Workshop on Sea Turtle and Atlantic Sturgeon Bycatch Reduction in Gillnet Fisheries

Conducted by the National Marine Fisheries Service
and the Atlantic States Marine Fisheries Commission

January 22 – 23, 2013
Clarion Resort Fountainbleu
Ocean City, MD

Preface

On January 22 and 23, 2013, the National Marine Fisheries Service's Northeast Region and the Atlantic States Marine Fisheries Commission co-hosted a workshop to discuss technological solutions to reduce sea turtle and Atlantic sturgeon bycatch in southern New England and Mid-Atlantic gillnet fisheries. The goal of the workshop was to identify potential gear technology solutions to reduce bycatch, or impacts from bycatch, in gillnet gear of species listed under the Endangered Species Act (ESA), while maintaining retention of the targeted catch. This was achieved through a collaborative process that involved the fishing industry, species experts/researchers, the conservation community, managers, and other interested parties. A range of research ideas were proposed, including deterrents and changes to fishing gear and practices. In addition, participants discussed research into sea turtle and Atlantic sturgeon behavior and data needs.

Workshop Goal: Identify potential gear technologies and research ideas to reduce protected species bycatch in gillnet gear

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Acknowledgements

The Workshop Planning Committee – Pat Campfield (ASMFC), Ellen Keane (NMFS), Lynn Lankshear (NMFS), Henry Milliken (NMFS), Derek Orner (NMFS) – thanks all the workshop participants for their attendance and contributions which led to a successful meeting. We specifically thank Albert Spells (USFWS) and Pat Campfield for facilitating the break-out groups. In addition, we would like to thank Jason Kahn (NMFS), Carrie Upite (NMFS), and Derek Orner for their willingness to help in preparing and/or conducting the workshop. We also thank Kate Taylor (ASMFC) for facilitating the webinar and fielding questions from webinar participants. Without their help, the workshop would not have been as productive. We also appreciate Ellen Keane for compiling the workshop report.

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Cover photo credits (from left): green sea turtle (NOAA), gillnet gear and Atlantic sturgeon (ASMFC).

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Introduction

Fourteen species of sea turtles, fish and whales that occur in the National Marine Fisheries Service's (NMFS) Northeast Region (NER) are listed under the Endangered Species Act (ESA). In addition, all marine mammals are protected under the Marine Mammal Protection Act (MMPA). Within this region, extending from Maine through Virginia, gillnet fisheries interact with several species protected under the MMPA and the ESA, including sea turtles and Atlantic sturgeon. Under the ESA, NMFS is mandated to conserve and recover sea turtles and listed fish. In addition, National Standard 9 of the Magnuson Stevens Fishery Conservation and Management Act (MSA) requires NMFS to minimize bycatch, to the extent practicable, and impacts from bycatch.

Bycatch: Animals caught by fishing that were not the intended target of the fishing activity.

All sea turtle species found in U.S. waters are listed under the ESA, and bycatch in fisheries is one of the primary threats to these species. Green, Kemp's ridley, leatherback and loggerhead sea turtle are known to interact with fisheries in the NER. However, bycatch estimates are only available for loggerhead sea turtles. From 1995 to 2006, the average annual bycatch of loggerheads in sink gillnet fisheries in the NER was 350 turtles (Murray 2009). Serious injury and mortality may result from these interactions.

Atlantic sturgeon are also captured in gillnet fisheries in the NER, and some interactions result in death. Bycatch mortality for Atlantic sturgeon is known to occur predominantly in sink gillnet gear (Stein *et al.* 2004a; ASMFC 2007). Studies have shown that Atlantic sturgeon can only sustain low levels of bycatch mortality (Boreman 1997; ASMFC 2007; Kahnle *et al*. 2007), and the available information suggests that current bycatch rates may be negatively impacting Atlantic sturgeon. NMFS determined that bycatch and bycatch mortality was one of the primary threats to Atlantic sturgeon, and this determination led NMFS to list five distinct population segments of Atlantic sturgeon under the ESA in 2012.

NMFS and the Atlantic States Marine Fisheries Commission (ASMFC) co-hosted a workshop on January 22 and 23, 2013, to discuss sea turtle and Atlantic sturgeon bycatch in southern New England and Mid-Atlantic gillnet fisheries. The goal of the workshop was to identify potential gear technologies and research ideas to reduce bycatch, or impacts from bycatch, in gillnet gear to species listed under the ESA while maintaining retention of the targeted catch. The objective was to generate these solutions through a collaborative process that involves fishery managers, the fishing industry, the conservation community, species experts/researchers, and other interested parties. This type of collaborative process has been used previously by NMFS to successfully identify potential gear technologies for further research. Within the NER, the Northeast Fisheries Science Center (NEFSC) has collaborated with the fishing industry and other interested parties on gear development and testing in the Atlantic sea scallop dredge, Virginia pound net, and Mid-Atlantic trawl fisheries. Workshop participation by a wide range of experts in several species and fisheries moves us towards a more holistic approach to reducing bycatch of protected species.

In addition to sea turtles and Atlantic sturgeon, certain marine mammal stocks have been documented with serious injuries and mortalities due to interactions with commercial gillnet gear

(e.g., gillnet net panels as well as other parts of the gear including vertical lines). These species are managed through the take reduction team process under the MMPA. As marine mammals are managed through a separate process, they were not addressed specifically during this workshop. However, marine mammal species experts participated in the discussion to identify whether potential bycatch reduction technologies proposed for research could potentially impact, beneficially or adversely, marine mammals. The workshop consisted of two half day sessions. The first day consisted of presentations to ensure a common understanding among participants. The second day focused on group discussion. This report summarizes the discussions that occurred throughout the workshop.

What We Know

The first session of the workshop included a series of presentations (see Appendix 1) that described what is currently know about bycatch and NER fisheries as well as bycatch reduction ideas that have been tested in the Atlantic and Pacific Oceans. A summary of these presentations and discussions is provided here.

Why Is It Necessary to Reduce Bycatch?

Carrie Upite, NMFS, briefly described NMFS' mandates under the ESA and the MSA. Under the ESA, it is unlawful to take any listed species within the United States. When this take results from, but is not the purpose of, an otherwise lawful activity, it is defined as an incidental take. Sea turtles and sturgeon caught during fisheries operations are incidental takes. Takes can be exempted from the prohibitions through incidental take or scientific research permits issued under Section 10 of the ESA. Takes that occur as a result of a federal activity that is consulted on under Section 7 of the ESA are not prohibited as long as the requirements of an Incidental Take Statement (ITS) are met. ITSs are included as part of Biological Opinions issued through the ESA Section 7 consultation process. The MSA also includes a mandate to monitor and reduce bycatch. Ms. Upite discussed the species of sea turtles present in the NER and conservation measures, including measures in the gillnet fisheries, in place to help protect sea turtles. Currently, vessels fishing with large mesh (≥7 inches stretched) gillnets are subject to seasonal area closures in the Mid-Atlantic. In response to a question about what NMFS is doing to protect habitat, Ms. Upite described current critical habitat designated for sea turtles under the ESA. She also touched on the critical habitat designation that is underway for loggerhead sea turtles, which will be proposed and open for public comment.

Take: Under the ESA, take means to harass, harm, pursue, hunt, shoot, wound, kill, trap, capture or collect, or to attempt to engage in any such conduct.

Kate Taylor, ASMFC, discussed the management of Atlantic sturgeon in state waters. The ASMFC Sturgeon Management Board oversees coast-wide management in state waters. The Board has representatives from all the Atlantic coastal states and jurisdictions and receives input from various sturgeon and diadromous-related committees (e.g., Sturgeon Technical Committee, Sturgeon Advisory Panel, Sturgeon Stock Assessment Sub-Committee, Habitat Committee, Fishing Passage Working Group). In 1998, the ASMFC through its management plan for sturgeon established a moratorium on harvest of Atlantic sturgeon and increased efforts to reduce

or eliminate fishing related mortality. Ms. Taylor also discussed the available data on sturgeon bycatch in state fisheries and through fisheries-independent research. Currently, the ASMFC is working with the states to assist them with the ESA Section 10 permitting process and has initiated a benchmark stock assessment. This updated assessment is expected to be completed in 2014. Participants were interested in learning how the ASMFC contributed to the listing of Atlantic sturgeon as some fishermen are seeing more Atlantic sturgeon now than they have previously. Ms. Taylor indicated that the ASMFC submitted comments to NMFS during the listing process. The ASMFC maintains that the management authority of Atlantic sturgeon should remain at the state level. Given the uncertainties in stock status, the ASMFC has initiated a stock assessment to provide updated information on the population. NMFS also explained the listing process it undertakes and the criteria evaluated to list a species under the ESA.

Atlantic sturgeon are diadromous, migrating between fresh and salt water.

What We Know about Sea Turtle Bycatch in Gillnets

Kimberly Murray, NMFS, described the characteristics of observed sea turtle bycatch from 1995 through 2011. Green, Kemp's ridley, leatherback, and loggerhead sea turtles have been documented captured in fisheries observed by the Northeast Fisheries Observer Program (NEFOP) and At Sea Monitoring Program (ASM). A high proportion of the takes were observed in more southern areas. Ms. Murray presented data on seasonality, mesh size, predominant catch, gear characteristics, and fishing practices. In an analysis of bycatch rates for loggerhead sea turtles from 1995-2006, higher rates were correlated with latitude, sea surface temperature (SST), and mesh size (Murray 2009). The highest rates were seen at low latitudes (<38° N), warm SST (>15 °C), and large mesh (>7") gillnets. Bycatch rates from 2007-2011 are on-going, and preliminary results were presented. Analyses conducted to date can help identify times, areas, and gear characteristics to focus bycatch reduction efforts. Potential areas for consideration might include large mesh gillnet gear north of the currently regulated area or small-mesh gillnet gear in more southern areas.

Kemp's ridley sea turtle. Photo: NOAA.

Workshop participants commented that the monkfish plan was implemented during the period considered in the first analysis, the data presented is dated, and the use of pounds landed for assigning takes to a fishery is problematic as it does not account for the efficiency of the fishermen. They indicated that the amount of net days in the water is what influences the take. Participants also suggested updating the gillnet vessel trip report (VTR) to include fields more specific to gillnets and recommended more outreach on completing these forms. In response to questions, Ms. Murray clarified that estimated takes are allocated to fisheries based on the proportions of reported catch on VTR logs, rather than on what fishermen declare to be targeting (which would underestimate takes in some fisheries). She also clarified that net days in the water cannot be used as a unit of effort because the quality of these fields are still poor in VTR data

despite recent outreach efforts. Participants suggested using Days-At-Sea (DAS) declarations for monkfish trips. Fishery participants also questioned why the current gillnet closures extend to the Exclusive Economic Zone as they don't see turtles out that far.

What We Know about Atlantic Sturgeon Bycatch in Gillnets

Dewayne Fox, Delaware State University, described Atlantic sturgeon populations in the NER. Ranging from Labrador through Florida, Atlantic sturgeon are an anadromous fish found primarily in coastal waters during their marine phase. Atlantic sturgeon aggregate at the mouths of large estuaries (e.g., Delaware Bay, Chesapeake Bay) at certain times of the year and seasonal shifts in depth occur. Dr. Fox described life history characteristics and his on-going capture and passive receiver studies off Delaware and New Jersey. In spring, 61% of his tagged and tracked sturgeons were in state waters, 39% in federal, and an indirect northerly movement was detected. In fall, 24% were in state waters, 76% in federal, and a southerly movement was detected.

Anadromous fish, such as Atlantic sturgeon, move from salt water to fresh water for breeding.

Lynn Lankshear, NMFS, presented on the bycatch of sturgeon. Three studies on Atlantic sturgeon distribution (Stein *et al.* 2004b, Dunton *et al.* 2010, Erickson *et al*. 2011), using different techniques, demonstrate that Atlantic sturgeon primarily are found in waters less than 50 m; although, sturgeon also occur in deeper waters. Three key bycatch reports (Stein *et al.* 2004a, ASMFC 2007, Miller and Shepherd 2011) are available. These reports are all based on data collected by NEFOP but are not directly comparable as they used different approaches and included different fisheries. However, some conclusions can be drawn. Bycatch is observed in sink gillnet and trawl gear, with sink gillnet gear having a higher observed mortality. Atlantic sturgeon are taken in both state and federal fisheries throughout the year; although, seasonal patterns do exist. Ms. Lankshear also described actions that NMFS is currently taking to address this bycatch.

Atlantic sturgeon. Photo: NEAMAP.

During discussion, it was noted that the weather conditions may affect catch as fish will not hug the bottom during high swell. Participants also mentioned the current effort restrictions on days fished in the monkfish and dogfish fisheries, noting that, in general, there is less gear in the water than previously. Some participants wondered about the effect of the moratorium on the population size and noted they are now seeing more sturgeon. They suggested that managers evaluate the age classes that are now present and not previously fished upon to assess the effect of the moratorium on the population. Concerns were noted with respect to the listing and its associated data, the relationship with other management measures, and the need for this to be discussed at the Mid-Atlantic Fisheries Management Council.

Marine Mammal Considerations

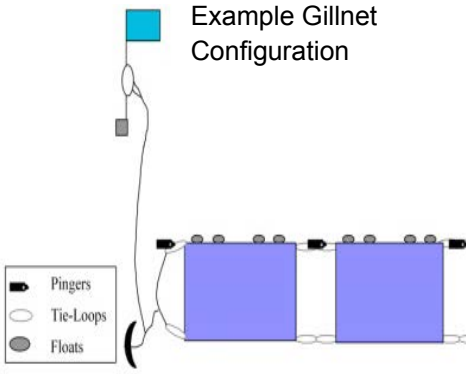
Glenn Salvador, NMFS, indicated that there are currently measures in place under the Harbor Porpoise Take Reduction Plan (HPTRP) to address the bycatch of harbor porpoise in Northeast and mid-Atlantic gillnet fisheries. A guide to the plan was available to interested participants and is at http://www.nero.noaa.gov/protected/porptrp/.

Southern New England and Mid-Atlantic Gillnet Fisheries

Up until this point, discussions focused on understanding the bycatch of protected species in gillnet gear. However, there was also a need to have a level of common understanding among participants about the fisheries themselves. Therefore, industry participants were asked to describe their fishing practices including targeted species, soak duration, depth fished, and gear characteristics (e.g., mesh size). Workshop participants target monkfish, dogfish, other species of sharks, and rockfish, among other species, in areas from Massachusetts through North Carolina. It was noted that the monkfish are targeted passively. For the other species, fishermen look for the fish and then set the net to optimize catch. Mesh sizes ranged from 2.25 to 14 inches, and several sizes may be on the boat at one time. Heavy anchors and ties are used to set gear on the bottom faster. It was noted that as the fish move through the Mid-Atlantic, fishermen must be flexible and adjust gears and fishing practices to target the species present. Float and sink nets were both used. Soak times are generally minimal. Participants mentioned that monkfish is fished for differently, but noted that gear is not left out as it was in the past. It was also noted that monkfish sets are the only sets left overnight off North Carolina. Many variables go into soak duration such as how fast the fish are moving, when the vessel gets out fishing (e.g., inlet passage open), and personal preferences. Other factors that might affect how long the gear is set include the weather, season, water temperature (e.g., fish movement, influence on mortality of species), and presence of other fishermen. Participants also indicated that, in general, variables that might affect finfish bycatch, including sturgeon, are net length, target species, and mesh size.

Research to Date

During the next session, presenters reviewed research that has occurred to date on gear technologies to reduce protected species bycatch in gillnet fisheries. The focus was on research to address sea turtle and Atlantic sturgeon bycatch. However, there was an additional presentation on a recent marine mammal study. The presenters acknowledged previous workshops that have focused on gillnet fisheries, including a 2009 Honolulu workshop (Gilman *et al.* 2009) that focused on sea turtles, a 2011 Boston workshop (Consortium for Wildlife Bycatch Reduction 2011) on marine mammals, and a 2011 Tampa workshop (Simpkins 2012) on marine mammals. When applicable, research presented at those workshops was considered during this workshop. However, in general, the participants of previous workshops concluded that it is important to consider the characteristics of the fishery and the local environment



when determining potential gear modifications. A gear modification that works in one area may not work in another as different water depths, water temperatures, and habitats with environmental or structural differences can affect the effectiveness of a modification. The research conducted was presented to facilitate discussion on which bycatch reduction techniques studied to date might be appropriate to evaluate in southern New England and mid-Atlantic fisheries.

Bycatch Reduction Research for Sea Turtles

Henry Milliken, NMFS, and John Wang, University of Hawaii – JIMAR, described gear technologies that have been proposed, and in most cases tested, to reduce sea turtle bycatch in the Atlantic and Pacific Oceans. Approaches included increasing gear visibility (e.g., illumination), reducing net height, eliminating tie-downs, modifying float characteristics, changing set direction (e.g., parallel or perpendicular to the shore), treating nets with barium sulfate, and reducing the breaking strength of the mesh. In the early 2000s, studies in Pamlico Sound, North Carolina showed positive sea turtle bycatch reduction by reducing the profile of the net. Currently, the low profile net is mandated in specified areas of North Carolina's inshore waters. It should be noted that, under the HPTRP, tie-downs are currently required in certain areas. The behavior of sea turtles around gillnets is poorly understood and may change by region and strata. This behavior is influenced by water temperatures, depth, and light, among other environmental characteristics. Therefore, gear solutions would likely need to be region/fishery specific.

Photo: J. Wang

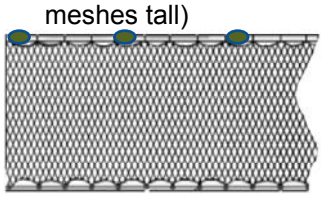
Dr. Wang described research on illuminated nets that he is conducting in the Pacific. The Pacific Islands Fisheries Science Center (PIFSC) has used an understanding of sensory systems (visual, auditory, chemosensory, electromagnetic systems) of sea turtles as a basis to develop Bycatch Reduction Technologies (BRTs). The PIFSC research has focused on visual cues that would act as an alert to sea turtles. Green LEDs, UV LEDs, and green light sticks have been used to illuminate nets by attaching the lights to the float lines. Results show that illumination reduces sea turtle interactions with nets by 40-60% and does not reduce target fish catch rates or catch values in Mexican coastal fisheries (Wang *et al.* 2010). Illumination of nets by UV light increased target catch such as *Paralichthys californicus*, while elasmobranch bycatch decreased. Recent experiments looking at effects on loggerhead turtles found differences between day and night sets, with the technology potentially effective during night sets but less so during day sets. During discussions, it was noted that placing lights on the float line may not work with a net hauler or for larger operations due to the time needed to place the lights.

Bycatch Reduction Research for Atlantic Sturgeon

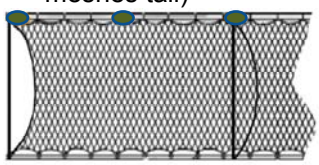
Kevin Wark, F/V Dana Christine, and Dewayne Fox, Delaware State University, presented on NMFS-funded bycatch reduction research for sturgeon and fish with similar morphologies.

Methods for reducing Atlantic sturgeon bycatch in gillnets that have been proposed include reducing the vertical height of the net, eliminating tie-downs, raising the net off the bottom, and changing the hanging ratio. These researchers evaluated the effect of tie-downs, tie-down height, and mesh height on the capture of Atlantic sturgeon, harbor porpoise, and monkfish (the target species). Over three years, gears compared included: (a) a 12-mesh tall net with 48 inch tie-downs (typical of those currently used in the monkfish fishery), (b) a 12-mesh tall stand-up net, (c) an 8-mesh tall net with 24 inch tie-downs, (d) and a 6-mesh tall net with 24 inch tie-downs. Preliminary results from this study indicate that tie-downs did not increase capture of Atlantic sturgeon; therefore, mortality was not increased. Based on NEFOP data, tie-downs appear to reduce the risk of entanglement of harbor porpoise. The standup net in this study did incidentally take dolphins. It was also shown that monkfish catch increased when tie-downs were used. Both the 6-mesh and 8-mesh high nets had less bycatch of sturgeon than the control nets. They also had less monkfish retention than the control nets. While the experimental nets were not tested against each other or in the same year, the numbers alone indicated that the 6-mesh high net had less sturgeon bycatch and less monkfish retention than the 8-mesh high net. In response to questions about the reduced effectiveness of the 8-mesh tall gillnet, the researchers indicated that Super Storm Sandy could have had an effect on the results. It was noted that this was a relatively small study, and additional work is needed.

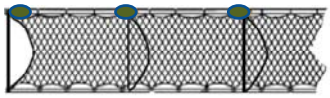
Stand-up gillnet (12 meshes tall)



Control gillnet (12 meshes tall)



Modified gillnet (6 or 8 meshes tall)

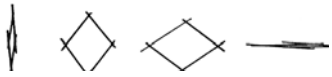


Pooled results (2010-2012) for the bycatch reduction study suggest that the mortality rate increased significantly with soak time. The ASMFC report on Atlantic sturgeon bycatch (ASMFC, 2007) likewise concluded that the mortality of Atlantic sturgeon increased as soak time increased. The ASMFC report also concluded that larger sturgeon appeared to be taken in larger mesh gillnets, and the percent mortality was higher in larger mesh sizes. However, a higher percentage of the nets were also soaked for greater than 24 hours.

Bycatch Reduction Research for Marine Mammals

In collaboration with A.I.S., Inc., NMFS recently evaluated the effect of hanging ratios on harbor porpoise bycatch. Mr. Milliken presented the research methods and results. The hanging ratio describes the ratio of the number of meshes along a distance of the floatline and affects the stiffness of the net. In this study, the number of targeted fish was greater in gear hung on the 1/3 (0.33) than on the 1/2 (0.50). The number of harbor porpoise captured was greater in gear hung on the 1/3 (0.33). Overall, the number of incidental takes of marine mammals was greater in gear hung on the 1/2 (0.50). However, these differences were not statistically significant.

Hanging ratio: length:height of meshes



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Break-Out Session

On the second day, participants briefly reviewed the discussions to date and divided into two concurrent break-out groups. One group, facilitated by Pat Campfield, ASMFC, focused on brainstorming bycatch reduction technologies for sea turtles. The other group, facilitated by Albert Spells, USFWS, focused on brainstorming bycatch reduction technologies for Atlantic sturgeon. After the break-out sessions, all participants came back together to report out on ideas generated, to assess where similar ideas might be tested for both sea turtles and Atlantic sturgeon, and to achieve a general understanding of which ideas might be most promising.

Sea Turtle Break-out Group

Pat Campfield, ASMFC, facilitated the sea turtle break-out group. Group participants shared information and brainstormed ideas for sea turtle bycatch reduction in gillnet gear. Sue Barco, Virginia Aquarium, began the session by presenting on sea turtle strandings in Virginia. NMFS NER coordinates stranding response throughout the region. In Virginia, Virginia Aquarium is the primary response organization. Ms. Barco described the available data, providing an example of the type of data that is available throughout the stranding network to help in identifying potential bycatch reduction ideas. These data include information on sea turtle strandings and/or entanglements (e.g., species, size, location), characteristics of gear collected from animals (e.g. mesh size, twine thickness), and impacts to sea turtles from the interaction (e.g., constriction marks, mortality). During the presentation, participants suggested that responders cut out a small panel of gillnet in order to be able to characterize the gear.

Ideas discussed during the break-out session included additional data analyses, sea turtle behavioral studies, gear changes, deterrents, and sea turtle bycatch studies. The discussions can be grouped by data, behavioral, deterrent, and gear studies. A two-pronged approach was suggested as effective mitigation might differ between smaller and larger sea turtles, and this should be considered in designing research projects. The focus of the research (i.e., bycatch reduction or mortality reduction) may also differ.

Data

Much of the discussion focused on improving the baseline data. It was noted that some of the gear interacting with sea turtles may be from recreational fisheries. In addition, some takes may occur in gillnets that have been set illegally. It is important to obtain accurate information and to follow-up to ensure an understanding of what is actually occurring. State fishery managers should be able to provide information on recreational and commercial fisheries in their waters. Recreational gillnet fisheries are known to occur in North Carolina, Virginia, and Delaware. Increased gear permitting and tagging requirements for both recreational and commercial gear would improve the understanding of the fisheries operating in the NER and which fisheries may be interacting with sea turtles.

For interactions documented by NEFOP, higher bycatch rates are correlated with larger mesh size. Much of the large mesh gear is targeting monkfish so participants wondered whether illumination or soak durations would work in this fishery. Participants suggested that the organizers convene fishery/gear specific working groups to better assess technologies that might work in specific situations (e.g, fisheries, gears). They also suggested that the categories of mesh

size be refined in order to better understand in which fisheries takes are occurring. Other factors to help refine our understanding of the fisheries interacting with sea turtles include the fishing depth and size of net. The break-out group also discussed how takes are allocated to a fishery. Within some fisheries (e.g., monkfish), DAS are available, and participants recommended this as a better way to evaluate the fisheries interacting with sea turtles. They also noted that perhaps both species landed and DAS could be evaluated.

Participants suggested opportunities for improving the available data. A gillnet-specific VTR could be designed to provide additional information. Under the MMPA, Category I and II fisheries are automatically registered in the Marine Mammal Authorization Program (MMAP), and participating vessels are issued a certificate. A survey could be distributed with this certificate to obtain additional information on the characteristics of the fishery, including gear parameters.

The discussion also focused on reductions in effort due to existing regulations under the ESA, MSA, and the MMPA. Both fishery-specific and protected resources regulations constrain how the fishery operates. Participants recommended that the impacts of these requirements be assessed for how they have affected protected species bycatch. In particular, actions taken under the Bottlenose Dolphin Take Reduction Plan and HPTRP should be considered.

Another potential area to evaluate would be the time that has elapsed since the sea turtle died and whether this could be assessed. Participants suggested that this assessment may help with understanding when, particularly with respect to day vs. night, the animal is being caught in the net.

Behavior

Participants discussed whether sea turtles may be feeding on the catch or at the base of the nets. In Virginia, 30-35% of the loggerhead sea turtles assessed had fed on fish. Participants also questioned if invertebrates are pooling at the net base, providing forage for sea turtles. While some information is available from stomach contents of stranded sea turtles, it is not clear whether sea turtles are foraging around the nets. Some fishermen noted that they have seen sea turtle depredation on gears such as gillnets and pots. Participants suggested that the foraging behavior of sea turtles around gillnets could be further assessed through the use of remotely operated vehicles (ROVs), tags (e.g., DTAGs), cameras (crittercams, on the net), and tracking devices. If sea turtles are foraging at the base of the nets, techniques to reduce this prey source might help decrease bycatch. North Carolina might be an area to focus this research due to the turtle species present and their abundance in that area. The NMFS facility in Galveston may also provide an opportunity for behavioral work in a captive environment.

Satellite tagged sea turtle.
Photo: Matzen/NOAA

Deterrents

Participants discussed both visual and acoustic deterrents. The commercial viability of light sticks was questioned as they may not be easily implemented in larger operations. Studies to date on illuminated nets have occurred primarily in estuaries, which can have relatively poor visibility. In addition to the work in the Pacific, illumination studies have been conducted on gillnets set in North Carolina sounds in waters less than six feet. The results from these studies were not conclusive. Other potential visual deterrents include the color of the twine/net and luminosity. Net colors used currently are based on what's available, what fishermen have heard "works", and individual preference. Luminescent pigments in nets are still being developed, but may be available in the relatively near future. Projects similar to the Smart Gear competition could generate more ideas about mitigation technologies.

Acoustic pingers. Photo: NOAA

Acoustic deterrents were mentioned briefly. It was suggested that studies evaluate whether pingers implemented elsewhere have had an effect on sea turtles. The currently used pingers are outside the range of sea turtle hearing; therefore, low frequency pingers were also suggested.

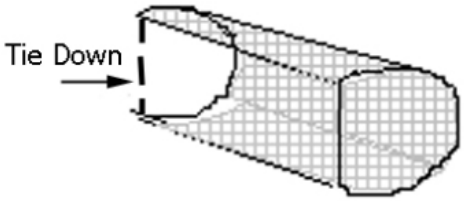
Gear

Several research ideas around the gear itself were considered. These included reduced profile/decreased flotation for nets. These nets would be similar to those tested for Atlantic sturgeon bycatch reduction. There has been work in the Pacific Ocean on buoy-less nets. Buoy-less nets are very similar to the reduced profile nets described during the first day. Without the float line buoys, the net has a lower profile.

Reducing the breaking strength of the net to allow sea turtles to break through the gear was suggested. However, it was noted that break-aways are difficult to design and implement as factors such as the tide and wind impact their effectiveness. Similarly, nets with finer twine were suggested. It was suggested that vessels stay with the finer twine nets to see how they hold up. It was noted that there are twine size requirements under the current HPTRP regulations.

Fishing Practices

The main fishing practice discussed was the soak duration. Participants wondered whether the soak time could be reduced without impacting the target catch. Currently available data could be analyzed to evaluate the effect of soak duration on maximizing catch and minimizing protected species bycatch. Fisheries for some target species will not have long soak times because of impacts to the quality of the catch. Additional studies could include hauling the net every few hours to learn more about when sea turtles are interacting with the gear.



The lower profile net might have some effect in reducing sea turtle bycatch; although, this would need to be evaluated. The use of tie-downs, and their impact on sea

turtle bycatch, was also discussed briefly. From 1995-2011, 42% of observed sea turtle captures in the Northeast Region were in nets where tie-downs were used, while 58% were in nets without tie-downs. There have also been a limited number of research studies that have changed the tie-down length or eliminated tie-downs to assess impacts on sea turtle bycatch (see summary in Gilman *et al.* 2010). One suggestion was to modify how the tie-down is attached to the net. This modification would be designed to deflect the turtle, sending it over the net.

Summary

The sea turtle break-out group had very productive discussions related to data needs and bycatch reduction. Areas considered included data, behavioral research, gear research, and fishing practices. One primary message was the need to take a holistic view of the available data, current regulations, and future research ideas. As many of these interact, there is a need to have a comprehensive understanding of how they relate. It was also recognized that there is no one magic bullet. Different mitigation ideas for different fisheries and areas will likely need to be considered.

Atlantic Sturgeon Break-out Group

Albert Spells, USFWS, facilitated the Atlantic sturgeon break-out group and began the session by asking group participants to share information and brainstorm ideas for Atlantic sturgeon bycatch reduction in gillnet gear. Participants were reminded that the intent was to identify ideas for future research to investigate ways to reduce Atlantic sturgeon bycatch while achieving targeted catch retention so that the fishery can still be successful. Ideas discussed included changing gear (e.g., raising footrope, changing hanging ratio, etc.), changing how detectable the gear is to sturgeon (e.g., deterrents), changing the orientation or location of the gear, the relationship of soak time and sturgeon bycatch mortality, and revisiting existing regulations that were implemented to address other species, but may no longer be necessary.

Atlantic sturgeon caught during research cruise. Photo: New York State Dept. of Environmental Conservation

Changing Gear

In the James River, Virginia, raising the footrope was investigated as a way of reducing Atlantic sturgeon bycatch in the striped bass fishery. The results indicate a reduction in Atlantic sturgeon bycatch when using a raised footrope. Further testing is planned for other areas of the river where the striped bass fishery occurs. An important point to note is that this is shallow water, in-river fishery.

In the monkfish fishery, the targeted species is on the bottom so raising the footrope would not work. The monkfish gillnet study conducted in marine waters off of New Jersey (presented on day one) described results based on “typical” monkfish gear compared to: (a) the same type of net fished without tie-downs, (b) the net only 6 meshes high and tie-downs, and (c) the net with 8

meshes high and tie-downs. The 12-mesh high net without tie-downs had poor monkfish retention and caught several dolphins. The net that was 6 meshes high had the least Atlantic sturgeon bycatch but also had less monkfish retention than the net that was 8 meshes high (note: the 6 mesh and 8 mesh nets were tested in different years; not against each other). Participants discussed how twine size might affect the results, and indicated that a lighter twine might provide more opportunity for the big sturgeon to break through the gear and escape.

Participants also discussed information related to net height. When fishing for smooth dogfish, one fisherman experienced sturgeon bycatch in a net that was 40-meshes tall. The net was cut to half its height and fished in the same location with no sturgeon bycatch.

In discussion on the number of tie-downs used, participants noted that if there are not enough, you catch fewer monkfish. If there are too many, then the net catches too much "junk." The point was made that in the study off of New Jersey, 48" tie-downs did not seem to affect the likelihood of sturgeon bycatch.

The participants briefly discussed the use of buoy-less nets. In some gillnet fisheries outside of the United States, floats are not used. They noted the situation is different here, and the net collapses if floats are not used.

Gear Orientation and Location

In New Jersey state waters, there is a skate fishery using extra-large (12+ inch) mesh in spring when sturgeon are close to shore and moving up the coast (~10-12 fathoms) (see the presentation from day one about Atlantic sturgeon coastal movement). If that fishery could move further offshore at that time of year, fishermen would avoid the concentration of Atlantic sturgeon in that area and at that time. Another idea was that the nets be tended daily.

Participants also discussed the orientation of the fishing gear. If sturgeon are moving up the coast, relatively close to shore in the spring then gear set perpendicular to shore might present a greater capture risk. Discussion pointed out a number of variables that affect how gear is set. For example, off North Carolina, the tide will roll nets up. Hence, depending on the orientation to the beach, gear must be set either north/south or east/west. Other variables that affect how gillnet gear is set (whether off North Carolina or elsewhere) include, for example, the water currents and weather conditions.

Gear Detection and Avoidance

On the first day, a study that investigated whether the use of lights affixed to gillnet gear would reduce sea turtle bycatch was described. The same principle (using differences in sensory perception of bycatch and targeted species) could be investigated for sturgeon. Such differences might include sensory perception related to sight, sound, light, smell, or electrical charge. Sturgeon have electrosensory receptors. Therefore, electropositive charged nets may repel sturgeon. In any of the sensory studies, the researchers would need to be aware of sensory sensitivities of the targeted catch (e.g., skates are also electrosensitive).

Soak Time and Sturgeon Bycatch Mortality

There was discussion about the relationship of soak time and sturgeon mortality for fish caught in gillnet gear (from the ASMFC 2007 bycatch report). In short, participants stated that reducing soak time may reduce bycatch mortality, if not bycatch. However, keep in mind that soak times are influenced by targeted catch. To maintain the quality of the catch, some gillnet fisheries (e.g., bluefish, dogfish) already have short soak times relative to the data in the ASMFC 2007 report. Participants suggested that water temperature also be considered as sturgeon mortality appears to increase at higher water temperature.

Existing Regulations and Other Management Related Issues

Participants described that constraints of the MSA (e.g., when targeting monkfish, spiny dogfish, bluefish, etc.) and protected species regulations (e.g., for whales, sea turtles, harbor porpoise, etc.) all impact how the gear can be fished. Therefore, it is very difficult to identify yet another change to their gear or how they fish the gear given the current regulations (e.g., gear requirements, time/area closures, day-at-sea allocations, quotas) that already restrict when, where, and how they fish. So, participants were asked if there were existing regulations that should be revisited to identify if any were no longer necessary given further changes to the fisheries or to other factors.

Participants indicated that the large-mesh (7 inches or greater) gillnet closures in the spring from North Carolina through Chincoteague, Virginia should be revisited. These are in addition to the harbor porpoise closures in some areas. The combination of the two effectively closes the North Carolina coast to gillnet fishing with mesh 7 inches or greater out to the outer boundary of the EEZ. Industry participants questioned how that helps to protect ESA and/or MMPA listed species if those species aren't even in the area (or the entire area) during that time. In North Carolina, this means being able to fish only 2-3 miles from shore. Fishermen are allowed 28 days-at-sea (for monkfish fishery), and the protected species regulations limit them to a 30-day season. Therefore, they need to use 28 days-at-sea in a specific 30-day time period. The very limited flexibility means that fishermen are forced to fish at times that are not optimal for the targeted species and can, in the long run, increase the bycatch problems.

It was recommended that Sustainable Fisheries staff should be involved in future meetings that address reducing bycatch of protected species. Compartmentalizing in the agency (e.g., some staff work only on MSA issues, others only on MMPA, and others only on ESA) limits effective communication and dialogue to address the issues as a whole and results in ineffective strategies and multiple regulations for fishermen. It was mentioned that Greg DiDomenico and Rick Marks have created a document to show current regulations in areas where Atlantic sturgeon bycatch has occurred. This document will be sent to the workshop coordinators for distribution to the whole group.

Summary

This was a very productive discussion. A primary message of the discussion is that a "broad brush approach" cannot be used when applying or researching bycatch reduction measures for Atlantic sturgeon. There are too many variables that result in many differences on how gillnet gear is fished. There is a need to look at small areas, the fisheries that occur there, and the manner in which they operate to find effective solutions.

A number of participants emphasized the need for better data and/or improved analyses of the existing data. For example, lumping all gillnet fisheries together does not provide an accurate picture of where/when sturgeon bycatch occurs and where/when it does not. Participants also noted the need to consider whether the goal is to address bycatch or bycatch mortality since different solutions are needed for each.

The break-out group did not discuss time/area closures since the focus of the workshop was to identify potential gear solutions for further research. However, it was mentioned during discussions that the time and area for fishing is currently so limited (e.g., from North Carolina to Chincoteague where the harbor porpoise and large-mesh closures co-occur) that any further time/area closures would effectively shut down fishing.

Bringing It All Together - Group Discussion

Following summary reports from each of the break-out groups, the discussion focused on identifying research ideas that were common to both sea turtles and Atlantic sturgeon and that appear most promising. Several similar ideas were identified in both the sea turtle and Atlantic sturgeon break-out groups. Both groups discussed data issues and needs. Common research ideas related to gear and fishing practices included soak duration, reduced profile nets, and behavioral studies. The participants also identified where there were differences. For example, reduced flotation was considered for sea turtle bycatch reduction, but the sturgeon group felt that it may not work in the NER. Other ideas were specific to only a single species. Electropositive nets and gear orientation were only discussed for Atlantic sturgeon. In general, industry participants thought the best approaches would include those that would cause sea turtles and Atlantic sturgeon to avoid the nets (i.e., deterrents). Both groups also acknowledged the need to take a more holistic approach and consider impacts on the fishery not only from protected species requirements, but from all requirements.

Net reel. Photo: NOAA.

Future Steps

Participants identified several concerns, issues, and potential research ideas related to interactions between sea turtles and Atlantic sturgeon and gillnet fisheries. We believe this was a productive workshop and appreciate all of the comments, suggestions, and discussions that contributed to its success. We will review all the suggestions provided and prioritize areas for further investigation. It was noted that funding is available to conduct research in NER this year. We look forward to working cooperatively with the workshop participants and other interested parties in researching these ideas and in future projects.

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Appendix 1: Presentations

The workshop consisted, in part, of a series of presentations. These presentations are listed below, and a copy of each presentation follows.

1. Welcome – Gillnet workshop: Henry Milliken (NMFS) and Pat Campfield (ASMFC)
2. Why consider bycatch mitigation
   i. Why is it necessary to reduce bycatch?: Carrie Upite (NMFS)
   ii. ASMFC Atlantic sturgeon management: Kate Taylor (ASMFC)
3. Sea turtle bycatch in sink gillnet gear: Observations and analyses from 1995-2011: Kimberly Murray (NMFS)
4. What we know about Atlantic sturgeon and gillnet bycatch
   i. Coastal movements of sturgeon in the mid-Atlantic Bight: Dewayne Fox (Delaware State University)
   ii. Atlantic sturgeon bycatch – What we know: Lynn Lankshear (NMFS)
5. Marine mammal considerations: Glenn Salvador (NMFS)
   Slides were not used for this presentation. Therefore, a copy is not included.
6. Overview of bycatch reduction research for sea turtles: Henry Milliken (NMFS) and John Wang (University of Hawaii – Joint Institute for Marine and Atmospheric Research)
7. Overview of bycatch reduction research for sturgeon, or fish with similar morphologies: Dewayne Fox (Delaware State University) and Kevin Wark (F/V Dana Christine)
8. Overview of gillnet research for marine mammal bycatch reduction
   i. The effects of hanging ratio on the catch of harbor porpoise and targeted finfish: Henry Milliken (NMFS)
   ii. Gillnet configurations and their impact on Atlantic sturgeon and marine mammal bycatch in the New Jersey monkfish fishery: Henry Mlliken (NMFS)
9. Opportunities for cooperative research: Henry Milliken (NMFS)
   Slides were not used for this presentation. Therefore, a copy is not included.

Gillnet Workshop

22-23 January 2013

NOAA FISHERIES

ATLANTIC STATES MARINE FISHERIES COMMISSION

Day 1	
12:30	Purpose, Goal, and Format of Workshop (including participant introductions)
12:45	Why consider bycatch mitigation – brief overview of mandates and requirements, including current bycatch mitigation actions
1:00	What we know about sea turtles and gillnet bycatch
	What we know about Atlantic sturgeon and gillnet bycatch
	Marine mammal considerations
1:55	Southern New England and Mid-Atlantic gillnet fisheries (e.g., gear characteristics, time of year, etc.)
2:45	**Break**
3:00	Overview of bycatch reduction (e.g., buoy-less nets, visual deterrents, tie-downs, etc.) research for sea turtles
	Overview of bycatch reduction research for sturgeon, or similar fish morphologies
	Overview of gillnet research for marine mammal bycatch reduction
4:15	Questions/discussion of studies presented Learning from experience: what has worked and why; what has not worked and why
5:00	Opportunities for cooperative research
5:15	Questions and format for next day
Day 2	
8:30	Breakout groups – Group 1: Reducing Atlantic sturgeon bycatch and/or bycatch mortality in mid-Atlantic gillnet fisheries Group 2: Reducing sea turtle bycatch and/or bycatch mortality in mid-Atlantic fisheries gillnet fisheries
10:30	**Break**
10:45	Report out from break-out groups
11:15	Group discussion – solutions to reducing sea turtle and Atlantic sturgeon bycatch and/or bycatch mortality in gillnet fisheries. Which look promising? Which are less so?
12:30	Brief summary of meeting and next steps
1:00	**Thank you**

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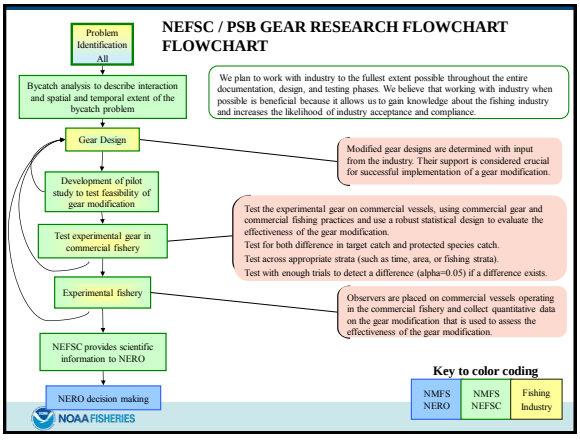
NEFSC / PSB GEAR RESEARCH FLOWCHART FLOWCHART



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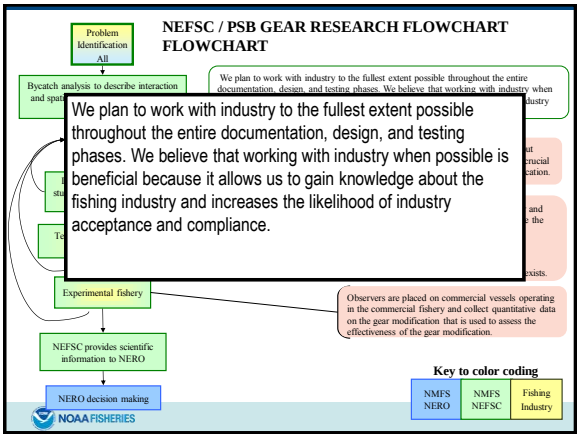

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Past Collaborative Projects

- **Chesapeake Bay modified pound nets** (sea turtle bycatch)
- **Scallop dredge** (sea turtle bycatch)
  - Chain mats
  - Deflector dredge
- **Trawl fishery** (sea turtle bycatch)
  - Quantification of catch loss associated with TEDs
  - Tow time data logger
  - Topless trawl
- **Monkfish gillnet fishery** (sturgeon bycatch)
- Etc.

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Our goal is to listen to what you have to say and collaboratively develop ideas that will help us move forward.

Thanks for participating!

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NOAA FISHERIES
Northeast Regional Office

Why is it necessary to reduce bycatch?

Sea turtles, Atlantic sturgeon and the Endangered Species Act

Carrie Upite
NMFS NERO Sea Turtle Recovery Coordinator
January 22, 2013

What's the big deal?

- NMFS is responsible for implementing the Endangered Species Act
- It is unlawful to take any listed species within the U.S.
- Take = *harass, harm, pursue, hunt, shoot, wound, kill, trap, capture, or collect or to attempt to engage in any such conduct*
- Incidental take = *take that results from, but not the purpose of, an otherwise lawful activity*
- Magnuson Stevens Act also includes a mandate to monitor and reduce bycatch

Are there any ESA exceptions?

- Section 7 consultations
  - Incidental take statements (included in Biological Opinions issued through formal consultation)
- Section 10
  - Scientific research permits
  - Incidental take permits (non-Federal)

What species are listed in the NER?

- FISH – Atlantic salmon, Atlantic sturgeon, shortnose sturgeon
- SEA TURTLES – leatherback, loggerhead, Kemp's ridley, green, and hawksbill
- WHALES – North Atlantic right, humpback, fin, sei
- We are going to focus on only Atlantic sturgeon and sea turtles……

Photo: Art Michaels

What are some NER conservation measures for sea turtles and fishing gear?

- *Trawls*: Turtle Excluder Device gear modifications
- *Virginia pound nets*: seasonal restrictions; modified leader gear modifications
- *Scallop dredge*: chain mat and turtle deflector dredge gear modifications
- *Pelagic longline*: gear/bait requirements, release protocols
- *Gillnets*: seasonal restrictions

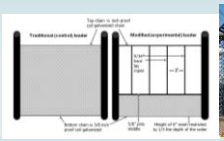
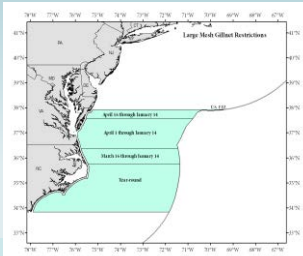


Photo: NOAA

Regulations on large mesh gillnets

- Largely implemented as a result of high NC strandings in 2000 and monkfish fishery interaction concerns
- Final rule 2002; revised in final rule 2006
- Seasonal restriction of gillnets ≥ 7" stretched mesh in EEZ waters off NC and VA



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Why focus on gear modifications?

- Maintain fishing activity while protecting listed species
- Stakeholder involvement
- Requirement in Biological Opinions (RPM/TC)
  - *NMFS must continue to investigate and implement, within a reasonable time frame following sound research, gear modifications to reduce incidental takes of sea turtles and/or the severity of the interactions that occur.*

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ASMFC ATLANTIC STURGEON MANAGEMENT

Kate Taylor
Atlantic States Marine Fisheries Commission

ASMFC Management

- Sturgeon Management Board, Technical Committee, Tagging Committee, Plan Review Team and Advisory Panel
  - Fish Passage Working Group
  - Habitat Committee
  - FERC Guidance Committee
- Atlantic Sturgeon Fishery Management Plan approved in 1990

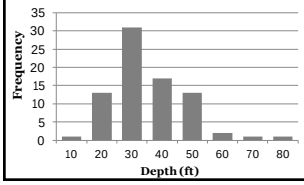
ASMFC Management

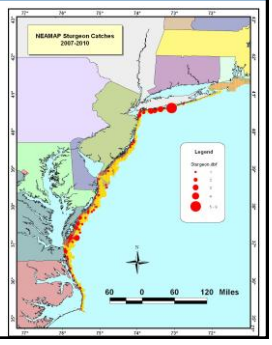
- Amendment 1 to the FMP approved in 1998
  - Protect spawning stock and habitat
  - Established 40+ year coastwide moratorium
  - Reduce or eliminate bycatch mortality

Bycatch Work

- ASMFC has identified bycatch as a lead issue in the recovery of Atlantic sturgeon populations throughout their range.
- 2006 - ASMFC Workshop on Assessment of Atlantic Sturgeon Bycatch
- 2007 - AMFC and NMFS Workshop
  - "Estimation of Atlantic Sturgeon Bycatch in Coastal Atlantic Commercial Fisheries of New England and the Mid-Atlantic"

NEAMAP





Future Action

- Sturgeon Management Board will continue to coordinate Atlantic coast management
- Commission is working with states to assist in Section 10 permitting under ESA listing
- Initiated a new benchmark assessment
  - Expected to be completed in 2014

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Protected Species Branch

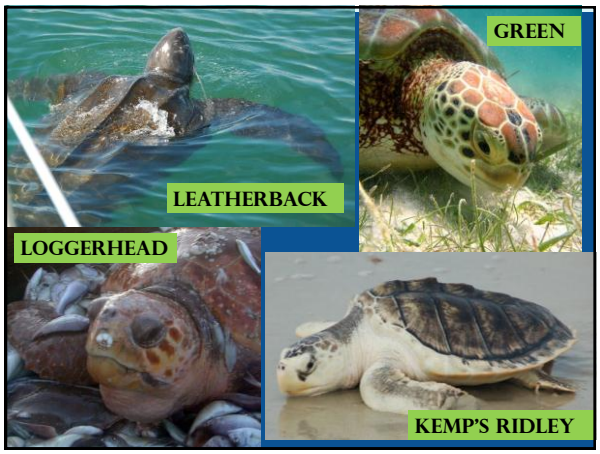
Sea Turtle Bycatch in Sink Gillnet Gear: Observations and Analyses from 1995-2011

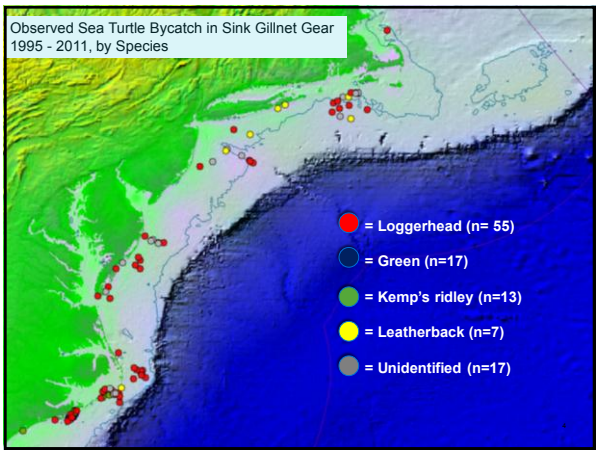
Kimberly T. Murray
Woods Hole, MA

Turtle & Sturgeon Gillnet Workshop, 22 January 2012

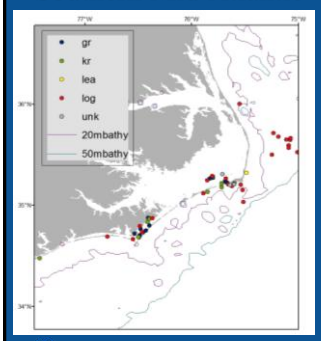
Goal for Today:

- Describe characteristics of observed turtle bycatch in sink gillnet gear 1995-2011
- Identify times, areas, & gear characteristics to focus bycatch reduction, using:
  - Completed analysis from 1995-2006
  - Preliminary analysis from 2007-2011

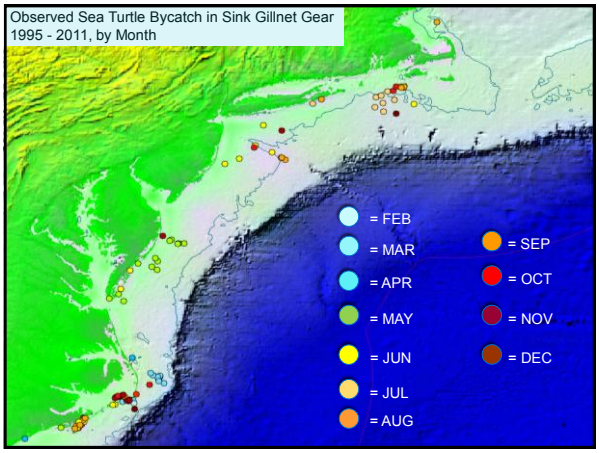


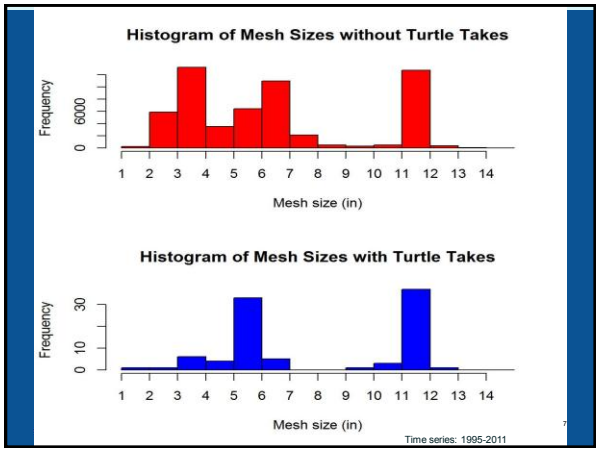


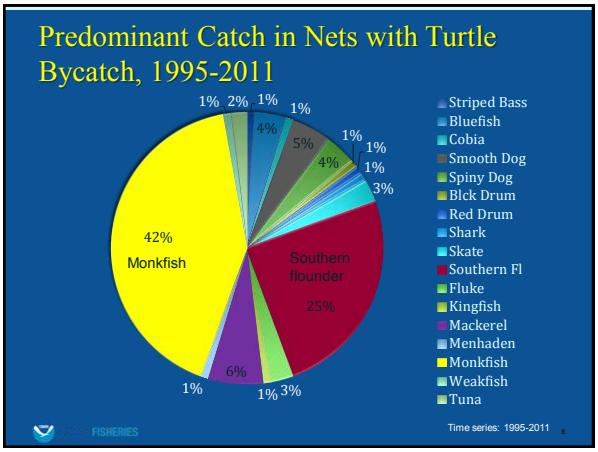
High Proportion of Turtle Bycatch in Southern Mid-Atlantic



- South of 36°N:
  - 30% of observed hauls occurred
  - 59% of observed turtle bycatch occurred
- Almost all Green and Kemp's ridley takes inside or just outside NC internal waters





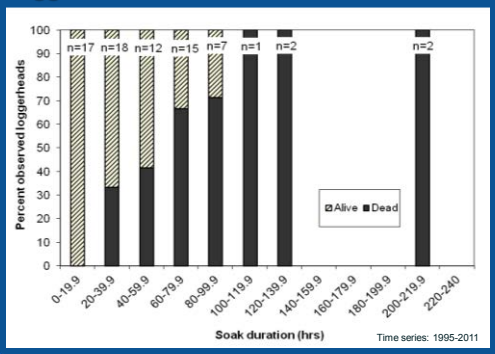


Other Gear Characteristics – Nets with Turtles

Hang Ratio	0.33 : 27% (n=23) 0.50 : 71% (n=60) 0.60 : 2% (n=2)
Tie Downs Used	No: 58% (n=55) Yes: 42% (n=40)
Tie Down Length	1.5 – 7.8 ft (n=40) Mode: 3.0 ft
Net Height (when no tie downs used)	4.0 – 60.0 ft (n=67) Mode: 12.0 ft

Time series: 1995-2011

Loggerhead Condition versus Soak Duration



Analysis of Bycatch Rates, 1995-2006

Details in:
Murray, K.T. 2009. Endangered Species Research 8(3): 211-224

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Loggerhead Bycatch Model

Variables considered:
- SST
- Latitude
- Depth
- Mesh size
- Hang ratio
- Year/year group
- Target species

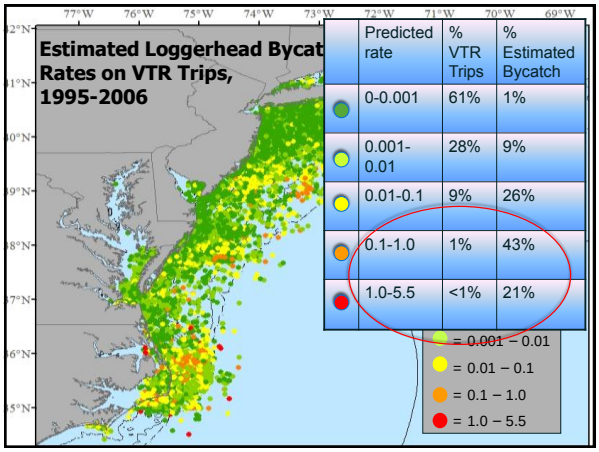
Preferred Model:
Logger ~ offset (tons landed) + SST + mesh size + latitude

↓

Commercial Data
- Estimated bycatch rate on each trip
- Estimated amount of bycatch on each trip

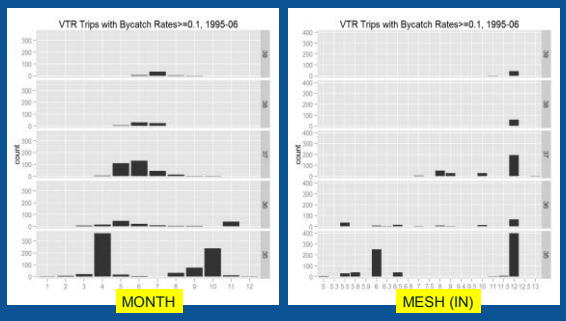
Bycatch Model Results

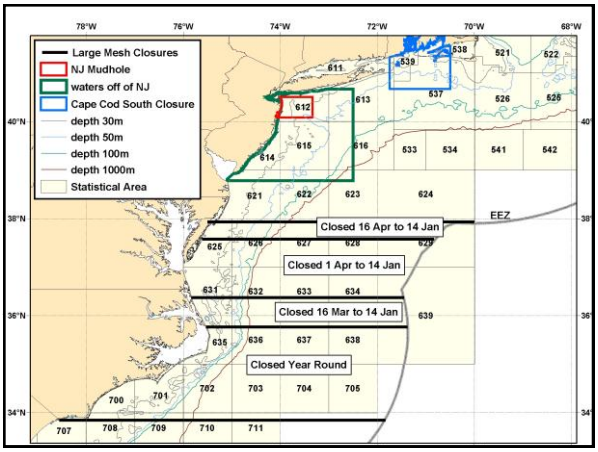
- Highest bycatch rates will be in low latitudes (<38°N), warm SST (>15°C), large mesh gillnets (>7")
- Lowest bycatch rates will be in higher latitudes, cooler SST, small mesh gillnets



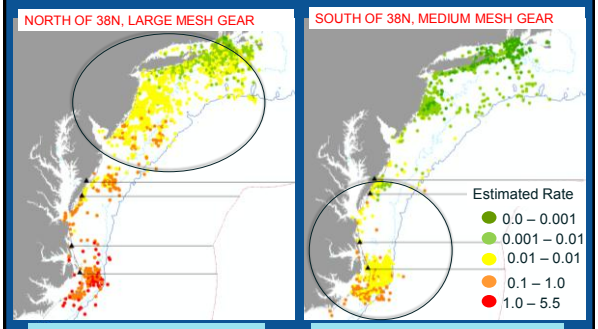
	Predicted rate	% VTR Trips	% Estimated Bycatch
	0-0.001	61%	1%
	0.001-0.01	28%	9%
	0.01-0.1	9%	26%
	0.1-1.0	1%	43%
	1.0-5.5	<1%	21%

Characteristics of Trips with Highest Bycatch Rates



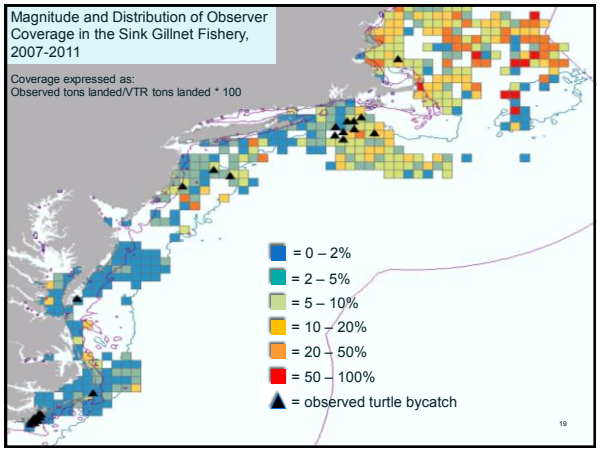


Where Can Further Bycatch Reduction Be Gained (1995-2006)?



(>7" mesh in >=15°C SST) (5 - 7" mesh in >=15°C SST)

Preliminary Analysis of Bycatch Rates, 2007-2011



Examination of More Recent Bycatch Rates

- Two approaches:
  - Stratified ratio estimates with 07-11 data
  - Update Murray 2009 model with pooled data from 1995-2011
- Preliminary results of both indicate elevated rates in large mesh gear, and in medium mesh gear in southern latitudes

20

Summary of Turtle/Gillnet Interactions

- Sea turtle bycatch observed year-round off NC, though mainly from May-Nov in northern latitudes
- Greens and Kemp's ridleys have mainly been observed in NC waters
- Large proportion of observed bycatch in monkfish (large mesh) and southern flounder (medium mesh) fisheries
- Time, area, and mesh size associated with turtle bycatch rates.
- Opportunities for bycatch reduction in large mesh gear north of 38°N, and in medium mesh gear south of 38°N

Data Quality Evaluation: VTR Effort

- Preferred indication of gillnet fishing effort is the length of time and space gear is in the water:

  soak time * total net length,

  where total net length=gear quantity * gear size
- Historically, VTR effort data quality was poor with respect to these variables
- Effort recently re-evaluated using 2007-2011 data to assess whether soaktime * total net length could be used as a unit of effort in bycatch rate analyses

Comparison of VTR and Observer Effort Data

- Over 2007-2011, observed trips were matched to the VTR log submitted for the same trip (n=3,342) via the VTR Serial number
- Data recorded on the observed log and the VTR log were compared for:
  - Gear quantity
  - Gear size
  - Soak duration
  - Number of hauls

VTR Reporting Instructions:

- **Gear quantity:** For fixed gear, fishers are instructed to record the average number of nets per string on each haul.
- Gear size: Average length of the nets used in a string (not the entire string)

Results of Comparisons

	VTR			OBSERVER		
	Mean	Median	Range	Mean	Median	Range
Gear quantity	29.3	18.0	1-700	10.4	10.0	1-50
Gear size	330.4	300.0	30-4000	303.8	300.0	50-1400
Soak duration	48.3	24.0	1-450	48.2	24.0	0-672
Number of Hauls	3.1	3.0	1-54	4.3	4.0	1-35

Average VTR values for 'gear quantity' were 3x higher than those recorded by observers on the same trip

Why the Discrepancy?

- Fishers may be recording the total quantity of gear fished or onboard during a trip rather than the average number fished on a haul
- Using gear quantity in the calculation of total fishing effort would over-estimate total bycatch
- Decision was made to not use soak time * net length as a unit of effort

Atlantic Sturgeon

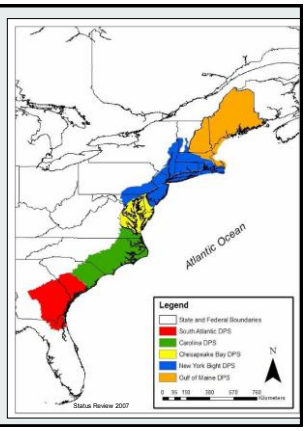
- Range - Labrador to FL
- Anadromous with high degree of "homing"
- Highly migratory while in marine environment
- Primarily thought to be in coastal waters during marine phase (Erickson et al. 2011)
  - Potential concentration areas at mouth of estuaries
  - Seasonal shifts in depth typically inside 20 fathoms

Atlantic Sturgeon Life History

- Long lived
  - Max age ≈ 60-75 yrs
- Late maturing
  - Males 10-13 years
  - Females 13-20 years
- Spawning 2-5 year intervals for females
- Large
  - Max length- 14'
  - Max wt. ≈ 900lb

5 Distinct Population Segments (DPS)

- Threatened (Proposed)
  - Gulf of Maine
- Endangered (Proposed)
  - South Atlantic
  - Carolina
  - Chesapeake Bay
  - New York Bight



Study Rationale

- Quantify differences in movement patterns
  - DPS
  - Reproductive condition
- Facilitate management to reduce anthropogenic impacts
  - Dredging
  - Ship strikes
  - Bycatch mortality

Methods

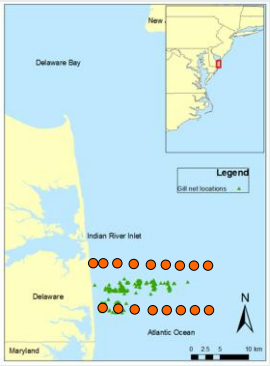
- 2009-2012
  - 90 days (March-May)
  - 435 miles of net hauled
  - 532 captures
  - 195 adults tagged (6.5 yr. tags)
    - Mean weight 88lb
    - Max ≈315 lb. and 7'6" fork length

Passive Receiver Array

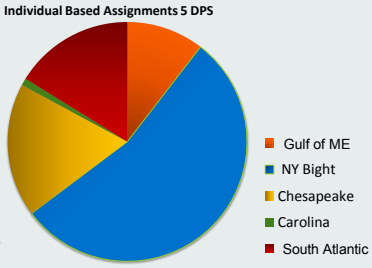
- > 150 Stationary Receivers
- Our focus
  - Delaware River/Bay
  - Hudson River
  - Atlantic Ocean

Methods: Sampling

- 2009-2012
  - 40x50 fathom shots
  - 12-12 90
  - 13-12-98
- Gate array
  - Hydrophones 1-16km offshore
  - Spring 2010
  - Spring 2011
  - Chincoteague Fall 2012

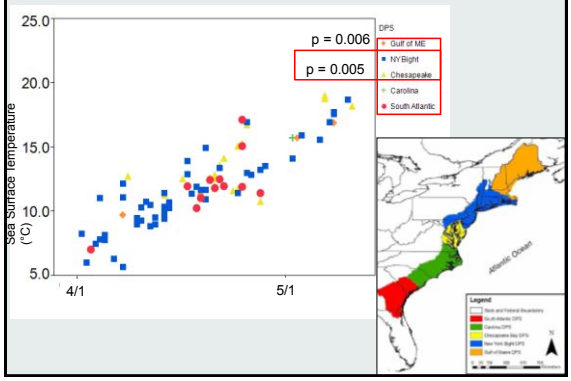


Genetic Assignments of Captured Atlantic Sturgeon 2009-2010

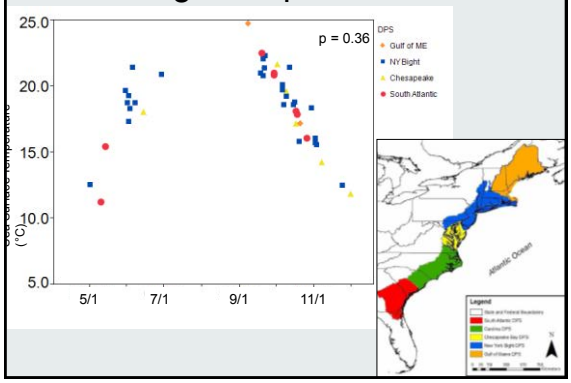


Courtesy of Isaac Wirgin and Tim King

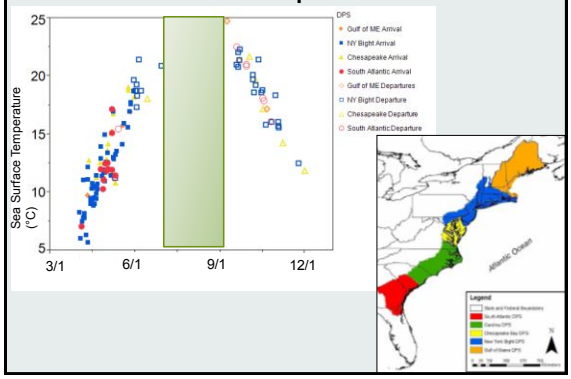
Timing of Arrival: DPS



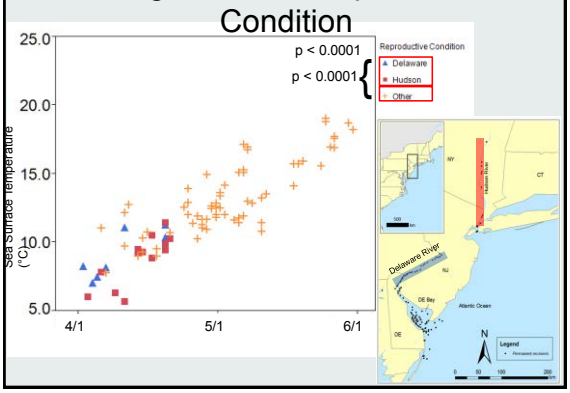
Timing of Departure: DPS



Arrivals and Departures: DPS

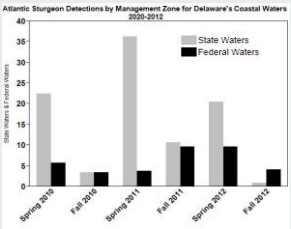


Timing of Arrival: Reproductive Condition



Coastal Movements Patterns

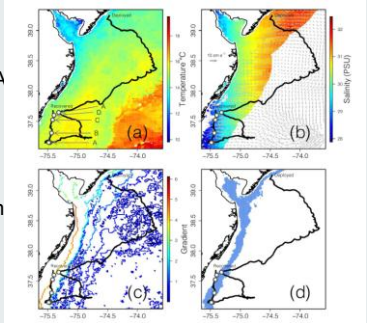
- Spring
  - 61% state/39% federal
  - Indirect northerly movement
  - Mean - 21 days (1-54)
- Fall
  - 24% state/76% federal
  - Direct southerly movement
  - Mean - 6 days (1-34)
- Total sturgeon detected
  - Spring 385
  - Fall 180
  - > 2x in spring suggesting behavioral differences between seasons



Moving Forward

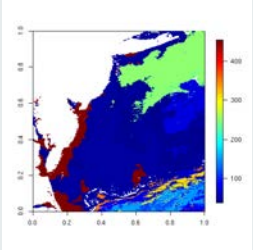
Moving Forward

- Mission run from Tuckerton, NJ to Chincoteague, VA
  - Telemetry data
  - Temperature
  - Salinity
  - Productivity
- Found 4 sturgeon
  - All in the same water mass



Moving Forward

- Environmental Drivers
  - Determine patterns/associations
  - Identify important water properties/types
- Facilitate Management
  - Minimize incidental take of Endangered Species
  - Not only helps sturgeon but allows fisheries to keep fishing



Research/Recovery Continuum

Cooperation < > Collaboration

Boats for hire

Integration into all stages

Acknowledgements
NOAA NMFS
Kim Damon-Randall/AFCA/Section 6
Ike Wirgin and Tim King- Genetic muscle
Lori Brown, DSU staff and students
Kevin Wark and Mike Lohr
1085554

Science, Service, Stewardship

Atlantic Sturgeon Bycatch – What we know

NOAA FISHERIES SERVICE

Distribution

(a) Stein *et al*. (2004b) based on recorded observed captures of Atlantic sturgeon in fishing gear;

(b) Dunton *et al*. (2010) based on incidental capture in five fishery independent surveys;

(c) Erickson *et al*. (2011) based on tracks of 13 satellite tagged Atlantic sturgeon.

All demonstrate that Atlantic sturgeon occur primarily in waters less than 50m although deeper waters are also used.

Bycatch of Atlantic Sturgeon

Three key reports, all are based on data collected by the Northeast Fisheries Observer Program

Stein *et al*., (2004a) for 1989-2000;

ASMFC Special Report (2007) for 2001-2006;

NEFSC report (by T. Miller and G. Shepherd (2011)) for 2006-2011.

The estimates of the three reports should not be compared because each report used a different approach for estimating the total bycatch or included different fisheries

Conclusions common to all three reports:

Total estimated bycatch of Atlantic sturgeon is in the thousands per year

Estimated capture of Atlantic sturgeon in sink gillnet and trawl gear were relatively similar

The observed mortality of sturgeon in sink gillnet gear is much higher than observed mortality of Atlantic sturgeon in trawl gear therefore, the estimated total mortality of Atlantic sturgeon in sink gillnet gear is much higher than in trawl gear

The estimated bycatch mortality in sink gillnet gear is in the hundreds per year

Other conclusions

A significant fraction of sturgeon takes are associated with non-FMP species (e.g, ASMFC plans or state fisheries)

Atlantic sturgeon bycatch tends to occur in waters less than 50 meters

Although seasonal patterns exist, sturgeon are encountered in sink gillnets throughout the year

Areas of higher bycatch coincide with areas where sturgeon are known to aggregate

NEFSC Report for years 2006-2010
Estimated Encounters

Sink Gillnet	Otter Trawl
1614	1606
1044	807
678	857
1428	1050
347	1752

NEFSC Report for years 2006-2010
Estimated Dead Encounters

Sink Gillnet	Otter Trawl
246	90
309	63
231	145
223	19
30	7

Actions to Address Bycatch

We are working with the Atlantic States Marine Fisheries Commission and the states to address bycatch of Atlantic sturgeon in state managed fisheries

Bycatch of Atlantic sturgeon that occurs as a result of federally-managed fisheries must be considered during section 7 consultation on those fisheries – consultation is in progress

Research - finding ways to minimize the number of sturgeon caught or the number of sturgeon killed in fishing gear

Overview of bycatch reduction research for sea turtles

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Henry Milliken - Northeast Fisheries Science Center

John Wang – Pacific Islands Fisheries Science Center

January 22, 2013

Methods tested to reduce sea turtle bycatch in the Atlantic

- Increasing gear visibility
  - Illumination (Werner et al., 2006)
  - Materials
- Reducing the height of the net (Eckert et al. 2008; Gearhart et al.2009)
- Eliminating tie-downs (Price and Van Salisbury 2007)
- Modifying float characteristics (Price and Van Salisbury 2007)
- Set direction
- Reduce breaking strength of mesh.

Ideas taken from Gillman et al. (2010)

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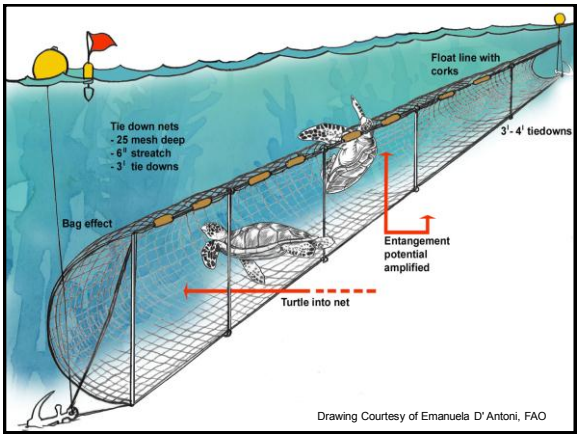
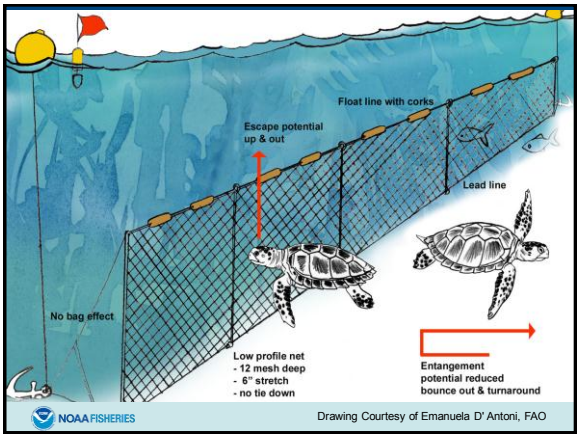


Drawing Courtesy of Emanuela D' Antoni, FAO



NOAA FISHERIES Drawing Courtesy of Emanuela D' Antoni, FAO

What we know

- Turtle behavior around gillnets is poorly understood
- Turtle behavior appears to change by region / strata and is influenced by water temperatures, depth, light, and other environmental factors
- Solutions likely need to be region / fishery specific

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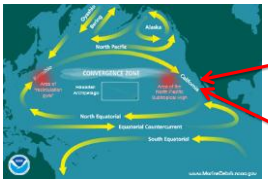
Overview of gillnet bycatch reduction experiments being conducted in the Pacific



Coastal gillnets are a common form of fishing
- Problematic due to non-selective impacts
- NOAA –PIFSC has examined sensory systems (visual, auditory, chemosensory, electromagnetic systems) as basis for potential Bycatch reduction technologies (BRTs)
- Focused on visual cues to reduce sea turtle interactions

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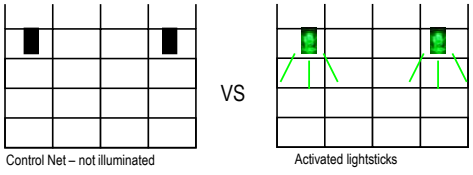
Can we develop visual cues that act as an alert for sea turtles?

Illuminate nets by attaching lightsticks onto the floatline of gillnets net
- illuminate portions of the net
- creates a visual alert



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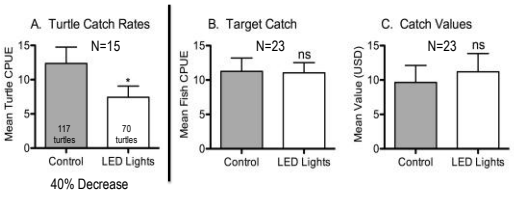
A. Net Illumination: Green LED lightsticks every 10m



Wilcoxon Matched-Pairs Signed-Rank test, significance: *P<0.05

Turtle trials conducted in Punta Abreojos, Baja MX and Fish trials conducted in Bahia de los Angeles, MX

Wang et al, 2010

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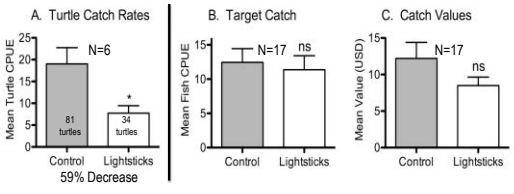
B. Net illumination: chemical lightsticks every 5m



Wilcoxon Matched-Pairs Signed-Rank test, significance: *P<0.05

Wang et al, 2010

Turtle trials conducted in Punta Abreojos, Baja MX and Fish trials conducted in Bahia de los Angeles, MX

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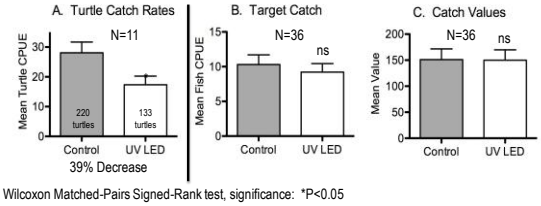
C. UV Net illumination LED lightsticks placed every 5m



Wilcoxon Matched-Pairs Signed-Rank test, significance: *P<0.05

Turtle trials conducted in Punta Abreojos, Baja MX and Fish trials conducted in Bahia de los Angeles, MX

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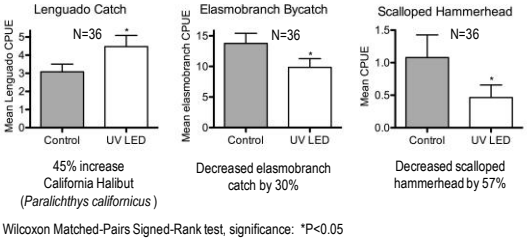
Wang et al preliminary data

The effects of UV illumination on primary target species and elasmobranchs

-Holds most value per kilo



Wilcoxon Matched-Pairs Signed-Rank test, significance: *P<0.05

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Wang et al preliminary data

Testing net illumination in Pacific fisheries with high sea turtle bycatch

A. Test net illumination in a Peruvian fisheries with high green turtle interaction rates
   Fishery interacts with 300+ green turtles/yr (Alfaro-Shigueto, 2011)

B. Examine potential with other turtle species
   - Loggerhead sea turtle interactions
   Foraging hotspot offshore
   Bycatch estimated at 550+ turtle/yr

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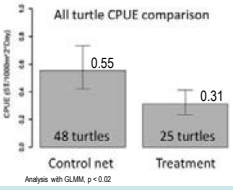
A. Peruvian Coastal Gillnet Fisheries

Fishery interacts with 300+ green turtles/yr (Alfaro-Shigueto, 2011)



51 pairs of bottom set gill nets
- 750m long, 3m deep

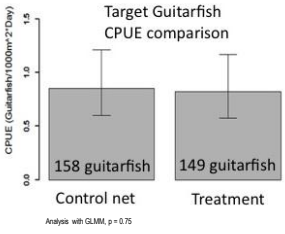
44% decrease in turtle bycatch
- 70 green sea turtles
- 2 hawksbill
- 1 olive ridley

- mean SCL (green) 55.8 cm
- 51% mortality rate

NOAA FISHERIES Data from Pro Delphinus

Illumination effects on target catch in Peruvian fisheries

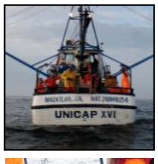
Guitarfish
(*Rhinobatus planiceps*)



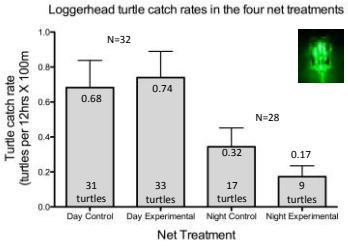
Other target species were sporadically caught:
Ray species (*Dasyatis brevis* and *Myliobatis* sp),
flounders (*Paralichthys* sp.) and croakers (*Paralonchurus peruanus*)

NOAA FISHERIES Data from Pro Delphinus

B. 2012 pilot study off Baja California Sur testing effects of illuminated nets on Loggerhead sea turtles



- Trials conducted on R/V UNICAP XVI in collaboration with Grupo Tortugero, Arizona State Univ, ProNatura, Ocean Discovery Inst., WWF



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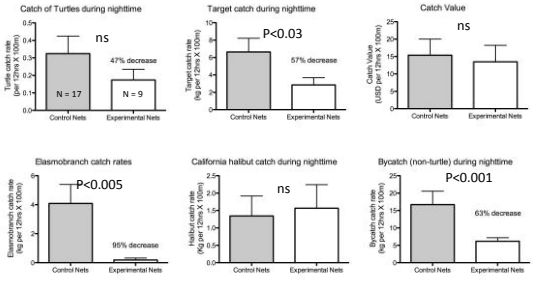
Night time net illumination effects



Wilcoxon Matched-Pairs Signed-Rank test

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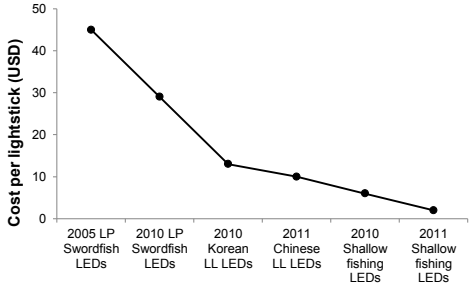
Cost of LED lightsticks have rapidly decreased



NOAA FISHERIES

Overview of bycatch reduction research for sturgeon, or similar fish morphologies

Kevin Wark (F/V Dana Christine)
Dewayne Fox (Delaware State University
Henry Milliken (NOAA-NMFS-NEFSC)
Jim Armstrong (MAFMC)

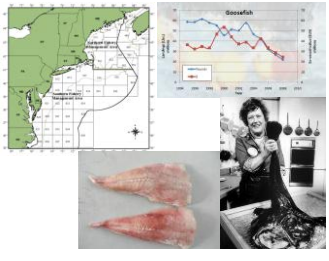
3/18/2013

Methods used to reduce sturgeon bycatch:

- Reducing net vertical height (Fox et al. 2012)
- Eliminating tiedowns (Fox et al. 2011)
- Raising net off bottom (Siberian sturgeon- Gessner and Ardnt (2006); Striped Bass- Trice 2011)
- Hanging ratio (Hamley 1975, Hovgard et al. 2000)

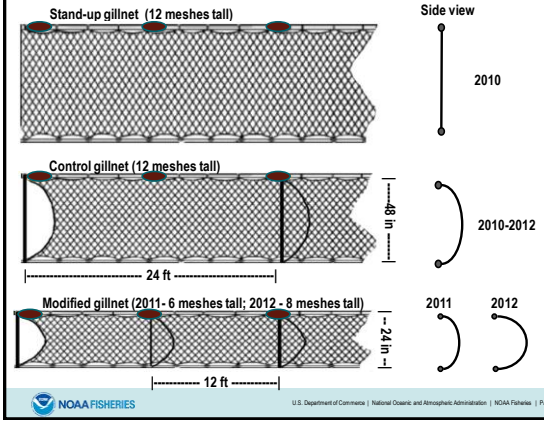
Monkfish Fishery

- 750Limited Access Vessels
- $25-50 Million Fishery
- Trawl fishery in NMA
- Gillnet fishery in SMA



Objectives

- **Evaluate effect of tie downs, tie-down height and mesh numbers on catches of:**
  - **Atlantic sturgeon**
  - **Harbor Porpoise**
  - **Monkfish**

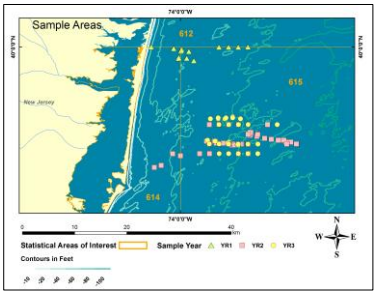


Methods

- Gillnetters randomly assigned paired replicates4
- Experimental gear fished along-side standard (control) gear
- N = 60 (120 hauls)/year
- Sturgeon and finfish data collected via trained observers
- Otherwise, fished as normal monkfish trips

Study Area

NMFS Statistical Areas 612,614, and 615



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Results

Sturgeon (Numbers)	Control	Experimental	Difference
Standup	18	5	72.2% *
Low Profile (12" x 6 mesh)	28	9	67.9%
Low Profile (12" x 8 mesh)	21	14	33.3%
Monkfish (kg)	**Control**	**Experimental**	**Difference**
Standup	7306	3737	48.9%
Low Profile (12" x 6 mesh)	4345	3341	23.1%
Low Profile (12" x 8 mesh)	5754	5255	9.7%
Skate (kg)	**Control**	**Experimental**	**Difference**
Standup	10048	1782	82.3%
Low Profile (12" x 6 mesh)	11921	9734	18.3%
Low Profile (12" x 8 mesh)	5319	4627	13.0%

DRAFT

* When DSU tested further, they found no difference.

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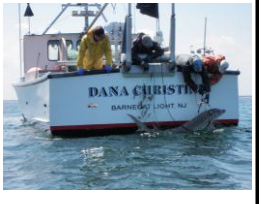
Conclusions

- Atlantic sturgeon
  - Within the limits of this work, tie-downs do not appear to increase capture and therefore, mortality
  - Low profile nets with additional two mesh do not appear as effective in reducing sturgeon bycatch
- Harbor Porpoise
  - Based on NEFOP data, tie-downs do appear to decrease risk of entanglement
  - Stand-up nets resulted in an unacceptable number of marine mammal encounters
- Monkfish (and winter skate)
  - Tie-downs do appear to increase capture, are favorable from a fishery profitability standpoint



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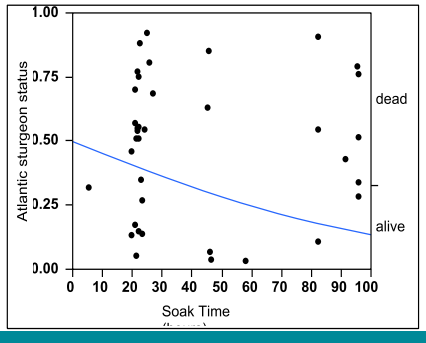
Atlantic Sturgeon Mortality vs. Soak Time BREP Study 2011



3/18/2013 NOAA FISHERIES

Bycatch and Atlantic Sturgeon Landings (VA)

Gear and application factors and incidence of mortality across categories of small, medium and large mesh (according to NMFS definitions). From NEFSC Sea Sampling (Observer) Database (2001-2006).

Mesh Size	Small Mesh (≤5")	Medium Mesh (>5" – <7")	Large Mesh (≥7")
Sturgeon Deaths	1	16	118
Interactions	55	80	330
Incidence of Mortality	2%	20%	36%
% of Total Deaths	1%	12%	87%
% Tie downs Used	0%	9%	74%
% Soak Time >24 hrs	4%	38%	70%

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Sturgeon Bycatch and Mesh Size (VA- Hagar)

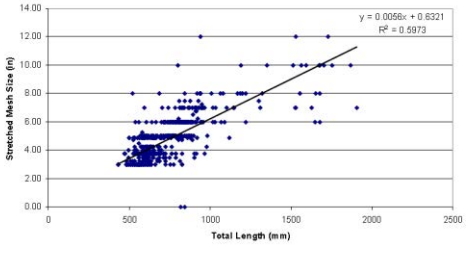

Figure 2. Virginia Sea Grant sink gillnet mesh specific length distributions of sturgeon.

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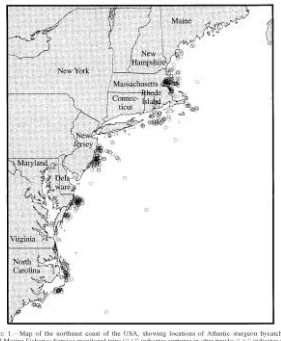


FIGURE 1.—Map of the northeast coast of the USA, showing locations of Atlantic sturgeon bycatch within National Marine Fisheries Service-monitored trips ("+" indicates captures in otter trawls; "·" indicates captures in drift gill nets; "O" indicates captures in sink gill nets).

Taken from: Andrew B. Stein , Kevin D. Friedland & Michael Sutherland (2004): Atlantic Sturgeon Marine Bycatch and Mortality on the Continental Shelf of the Northeast United States, North American Journal of Fisheries Management, 24:1, 171-183

TABLE 4.—Bycatch of Atlantic sturgeon (lb) and landings for monitored trips (lb) by declared target species. Associated bycatch rate was calculated as pounds of sturgeon per pound landed.

Target species	Sturgeon catch	Landings for monitored trips	Bycatch rate
Bluefish	169	257,215	0.000657
Butterfish *Peprilus triacanthus*	265	331,064	0.000800
Atlantic cod	1,542	323,795	0.004762
Atlantic croaker	175	746,476	0.000197
Haddock *Melanogrammus aeglefinus*	45	97,974	0.000459
Horseshoe crab	97	205,728	0.000471
Northern kingfish *Menticirrhus saxatilis*	85	3,511	0.024213
Longfin inshore squid	355	1,826,769	0.000194
Atlantic menhaden *Brevoortia tyrannus*	8	25,792	0.000291
Goosefish	7,975	1,599,948	0.004984
Pollock	75	717,607	0.000105
Red hake *Urophycis chuss*–silver hake	50	2,912	0.017170
Scup *Stenotomus chrysops*	570	48,525	0.011747
American shad	540	22,582	0.023899
Smooth dogfish *Mustelus canis*	760	246,244	0.003086
Southern flounder *Paralichthys lethostigma*	107	5,363	0.019959
Spiny dogfish	4,910	4,126,478	0.000947
Striped bass *Morone saxatilis*	456	58,874	0.007747
Summer flounder	3,196	220,499	0.001566
Tautog *Tautoga onitis*	10	8,906	0.001123
Unidentified dogfish	2,107	1,320,843	0.001595
Unidentified squid	50	570,953	0.000096
Unidentified tuna	8	843,336	0.000009
Weakfish *Cynoscion regalis*–bluefish	116	11,163	0.010391
Weakfish–Atlantic croaker	10	45,290	0.000221
Weakfish–Striped bass	35	210	0.166667
Winter flounder *Pleuronectes americanus*	277	108,613	0.002550
Winter skate *Raja ocellata*	105	7,008	0.014983
Witch flounder *Glyptocephalus cynoglossus*	341	20,628	0.016531
Yellowtail flounder *Pleuronectes ferrugineus*	230	434,270	0.000530

Taken from: Andrew B. Stein , Kevin D. Friedland & Michael Sutherland (2004): Atlantic Sturgeon Marine Bycatch and Mortality on the Continental Shelf of the Northeast United States, North American Journal of Fisheries Management, 24:1, 171-183

TABLE 3.—Matrix of mean bycatch rate of Atlantic sturgeon (1989–2000) stratified by fishing gear, month, and state. Units are sturgeon pounds per 1,000 lb of monitored landings.

State	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Otter trawl												
Maine	1.545	0.229	0.021	0.173	1.038	2.367	0.034	0.003	0.294	1.460	2.280	0.788
New Hampshire	2.133	0.317	0.032	0.239	1.432	3.267	0.047	0.046	0.403	2.017	3.147	1.088
Massachusetts	1.545	0.229	0.021	0.173	1.038	2.367	0.034	0.034	0.294	1.460	2.280	0.788
Rhode Island	0.003	0.002	0.000	0.001	0.007	0.016	0.000	0.000	0.002	0.010	0.015	0.005
Connecticut	1.545	0.229	0.021	0.173	1.038	2.367	0.034	0.034	0.294	1.460	2.280	0.788
New York	1.536	0.228	0.023	0.172	1.032	2.353	0.034	0.033	0.292	1.451	2.267	0.784
New Jersey	0.416	0.062	0.006	0.047	0.279	0.637	0.009	0.009	0.079	0.393	0.614	0.212
Pennsylvania	1.545	0.229	0.021	0.173	1.038	2.367	0.034	0.003	0.294	1.460	2.280	0.788
Delaware	1.545	0.229	0.021	0.173	1.038	2.367	0.034	0.003	0.294	1.460	2.280	0.788
Maryland	2.966	0.437	0.044	0.330	1.979	4.514	0.065	0.064	0.560	2.787	4.340	1.503
Virginia	1.557	0.231	0.023	0.178	1.066	2.396	0.035	0.034	0.296	1.473	2.298	0.796
North Carolina	2.218	0.329	0.033	0.248	1.490	3.399	0.049	0.048	0.422	2.098	3.274	1.132
Sink gill nets												
Maine	0.147	0.132	0.228	0.211	0.240	0.085	0.042	0.016	0.009	0.057	0.184	0.180
New Hampshire	0.440	0.394	0.682	0.630	0.778	0.255	0.125	0.049	0.028	0.170	0.551	0.536
Massachusetts	1.062	0.953	1.651	1.491	1.839	0.601	0.297	0.115	0.066	0.401	1.303	1.268
Rhode Island	2.201	1.971	3.416	3.150	3.886	1.273	0.627	0.244	0.140	0.844	2.753	2.680
Connecticut	2.778	2.480	4.290	3.960	4.890	1.600	0.790	0.300	0.180	1.100	3.460	3.370
New York	3.261	2.919	5.040	4.666	5.757	1.889	0.929	0.363	0.207	1.254	4.078	3.970
New Jersey	9.156	8.196	14.177	13.102	16.167	5.308	2.609	1.013	0.582	3.527	11.453	11.147
Delaware	2.778	2.480	4.290	3.960	4.890	1.600	0.790	0.300	0.180	1.100	3.460	3.370
Maryland	3.057	2.737	4.732	4.378	5.397	1.771	0.871	0.338	0.194	1.177	3.823	3.721
Virginia	2.407	2.155	3.727	3.444	4.249	1.394	0.686	0.266	0.153	0.927	3.010	2.930
North Carolina	3.201	2.866	4.956	4.580	5.651	1.854	0.912	0.354	0.204	1.233	4.003	3.897
Drift gill nets												
Maine	5.9		2.2	33.7				3.0			5.9	
New Hampshire	5.9										5.9	
Massachusetts	5.9										5.9	
Rhode Island	5.9		2.2	33.7				3.0			5.9	
Connecticut	5.9		2.2	33.7				3.0			5.9	
New York	5.9										5.9	
New Jersey	5.9		0.380	7.016				0.390			5.9	
Delaware	5.9		0.146	2.556				0.198			5.9	
Maryland	5.9		0.179	4.373				0.242			5.9	
Virginia	5.9		17.860	434.428				23.017			5.9	
North Carolina	5.9										5.9	

Taken from: Andrew B. Stein , Kevin D. Friedland & Michael Sutherland (2004): Atlantic Sturgeon Marine Bycatch and Mortality on the Continental Shelf of the Northeast United States, North American Journal of Fisheries Management, 24:1, 171-183

NOAA FISHERIES
NEFSC

The effects of hanging ratio on the catch of harbor porpoise and targeted finfish species

Gwynne Schnaittacher, A.I.S., Inc., New Bedford, MA * ; Gwynne.Schnaittacher@noaa.gov

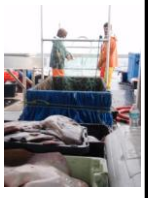
Henry Milliken, NEFSC, Woods Hole, MA; Henry.Milliken@noaa.gov

November, 28 2012

* Now with NMFS

Background

- Analysis of observer data by scientists at the NEFSC, Protected Species Branch (PSB) showed greater harbor porpoise bycatch in gear hung on the 1/3 (0.33) vs. gear hung on the 1/2 (0.50) in the area south of the South of Cape Management Area.

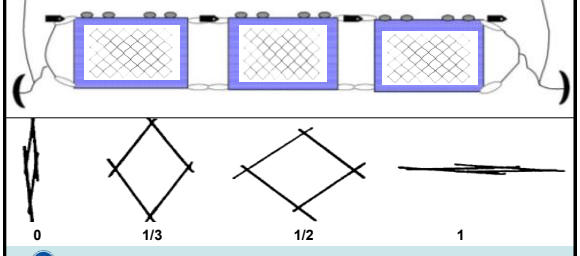


Goal

- To examine the effects of two hanging ratios on Harbor Porpoise bycatch and targeted catch

Hanging Ratio

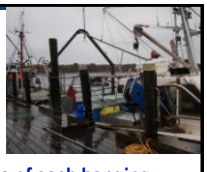
Definition: Describes the length vs. height ratio of the meshes or the stretch capacity of the mesh.



Methods (con't)

- Fishing Practices
  - Set and hauled in a manner consistent with normal fishing practices in designated study area
  - Targeted soak time was <96 hours
  - Standard haul information was collected for each haul
  - Effort was to be consistent between treatments

Gear Reconfiguration



- 2009:

  Phase I [2009]
  - Hauls 1-19: randomized array; 7 nets of each hanging ratio randomly placed on each string. 18 February-6 March, 2009
  - Hauls 20-79: Each string consisted of only one hanging ratio. 8 March-28 April, 2009

  Phase II [2010]
  - No reconfiguration needed; configuration the same as Phase II of 2009 season

Results

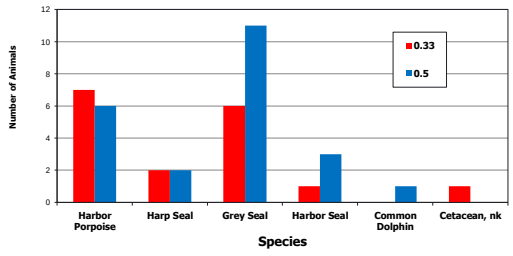
- 79 hauls completed between 18 February and 28 April, 2009 and 80 hauls completed between 28 February to 28 April, 2010 (Total 159 hauls)
- Field Season 2009: 19 hauls completed in Phase I; 60 Hauls Phase II
- Field Season 2010: All 80 hauls same configuration of Phase II of 2009 field season
- Average soak time=127 hours
- Depth ranges 40-84 fm

Results (con't)

- **Marine Mammals (Phase II)**
  - **Total caught Phase II: 13 harbor porpoise, 4 harp seals, 17 grey seals, 4 harbor seals and 1 common dolphin.**
  - **Hanging ratio 0.33: 17 animals; hanging ratio 0.50: 23 animals. Differences not significantly different from zero.**

Species	0.33	0.50
Harbor Porpoise	7	6
Harp Seal	2	2
Grey Seal	6	11
Harbor Seal	1	3
Common Dolphin	0	1
Cetacean, nk	1	0
TOTAL	17	23

Bycatch of Marine Mammals by Hanging Ratio, 2009-2010

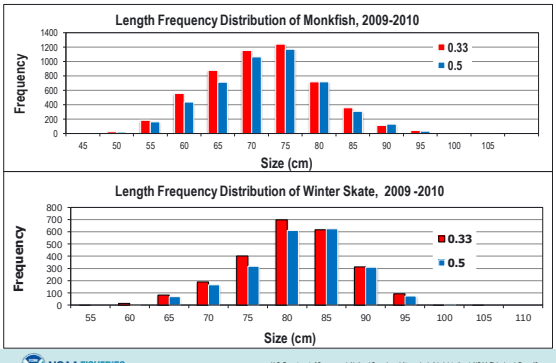


Results (con't)

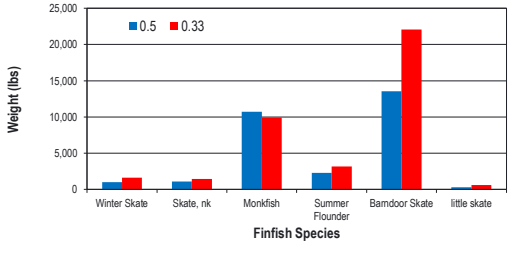
Finfish

Status (Kept or Discarded)	Species	0.50 (lbs)	0.33 (lbs)
K	Monkfish	75,940	81,568
K	Winter Skate	47,750	68,736
D	Winter Skate	1,023	1,647
D	Skate, nk	1,095	1,468
D	Monkfish	10,729	9,927
D	Summer Flounder	2,313	3,179
D	Barndoor Skate	13,529	22,051
D	little skate	303	601

Results (con't)



Discarded Finfish Species By Hanging Ratio 2009-2010



Conclusions

- **Number of targeted fish greater in gear hung on the 0.33.**
- **Number of incidental takes greater in gear hung on the 0.50, except number of harbor porpoise were greater in gear hung on the 0.33 differences NOT significantly different from zero**

Take Home Messages

This study suggests that hanging ratio does NOT appear to decrease harbor porpoise / marine mammal bycatch. We hope that the results of this work provides information which can be used to make informed decisions.

Future Research Suggestions

- Increase bridle/spacing between nets
- Other types of pingers with scanning frequencies
- Reconfigure with tie down at every float

Acknowledgements

- Luke Szymanski-Project coordination and data collection
- Eric Matzen for his technical assistance and support
- Technicians: Rob Bland, Jenna Christiansenn, Matt Coble, CW Clarke, Randy Collins, Craig Gogan, Nikole Jalbert, Janine L'Heureux, Trevor Horwell, Jen Langares, Allison MacConnell, Chris Marsden, Meghan Miner, Max Morgan, Cara Sands, Lauren Wahl, and Lauren Zatorski
- Captain and Crew of the F/Vs D&S Express, Jessica Marie, Kim & Jake and Shamrock
- Matt Coble, Nikole Jalbert and Trevor Horwell-Data entry and audits
- Betty Lentell and Fred Wenzel for assistance with marine mammal samples
- NEFOP
- AIS Support Staff

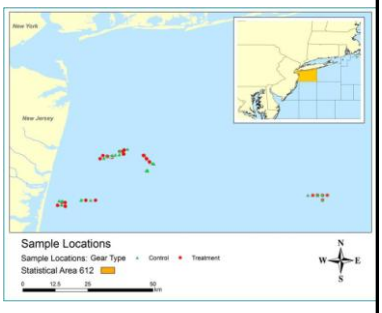
NOAA FISHERIES
NEFSC

Gillnet Configurations and their Impact on Atlantic Sturgeon and Marine Mammal Bycatch in the New Jersey Monkfish Fishery

James L. Armstrong
Lori M. Brown
Dewayne A. Fox
Henry Milliken

Study Area

- Nov –Dec 2010
- Two sites
  - Nearshore
  - Offshore
- Two monkfish gillnetters
- Observers

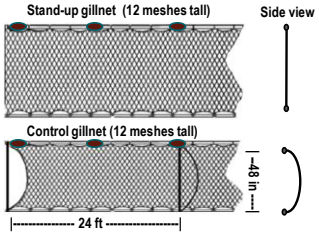


Objectives

- Evaluate affect of tie downs on catches of:
  - Atlantic sturgeon
  - Harbor Porpoise / Marine Mammals
  - Monkfish

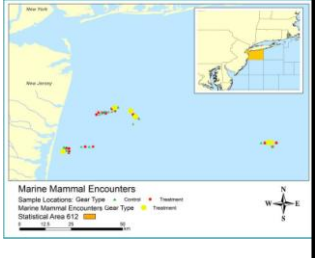
Methods

- Control – Tie Down
- Treatment – No Tie Down
- Two strings each per site
- Ten panels per string
- Panels 300 ft
- Mesh 12 inch



Results – Harbor porpoise

- Harbor Porpoise encounter rate *appears* to be lower in pre-HPTRP era when tie-downs were used
- Current study - eight marine mammals captured in stand-up nets, none in tie-down nets



Results – Monkfish
(and other target species)

- Monkfish catch 11,044 kg
  - Control = 7,306 kg
  - Treatment = 3,738 kg
  - $p < 0.0001$
- Winter skate catch 11,831 kg
  - Control = 10,048 kg
  - Treatment = 1,782 kg
  - $p < 0.0001$

		Control	Experimental
Monkfish	% Landing	66.2%	33.8%
	Average Length (cm)	69.6	67.7
	Total Weight (kg)	7306.3	3737.9
Winter Skate	% Landing	84.9%	15.1%
	Average Length (cm)	81.8	84.1
	Total Weight (kg)	10048.5	1782.3

Conclusions

- Atlantic sturgeon
  Within the limits of this study, tie-downs do not appear to increase capture probability and hence, mortality.
- Harbor Porpoise
  Based on NEFOP data, tie-downs do appear to decrease risk of entanglement.
  Stand-up nets caught more marine mammals.
- Monkfish (and winter skate)
  Tie-downs significantly increased the catch of the targeted species.

Acknowledgements

Capt.'s
Kevin Wark
Mike Karch

Mike Lohr

Matt Breece

AIS Observers

Conclusions

- Hanging ratio does not appear to reduce marine mammal takes.
- Stand-up gear appears to increase the bycatch of marine mammals.

Appendix 2: Gillnet Bycatch Workshop - Agenda

January 22 and 23, 2013
Ocean City, MD

Day 1	
12:30	Purpose, Goal, and Format of Workshop (including participant introductions)
12:45	Why consider bycatch mitigation – brief overview of mandates and requirements, including current bycatch mitigation actions
1:00	What we know about sea turtles and gillnet bycatch
	What we know about Atlantic sturgeon and gillnet bycatch
	Marine mammal considerations
1:55	Southern New England and Mid-Atlantic gillnet fisheries (e.g., gear characteristics, time of year, etc.)
2:45	**Break**
3:00	Overview of bycatch reduction (e.g., buoy-less nets, visual deterrents, tie-downs, etc.) research for sea turtles
	Overview of bycatch reduction research for sturgeon, or similar fish morphologies
	Overview of gillnet research for marine mammal bycatch reduction
4:15	Questions/discussion of studies presented Learning from experience: what has worked and why; what has not worked and why
5:00	Opportunities for cooperative research
5:15	Questions and format for next day
Day 2	
8:30	Breakout groups – Group 1: Reducing Atlantic sturgeon bycatch and/or bycatch mortality in mid-Atlantic gillnet fisheries Group 2: Reducing sea turtle bycatch and/or bycatch mortality in mid-Atlantic fisheries gillnet fisheries
10:30	**Break**
10:45	Report out from break-out groups
11:15	Group discussion – solutions to reducing sea turtle and Atlantic sturgeon bycatch and/or bycatch mortality in gillnet fisheries. Which look promising? Which are less so?
12:30	Brief summary of meeting and next steps
1:00	**Thank you**

Appendix 3: Workshop Participants

Russ Allen	New Jersey Division of Fish and Wildlife
Jim Armstrong	Mid-Atlantic Fishery Management Council staff
Sue Barco	Virginia Aquarium and Marine Science Center Foundation
Richard Brill	National Marine Fisheries Service/Virginia Institute of Marine Science
Pat Campfield	Atlantic States Marine Fisheries Commission
Heather Coll	National Marine Fisheries Service
Therese Conant	National Marine Fisheries Service
Tommy Danchese	Fisherman
Farrell Davis	Coonamessett Farm Foundation
Chelsea Doepp	A.I.S. Inc.
Steve Ellis	National Marine Fisheries Service
Matt Fisher	Delaware Division of Fish and Wildlife
Dewayne Fox	Delaware State University
Tara Froehlich	Cornell Marine Program
Edward Frost	Maryland Natural Resources Police
Michael Greco	Delaware Division of Fish and Wildlife
Sonny Gwin	Fisherman
Emerson Hasbrouck	Cornell Marine Program
Pingguo He	University of Massachusetts Dartmouth
Dewey Hemilright	Mid-Atlantic Fishery Management Council; Fisherman
Jason Kahn	National Marine Fisheries Service
Ellen Keane	National Marine Fisheries Service
Brenda Kibler	Maryland Department of Natural Resources Fisheries
Howard King	Mid-Atlantic Fishery Management Council
Dennis Klemm	National Marine Fisheries Service
Lynn Lankshear	National Marine Fisheries Service
Michael Loeffler	North Carolina Division of Marine Fisheries
Maggie Lynott	Virginia Aquarium and Marine Science Center Foundation
Sara McNulty	National Marine Fisheries Service
Stew Michels	Delaware Division of Fish and Wildlife
Henry Milliken	National Marine Fisheries Service
Kimberly Murray	National Marine Fisheries Service
Scott Newlin	Delaware Division of Fish and Wildlife
Chris Parkins	University of Rhode Island
Ted Platz	New England Fishery Management Council's Sturgeon Committee
Blake Price	National Marine Fisheries Service
Glenn Salvador	National Marine Fisheries Service
Ainsley Smith	Duke University
Albert Spells	U.S. Fish and Wildlife Service
Brian Stacy	National Marine Fisheries Service
Edna Stetzar	Delaware Division of Fish and Wildlife
Terry Stockwell	New England Fishery Management Council – vice-chair
Nils Stolpe	Monkfish Defense Fund

Kate Taylor	Atlantic States Marine Fisheries Commission
Jamie Testa	Maryland Department of Natural Resources
Wes Townsend	Fisherman
Carrie Upite	National Marine Fisheries Service
Rick Usher	A.I.S. Inc.
Chris Walker	Fisherman
John Wang	University of Hawaii - Joint Institute for Marine and Atmospheric Research (JIMAR)
Kevin Wark	Fisherman
Steve Welch	Fisherman
Jamie Wescott	Fisherman
Roger Wooleyhan	Fisherman

In addition, the workshop was available via webinar for those who were unable to attend, but were interested in listening to the discussions. Webinar participants include:

Rob Banks	Northeast Fishery Sector 3
Jacqueline Benway	Connecticut Department of Energy and Environmental Protection, Marine Fisheries
Lisa Bonacci	New York State, Department of Environmental Conservation, Marine Resources
Kevin Brown	North Carolina Division of Marine Fisheries
Charles Etzel	Fisherman
fisherynation.com	fisherynation.com
James Fletcher	United National Fisherman's Association
Dominick Fresco	New Jersey Division of Fish and Wildlife
Colleen Giannini	Connecticut Department of Energy and Environmental Protection
William Greer	National Marine Fisheries Service
Mark Hager	National Marine Fisheries Service
Kathy Hattala	New York State Department of Environmental Conservation
Stacey Horstman	National Marine Fisheries Service
D'Ambrisi Janna	NRDC
Andrew Kahnle	New York State Department of Environmental Conservation
Charles Keith	National Marine Fisheries Service
Irene Kelly	National Marine Fisheries Service
John Kenney	National Marine Fisheries Service
Jessica Marlies	North Carolina Department of Environment and Natural Resources
Eric Matzen	National Marine Fisheries Service
Kim McKown	New York State Department of Environmental Conservation
Jerre Mohler	US Fish & Wildlife Service
Alicia Nelson	Virginia Marine Resources Commission
Pat Opay	National Marine Fisheries Service
Derek Orner	National Marine Fisheries Service
Cheri Patterson	New Hampshire Fish and Game Department

Joanne Pellegrino	National Marine Fisheries Service
Bill Post	South Carolina Department of Natural Resources
Jessica Powell	National Marine Fisheries Service
Jeff Ray	NOAA Office of Law Enforcement
James Reardon	X Northeast Fishery Sector, Inc.
Jason Rock	North Carolina Division of Marine Fishereis
Sally Roman	School for Marine Science and Technology (SMAST)
Marjorie Rossman	National Marine Fisheries Service
Kathryn Roy	National Marine Fisheries Service
David Sanford	Checkyourfly A conservation group
Tom Savoy	Connecticut Department of Energy and Environmental Protection
Eric Schneider	Rhode Island Department of Environmental Management, Fish and Wildlife Marine Fisheries
Brad Sewell	National Resources Defense Council
Yonat Swimmer	National Marine Fisheries Service
Dorothy Thumm	New York State Department of Environmental Conservation
April Valliere	Rhode Island Department of Environmental Management, Marine Fisheries
Mike Waine	Atlantic States Marine Fisheries Commission
Joshua Wrigley	Independent
Sara Young	Oceana