Completion Report

for

Sturgeon Gillnet Study (number EA133F-10-SE-3358)

The Influence of Sink Gillnet Profile on Bycatch of Atlantic Sturgeon in the Mid-Atlantic Monkfish Fishery

Recipient Name: Endeavor Fisheries Inc.

Fox, D. A. J. L. Armstrong, L. M. Brown, and K. Wark

NMFS COR:
Henry Milliken

Summary

On April 6th 2012, the final ruling to list five Distinct Population Segments (DPSs) of Atlantic sturgeon (*Acipenser oxyrinchus oxyrinchus*) under the Endangered Species Act was implemented. This decision to list Atlantic sturgeon was based on a number of factors including degradation and loss of habitat, vessel strikes, and bycatch in commercial fisheries. The preceding Status Review concluded that bycatch in sink-gillnets was a significant hurdle to Atlantic sturgeon recovery. The Status Review specifically mentioned landings in the monkfish (*Lophius americanus*) gillnet fishery, which provides economic benefits to fishing communities in the mid-Atlantic and northeast U.S. The manner in which gillnets are fished, including net configuration (e.g. use of tie downs and net profile) and soak duration is believed to influence both Atlantic sturgeon encounter and mortality rates.

Cooperating monkfish harvesters' fished paired replicates of two gillnet configurations (control and treatment (low profile)) totaling 120 hauls in accordance with normal monkfish fishing operations. Atlantic sturgeon bycatch (CPUE) was significantly different (p=.0118) between gillnet configurations, with treatment nets encountering fewer individuals. With the exception of spiny dogfish (*Squalus acanthias*), we documented no significant differences in the landings of target species although overall catch rates were lower with the treatment gillnets. Our findings suggest that future modifications of gillnets may provide technological solutions to the problem of Atlantic sturgeon bycatch in large mesh sink gillnets in the mid-Atlantic and northeast U.S.

Background

The Atlantic sturgeon (*Acipenser oxyrinchus oxyrinchus*) is one of 27 species within the family Acipenseridae and one of nine species/subspecies native to North American waters (Cech and Doroshov 2004). Characterized by a mostly cartilaginous skeleton, sturgeons can be traced back more than 200 million years and are recognizable in their present day form beginning approximately 85 million years ago (Bemis and Kynard 1997). Atlantic sturgeon historically occupied all major river systems along the Atlantic coast between the St.

Lawrence River, Canada (Bachus 1951) and the St. Johns River, Florida (Vladykov and Greely 1963). Additionally, Atlantic sturgeon were believed to have once co-occurred with native European sturgeon (*A. sturio*) in the Baltic Sea (500-1,500 years ago) before anthropogenic influences led to their extirpation from Europe (Ludwig et al. 2002).

Commercial harvest of sturgeon for roe (caviar) started during the 17th century and began in the U.S. in the late 1800's (Saffron 2002). In the mid-Atlantic, small scale fisheries that were directed predominantly at flesh rapidly transformed into the leaders of global caviar production (Townsend 1900). The US commercial caviar fishery was started in the Delaware River, which historically supported the largest Atlantic sturgeon population (Secor and Waldman 1999) and rapidly expanded to other river systems in the mid-Atlantic Bight before collapsing after just over a decade of high fishing effort (Cobb 1900). The success of the U.S. Atlantic sturgeon fishery was short-lived, and by 1900 the total catch was less than 10% of the peak harvest totals (Borodin 1925).

Following nearly a century of lack of recovery, the Atlantic States Marine Fisheries Commission (ASMFC) produced a Fishery Management Plan (FMP) for Atlantic sturgeon with a goal of restoring a sustainable fishery throughout its range (ASMFC 1998). The FMP implemented a coast-wide ban on harvest in state waters, which was followed shortly by a National Marine Fisheries Service (NMFS) ban in federal waters. In 2005, the NMFS established an Atlantic Sturgeon Status Review Team (ASSRT) which recommended that three of the five distinct population segments (DPS) of Atlantic sturgeon be listed as threatened under the Endangered Species Act (ESA), including the New York Bight and Chesapeake Bay DPSs (ASSRT 2007). On October 6, 2010, NMFS published a notice in the Federal Register proposing to list four of the Atlantic sturgeon DPSs, including the New York Bight and Chesapeake Bay DPSs, as endangered, and the Gulf of Maine DPS as threatened (U.S. Office of the Federal Register 2010). On April 6th 2012, the final ruling to list five Distinct Population Segments (DPSs) of Atlantic sturgeon under the Endangered Species Act was implemented. The decision to list Atlantic sturgeon was based on a number of factors including degradation and loss of habitat, vessel strikes, and bycatch in commercial fisheries.

Atlantic sturgeons are anadromous spending much of their life in the marine environment. In both the Status Review and FMP documents there are calls for more directed research on the marine phase of Atlantic sturgeon life history, which has been underrepresented in the scientific literature (Stein et al. 2004a). The general lack of biological information causes problems for fisheries professionals working within the confines of state jurisdictional boundaries, and it is especially problematic for Atlantic sturgeon as they are known to suffer from interactions with coastal marine fisheries including gillnets (Stein et al. 2004b, ASMFC 2007).

The use of gillnets to capture fish dates back over 3,000 years although relatively recent advances in technology including synthetic materials and hydraulic haulers has led to increased use of this methodology (Potter and Pawson 1991, He 2006a). Unfortunately our understanding of the mechanisms influencing bycatch in gillnets has lagged behind technological advances in the fishing industry, leading to increased concerns over the incidental take of imperiled birds, fishes, and mammals (He and Pol 2010). In the mid-Atlantic and northeast U.S., monkfish (*Lophius americanus*) support a lucrative commercial fishery out to the edge of the continental shelf. Monkfish are targeted primarily with trawls in the northern management area and sink-gillnets in the mid-Atlantic. The sink-gillnets employed in the monkfish fishery have been identified as a significant source of bycatch mortality for Atlantic sturgeon during their marine phase of their life history (Stein et al. 2004b, ASMFC 2007). As such, it is believed that changes in fishing practices in the monkfish fishery may have the potential to decrease the bycatch of Atlantic sturgeon. Unfortunately, data on bycatch reduction technologies in the monkfish gillnet fishery (e.g. net profile and tie-downs) are lacking although mesh size, tie downs, and soak times are thought to be mitigating factors in Atlantic sturgeon bycatch mortality, which ranges from 14% (ASMFC 2007) to 22.% (Stein et al. 2004).

Objectives

The objectives of the study were as follows: 1) compare the bycatch rates of Atlantic sturgeon encountered in both control and experimental gillnets in NMFS Statistical Area 614 and 615; 2) compare the catch rates of the target species (monkfish) in each gillnet configuration; and 3) record the bycatch of other NMFS regulated or protected species.

Methods

Field Studies: Through cooperative agreements with participating commercial harvesters, we examined catch rates of targeted species (e.g. monkfish and winter skate (*Leucoraja ocellata*) and bycatch of Atlantic sturgeon for two gillnet configurations. We utilized NMFS supplied gillnets which were 300 ft (91.4 m) in length and consisted of two configurations that varied in vertical profile. The control nets were comprised of 12 meshes x 12 in (30.5 cm) stretch mesh with four 48 in (1.2 m) mesh tie-downs spaced 24 ft (7.3 m) apart on alternating corks on the float line. The lower profile treatment nets were constructed of 6 meshes x 12 in (30.5 cm) stretch mesh with 24 in (0.6 m) tie-downs spaced every 12 ft (3.65 m) apart, which corresponded to the location of corks in the float line. Panels were constructed using Chatham green webbing (0.90mm) with a 0.50 hanging ratio, 0.375 in (9.5 mm) poly float line with five 1,100 lb (500 kg) weak links per panel spliced into a 0.31 in (7.9 mm) float line, and a 75 lb (34.1 kg) leadline (75 lb (34.1kg)/600 ft (182.8 m) spool). Each vessel deployed 40 panels of gillnet configured in 10 panel strings totaling 3,000 ft (914m). Each string comprised either control (standard profile) or treatment (low profile) nets. Cooperating monkfish harvesters fished the strings of gillnets as paired replicates, with the pair including both the control and treatment gillnets strings set in a similar location, at a similar depth, and fished for a similar amount of time. A total of 120 hauls of 60 replicates were completed, with hauls split evenly between vessels and the set sequence for net strings randomly selected at the start of the study. A copy of the haul schedule was kept on board each vessel and confirmed by the vessel master and NMFS trained observer.

Two monkfish fishing vessels (F/V Dana Christine and F/V Traveller II) employed normal gillnetting operations with soak times dependent upon fishing and weather conditions. Sampling operations took place in November and December of 2011 off the coast of New Jersey in waters which have historically supported commercial monkfish operations (Statistical Areas 614 and 615) (Figure 1) and where the vessel captains believed they would encounter Atlantic sturgeon. In the event of snags or tears, gillnet panels were either replaced entirely (if available), repaired on site if damage was minimal, or hauled and repaired on land if damage was sufficient to not allow at-sea repairs. Both fishing vessels operated in the same general vicinity, fishing inshore waters less than 100 m in depth. Effort was standardized to net days which were defined as 10 strings fished for a 24h period.

Fishing operations were monitored by NMFS trained observers (AIS Inc.) who recorded total weight and length measurements for all monkfish and other commercially landed species. In instances where the number of individuals per net string exceeded 100, a sub-sample (n=100) was randomly selected, and the total weight recorded. Atlantic sturgeon brought aboard the vessel were measured, weighed, a small tissue sample was recovered, and, in the case of mortalities, the pectoral girdles were removed for future age and growth studies. Atlantic sturgeon were scanned for the presence of a passive integrated transponder (PIT) tag. If no PIT tag was found in live individuals, a 12 mm 134.2 kHz PIT tag was implanted on the left side at the base of the dorsal fin and the fish were immediately released at the site of capture. In these instances the disposition (i.e., live vs. mortality) was recorded as was the vertical and horizontal location of the sturgeon capture in the net panel. In the case of the low-profile nets vertical location in the net panel was difficult to ascertain as the entire profile of the net was often bunched together.

Original data sheets (available upon request) were signed by both the vessel captain and fishery observer and then scanned to ensure quick data entry and secure back up of the data. Data sheets were then entered into a relational database for generation of tables to facilitate report writing and statistical analyses. All statistical analyses were conducted using JMP Version 9.0 (2011) using a paired comparison to test for differences in soak times and catch rates between gear types. We examined the role of soak times and Atlantic sturgeon size (FL) in influencing status (live/dead) at the time of capture through a logistic regression model. Catch-per-unit-effort (CPUE) was defined as weight (kg) landed per net day per 1000 yards of net, except for Atlantic sturgeon where numbers encountered were utilized. Statistical significance was inferred at $p \leq 0.05$.

Results and Discussion

All field sampling was conducted in NMFS Statistical Area 614 and 615 (Figure 1) and was initiated on Nov. 22, 2011 by the commercial fishing vessels F/V Dana Christine and F/V Traveller II. Operations were concluded on Dec. 14, 2011 at the completion of 120 net hauls (Table 1). Soak times for control gillnets averaged 32.24 hours (range = 5.4-97.4h), while the soak times for the lower profile treatment gillnets averaged 32.48 hours (range = 6.6-95.9h). There was no significant difference in the duration of soak time of control and treatment gillnets based on a paired comparison t-test (p = 0.7209).

A total of 11 identified species were encountered in the course of sampling, totaling 32,085 kg (Table 2). The vast majority of landings (95.1%) were of monkfish (7,687 kg), winter skate (21,655 kg) and spiny dogfish (*Squalus acanthias*) (1,175 kg). Discards of regulated species (i.e., monkfish, winter skate, and spiny dogfish) were limited by market conditions and quotas. During the course of this work, no marine mammals were caught in either control or treatment nets.

In total, 37 adult and juvenile Atlantic sturgeon with a mean size of 152.3 cm FL (range = 117-217 cm) were encountered during the course of the project ranging (Figure 2). Capture rates of Atlantic sturgeon varied significantly (p = 0.0079) by gillnet type (Figure 3), with 28 (75.7%) captured in control gillnets and the remaining nine (24.3%) captured in the lower profile treatment nets. During the first sampling event (Haul 1-F/V Dana Christine) an Atlantic sturgeon was captured during a short soak of the control gear, which doubled as an observer training trip. We have included this sampling event because it took place in the same general area as later sampling events although the soak time was markedly shorter. We were able to attain length measurements on a total of 33 Atlantic sturgeon, the vast majority (87.9%) of which were above the minimum size of maturity (130 cm FL) for Atlantic sturgeon (Van Eenennaam et al. 1996) (Table 3). We were unable to measure the remaining individuals because three of them escaped from the gillnets as the gear was being hauled from the water, and the final Atlantic sturgeon (Haul 81; 12-9-12) was dead and slid out of the net prior to coming aboard the vessel. Of the 28 Atlantic sturgeon captured in the control nets, we were able to assess the vertical placement of 10 in the net: five (50%) were located in the upper quarter of the net, four in the 2nd quarter, and the remaining individual was located in the 3rd quarter of the net. In the low profile treatment nets, Atlantic sturgeon tended to collapse the entire net which prohibited us from assigning vertical placement in all but four individuals. These four Atlantic sturgeon were distributed with one individual in the upper quarter, two in the 2nd quarter, and one in the 3rd quarter of the net. Although sample sizes are limited, these results appear to indicate Atlantic sturgeon catch rates are lowest at the bottom of the net. Sturgeons are traditionally referred to as benthic cruisers (Findeis 1997) though there is a growing body of evidence to suggest that they commonly are in the water column (Sulak et al. 2002, Erickson and Hightower 2007). Our limited results support the idea that sturgeons may occupy portions of the water column more frequently than previously thought.

Of the 37 Atlantic sturgeon observed through our sampling, a total of 25 (67.6%) were dead when landed, while the remaining 12 (32.4%) were released alive. A contingency analysis of Atlantic sturgeon mortalities between control and treatment captures was suggestive of a potential relationship ($p = 0.0606$), although the mortality rate appeared to be lower in the control gear (60.7%) than in the low profile treatment nets (88.9%). Due to low capture rates, we pooled across gillnet treatment types to examine the influence of soak time on Atlantic sturgeon disposition (i.e. live/dead) upon landing. The results of a logistic regression analysis of pooled Atlantic sturgeon encounters by soak time indicated that mortality rate was not significantly correlated with soak time ($p = 0.1608$) (Figure 4). Although it is intuitive that soak time plays a role in mediating survival risk in entangled individuals, the difficulty in assigning the actual timing of entanglement for individuals leads to much uncertainty. Although our results were not significant, they do appear to add to the growing body of evidence which suggests that the soak time of anchored gillnets may be positively correlated with mortality risk, especially in cases where soak times exceed 24h (Stein et al. 2004b, ASMFC 2007). In the present study, Atlantic sturgeon mortality rates increase from approximately 60% at 24h to almost 90% when soak times of 96h are reached.

Through our sampling efforts for this study, a total of 7,687 kg of monkfish were landed (Table 2). Slightly more than half (56.5%) of monkfish were landed in control nets. In total, landings in the treatment gear (3.341 kg) were 23.1% lower than landings in control gear (4,435 kg). The mean haul rate of monkfish for control gillnets was 70.1 kg/haul (95% CI 54.5 - 84.7) compared to a rate of 53.0 kg/haul (95% CI 41.4 – 64.7) for treatment gillnets. An examination of landings by gear type indicated that the vast majority of hauls landed monkfish at rates less than 150 kg/haul although there were six hauls (four control and two treatment gillnets) where monkfish landings exceeded 200kg/haul. Catch rates of monkfish (CPUE) were not significantly different between the gear types ($p = 0.1166$) (Figure 5), although the monkfish CPUE did differ significantly between vessels ($p = 0.0004$), reflecting the greater landings recorded on the F.V. Dana Christine (Table 4). Monkfish catch rates did not vary significantly by gear type for either fishing vessel indicated that both were still non-significant (Traveller II $p = .2766$; Dana Christine $p = .0734$) although there were marked differences in the probability estimates further suggesting differences between fishing vessels. The mean size of monkfish landed in the control gillnets was 71.3 cm TL (median = 71cm TL) while the mean size of monkfish landed in the lower profile treatments (72.1 cm TL) (median = 71cm TL) was slightly, although not significantly, larger ($p = 0.0817$) (Figure 6).

Winter skate, the dominant species landed by weight (21,655 kg), catch rates did not vary significantly ($p = 0.4212$) by gear type although the majority (55.1%) of landings were in the control gillnets (Figure 7). The landings of winter skate were significantly between vessels ($p = 0.0154$) with landings greatest on the F.V. Dana Christine (Table 5). Lengths of winter skate landed in the control gillnets (mean = 81.8 cm TL) were not significantly different ($p = 0.1616$) than those landed in the lower profile treatment nets (mean = 82.1cm TL) (Figure 8). Spiny dogfish which represented the species with the lowest landings considered commercially viable were landed at significantly lower levels ($p < 0.0001$) in the low profile treatment nets compared to the control gear (Figure 9). Similar to the other species, we also documented a significant difference in spiny dogfish landings between vessels, with the F.V. Dana Christine landing greater numbers (Table 5). Similar to our findings with monkfish and winter skate, we found no significant difference ($p = 0.8429$) between the lengths of spiny dogfish landed in the control gear (mean = 83.3 cm TL) and those landed in the lower profile treatment nets (mean = 83.1 cm TL).

Through this study we have provided quantifiable results suggesting that decreasing the net profile can significantly reduce the capture rates of critically imperiled Atlantic sturgeon. This finding provides hope that through continued modification and testing we can increase the levels of monkfish landed in the lower profile treatment gillnets to begin to approximate landings in traditional control nets. The use of modified net profiles has been examined in other systems (He 2006b) with mixed success; nevertheless providing hope for a technological solution to the issue surrounding Atlantic sturgeon bycatch in large mesh sink gillnets (ASMFC 2007). At the conclusion of the present study, both vessel captains felt strongly that modifying the treatment gear design to maintain the lowered profile but increasing the bag may help increase the landings of target species in future studies. We hope that these recommendations can be tested in further rigorous field trials.

Literature Cited

Atlantic States Marine Fisheries Commission (ASMFC). 2007. Special Report to the ASMFC Atlantic Sturgeon Management Board: Estimation of Atlantic sturgeon bycatch in coastal Atlantic commercial fisheries of New England and the Mid-Atlantic. 95 p.

Atlantic States Marine Fisheries Commission (ASMFC). 1998. Amendment 1 to the Interstate Fishery Management Plan for Atlantic sturgeon. Fishery Management Report No. 31 of the ASMFC. 43 pp.

Atlantic Sturgeon Status Review Team. 2007. Status review of Atlantic sturgeon (*Acipenser oxyrinchus oxyrinchus*). Report to National Marine Fisheries Service Regional Office. February 23, 2007. 174 pp.

Bachus, R.H. 1951. New and rare records of fishers from Labrador. Copeia 1951:288-294.

Bemis, W.E. and B. Kynard. 1997. Sturgeon rivers: an introduction to acipenseriform biogeography and life history. Environmental Biology of Fishes, 48: 167-183.

Borodin, N.A. 1925. Biological observations on the Atlantic sturgeon (*Acipenser sturio*). Transactions of the American Fisheries Society 55:184-190.

Cech, J.J., and S.I. Doroshov. 2004. Environmental requirements, preferences, and tolerance limits of North American sturgeons. Pages 73-86 *in* LeBreton, G.T.O., F.W.H. Beamish and R.S. McKinley, editors. Sturgeons and Paddlefish of North America. Kluwer Academic Publishers, Dordrecht, The Netherlands.

Cobb, J.N. 1900. The sturgeon fishery of Delaware River and Bay. Reports of United States Commission of Fish, 25:369-380.

Erickson, D. L., and J. E. Hightower. 2007. Oceanic distribution and behavior of green sturgeon (*Acipenser medirostris*). Pages 197–211 *in* J. Munro, J. E. Hightower, K. McKown, K. J. Sulak, A. W. Kahnle, and F. Caron, editors. Anadromous sturgeons: habitats, threats, and management. American Fisheries Society, Symposium 56, Bethesda, Maryland.

Findeis, E. K. 1997. Osteology and phylogenetic interrelationships of sturgeons (Acipenserids). Environmental Biology of Fishes 48: 73-126.

He, P. 2006a. Gillnets: gear design, fishing performance and conservation challenges. Marine Technology Society Journal. 40(3): 11-18.

He, P. 2006b. Effect of the headline height of gillnets on species selectivity in the Gulf of Maine. Fisheries Research 78: 252-256.

He, P. and M. Pol. 2010. Fish Behavior near Gillnets: Capture Processes and Influencing Factors. Pages 183-204 *In* P. He. editor Behavior of Marine Fishes: Capture Processes and Conservation. Willey-Blackwell. Ames, Iowa.

JMP, Version 9.0. 2011. SAS Institute Incorporated, Cary, NC, 1989-2011

Ludwig, A. 2002. When the American sea sturgeon swam east: a colder Baltic Sea greeted this fish from across the Atlantic Ocean in the Middle Ages. Nature 419: 447-448.

National Marine Fisheries Service (NMFS). 1998. Taking of Marine Mammals Incidental to Commercial Fishing Operations; Harbor Porpoise Take Reduction Plan Regulations (Final Rule). Fed Reg. 63(231):66464-66490.

Potter, E. C. E. and M. G. Pawson. 1991. Gill netting. Laboratory Leaflet 69. Ministry of Agriculture, Fisheries, and Food. Directorate of Fisheries Research Lowestoft

Saffron, I. 2002. Caviar. Broadway Books, New York, NY.

Secor, D.H. and J.R. Waldman. 1999. Historical abundance of Delaware Bay Atlantic sturgeon and potential rate of recovery. American Fisheries Society Symposium, 23:203-216.

Stein, A. B., K. D. Friedland, and M. Sutherland. 2004 a. Atlantic sturgeon marine distribution and habitat use along the northeastern coast of the United States. Transactions of the American Fisheries Society. 133: 527-537.

Stein, A. B., K. D. Friedland, and M. Sutherland. 2004 b. Atlantic sturgeon marine bycatch and mortality on the continental shelf of the Northeast United States. North American Journal of Fisheries Management. 24: 171-183.

Sulak, K. J., R. E. Edwards, G. W. Hill, and M. T. Randall. 2002. Why do sturgeons jump? Insights from acoustic investigations of the Gulf sturgeon in the Suwannee River, Florida, USA. Journal of Applied Ichthyology. 18:617–620.

Townsend, C.H. 1900. Statistics of the fisheries of the Middle Atlantic States. Part 26 of the Commissioner's Report to the U.S. Commission of Fish and Fisheries: 195-310.

U.S. Office of the Federal Register. 2010. Endangered and Threatened Wildlife and Plants; Proposed Listing Determinations for Three Distinct Population Segments of Atlantic Sturgeon in the Northeast Region. Federal Register 75:193(10 October 2010):61872–61903.

U.S. Office of the Federal Register. 2012a. Endangered and Threatened Wildlife and Plants; Threatened and Endangered Status for Distinct Population Segments of Atlantic Sturgeon in the Northeast Region. Federal Register 77:24(6 February 2012):5880–5912.

U.S. Office of the Federal Register. 2012b. Endangered and Threatened Wildlife and Plants; Final Listing Determinations for Two Distinct Population Segments of Atlantic Sturgeon (*Acipenser oxyrinchus oxyrinchus*) in the Southeast. Federal Register 77:24(6 February 2012):55914–5982.

Van Eenennaam, J. P., S. I. Doroshov, G. P. Moberg, J. G. Watson, D. S. Moore, and J. Linares. 1996. Reproductive conditions of the Atlantic sturgeon (*Acipenser oxyrinchus*) in the Hudson River. Estuaries 19: 769-777.

Vladykov, V.D., and J.R. Greely. 1963. Fishes of the Western North Atlantic 1:24-60.

Table 1: Sample locations (decimal degrees) and haul information for F.Vs. Dana Christine and Traveller II.

Haul Number	Pair	Vessel Name	Gear Type	Set Date	Latitude	Longitude	Haul Date	Soak Time (hours)
1	1	Dana	Control	11/22/2011	39.7835	-74.0335	11/22/2011	5.4
2	1	Dana	Treatment	11/22/2011	39.78356	-74.01692	11/22/2011	6.6
3	2	Dana	Control	11/22/2011	39.80017	-74.00022	11/22/2011	6.1
4	2	Dana	Treatment	11/22/2011	39.80019	-74	11/22/2011	6.8
5	3	Traveler II	Treatment	11/24/2011	39.83339	-73.95006	11/25/2011	20.1
6	3	Traveler II	Control	11/24/2011	39.83336	-73.93344	11/25/2011	21.1
7	4	Traveler II	Treatment	11/24/2011	39.81692	-73.91678	11/25/2011	22
8	4	Traveler II	Control	11/24/2011	39.81692	-73.90014	11/25/2011	22.8
9	5	Dana	Treatment	11/24/2011	39.85	-73.88347	11/25/2011	20.1
10	5	Dana	Control	11/24/2011	39.83358	-73.86686	11/25/2011	21
11	6	Dana	Treatment	11/24/2011	39.90019	-73.85025	11/25/2011	22.8
12	6	Dana	Control	11/24/2011	39.8335	-73.85006	11/25/2011	22.9
13	7	Dana	Control	11/25/2011	39.83358	-73.86686	11/26/2011	22.1
14	7	Dana	Treatment	11/25/2011	39.85	-73.88347	11/26/2011	22.3
15	8	Dana	Control	11/25/2011	39.8335	-73.85025	11/26/2011	21.7
16	8	Dana	Treatment	11/25/2011	39.8335	-73.85025	11/26/2011	22.6
17	9	Traveler II	Control	11/25/2011	39.83336	-73.93342	11/26/2011	21.8
18	9	Traveler II	Treatment	11/25/2011	39.81692	-73.91678	11/26/2011	21.8
19	10	Traveler II	Control	11/25/2011	39.83333	-73.90014	11/26/2011	22.5
20	10	Traveler II	Treatment	11/25/2011	39.83342	-73.95003	11/26/2011	26.3
21	11	Dana	Control	11/26/2011	39.83358	-73.86686	11/27/2011	21.8
22	11	Dana	Treatment	11/26/2011	39.85	-73.88347	11/27/2011	22.9
23	12	Dana	Treatment	11/26/2011	39.83342	-73.81692	11/27/2011	21.9
24	12	Dana	Control	11/26/2011	39.83336	-73.81669	11/27/2011	22.5
25	13	Traveler II	Control	11/26/2011	39.83333	-73.90011	11/27/2011	21.8
26	13	Traveler II	Treatment	11/26/2011	39.81692	-73.91678	11/27/2011	32.9
27	14	Traveler II	Treatment	11/26/2011	39.83342	-73.95006	11/27/2011	23.7
28	14	Traveler II	Control	11/26/2011	39.83336	-73.93342	11/27/2011	27.2
29	15	Dana	Treatment	11/27/2011	39.83342	-73.81692	11/28/2011	21.9
30	15	Dana	Control	11/27/2011	39.83336	-73.81692	11/28/2011	21.7
31	16	Dana	Control	11/27/2011	39.83358	-73.85025	11/28/2011	25
32	16	Dana	Treatment	11/27/2011	39.85008	-73.88344	11/28/2011	22.5
33	17	Traveler II	Control	11/27/2011	39.83333	-73.90014	11/28/2011	23.6
34	17	Traveler II	Treatment	11/27/2011	39.83333	-73.91678	11/28/2011	23
35	18	Traveler II	Control	11/27/2011	39.83336	-73.93342	11/28/2011	21.6
36	18	Traveler II	Treatment	11/27/2011	39.83342	-73.95	11/28/2011	23.7
37	19	Dana	Control	11/28/2011	39.85	-73.86686	12/2/2011	91.8
38	19	Dana	Treatment	11/28/2011	39.85008	-73.88344	12/2/2011	93.5
39	20	Dana	Treatment	11/28/2011	39.83347	-73.81692	12/2/2011	95.1
40	20	Dana	Control	11/28/2011	39.83342	-73.81669	12/2/2011	97.4
41	21	Traveler II	Control	11/28/2011	39.83333	-73.90014	12/2/2011	82.6
42	21	Traveler II	Treatment	11/28/2011	39.83333	-73.91678	12/2/2011	95.8
43	22	Traveler II	Control	11/28/2011	39.83339	-73.91683	12/2/2011	96.2
44	22	Traveler II	Treatment	11/28/2011	39.83342	-73.93347	12/2/2011	95.9
45	23	Dana	Treatment	12/2/2011	39.85006	-73.90011	12/4/2011	46
46	23	Dana	Control	12/2/2011	39.85	-73.86686	12/4/2011	46.6
47	24	Dana	Treatment	12/2/2011	39.83347	-73.81692	12/4/2011	44.5
48	24	Dana	Control	12/2/2011	39.83339	-73.81667	12/4/2011	46.5
49	25	Traveler II	Control	12/2/2011	39.83333	-73.88358	12/4/2011	47.3
50	25	Traveler II	Treatment	12/2/2011	39.81692	-73.91678	12/4/2011	47.5
51	26	Traveler II	Control	12/2/2011	39.83336	-73.93342	12/4/2011	46.4
52	26	Traveler II	Treatment	12/2/2011	39.83344	-73.93347	12/4/2011	45.9
53	27	Dana	Treatment	12/4/2011	39.85006	-73.88344	12/5/2011	22.7
54	27	Dana	Control	12/4/2011	39.85	-73.86692	12/5/2011	23.6
55	28	Dana	Control	12/4/2011	39.83347	-73.81692	12/5/2011	22.5
56	28	Dana	Treatment	12/4/2011	39.83339	-73.80025	12/5/2011	23
57	29	Traveler II	Control	12/4/2011	39.83333	-73.88358	12/5/2011	23.7
58	29	Traveler II	Treatment	12/4/2011	39.83344	-73.9335	12/5/2011	22.2
59	30	Traveler II	Treatment	12/4/2011	39.83333	-73.90022	12/5/2011	24.8

Table 1 continued: Sample locations (decimal degrees) and haul information for F.Vs. Dana Christine and Traveller II.

Haul Number	PAIR	Vessel Name	Gear Type	Set Date	Latitude	Longitude	Haul Date	Soak Time (hours)
60	30	Traveler II	Control	12/4/2011	39.83342	-73.91686	12/5/2011	26
61	31	Dana Christine	Treatment	12/5/2011	39.85014	-73.88347	12/6/2011	22.9
62	31	Dana Christine	Control	12/5/2011	39.85003	-73.86689	12/6/2011	23.3
63	32	Dana Christine	Control	12/5/2011	39.83347	-73.81692	12/6/2011	22.8
64	32	Dana Christine	Treatment	12/5/2011	39.83339	-73.80025	12/6/2011	23.7
65	33	Traveler II	Treatment	12/5/2011	39.83342	-73.95006	12/6/2011	22.6
66	33	Traveler II	Control	12/5/2011	39.83342	-73.93344	12/6/2011	20.1
67	34	Traveler II	Control	12/5/2011	39.83333	-73.88358	12/6/2011	24.9
68	34	Traveler II	Treatment	12/5/2011	39.83333	-73.91678	12/6/2011	24.2
69	35	Dana Christine	Control	12/6/2011	39.85011	-73.8835	12/7/2011	22
70	35	Dana Christine	Treatment	12/6/2011	39.85003	-73.86692	12/7/2011	22.8
71	36	Dana Christine	Control	12/6/2011	39.8335	-73.81692	12/7/2011	22.3
72	36	Dana Christine	Treatment	12/6/2011	39.83342	-73.81669	12/7/2011	22.8
73	37	Traveler II	Control	12/6/2011	39.83342	-73.93344	12/7/2011	22.5
74	37	Traveler II	Treatment	12/6/2011	39.83344	-73.9335	12/7/2011	24.2
75	38	Traveler II	Treatment	12/6/2011	39.83333	-73.91678	12/7/2011	22.5
76	38	Traveler II	Control	12/6/2011	39.83333	-73.90014	12/7/2011	23.9
77	39	Dana Christine	Control	12/7/2011	39.85014	-73.88342	12/9/2011	46
78	39	Dana Christine	Treatment	12/7/2011	39.85003	-73.86675	12/9/2011	47.3
79	40	Dana Christine	Treatment	12/7/2011	39.86675	-73.90025	12/9/2011	44.2
80	40	Dana Christine	Control	12/7/2011	39.86692	-73.91678	12/9/2011	43.2
81	41	Traveler II	Treatment	12/7/2011	39.83342	-73.95006	12/9/2011	45.6
82	41	Traveler II	Control	12/7/2011	39.83342	-73.93342	12/9/2011	47.1
83	42	Traveler II	Control	12/7/2011	39.83333	-73.90014	12/9/2011	46
84	42	Traveler II	Treatment	12/7/2011	39.83336	-73.91675	12/9/2011	47.9
85	43	Traveler II	Treatment	12/9/2011	39.83342	-73.95006	12/11/2011	48.5
86	43	Traveler II	Control	12/9/2011	39.83333	-73.90014	12/11/2011	47.6
87	44	Traveler II	Treatment	12/9/2011	39.83336	-73.91672	12/11/2011	47.7
88	44	Traveler II	Control	12/9/2011	39.83342	-73.93342	12/11/2011	50.3
89	45	Dana Christine	Treatment	12/9/2011	39.86686	-73.90011	12/11/2011	20.1
90	45	Dana Christine	Control	12/9/2011	39.88336	-73.93339	12/11/2011	21.3
91	46	Dana Christine	Treatment	12/9/2011	39.85011	-73.86692	12/11/2011	25.1
92	46	Dana Christine	Control	12/9/2011	39.85014	-73.86692	12/11/2011	26
93	47	Dana Christine	Control	12/11/2011	39.88336	-73.93336	12/12/2011	21.9
94	47	Dana Christine	Treatment	12/11/2011	39.86692	-73.91669	12/12/2011	22.5
95	48	Dana Christine	Control	12/11/2011	39.86692	-73.93358	12/12/2011	21.6
96	48	Dana Christine	Treatment	12/11/2011	39.86692	-73.95025	12/12/2011	22.4
97	49	Traveler II	Control	12/11/2011	39.83333	-73.88356	12/12/2011	20.3
98	49	Traveler II	Treatment	12/11/2011	39.83336	-73.90022	12/12/2011	21.3
99	50	Traveler II	Control	12/11/2011	39.83339	-73.91681	12/12/2011	20.9
100	50	Traveler II	Treatment	12/11/2011	39.81681	-73.9	12/12/2011	25
101	51	Traveler II	Control	12/12/2011	39.83333	-73.90014	12/13/2011	23.5
102	51	Traveler II	Treatment	12/12/2011	39.81692	-73.95022	12/13/2011	20.3
103	52	Traveler II	Control	12/12/2011	39.83344	-73.93342	12/13/2011	23.7
104	52	Traveler II	Treatment	12/12/2011	39.83336	-73.91678	12/13/2011	25.2
105	53	Dana Christine	Control	12/12/2011	39.86683	-73.93339	12/13/2011	22.4
106	53	Dana Christine	Treatment	12/12/2011	39.95017	-73.91675	12/13/2011	23.5
107	54	Dana Christine	Control	12/12/2011	39.86686	-73.95	12/13/2011	22.3
108	54	Dana Christine	Treatment	12/12/2011	39.86689	-73.95022	12/13/2011	23.5
109	55	Dana Christine	Control	12/13/2011	39.86683	-73.93339	12/14/2011	22.4
110	55	Dana Christine	Treatment	12/13/2011	39.86683	-73.91675	12/14/2011	23.4
111	56	Dana Christine	Treatment	12/13/2011	39.86689	-73.95022	12/14/2011	22.1
112	56	Dana Christine	Control	12/13/2011	39.86683	-73.93358	12/14/2011	22.8
113	57	Traveler II	Control	12/13/2011	39.83333	-73.93344	12/14/2011	23.7
114	57	Traveler II	Treatment	12/13/2011	39.81689	-73.96675	12/14/2011	23.8
115	58	Traveler II	Treatment	12/13/2011	39.83339	-73.91678	12/14/2011	22.9
116	58	Traveler II	Control	12/13/2011	39.83344	-73.93339	12/14/2011	24.6
117	59	Traveler II	Treatment	12/14/2011	39.83339	-73.91678	12/17/2011	57.7
118	59	Traveler II	Control	12/14/2011	39.83344	-73.93339	12/17/2011	58.1
119	60	Traveler II	Control	12/14/2011	39.75	-73.95003	12/17/2011	73.8
120	60	Traveler II	Treatment	12/14/2011	39.81689	-73.96678	12/17/2011	62.1

Table 2: Summary of catch weight (kg) for identified and weighed species by both vessel and gear type. Note: table does not include Atlantic sturgeon where weights were estimated due to escapement at the vessel where interactions were recorded.

Vessel Name	Gear Type	Atlantic Sturgeon	Bluefish	Clearnose Skate	Horseshoe Crab	Little Skate	Monkfish	Unknown Seastar	Unknown Skate	Spiny Dogfish	Summer Flounder	Weakfish	Winter Skate
Dana Christine	Control	383	11	8	41	29	2208	2	0	634	11	2	6127
Dana Christine	Treatment	113	7	4	45	6	1381	6	0	156	0	0	4482
Traveler II	Control	496	13	2	34	0	2138	0	93	307	14	0	5794
Traveler II	Treatment	120	12	6	48	0	1961	0	61	78	0	0	5252
	Control	879	24	10	75	29	4345	2	93	941	24	2	11921
	Treatment	234	19	10	93	6	3341	6	61	235	0	0	9734
	Total Weights	1113	43	20	168	36	7687	8	154	1175	24	2	21655

Table 3: Summary of Atlantic sturgeon captures by haul number, with information on vessel, gear type, dates, soak times, weight, fork length, and individual status. Missing values were not recorded due to escapement. Weights estimated by vessel captains prior to escapement are noted by *.

Haul Number	Vessel Name	Gear Type	Set Date	Haul Date	Soak Time (hours)	Weight (kg)	Fork Length (cm)	Status
1	Dana Christine	Control 2	11/22/2011	11/22/2011	5.4	40*	NA	alive
6	Traveler II	Control 2	11/24/2011	11/25/2011	21.1	23	144	dead
8	Traveler II	Control 2	11/24/2011	11/25/2011	22.8	50	217	dead
9	Dana Christine	Treatment 2	11/24/2011	11/25/2011	20.1	23	156	dead
13	Dana Christine	Control 2	11/25/2011	11/26/2011	22.1	23	145	dead
15	Dana Christine	Control 2	11/25/2011	11/26/2011	21.7	66	185	alive
15	Dana Christine	Control 2	11/25/2011	11/26/2011	21.7	66	145	dead
18	Traveler II	Treatment 2	11/25/2011	11/26/2011	21.8	12	124	dead
19	Traveler II	Control 2	11/25/2011	11/26/2011	22.5	45	191	alive
27	Traveler II	Treatment 2	11/26/2011	11/27/2011	23.7	36	160	alive
28	Traveler II	Control 2	11/26/2011	11/27/2011	27.2	20	134	dead
29	Dana Christine	Treatment 2	11/27/2011	11/28/2011	21.9	68	187	dead
31	Dana Christine	Control 2	11/27/2011	11/28/2011	25	63	166	dead
37	Dana Christine	Control 2	11/28/2011	12/2/2011	91.8	18	136	dead
41	Traveler II	Control 2	11/28/2011	12/2/2011	82.6	73	174	dead
41	Traveler II	Control 2	11/28/2011	12/2/2011	82.6	73	164	dead
41	Traveler II	Control 2	11/28/2011	12/2/2011	82.6	73	144	alive
42	Traveler II	Treatment 2	11/28/2011	12/2/2011	95.8	10	122	dead
43	Traveler II	Control 2	11/28/2011	12/2/2011	96.2	79	154	dead
43	Traveler II	Control 2	11/28/2011	12/2/2011	96.2	79	154	dead
43	Traveler II	Control 2	11/28/2011	12/2/2011	96.2	79	170	dead
44	Traveler II	Treatment 2	11/28/2011	12/2/2011	95.9	32	152	dead
45	Dana Christine	Treatment 2	12/2/2011	12/4/2011	46	23	139	dead
46	Dana Christine	Control 2	12/2/2011	12/4/2011	46.6	27	117	alive
51	Traveler II	Control 2	12/2/2011	12/4/2011	46.4	25	135	alive
57	Traveler II	Control 2	12/4/2011	12/5/2011	23.7	29	144	alive
60	Traveler II	Control 2	12/4/2011	12/5/2011	26	43	173	dead
62	Dana Christine	Control 2	12/5/2011	12/6/2011	23.3	27	134	alive
66	Traveler II	Control 2	12/5/2011	12/6/2011	20.1	45*	NA	alive
68	Traveler II	Treatment 2	12/5/2011	12/6/2011	24.2	29	141	dead
71	Dana Christine	Control 2	12/6/2011	12/7/2011	22.3	23	135	dead
73	Traveler II	Control 2	12/6/2011	12/7/2011	22.5	41	163	dead
81	Traveler II	Treatment 2	12/7/2011	12/9/2011	45.6	NA	NA	dead
90	Dana Christine	Control 2	12/9/2011	12/11/2011	21.3	77*	NA	alive
90	Dana Christine	Control 2	12/9/2011	12/11/2011	21.3	77	152	dead
107	Dana Christine	Control 2	12/12/2011	12/13/2011	22.3	18	128	dead
118	Traveler II	Control 2	12/14/2011	12/17/2011	58.1	23	142	alive

Table 4: Catch information for monkfish (target species). Table includes kept fish only.

Haul	Vessel	Set Date	Haul Date	Soak Time (hours)	Gear	Monkfish Landed	Total Weight of Monkfish (kg)	Median Total Length (cm)
1	Dana Christine	11/22/11	11/22/11	5.4	Control	0	0.0	NA
2	Dana Christine	11/22/11	11/22/11	6.6	Treatment	1	7.3	73
3	Dana Christine	11/22/11	11/22/11	6.1	Control	1	6.8	71
4	Dana Christine	11/22/11	11/22/11	6.8	Treatment	0	0.0	NA
5	Traveler II	11/24/11	11/25/11	20.1	Treatment	9	579.6	72
6	Traveler II	11/24/11	11/25/11	21.1	Control	12	1235.4	68
7	Traveler II	11/24/11	11/25/11	22	Treatment	10	666.7	74
8	Traveler II	11/24/11	11/25/11	22.8	Control	7	387.3	73
9	Dana Christine	11/24/11	11/25/11	20.1	Treatment	9	449.0	74
10	Dana Christine	11/24/11	11/25/11	21	Control	9	483.7	73
11	Dana Christine	11/24/11	11/25/11	22.8	Treatment	4	75.3	68
12	Dana Christine	11/24/11	11/25/11	22.9	Control	14	1368.3	70
13	Dana Christine	11/25/11	11/26/11	22.1	Control	7	288.9	75
14	Dana Christine	11/25/11	11/26/11	22.3	Treatment	6	274.8	78
15	Dana Christine	11/25/11	11/26/11	21.7	Control	8	321.1	69
16	Dana Christine	11/25/11	11/26/11	22.6	Treatment	1	5.4	62
17	Traveler II	11/25/11	11/26/11	21.8	Control	1	7.3	80
18	Traveler II	11/25/11	11/26/11	21.8	Treatment	5	158.7	71
19	Traveler II	11/25/11	11/26/11	22.5	Control	6	302.0	63
20	Traveler II	11/25/11	11/26/11	26.3	Treatment	3	76.2	80
21	Dana Christine	11/26/11	11/27/11	21.8	Control	13	1016.0	75
22	Dana Christine	11/26/11	11/27/11	22.9	Treatment	18	1534.7	70.5
23	Dana Christine	11/26/11	11/27/11	21.9	Treatment	13	1214.5	76
24	Dana Christine	11/26/11	11/27/11	22.5	Control	9	487.8	71
25	Traveler II	11/26/11	11/27/11	21.8	Control	12	810.9	66
26	Traveler II	11/26/11	11/27/11	32.9	Treatment	14	1644.4	72.5
27	Traveler II	11/26/11	11/27/11	23.7	Treatment	17	2243.5	68
28	Traveler II	11/26/11	11/27/11	27.2	Control	16	1850.3	69.5
29	Dana Christine	11/27/11	11/28/11	21.9	Treatment	15	104.5	74
30	Dana Christine	11/27/11	11/28/11	21.7	Control	6	370.1	65
31	Dana Christine	11/27/11	11/28/11	25	Control	16	1542.0	69.5
32	Dana Christine	11/27/11	11/28/11	22.5	Treatment	6	217.7	75
33	Traveler II	11/27/11	11/28/11	23.6	Control	15	1449.0	73
34	Traveler II	11/27/11	11/28/11	23	Treatment	5	170.1	89
35	Traveler II	11/27/11	11/28/11	21.6	Control	17	1842.6	75
36	Traveler II	11/27/11	11/28/11	23.7	Treatment	15	1251.7	70
37	Dana Christine	11/28/11	12/2/11	91.8	Control	45	11142.9	72
38	Dana Christine	11/28/11	12/2/11	93.5	Treatment	29	4313.8	73
39	Dana Christine	11/28/11	12/2/11	95.1	Treatment	15	1517.0	71
40	Dana Christine	11/28/11	12/2/11	97.4	Control	42	8304.8	70
41	Traveler II	11/28/11	12/2/11	82.6	Control	21	2695.2	69
42	Traveler II	11/28/11	12/2/11	95.8	Treatment	36	9142.9	70.5
43	Traveler II	11/28/11	12/2/11	96.2	Control	39	10523.8	70
44	Traveler II	11/28/11	12/2/11	95.9	Treatment	24	4767.3	70.5
45	Dana Christine	12/2/11	12/4/11	46	Treatment	7	279.4	75
46	Dana Christine	12/2/11	12/4/11	46.6	Control	14	730.2	72
47	Dana Christine	12/2/11	12/4/11	44.5	Treatment	5	146.3	69
48	Dana Christine	12/2/11	12/4/11	46.5	Control	23	3040.6	72
49	Traveler II	12/2/11	12/4/11	47.3	Control	12	876.2	67.5
50	Traveler II	12/2/11	12/4/11	47.5	Treatment	8	475.3	73
51	Traveler II	12/2/11	12/4/11	46.4	Control	19	2386.8	70
52	Traveler II	12/2/11	12/4/11	45.9	Treatment	10	734.7	74
53	Dana Christine	12/4/11	12/5/11	22.7	Treatment	5	189.3	78
54	Dana Christine	12/4/11	12/5/11	23.6	Control	2	15.4	65.5
55	Dana Christine	12/4/11	12/5/11	22.5	Control	2	40.8	68.5
56	Dana Christine	12/4/11	12/5/11	23	Treatment	0	0.0	NA
57	Traveler II	12/4/11	12/5/11	23.7	Control	5	208.6	73
58	Traveler II	12/4/11	12/5/11	22.2	Treatment	5	163.3	66
59	Traveler II	12/4/11	12/5/11	24.8	Treatment	6	166.0	67

Table 4 (continued): Catch information for monkfish (target species). Table includes kept fish only.

Haul	Vessel	Set Date	Haul Date	Soak Time (hours)	Gear	Monkfish Landed	Total Weight of Monkfish (kg)	Median Total Length (cm)
60	Traveler II	12/4/11	12/5/11	26	Control	4	42.2	69
61	Dana Christine	12/5/11	12/6/11	22.9	Treatment	7	290.5	68
62	Dana Christine	12/5/11	12/6/11	23.3	Control	0	0.0	NA
63	Dana Christine	12/5/11	12/6/11	22.8	Control	13	834.2	69
64	Dana Christine	12/5/11	12/6/11	23.7	Treatment	14	1507.9	72
65	Traveler II	12/5/11	12/6/11	22.6	Treatment	6	223.1	71.5
66	Traveler II	12/5/11	12/6/11	20.1	Control	4	154.2	73.5
67	Traveler II	12/5/11	12/6/11	24.9	Control	4	90.7	67
68	Traveler II	12/5/11	12/6/11	24.2	Treatment	7	251.7	74
69	Dana Christine	12/6/11	12/7/11	22	Control	8	288.4	67.5
70	Dana Christine	12/6/11	12/7/11	22.8	Treatment	5	185.9	74
71	Dana Christine	12/6/11	12/7/11	22.3	Control	12	955.1	73
72	Dana Christine	12/6/11	12/7/11	22.8	Treatment	3	65.3	85
73	Traveler II	12/6/11	12/7/11	22.5	Control	8	446.3	68
74	Traveler II	12/6/11	12/7/11	24.2	Treatment	0	0.0	NA
75	Traveler II	12/6/11	12/7/11	22.5	Treatment	6	190.5	70.5
76	Traveler II	12/6/11	12/7/11	23.9	Control	3	59.9	69
77	Dana Christine	12/7/11	12/9/11	46	Control	17	1534.2	73
78	Dana Christine	12/7/11	12/9/11	47.3	Treatment	17	1133.3	70
79	Dana Christine	12/7/11	12/9/11	44.2	Treatment	11	725.9	71
80	Dana Christine	12/7/11	12/9/11	43.2	Control	14	676.2	73
81	Traveler II	12/7/11	12/9/11	45.6	Treatment	7	393.7	72
82	Traveler II	12/7/11	12/9/11	47.1	Control	23	3390.0	73
83	Traveler II	12/7/11	12/9/11	46	Control	19	2455.8	73
84	Traveler II	12/7/11	12/9/11	47.9	Treatment	11	713.4	71
85	Traveler II	12/9/11	12/11/11	48.5	Treatment	9	506.1	70
86	Traveler II	12/9/11	12/11/11	47.6	Control	11	793.2	70
87	Traveler II	12/9/11	12/11/11	47.7	Treatment	14	1415.9	72
88	Traveler II	12/9/11	12/11/11	50.3	Control	12	995.9	70.5
89	Dana Christine	12/9/11	12/11/11	20.1	Treatment	19	2115.4	72
90	Dana Christine	12/9/11	12/11/11	21.3	Control	30	6966.0	79
91	Dana Christine	12/9/11	12/11/11	25.1	Treatment	8	495.2	76
92	Dana Christine	12/9/11	12/11/11	26	Control	19	1826.8	71
93	Dana Christine	12/11/11	12/12/11	21.9	Control	6	306.1	77.5
94	Dana Christine	12/11/11	12/12/11	22.5	Treatment	4	67.1	73
95	Dana Christine	12/11/11	12/12/11	21.6	Control	6	247.6	68
96	Dana Christine	12/11/11	12/12/11	22.4	Treatment	5	248.3	80
97	Traveler II	12/11/11	12/12/11	20.3	Control	7	298.4	69
98	Traveler II	12/11/11	12/12/11	21.3	Treatment	6	239.5	74.5
99	Traveler II	12/11/11	12/12/11	20.9	Control	5	197.3	74
100	Traveler II	12/11/11	12/12/11	25	Treatment	4	107.0	71
101	Traveler II	12/12/11	12/13/11	23.5	Control	2	37.2	73.5
102	Traveler II	12/12/11	12/13/11	20.3	Treatment	4	99.8	71
103	Traveler II	12/12/11	12/13/11	23.7	Control	3	65.3	70
104	Traveler II	12/12/11	12/13/11	25.2	Treatment	2	28.1	77.5
105	Dana Christine	12/12/11	12/13/11	22.4	Control	5	111.1	65
106	Dana Christine	12/12/11	12/13/11	23.5	Treatment	1	10.2	85
107	Dana Christine	12/12/11	12/13/11	22.3	Control	5	196.1	75
108	Dana Christine	12/12/11	12/13/11	23.5	Treatment	3	56.5	67
109	Dana Christine	12/13/11	12/14/11	22.4	Control	10	532.9	70.5
110	Dana Christine	12/13/11	12/14/11	23.4	Treatment	6	231.3	75
111	Dana Christine	12/13/11	12/14/11	22.1	Treatment	3	54.4	75
112	Dana Christine	12/13/11	12/14/11	22.8	Control	13	1241.0	75
113	Traveler II	12/13/11	12/14/11	23.7	Control	4	85.3	66.5
114	Traveler II	12/13/11	12/14/11	23.8	Treatment	8	413.6	72
115	Traveler II	12/13/11	12/14/11	22.9	Treatment	6	291.2	79
116	Traveler II	12/13/11	12/14/11	24.6	Control	1	89.8	62
117	Traveler II	12/14/11	12/17/11	57.7	Treatment	12	903.4	68
118	Traveler II	12/14/11	12/17/11	58.1	Control	8	410.0	69
119	Traveler II	12/14/11	12/17/11	73.8	Control	2	28.1	74
120	Traveler II	12/14/11	12/17/11	62.1	Treatment	6	326.5	71.5

Table 5: Catch information for winter skate and spiny dogfish (target species). Missing values represent no landings or that a variable was not recorded on the vessel.

Haul Numbers	Vessel	Geat Type	Set Date	Haul Date	Soak Time (hour)	Winter Skate Weight (kg)	Winter Skate Mean Length (cm)	Spiny Dogfish Weight (kg)	Spiny Dogfish Mean Length (cm)
1	Dana Christine	Control 2	11/22/2011	11/22/2011	5.4	433	80		
2	Dana Christine	Treatment 2	11/22/2011	11/22/2011	6.6	410	80	11	87
3	Dana Christine	Control 2	11/22/2011	11/22/2011	6.1	210	81		
4	Dana Christine	Treatment 2	11/22/2011	11/22/2011	6.8	221	83		
5	Traveler II	Treatment 2	11/24/2011	11/25/2011	20.1	259	83		
6	Traveler II	Control 2	11/24/2011	11/25/2011	21.1	231	82	5	
7	Traveler II	Treatment 2	11/24/2011	11/25/2011	22	188	82		
8	Traveler II	Control 2	11/24/2011	11/25/2011	22.8	304	81	2	
9	Dana Christine	Treatment 2	11/24/2011	11/25/2011	20.1	201	84		
10	Dana Christine	Control 2	11/24/2011	11/25/2011	21	398	81	15	
11	Dana Christine	Treatment 2	11/24/2011	11/25/2011	22.8	260	80		
12	Dana Christine	Control 2	11/24/2011	11/25/2011	22.9	349	82		
13	Dana Christine	Control 2	11/25/2011	11/26/2011	22.1	319	80	17	88
14	Dana Christine	Treatment 2	11/25/2011	11/26/2011	22.3	209	82		86
15	Dana Christine	Control 2	11/25/2011	11/26/2011	21.7	153	82	9	87
16	Dana Christine	Treatment 2	11/25/2011	11/26/2011	22.6	227	82	8	84
17	Traveler II	Control 2	11/25/2011	11/26/2011	21.8	278	83	5	
18	Traveler II	Treatment 2	11/25/2011	11/26/2011	21.8	266	83		
19	Traveler II	Control 2	11/25/2011	11/26/2011	22.5	218	80		
20	Traveler II	Treatment 2	11/25/2011	11/26/2011	26.3	237	81		
21	Dana Christine	Control 2	11/26/2011	11/27/2011	21.8	159	84	23	90
22	Dana Christine	Treatment 2	11/26/2011	11/27/2011	22.9	87	82		
23	Dana Christine	Treatment 2	11/26/2011	11/27/2011	21.9	99	83	3	76
24	Dana Christine	Control 2	11/26/2011	11/27/2011	22.5	59	85	13	89
25	Traveler II	Control 2	11/26/2011	11/27/2011	21.8	171	82	5	
26	Traveler II	Treatment 2	11/26/2011	11/27/2011	32.9	160	84		
27	Traveler II	Treatment 2	11/26/2011	11/27/2011	23.7	118	83	5	
28	Traveler II	Control 2	11/26/2011	11/27/2011	27.2	127	85		
29	Dana Christine	Treatment 2	11/27/2011	11/28/2011	21.9	29	86		
30	Dana Christine	Control 2	11/27/2011	11/28/2011	21.7	74	87	6	93
31	Dana Christine	Control 2	11/27/2011	11/28/2011	25	115	85	9	87
32	Dana Christine	Treatment 2	11/27/2011	11/28/2011	22.5	73	81	8	87
33	Traveler II	Control 2	11/27/2011	11/28/2011	23.6	100	82	13	74
34	Traveler II	Treatment 2	11/27/2011	11/28/2011	23	75	86	2	73
35	Traveler II	Control 2	11/27/2011	11/28/2011	21.6	71	84	2	76
36	Traveler II	Treatment 2	11/27/2011	11/28/2011	23.7	43	81	6	84
37	Dana Christine	Control 2	11/28/2011	12/2/2011	91.8	389	82	196	88
38	Dana Christine	Treatment 2	11/28/2011	12/2/2011	93.5	338	83	16	88
39	Dana Christine	Treatment 2	11/28/2011	12/2/2011	95.1	348	84	10	86
40	Dana Christine	Control 2	11/28/2011	12/2/2011	97.4	336	86	34	86
41	Traveler II	Control 2	11/28/2011	12/2/2011	82.6	413	85	11	
42	Traveler II	Treatment 2	11/28/2011	12/2/2011	95.8	257	85		
43	Traveler II	Control 2	11/28/2011	12/2/2011	96.2	331	81		
44	Traveler II	Treatment 2	11/28/2011	12/2/2011	95.9	343	83	7	
45	Dana Christine	Treatment 2	12/2/2011	12/4/2011	46	145	82	10	86
46	Dana Christine	Control 2	12/2/2011	12/4/2011	46.6	164	84	22	87
47	Dana Christine	Treatment 2	12/2/2011	12/4/2011	44.5	257	84	5	87
48	Dana Christine	Control 2	12/2/2011	12/4/2011	46.5	350	84	11	84
49	Traveler II	Control 2	12/2/2011	12/4/2011	47.3	166	82	24	80
50	Traveler II	Treatment 2	12/2/2011	12/4/2011	47.5	103	82	5	75
51	Traveler II	Control 2	12/2/2011	12/4/2011	46.4	116	83	14	76
52	Traveler II	Treatment 2	12/2/2011	12/4/2011	45.9	59	81	9	75
53	Dana Christine	Treatment 2	12/4/2011	12/5/2011	22.7	71	83	2	84
54	Dana Christine	Control 2	12/4/2011	12/5/2011	23.6	56	81	41	86
55	Dana Christine	Control 2	12/4/2011	12/5/2011	22.5	180	83	29	85
56	Dana Christine	Treatment 2	12/4/2011	12/5/2011	23	43	84	1	
57	Traveler II	Control 2	12/4/2011	12/5/2011	23.7	78	81	16	77
58	Traveler II	Treatment 2	12/4/2011	12/5/2011	22.2	62	84	5	76

Table 5 (continued): Catch information for winter skate and spiny dogfish (target species). Missing values represent no landings or that a variable was not recorded on the vessel.

Haul Numbers	Vessel	Geat Type	Set Date	Haul Date	Soak Time (hour)	Winter Skate Weight (kg)	Winter Skate Mean Length (cm)	Spiny Dogfish Weight (kg)	Spiny Dogfish Mean Length (cm)
59	Traveler II	Treatment 2	12/4/2011	12/5/2011	24.8	56	84		
60	Traveler II	Control 2	12/4/2011	12/5/2011	26	81	85	26	76
61	Dana Christine	Treatment 2	12/5/2011	12/6/2011	22.9	62	81	5	87
62	Dana Christine	Control 2	12/5/2011	12/6/2011	23.3	73	78	14	85
63	Dana Christine	Control 2	12/5/2011	12/6/2011	22.8	100	83	35	87
64	Dana Christine	Treatment 2	12/5/2011	12/6/2011	23.7	30	83	4	79
65	Traveler II	Treatment 2	12/5/2011	12/6/2011	22.6	22	84	5	72
66	Traveler II	Control 2	12/5/2011	12/6/2011	20.1	79	82	22	78
67	Traveler II	Control 2	12/5/2011	12/6/2011	24.9	80	79	47	77
68	Traveler II	Treatment 2	12/5/2011	12/6/2011	24.2	61	83		
69	Dana Christine	Control 2	12/6/2011	12/7/2011	22	111	85	23	86
70	Dana Christine	Treatment 2	12/6/2011	12/7/2011	22.8	53	84	7	86
71	Dana Christine	Control 2	12/6/2011	12/7/2011	22.3	113	85	6	92
72	Dana Christine	Treatment 2	12/6/2011	12/7/2011	22.8	22	83	5	84
73	Traveler II	Control 2	12/6/2011	12/7/2011	22.5	125	84	2	77
74	Traveler II	Treatment 2	12/6/2011	12/7/2011	24.2	94	82	2	74
75	Traveler II	Treatment 2	12/6/2011	12/7/2011	22.5	128	85	3	71
76	Traveler II	Control 2	12/6/2011	12/7/2011	23.9	148	85	9	77
77	Dana Christine	Control 2	12/7/2011	12/9/2011	46	255	76	21	85
78	Dana Christine	Treatment 2	12/7/2011	12/9/2011	47.3	212	83	6	90
79	Dana Christine	Treatment 2	12/7/2011	12/9/2011	44.2	129	84	13	89
80	Dana Christine	Control 2	12/7/2011	12/9/2011	43.2	134	83	8	87
81	Traveler II	Treatment 2	12/7/2011	12/9/2011	45.6	216	82	5	75
82	Traveler II	Control 2	12/7/2011	12/9/2011	47.1	278	82	10	79
83	Traveler II	Control 2	12/7/2011	12/9/2011	46	408	79	20	75
84	Traveler II	Treatment 2	12/7/2011	12/9/2011	47.9	204	80	6	74
85	Traveler II	Treatment 2	12/9/2011	12/11/2011	48.5	99	82	7	
86	Traveler II	Control 2	12/9/2011	12/11/2011	47.6	269	81	14	
87	Traveler II	Treatment 2	12/9/2011	12/11/2011	47.7	195	81		
88	Traveler II	Control 2	12/9/2011	12/11/2011	50.3	205	85	16	
89	Dana Christine	Treatment 2	12/9/2011	12/11/2011	20.1	196	82	11	86
90	Dana Christine	Control 2	12/9/2011	12/11/2011	21.3	460	83	27	87
91	Dana Christine	Treatment 2	12/9/2011	12/11/2011	25.1	103	82	5	82
92	Dana Christine	Control 2	12/9/2011	12/11/2011	26	187	80	6	87
93	Dana Christine	Control 2	12/11/2011	12/12/2011	21.9	177	82	10	87
94	Dana Christine	Treatment 2	12/11/2011	12/12/2011	22.5	139	85	4	100
95	Dana Christine	Control 2	12/11/2011	12/12/2011	21.6	345	82	6	89
96	Dana Christine	Treatment 2	12/11/2011	12/12/2011	22.4	251	81		
97	Traveler II	Control 2	12/11/2011	12/12/2011	20.3	259	79		
98	Traveler II	Treatment 2	12/11/2011	12/12/2011	21.3	204	81		
99	Traveler II	Control 2	12/11/2011	12/12/2011	20.9	236	79	7	59
100	Traveler II	Treatment 2	12/11/2011	12/12/2011	25	327	78		
101	Traveler II	Control 2	12/12/2011	12/13/2011	23.5	29	76	7	80
102	Traveler II	Treatment 2	12/12/2011	12/13/2011	20.3	149	79		
103	Traveler II	Control 2	12/12/2011	12/13/2011	23.7	81	78	7	78
104	Traveler II	Treatment 2	12/12/2011	12/13/2011	25.2	66	82		
105	Dana Christine	Control 2	12/12/2011	12/13/2011	22.4	108	81	23	88
106	Dana Christine	Treatment 2	12/12/2011	12/13/2011	23.5	83	83	9	81
107	Dana Christine	Control 2	12/12/2011	12/13/2011	22.3	111	82	13	91
108	Dana Christine	Treatment 2	12/12/2011	12/13/2011	23.5	46	81	2	84
109	Dana Christine	Control 2	12/13/2011	12/14/2011	22.4	68	82	6	85
110	Dana Christine	Treatment 2	12/13/2011	12/14/2011	23.4	64	85	2	82
111	Dana Christine	Treatment 2	12/13/2011	12/14/2011	22.1	76	82	7	88
112	Dana Christine	Control 2	12/13/2011	12/14/2011	22.8	141	84	9	88
113	Traveler II	Control 2	12/13/2011	12/14/2011	23.7	133	80	2	68
114	Traveler II	Treatment 2	12/13/2011	12/14/2011	23.8	93	79	4	82
115	Traveler II	Treatment 2	12/13/2011	12/14/2011	22.9	78	80		
116	Traveler II	Control 2	12/13/2011	12/14/2011	24.6	94	80	17	75
117	Traveler II	Treatment 2	12/14/2011	12/17/2011	57.7	551	79	5	
118	Traveler II	Control 2	12/14/2011	12/17/2011	58.1	299	80		
119	Traveler II	Control 2	12/14/2011	12/17/2011	73.8	388	78	6	
120	Traveler II	Treatment 2	12/14/2011	12/17/2011	62.1	540	81	3	

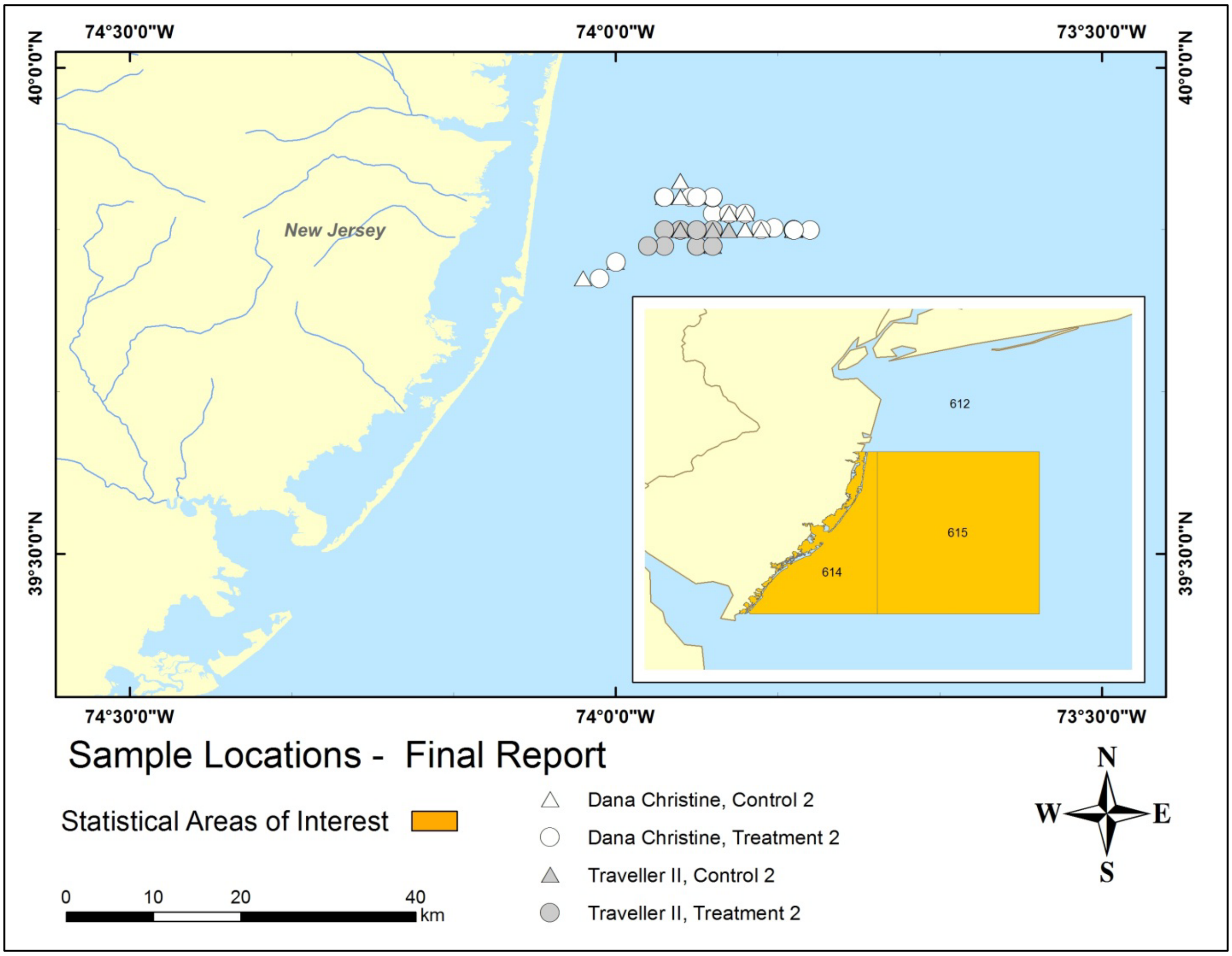


Figure 1: Location of gillnet sampling areas within NMFS Statistical Area 614 and 615 (inset) plotted by net type (triangle= control, circles = treatment) and vessel (white symbols = F.V. Dana Christine, gray symbols = F/V Traveller II).

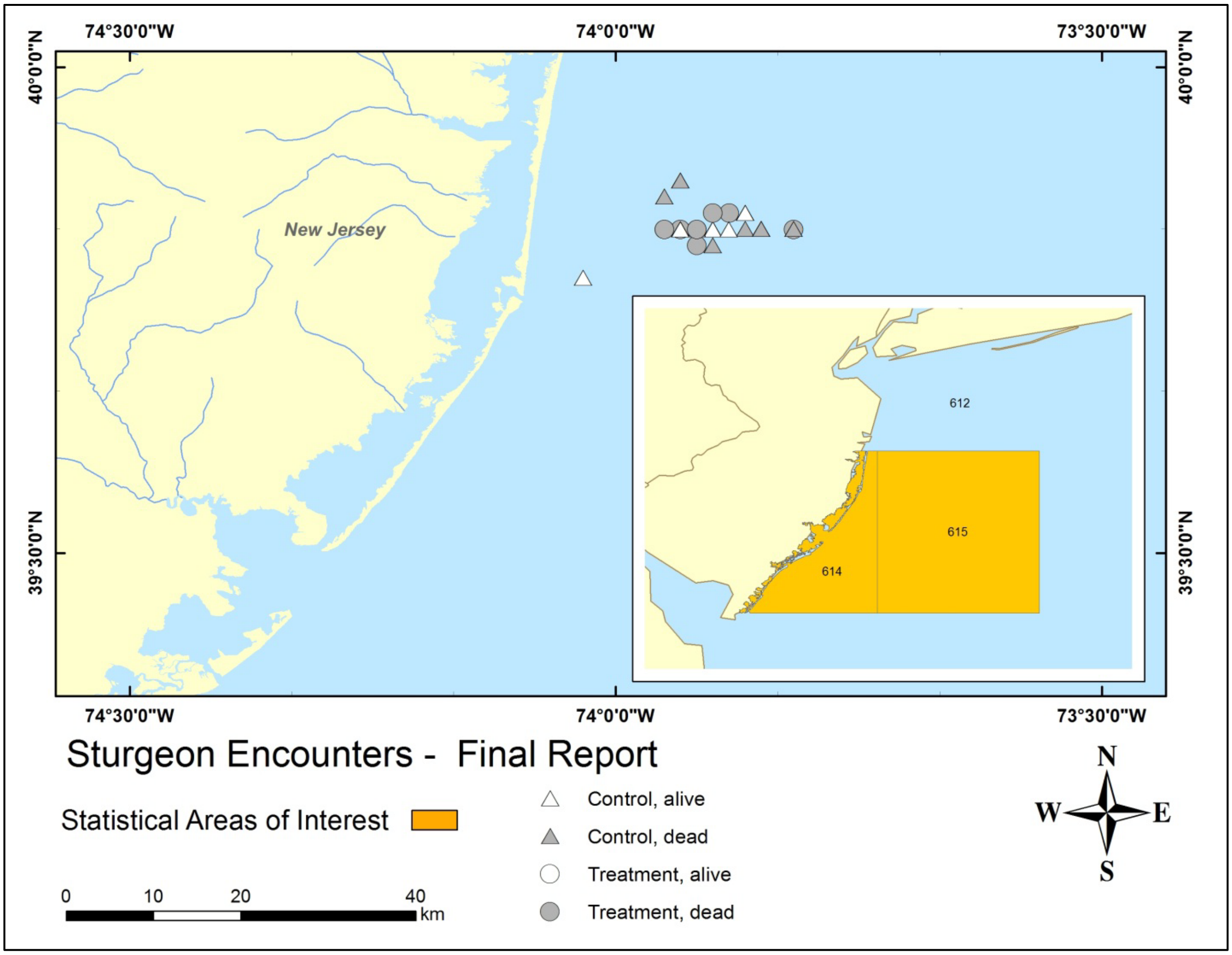


Figure 2: Location of Atlantic sturgeon encounters by mortality status (alive = white symbols; dead= gray symbols) and gear type (control = triangles; treatment= circles) within NMFS Statistical Areas 614 and 615 during the 2011 field season.

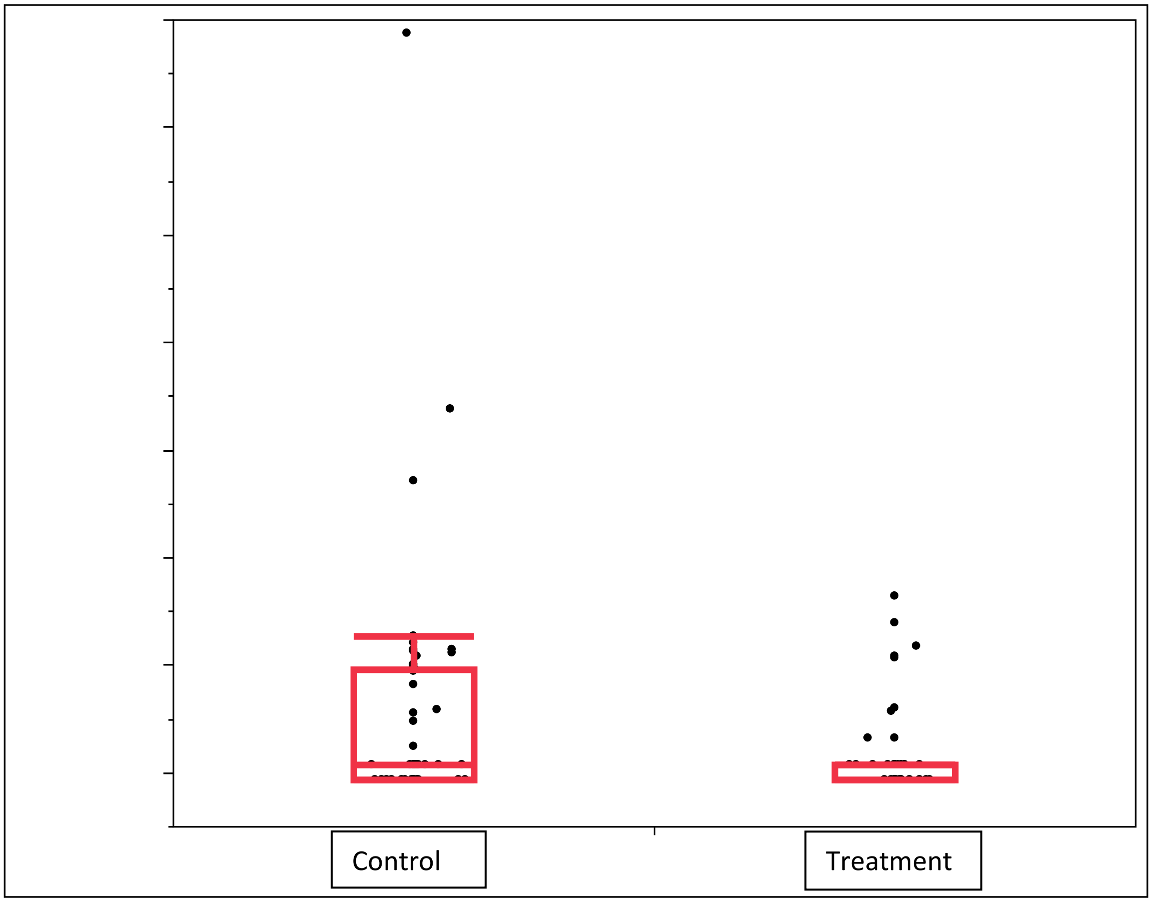


Figure 3: Atlantic sturgeon capture rates by gear type for the 2011 sampling season. Box plots represent median with 25th and 75th percentiles.

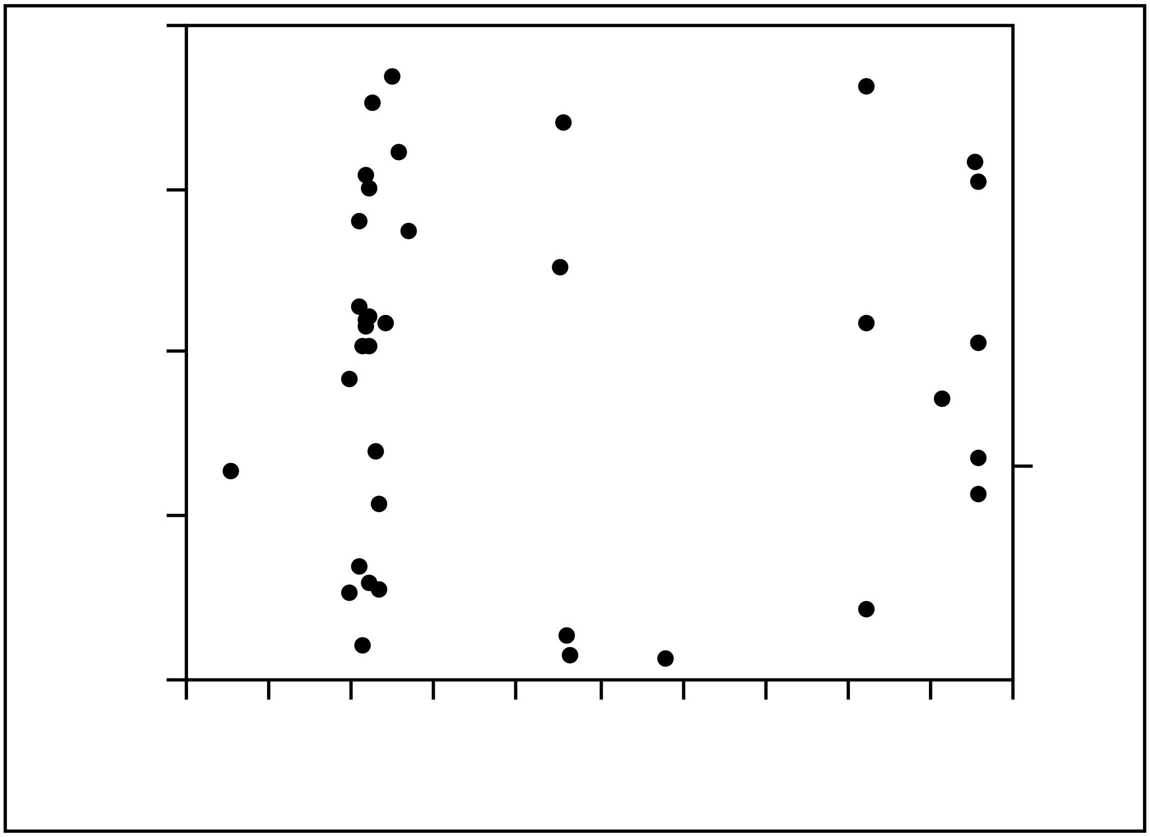
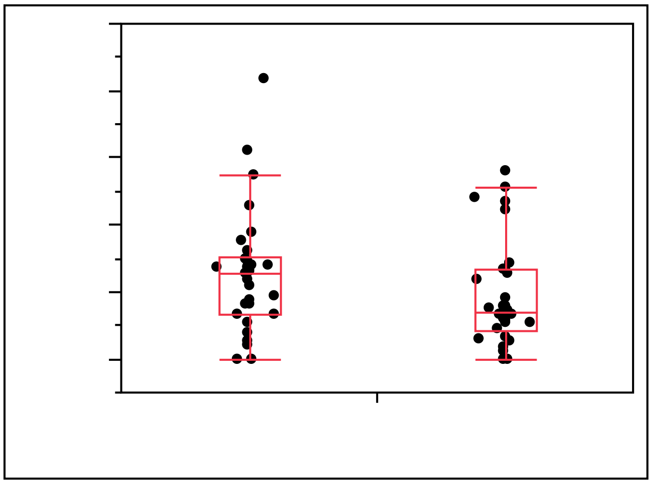
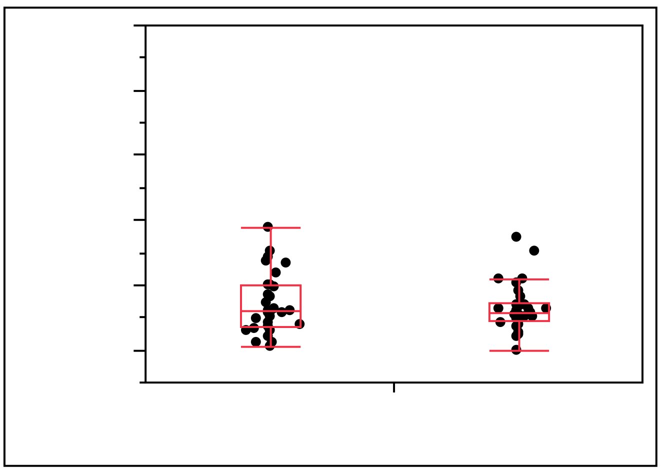


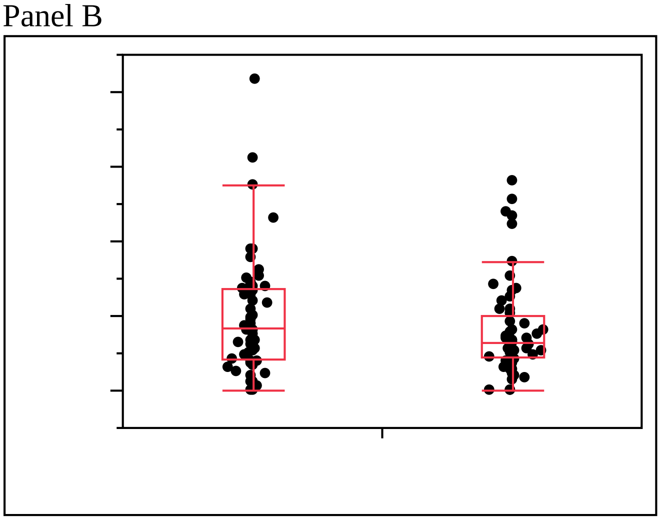
Figure 4: Results of logistic regression fit of Atlantic sturgeon status (alive vs. dead) by soak time for gillnet encounters. Points plotted above the solid line represent Atlantic sturgeon dead at the time of the encounter. At each soak time value, the probability scale for Atlantic sturgeon status is partitioned into probabilities for live/dead categories. The probabilities are measured as the vertical distance between the curves (Total Y = 1.0).



Panel A



Panel B



Panel C

Figure 5: Monkfish catch rates by gear type for the 2011 sampling season. Box plots represent median with 25th and 75th percentiles. Panel A represents F/V Dana Christine, Panel B represents F/V Traveller II, and Panel C represents combined landings (note change in Y axis).

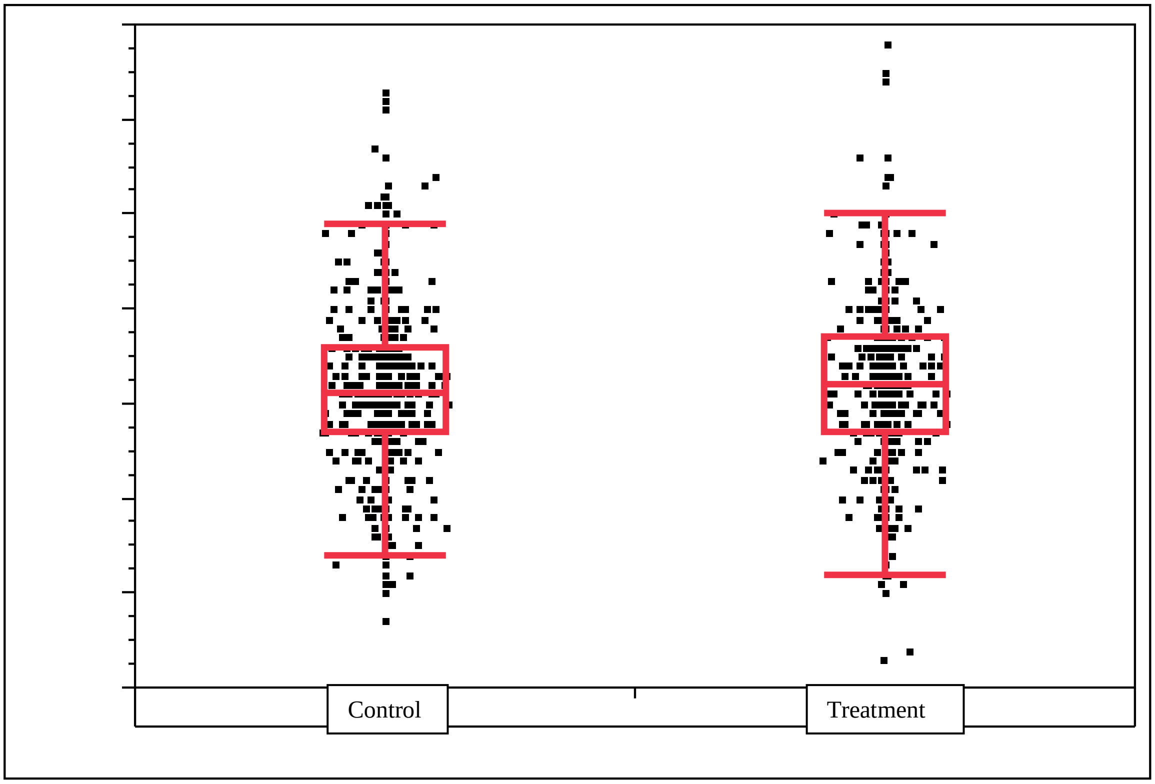


Figure 6: Length (cm) of monkfish landed by gillnet configuration. Box plots represent median and 25-75th quartiles.

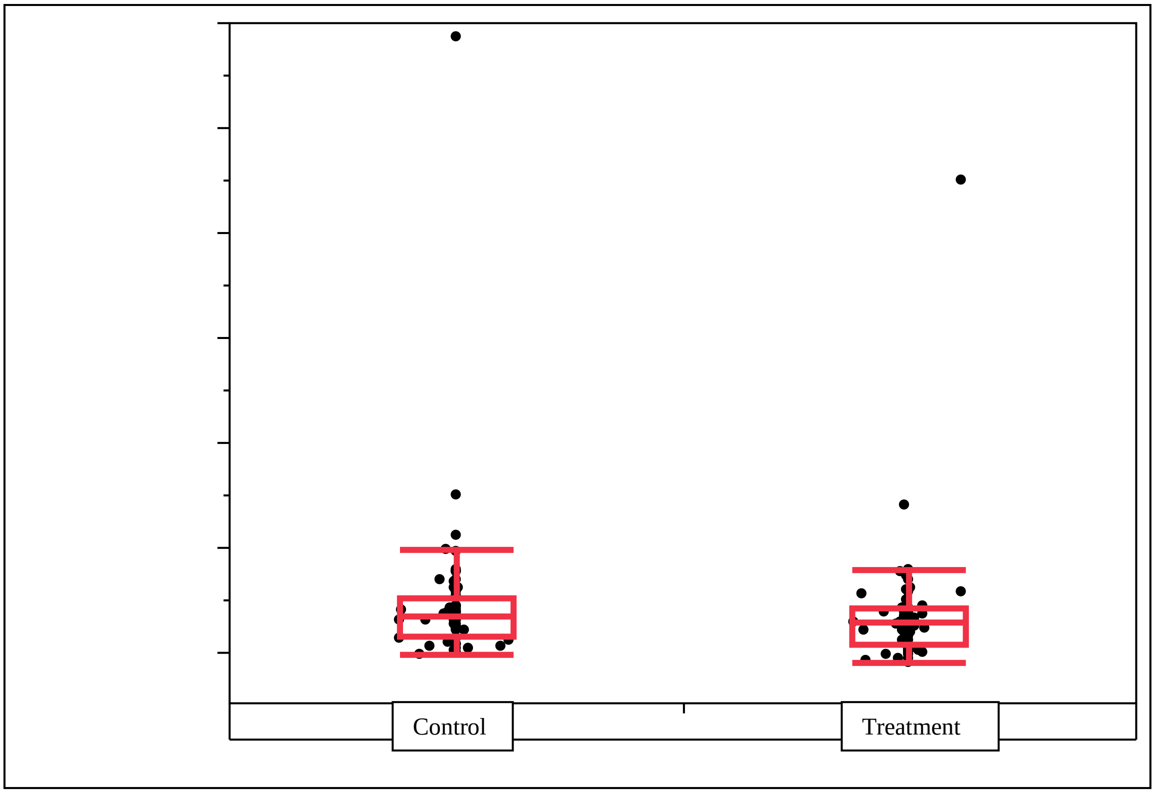


Figure 7: Winter skate catch rates by gear type for the 2011 sampling season. Box plots represent median with 25th and 75th percentiles.

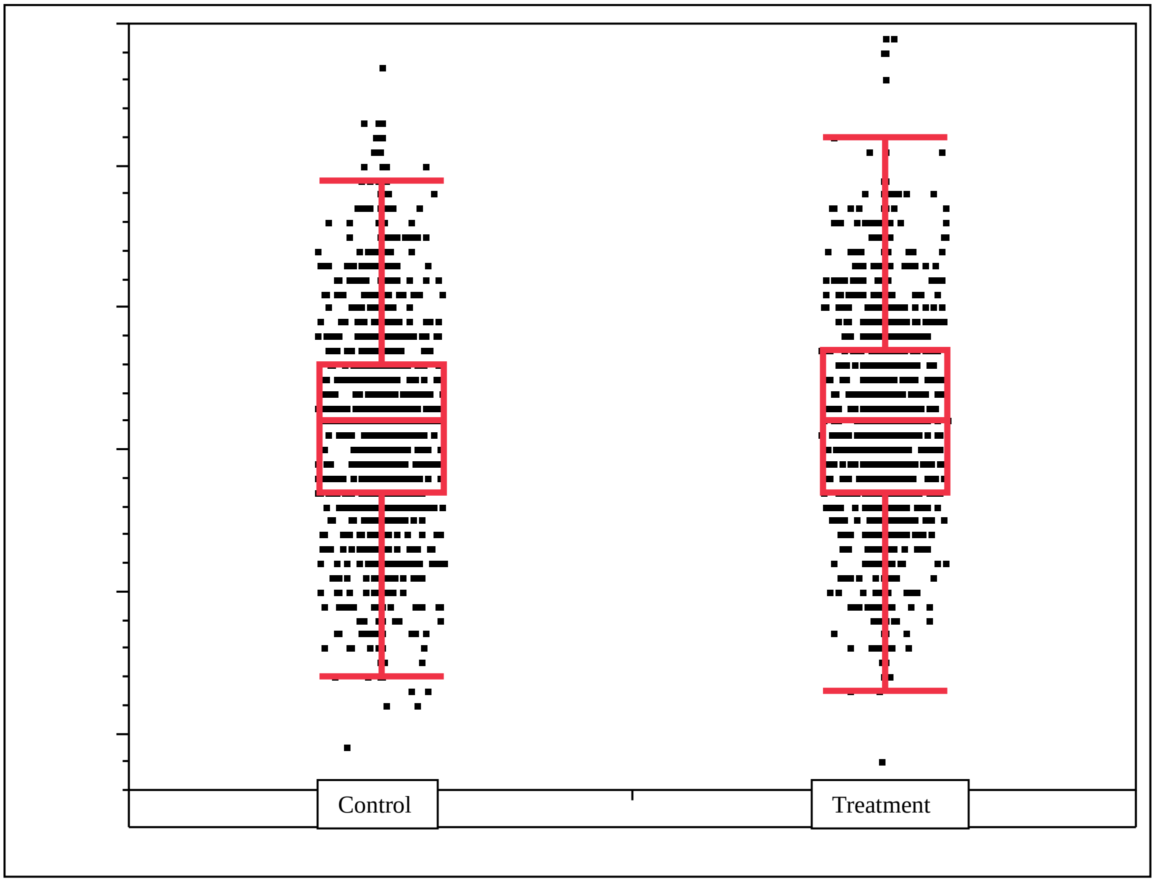


Figure 8: Width (cm) of winter skate landed by gillnet configuration. Box plots represent median and 25-75th quartiles.

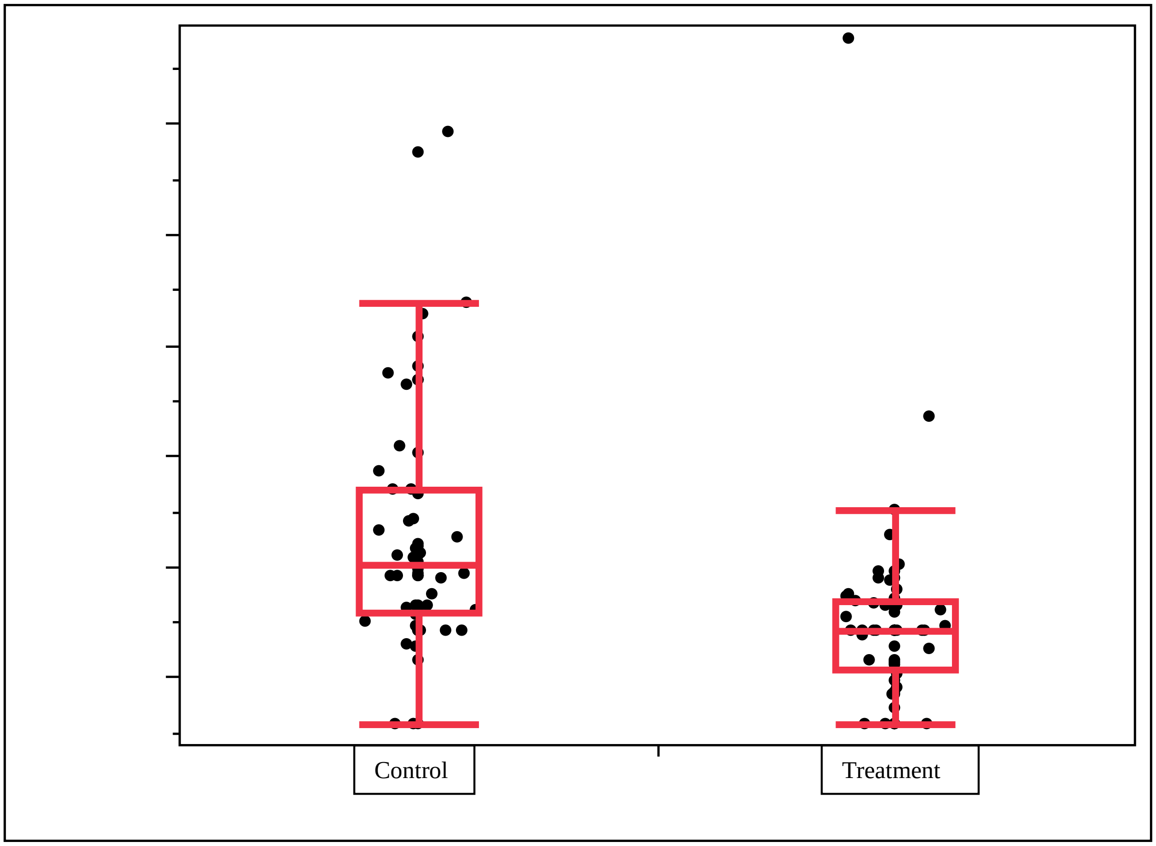


Figure 9: Spiny dogfish catch rates by gear type for the 2011 sampling season. Box plots represent median with 25th and 75th percentiles.

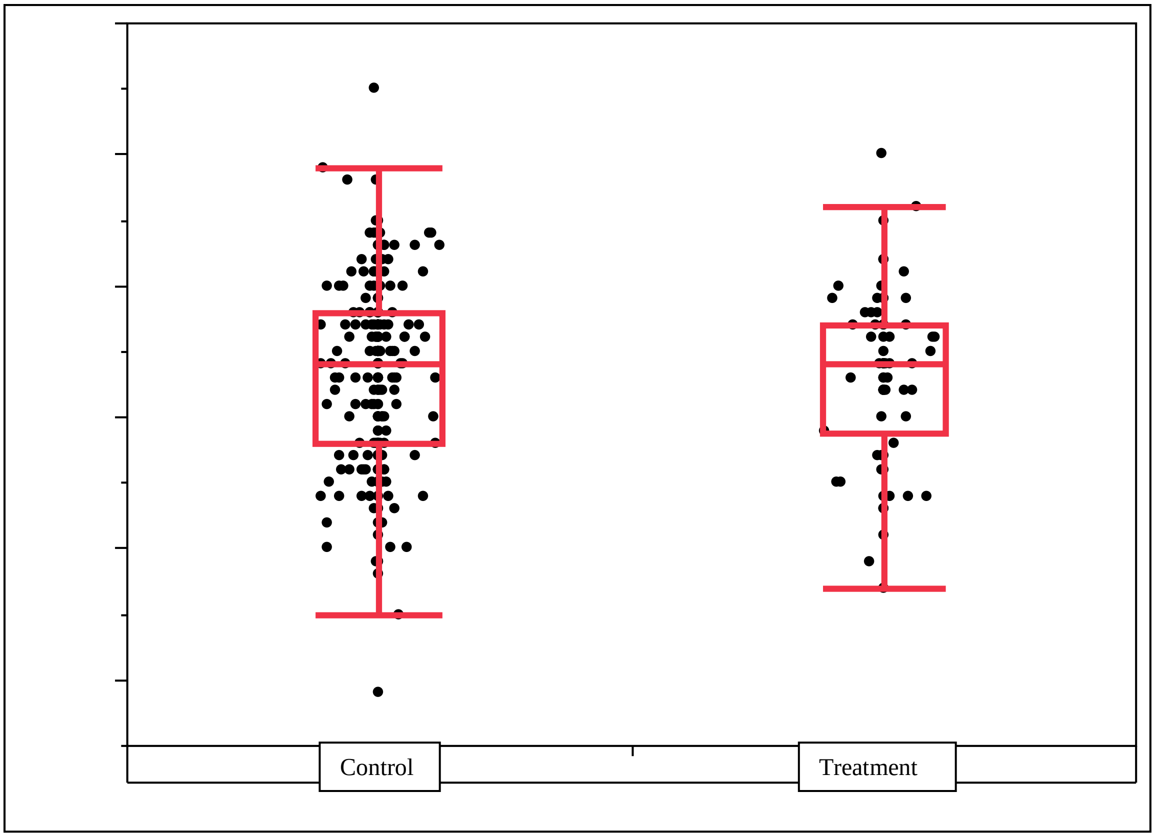


Figure 10: Length (cm) of spiny dogfish landed by gillnet configuration. Box plots represent median and 25-75th quartiles.