze
Sea Breeze LLC
70 Elmwood Drive
North Kingstown, RI 02852

F/V Second Effort
Second Effort Fisheries Inc
PO Box 259
Provincetown, MA 02657

F/V Silver Mink
Paulo-Marc Fishing Corp
PO Box 202
35B Court Street
Provincetown, MA 02657

F/V Stirs One
Stirs One Inc
36 Ryder Avenue
Dix Hills, NY 11746

Appendix G (cont.): List of Video Recipients, Based on Cultivator Shoals and Exempted RFT Fishery Participants

F/V Super Squirrel
Super Squirrel Fishrs Inc
9 Beech Hill Road
Peacedale, RI 02883

F/V Tempest
The Tempest Inc
137 South Street #3
Boston, MA 02111

F/V The Jocka
Jordan Lynn Inc
67 Grover Lane
Harpswell, ME 04079

F/V Travis & Natalie
Travis & Natalie Inc
113 Lewiston Avenue
West Kingston, RI 02892

F/V Vic-Ter-Rae
Raymond W Livernois
PO Box 5632
Wakefield, RI 02880

F/V Victory
L & M Fishing Corp
84 Front Street
New Bedford, MA 02740