

SHRIMP TRAWLING IN INSIDE WATERS OF NORTH CAROLINA

FACT AND FICTION

Recent articles and videos by nongovernmental organizations make statements about shrimp trawling in the internal waters of North Carolina to support prohibiting or significantly curtailing this activity.

What is fact and what is fiction?

#1 “Trawls are recognized as highly destructive, nondiscriminatory killers”

“Shrimp and anything else entering the opening of the net are captured”

-In some cases such as over reefs or other structured sea bottom, trawls and the doors that are used to spread the net can be very harmful.¹ Trawl effects depend on the design, intensity of use and location used.² On soft, muddy bottom or sandy/muddy bottom like what is found in most of Pamlico Sound, shrimp trawls and their doors are not highly destructive. Shrimp trawl effects on the bottom found in most of Pamlico Sound have been described by scientists as similar to harsh winter storms with short-term impacts.³ Scientists have found that trawling disturbance can stimulate an increase in population numbers of bottom invertebrates. However, predators of those invertebrates were more common in areas not open to trawling.⁴

¹National Research Council. 2002. Effects of Trawling and Dredging on Seafloor Habitat. Committee on Ecosystem Effects of Fishing: Phase 1 Effects of Trawling on Seafloor Habitats. Ocean Studies Board. National Academy Press. Washington D.C. 136 p.

²J.B. Jones. 1992. Environmental impacts of trawling on the seabed: A review. New Zealand Journal of Marine and Freshwater Research. 26:1, 59-67.

³D. Corbett et al. 2004. Potential impacts of bottom trawling on water column productivity and sediment transport processes. NC SeaGrant, Raleigh, NC. No. 01-EP-04, 57 p.

⁴R.A. Deehr. 2012. Measuring the ecosystem impacts of commercial shrimp trawling and other fishing gear in Core Sound, NC using ecological network analysis. PhD Dissertation. ECU. 410 p.

-Trawls are often designed to be selective for certain-sized fish/shellfish by modifying the mesh size (size of material in the tailbag or body), modifying the design (fish top-water or bottom), and speed of tow (slower speeds select for slower swimming creatures or smaller organisms).⁵ The most common organisms caught in shrimp trawls are shrimp, small fish, crabs, and jellyfish.⁶ Larger, adult fish and fast-swimming fish most often escape or avoid the shrimp trawl. Shrimp trawls in North Carolina are required to use finfish excluders to allow small fish to escape.⁷ As much as 70% of the juvenile finfish are excluded with these devices. Shrimp trawls are also required to use Turtle Excluder Devices (TED) to allow sea turtles to escape. TED's can also exclude significant amounts of juvenile finfish.⁸

⁵ Watson, J.W. et al. 1984. Configurations and Relative Efficiencies of Shrimp Trawls Employed in Southeastern United States Waters. NOAA Technical Report NMFS 3. 12p.

⁶DMF. 2006. North Carolina Shrimp Fishery Management Plan. N.C. Dept of Environment and Natural

⁷SH-3-12; Re: Shrimp Trawling N.C. Bycatch Reduction Device (BRD) Specifications. N.C. Division of Marine Fisheries (May 24, 2012), available at http://portal.ncdenr.org/c/document_library/get_file?uuid=79d27a57-6b-4664-b6ae2df70a3ca132&grouped=38337.

⁸Harrington, D.L. and R.A. Vendetti. 1996. Shrimp Trawl Bycatch Reduction in the SE United States. p. 129-137. In: Solving Bycatch: Considerations for Today and Tomorrow. Sea Grant Publication AK-SG-96-03. 336 p.

#2 “All states on the Atlantic coast except North Carolina have seen the destruction from otter trawls and have prohibited or greatly restricted the use of otter trawls in inshore waters”

“Every state on the Atlantic coast has banned inshore trawling except North Carolina, while all those states ban or restrict inshore trawling to protect their nursery areas and fragile ecosystem”

-North Carolina contains a unique ecosystem called the Albemarle-Pamlico Sound, which is the largest brackish water body in any one state for the entire USA⁹, so comparisons with other states are not always valid. The ecosystem is dynamic and huge, but relatively shallow. Pamlico Sound is one of the few water bodies that support commercial quantities of pink, white and brown shrimp in the south Atlantic (ocean waters of Florida is the other).¹⁰

-While North Carolina has not banned inshore shrimp trawling, the state has passed measures which greatly restrict the fishery.

-North Carolina is the only state that has formally designated nursery areas for juvenile fish, shrimp and crabs. All bottom-disturbing fishing gear is prohibited in these areas, including shrimp trawls and has been prohibited as such for over 35 years.¹¹ Some states that prohibit trawling in their more open bays such as Georgia and Florida allow bait shrimp trawling in small creeks and rivers where juvenile finfish densities are relatively high (they limit tow times and trawl size).

⁹Deaton, A.S et al. 2010. North Carolina Coastal Habitat Protection Plan. North Carolina Department of Environment and Natural Resources. North Carolina Division of Marine Fisheries, 639 p.

¹⁰ South Atlantic Fishery Management Council. 1993. Fishery management plan for the shrimp fishery of the South Atlantic region including a final environmental impact statement and regulatory impact review. SAFMC, Charleston, SC, 184 pp. + appendices.

¹¹15A NCAC 03N .0104 (2014).

-Almost all the bays and creeks of western and northern Pamlico Sound are classified as secondary nursery areas to protect juvenile fish, shrimp and crabs. These areas have been closed to all types of trawling for over 35 years.¹²

-Almost 124,000 acres of estuarine areas are classified as primary or secondary nursery areas.¹³

-Another 47,000 acres of brackish waters are classified as special secondary nursery areas. These areas are closed to trawling, but may be opened when the majority of juvenile fish have migrated from the areas.¹⁴

-North Carolina has not allowed trawling in Albemarle Sound for over 25 years (since 1987) due to low shrimp abundance (low salinity), conservation issues and gear conflicts.¹⁵

-North Carolina closed extensive areas of submerged aquatic vegetation located on the eastern shore of the Outer Banks from Oregon Inlet to the mouth of Core Sound to shrimp trawling in 1994. These areas serve as nurseries for juvenile fish and shrimp.¹⁶

-North Carolina was the first state to require finfish excluders in shrimp trawls in its internal waters. Finfish excluders have been required for over 20 years and were based on extensive research conducted by state biologists. These excluders were shown to significantly reduce juvenile finfish amounts in shrimp trawls.¹⁷

-In 1994 North Carolina prohibited inside shrimp trawling during the weekend to give the sounds “two days rest” and possibly reduce finfish bycatch.¹⁸

¹² 15A NCAC 03N .0105(2014).

¹³DMF. 2015. Draft Amendment 1. North Carolina Shrimp Fishery Management Plan. N.C. Dept of Environment and Natural Resources, Division of Marine Fisheries, 514 p.

¹⁴Ibid.

¹⁵Ibid.

¹⁶DMF. 2006. North Carolina Shrimp Fishery Management Plan. N.C. Dept of Environment and Natural Resources, Division of Marine Fisheries, 384 p.

¹⁷Ibid.

¹⁸15A NCAC 03J .0104(b)(1) (2014).

-In 2006 almost 92,000 acres in the Pamlico, Pungo and Neuse Rivers were closed to shrimp trawling as part of the North Carolina Shrimp Fishery Management Plan (FMP). These areas were closed due to highly variable shrimp production and relatively high numbers of juvenile fish.¹⁹

-In 2006 shrimp trawls, as part of the Shrimp FMP, were limited to a maximum total trawl headrope of 90ft in the lower Pamlico/Pungo and Neuse Rivers to maintain the traditional “smaller” boat fishery and reduce finfish bycatch.²⁰

- In 2008 North Carolina required Turtle Excluder Devices (TED) in shrimp trawls, which allowed approximately 50 state fisheries officers to enforce this restriction, in addition to the 1-2 federal officers. Scientists have also documented that TED’s exclude finfish in addition to sea turtles.²¹

-For over 30 years North Carolina has not allowed targeted catches of finfish by shrimp trawlers in its internal waters. Current restrictions allow 500lbs of fishfish bycatch as part of shrimp trawling Dec1-Feb28 and 1000lbs from March 1- Nov 30.²²

-Almost 1,000,000 acres of internal coastal waters are closed to trawling in North Carolina, approximately 48% of the total.²³

¹⁹DMF. 2006. North Carolina Shrimp Fishery Management Plan. N.C. Dept of Environment and Natural Resources, Division of Marine Fisheries, 384 p.

²⁰Ibid.

²¹15A NCAC 03L .0103 (g) (2014).

²²15A NCAC 03J .0104 (a) (2014).

²³DMF. 2015. Draft Amendment 1. North Carolina Shrimp Fishery Management Plan. N.C. Dept of Environment and Natural Resources, Division of Marine Fisheries, 514 p.

#3 “These trawlers often run side by side, greatly increasing the coverage of the bottom”

“Trawlers cover a huge swath of big water”

“However on larger trawlers being used today in our inshore waters, four otter trawls with headrope lengths of 60ft are pulled at the same time, sweeping 240ft of bottom”

“(shrimp trawlers) use four 55ft nets”

“boats line up and span for over a mile”

“not an industry led by small family fishermen, but large corporate boats”

-The vast majority of shrimp trawlers fishing in North Carolina’s inside waters are less than 53ft and family owned, small businesses. Most of the shrimp trawlers fishing in Pamlico Sound, our largest inside water body are 49-53ft, most using the mouths of Pamlico/Pungo and Neuse Rivers are 30-31ft, and most using Core Sound, Bogue Sound and Newport/North Rivers are 28-29 ft in length.²⁴ Most shrimp trawlers fishing in Pamlico Sound are no larger than a vessel many sport fishermen would charter to catch dolphinfish (mahi-mahi) offshore.

-About half(46-54%) of the shrimpers fishing in Pamlico Sound do use four nets; however, in the other internal waters where shrimpers use otter trawls, the vast majority (greater than 90%) use one or two nets.²⁵

-An analyses of headrope size used by shrimp trawlers (examining hundreds of vessels) by state biologists, did not observe a single shrimp trawler using nets that totaled 240ft. While some vessels fishing in Pamlico Sound did use up to 210 ft of total trawl headrope, the averages of two years of data were 117ft and 123 ft, almost half of what is portrayed by some nongovernmental groups. In the Pamlico/Pungo and Neuse Rivers the average total headrope pulled was between 52-55ft and in Core Sound, Bogue Sound and North/Newport Rivers, the average was 46-47ft.²⁶

-Data show that there are hundreds of fishermen that trawl for shrimp in North Carolina. Surveys have shown that they come from numerous small villages/towns spread throughout the coastal plain. The majority come from places called Sneads Ferry, Beaufort, Supply, Atlantic, and Belhaven.²⁷ They are usually small, family-owned, independent businesses that sell to hundreds of seafood dealers and whose expenditures spread through the communities where they live.

²⁴ DMF. 2015. Draft Amendment 1. North Carolina Shrimp Fishery Management Plan. N.C. Dept of Environment and Natural Resources, Division of Marine Fisheries, 514 p.

²⁵ Ibid.

²⁶ Ibid.

²⁷ Ibid.

-The manner individual shrimp trawl fishermen fish varies greatly based on experience, skill, boat type/size, location fished, economic costs and the presence of shrimp and/or fish. Very seldom do they line up in unison and pull through a large swath of water side by side. Fishing behavior is usually based on wind and sea conditions, due to safety concerns and the presence of shrimp/fish. Sometimes shrimp trawl fishermen do have a “sister” boat that travels to similar areas, due to friendship between captains and safety considerations (there to help if vessel is compromised).

-Shrimp fishermen using otter trawls commonly utilize a “try” net in addition to their larger net(s) which provides an indication of the amount of shrimp and fish that are being captured by the vessel. The small “try” net is pulled in front of the larger trawls for a short amount of time. Fishermen use the numbers of shrimp and fish in the “try” net to determine whether to continue fishing in that area, move, or quit fishing.²⁸

-Shrimp trawl fishermen try to fish in areas that maximize shrimp catch and minimize finfish bycatch. High amounts of finfish bycatch increases fuel costs, increases culling time (may increase labor costs), decreases the economic quality of the shrimp caught, in addition to causing conservation concerns.²⁹

-Shrimp distribution in North Carolina waters is not uniform. Also, the various types of shrimp prefer inhabiting certain areas. For example, pink shrimp prefer areas on the eastern side of Pamlico Sound and a fishermen targeting that species would not trawl in western or northern Pamlico Sound. So, all internal waters are not trawled in the same manner.

-There are numerous underwater obstructions in Pamlico Sound, so shrimp trawlers cannot work in all open waters, especially “side by side”. There are over 70,000 acres of military prohibited areas in North Carolina’s internal waters that cannot be fished.³⁰ Shrimp trawl fishermen also try to avoid crab pots, which are set throughout Pamlico Sound during the spring-fall. If crab pots are captured by otter trawls, they often tangle the trawl or become stuck in the net, causing lost fishing time.

²⁸Food and Agricultural Organization of the United Nations. 2015. Fishing Techniques-Shrimp Outrigger Trawling. www.fao.org/fi;website/FISiteMap.doj.

²⁹Watson, J.W. et al. 1984. Configurations and Relative Efficiencies of Shrimp Trawls Employed in Southeastern United States Waters. NOAA Technical Report NMFS 3. 12p.

³⁰ DMF. 2015. Draft Amendment 1. North Carolina Shrimp Fishery Management Plan. N.C. Dept of Environment and Natural Resources, Division of Marine Fisheries, 514 p.

#4 “For every 1 lb of shrimp, 4.5 lbs of fish and others are caught and discarded”

“Nothing much survives the compressing pressure of the hour long pull in the catch bag and the long exposure to die during the sorting. So to harvest one pound of shrimp using an otter trawl, 4.5 lbs of non-target fish and other bycatch are killed and discarded”

“Approximately 21 million lbs of waste is generated with North Carolina’s shrimp trawl catch”

-Shrimp trawls do harvest juvenile finfish as bycatch. Bycatch occurs in all fisheries. Bycatch is the catch of untargeted, undesired, or prohibited species. An example of untargeted bycatch is the catch of red drum while fishing for flounder (hook/line or net); and example of undesired bycatch is the catch of a stingray while fishing for flounder; and an example of prohibited species bycatch is the catch of sublegal flounder while flounder fishing. Most fishermen do not want to harvest bycatch, unless it can be legally retained or eaten/sold. Bycatch of undesired (such as juvenile finfish) or prohibited species (sublegal fish) causes economic loss to commercial fishermen (culling time, fuel costs), in addition to raising conservation concerns.

-Accurately characterizing bycatch in fisheries is difficult and costly due to several factors: the distribution of the bycatch species, variation in fishing effort, variations in gear, the seasonality of the fishery, and the mortality of the bycatch species.

-Characterizing bycatch in the North Carolina shrimp trawl fishery is especially difficult because shrimp are an annual species, that is, not living over 1.5 years and their abundance largely controlled by environmental factors.³¹ North Carolina also has three productive shrimp fisheries in estuarine waters, targeting pink shrimp primarily in the spring, brown shrimp in mid-summer to fall and white shrimp in late summer to late fall. Each fishery is different in where they fish, when they fish, and the trawls used to catch them.

-The head of the North Carolina Division of Marine Fisheries has gone on record that the 4.5 lbs of fish per lb of shrimp is “not a good estimate” and is “not the appropriate way to characterize bycatch”.³²

³¹ DMF. 2015. Draft Amendment 1. North Carolina Shrimp Fishery Management Plan. N.C. Dept of Environment and Natural Resources, Division of Marine Fisheries, 514 p.

³² Dr. Louis B. Daniel III. Minutes from North Carolina Marine Fisheries Commission meeting to review Petition For Rulemaking to Designate Internal Coastal Waters as Secondary Nursery Areas. New Bern, NC. August 29, 2013.

-The variation of the amount of finfish to shrimp in a shrimp trawl is tremendous, even within year and on the same day. In some locations of Pamlico Sound scientists have found 0lbs of fish per pound of shrimp caught and in other locations found ratios much higher.

-The 4.5 lb estimate was based on a scientific study done for a very limited time and examining a relatively low number of shrimp trawl trips (less than 100).

-Scientists studying bycatch in North Carolina have cautioned that finfish/shrimp ratios tend to overestimate bycatch.^{33 34}

-Other scientific studies have found finfish to shrimp ratios of shrimp trawls in the internal waters of North Carolina at 1.5 lbs of fish to 1 lb of shrimp (1950)³⁵, 1.6 lbs (1999)^{36 37}, 3.1lbs (2003)³⁸, 0.5 lbs (2005)³⁹, and 2.7lbs (2010)⁴⁰ per pound of shrimp.

³³Coale, J. S. et al. 1994. Comparisons of shrimp catch and bycatch between a skimmer trawl and an otter trawl in the North Carolina inshore shrimp fishery. *North American Journal of Fisheries Management* 14:751-768.

³⁴Diamond S.L. 2003. Estimation of bycatch in shrimp trawl fisheries: a comparison of estimation methods using field data and simulated data. *Fishery Bulletin* 101(Supplement 3), 484–500.

³⁵Roelofs, E. W. 1950. Observations of the capture of small fish by the shrimp trawls. Annual Report, Institute of Fisheries Research UNC, Morehead City, NC: 111-115.

³⁶Diamond-Tissue, S. L. 1999. Characterization and estimation of shrimp trawl bycatch in North Carolina waters. Doctorate dissertation, North Carolina State University, Department of Zoology, Raleigh, NC 27695. 54 p.

³⁷Johnson, G.A. 2006. Multispecies Interactions in a Fishery Ecosystem and Implications for Fisheries Management: The Impacts of the Estuarine Shrimp Trawl Fishery in North Carolina. Doctorate dissertation, UNC-Chapel Hill, Chapel Hill NC. 147 p.

³⁸Johnson, G. A. 2003. The role of trawl discards in sustaining blue crab populations. North Carolina Fisheries Resource Grant. FRG-99-EP-07.

³⁹Logothetis, E. and D McCuiston. 2006. An assessment of the bycatch generated in the inside commercial shrimp fishery in southeastern North Carolina, 2004 & 2005. North Carolina Sea Grant Fisheries Resource Grant Program, Project #05-EP-04. 87 pp.

⁴⁰Brown, K.B. 2010. Characterization of the inshore commercial shrimp trawl fishery in Pamlico Sound and its tributaries, North Carolina Completion report for NOAA award no. NA05NMF4741003 North Carolina Department of Environment and Natural Resources, Division of Marine Fisheries, 28p.

-Survival rates of discarded finfish from the shrimp trawl catches are also difficult to accurately calculate.

-Survival rates are greatly influenced by trawl tow times, water temperatures, catch volumes, and time it takes to cull the fish from the shrimp.

-Limited studies in North Carolina have found survival rates of fish captured in shrimp trawls and discarded to be 22%⁴¹ and 48%⁴².

-More recent studies found that 82% of the Atlantic croaker, 55% of the spot, and 76% of the weakfish were observed alive in catches of commercial shrimp trawlers when brought on board.⁴³

-Studies have shown that creatures of the ecosystem where the shrimp are captured do consume quantities of the discarded finfish that die.^{44 45} Organisms that have been shown to consume the discarded fish are blue crabs and other benthic invertebrates, various species of birds and bottlenose dolphins.

⁴¹Johnson, G. A. 2003. The role of trawl discards in sustaining blue crab populations. North Carolina Fisheries Resource Grant. FRG-99-EP-07.

⁴²Logothetis, E. and D McCuiston. 2006. An assessment of the bycatch generated in the inside commercial shrimp fishery in southeastern North Carolina, 2004 & 2005. North Carolina Sea Grant Fisheries Resource Grant Program, Project #05-EP-04. 87 pp.

⁴³Brown, K.B. 2014. Preliminary Report on Characterization of the inshore commercial shrimp trawl fishery in Pamlico Sound and its tributaries, North Carolina Department of Environment and Natural Resources, Division of Marine Fisheries.

⁴⁴Logothetis, E. and D McCuiston. 2006. An assessment of the bycatch generated in the inside commercial shrimp fishery in southeastern North Carolina, 2004 & 2005. North Carolina Sea Grant Fisheries Resource Grant Program, Project #05-EP-04. 87 pp.

⁴⁵Johnson, G. A. 2003. The role of trawl discards in sustaining blue crab populations. North Carolina Fisheries Resource Grant. FRG-99-EP-07.

#5 “One measure we do have that indicates shrimp trawling has a negative impact on finfish is the status of these fish---spot are classified concerned; Atlantic croaker-concerned; and gray trout-depleted”

“Our management measures must do no harm and be within the sustainable capacity of the resource as demonstrated through clear and convincing scientific evidence and evaluation”

“In the face of overwhelming evidence that the level of bycatch in the shrimp trawl fishery is unacceptably high...”

“Does this (shrimp trawling) have a quantifiable effect”....”there are no direct studies by the North Carolina Division of Marine Fisheries on the subject”

“Current stock status of some important inshore fish is staggering of those directly affected by shrimp trawling---gray trout and southern flounder are depleted, spot and Atlantic croaker are concerned; spot, croaker and gray trout are major sources of food for speckled trout, red drum and striped bass”

“Finfish can no longer sustain the amount of senseless killing that is caused by shrimp trawling in our estuaries”

“Destruction by shrimp trawling has far-reaching effects”

-North Carolina is recognized by states and the federal government as having one of the best fisheries data collection programs in the country. The state fisheries agency has extensive programs that samples commercial and recreational fisheries and has numerous surveys where it samples resources independently of fishermen. The state has been collecting detailed biological data on spot, Atlantic croaker, and gray trout since 1978. These species are three of the most common finfish species found in shrimp trawl bycatch.⁴⁶ Data collected by the Division of Marine Fisheries are used to assess population levels and to identify sources of fishing mortality.

⁴⁶ DMF. 2015. Draft Amendment 1. North Carolina Shrimp Fishery Management Plan. N.C. Dept of Environment and Natural Resources, Division of Marine Fisheries, 514 p.

-Based on extensive and current scientific data, fishermen are not overfishing Atlantic croaker and croaker are likely not overfished.⁴⁷ The Atlantic croaker population has been classified as viable/healthy from 2004-2010. In 2004 a population assessment found that croaker were not overfished and overfishing was not occurring from North Carolina north.⁴⁸ In 2010 a new stock assessment found that overfishing was not occurring, but there was too much uncertainty in the models to precisely determine if the population was overfished. However, scientists state it is unlikely the stock is overfished based on other population data⁴⁹.

-Spot are not classified as overfished; however they are classified as concerned by the North Carolina Division of Marine Fisheries.⁵⁰ A stock assessment on spot has not been completed. State experts classified spot as healthy/viable from 1998(first yr such determinations were published) to 2006(8yrs).⁵¹ Scientists primarily used biological data (age, sex, catch per unit effort) and landings to assess the population, noting that for a short-lived species such as spot, landing fluctuations are not unusual. The population status of spot was lowered to concern in 2007 to 2014(8yrs), primarily due to declining landings.⁵² Scientists recognize it is very difficult to determine population status from landings data.

⁴⁷ASMFC. 2010. Atlantic Croaker Stock Assessment Report for Peer Review. Atlantic States Marine Fisheries Commission, Stock Assessment Report No. 10-1 (supplement), 236p.

⁴⁸ASMFC. 2004. Atlantic Croaker 2004 Stock Assessment Supplement. Atlantic States Marine Fisheries Commission. Washington, D.C. 188p.

⁴⁹ASMFC. 2010. Atlantic Croaker Stock Assessment Report for Peer Review. Atlantic States Marine Fisheries Commission, Stock Assessment Report No. 10-1 (supplement), 236p.

⁵⁰NCDMF. 2014. Stock Status Report-Spot. <http://portal.ncdenr.org/web/mf/stock-status-reports>.

⁵¹NCDMF. 1998-2006. Stock Status Reports-Spot. <http://portal.ncdenr.org/web/mf/stock-status-reports>.

⁵²NCDMF. 2007-14. Stock Status Reports-Spot. <http://portal.ncdenr.org/web/mf/stock-status-reports>.

-Gray trout (weakfish) are depleted, not just in North Carolina, but throughout their range into New York.⁵³ Weakfish have been classified as depleted by North Carolina since 2007; they were classified as concern from 1998 to 2006.⁵⁴ Weakfish have been a very important species for North Carolina commercial and recreational fishermen throughout its history. Low population levels led to extensive conservation measures being implemented in North Carolina and mid-Atlantic states in the 1990's.⁵⁵ In North Carolina size limits were increased, strict harvest limits were placed on recreational and commercial fishermen, major harvest areas for small weakfish were closed to commercial harvest for certain gears(south of Cape Hatteras by flynets), bycatch reduction devices were required in trawls and long haul seines and gill net mesh sizes in the ocean were increased. The weakfish population did not recover as expected by scientists. A new stock assessment was completed in 2009 and experts determined that there is little evidence that overfishing is occurring on weakfish; they believe that other factors besides fishing are causing the weakfish stock decline.⁵⁶

-Scientists have examined data to determine if shrimp trawl discards of spot, Atlantic croaker and weakfish affect the sustainability of their population levels.

-Federal scientists in the 2005 South Atlantic Shrimp FMP found that while reviewing the stock status of weakfish, spot and Atlantic croaker, they could find no evidence to indicate that mortality by shrimp trawls(with TED's) was having a significant adverse effect on those populations.⁵⁷

⁵³ASMFC . 2009. Weakfish 2009 Stock Assessment Report. Atlantic States Marine Fisheries Commission. Washington, D.C. 396p.

⁵⁴NCDMF. 1998-2014. Stock Status Reports-Weakfish. <http://portal.ncdenr.org/web/mf/stock-status-reports>.

⁵⁵ASMFC . 1992. Weakfish Fishery Management Plan-Amendment 1. Atlantic States Marine Fisheries Commission. Washington, D.C. 69p.

⁵⁶ASMFC . 2009. Weakfish 2009 Stock Assessment Report. Atlantic States Marine Fisheries Commission. Washington, D.C. 396p.

⁵⁷SAFMC. 2005. Fishery management plan for the shrimp fishery of the South Atlantic region including a final environmental impact statement and regulatory impact review. Amendment 6. South Atlantic Fishery Management Council. Charleston, SC. 305pp. + appendices.

- Models of Atlantic croaker populations showed little or no affect when shrimp trawl discards were increased. Shrimp trawl discards were determined not to be a major source of fishing mortality for croaker along the Atlantic coast. Other fisheries were determined to have much more significant impacts on fishing mortality for Atlantic croaker.⁵⁸ A recent population assessment found that rough estimates of shrimp trawl discards did not change spawning stock levels of Atlantic croaker.⁵⁹

-No population assessment has been completed for spot; however scientists are concerned about spot discards in the shrimp trawl fishery.⁶⁰

-Modeling of weakfish populations in 1991 by scientists did find a correlation between population levels and varying levels of shrimp trawl bycatch.⁶¹ This modeling helped support measures requiring finfish excluder devices in states and mandated a minimum standard for weakfish exclusion in shrimp trawls. More recent weakfish population assessments did not find that correlation, in fact experts believe that other factors besides fishing are causing the weakfish population decline.⁶²

-No correlation was observed of Atlantic croaker, weakfish, and spot juvenile catch per unit effort and shrimp trawl effort for the last 21 years (p-values and r-values were extremely low, less than 0.63 and 0.04, respectively).⁶³

⁵⁸Diamond-Tissue, S. L. 1999. Characterization and estimation of shrimp trawl bycatch in North Carolina waters. Doctorate dissertation, North Carolina State University, Department of Zoology, Raleigh, NC 27695. 54 p.

⁵⁹ASMFC. 2010. Atlantic Croaker Stock Assessment Report for Peer Review. Atlantic States Marine Fisheries Commission, Stock Assessment Report No. 10-1 (supplement), 236p.

⁶⁰ASMFC. 2011. Omnibus Amendment to the Interstate Fishery Management Plans For Spanish Mackerel, Spot, and Spotted Seatrout. Atlantic States Marine Fisheries Commission. Washington, D.C. 161p.

⁶¹Vaughan, D.S., R.J. Seagraves and K. West. 1991. An assessment of the status of the Atlantic weakfish stock, 1982-1988. Special Report No. 21. Atlantic States Marine Fisheries Commission. 9p + tables and figures.

⁶²ASMFC . 2009. Weakfish 2009 Stock Assessment Report. Atlantic States Marine Fisheries Commission. Washington, D.C. 396p.

⁶³ DMF. 2015. Draft Amendment 1. North Carolina Shrimp Fishery Management Plan. N.C. Dept of Environment and Natural Resources, Division of Marine Fisheries, 514 p.

-Shrimp trawl effort in North Carolina has greatly decreased in recent years, declining from a peak of 15,482 trips in 1995 to 3,004 trips in 2011(decrease of 80% statewide). Trips by shrimp trawlers using Pamlico Sound has also decreased substantially, falling 65% for the same time period.⁶⁴

-Natural mortality (death from environment, predation) are relatively high on spot, Atlantic croaker, and weakfish, causing wide population fluctuations.^{65 66 67} Huge landing fluctuations have been recorded for weakfish in North Carolina since the early 1900's. Recent population assessments on weakfish show a strong correlation with decreasing juvenile numbers and rising striped bass and spiny dogfish abundance.⁶⁸ This correlation indicates that predation by these species might be a major factor contributing to low population numbers of weakfish.

-The level of finfish bycatch in the inshore shrimp trawl fishery in North Carolina is much lower than that in the Gulf of Mexico shrimp trawl fishery, where an extensive trawl fishery exists. The Gulf of Mexico shrimp trawl fishery accounts for 82% of the shrimp landed in the U.S. Federal studies have found finfish bycatch rates in Pamlico Sound to be lower than most of the locations examined in the Gulf.^{69 70}

⁶⁴ DMF. 2015. Draft Amendment 1. North Carolina Shrimp Fishery Management Plan. N.C. Dept of Environment and Natural Resources, Division of Marine Fisheries, 514 p.

⁶⁵ASMFC. 2011. Omnibus Amendment to the Interstate Fishery Management Plans for Spanish Mackerel, Spot, and Spotted Seatrout. Atlantic States Marine Fisheries Commission. Washington, D.C. 161p.

⁶⁶ASMFC. 2010. Atlantic Croaker Stock Assessment Report for Peer Review. Atlantic States Marine Fisheries Commission, Stock Assessment Report No. 10-1 (supplement), 236p.

⁶⁷ASMFC . 2009. Weakfish 2009 Stock Assessment Report. Atlantic States Marine Fisheries Commission. Washington, D.C. 396p.

⁶⁸Ibid.

⁶⁹Branstetter, S. 1997. Bycatch and its Reduction in the Gulf of Mexico and South Atlantic Shrimp Fisheries. Gulf and South Atlantic Fisheries Development Foundation, Inc. 27p +figures and tables.

⁷⁰Scott-Denton, E. et al. 2012. Characterization of the U.S. Gulf of Mexico and South Atlantic penaeid and rock shrimp fisheries based on observer data. Marine Fisheries Review. 74(4) 1-26.

-North Carolina has produced fishery management plans (FMPs) for shrimp, red drum, southern flounder, sea mullet, speckled trout and other recreationally/commercially important species.⁷¹ North Carolina participates in the development of FMPs for fish species that migrate up and down the Atlantic coast under the jurisdiction of the Atlantic States Marine Fisheries Commission (ASMFC). Plans have been produced on weakfish and Atlantic croaker by this agency and spot conservation has been grouped into a FMP with other species.^{72 73 74} The federal government has developed a FMP for shrimp in the south Atlantic, with numerous amendments.⁷⁵ Each of the fishery management plans compiles and evaluates science collected regarding these species, evaluates the effects of fisheries that harvest these species (including bycatch) and recommends conservation measures that will objectively and effectively ensure sustainability of these fisheries resources. None of the plans, amendments, or addendums have recommended a ban on inside shrimp trawling in North Carolina to ensure sustainability of these fisheries resources.

⁷¹NCDMF. 1998-2014. Fishery Management Plans Under Review or Completed. <http://portal.ncdenr.org/web/mf/fmps-under-development>.

⁷²ASMFC . 1985, 1992, 1996, 2000, 2002, 2003, 2005, 2007, 2009. Weakfish Fishery Management Plan, four amendments, plus four addendums. Atlantic States Marine Fisheries Commission. Washington, D.C. <http://www.asmfc.org/species/weakfish>.

⁷³ASMFC . 1987, 2005, 2011, 2014. Atlantic Croaker Fishery Management Plan, one amendment, plus two addendums. Atlantic States Marine Fisheries Commission. Washington, D.C. <http://www.asmfc.org/species/croaker>.

⁷⁴ASMFC. 1987, 2012, 2014. Spot Fishery Management Plan and Omnibus Amendments(2) to the Interstate Fishery Management Plans for Spanish Mackerel, Spot, and Spotted Seatrout. Atlantic States Marine Fisheries Commission. Washington, D.C.. <http://www.asmfc.org/species/spot>.

⁷⁵SAFMC. 1991, 1995, 1996, 2003, 2005. Fishery Management Plan for the Shrimp Fishery of the South Atlantic Region plus six amendments. South Atlantic Fishery Management Council. Charleston, SC. <http://safmc.net/resource-library/shrimp>.

#6 “Turtle excluder devices are required on most nets to allow captured sea turtles to escape”

“Finfish excluder devices are being evaluated for mandatory requirements in trawls”

-Turtle Excluder Devices (TED's) are required in all shrimp otter trawls in North Carolina, which account for 92% of the state's shrimp harvest. As noted earlier North Carolina made it a state violation to not have a TED in an otter shrimp trawl in 2008⁷⁶; it has been a federal violation since 1992⁷⁷. TED's, especially those with “soft” designs, can also exclude substantial proportions of finfish (40-60%).⁷⁸ Georgia and South Carolina credited their fishermen with a 23% reduction in finfish bycatch if they used a TED⁷⁹.

-North Carolina led the research in the south Atlantic to develop devices to exclude juvenile finfish in shrimp trawls, starting to evaluate devices in the early 1990's⁸⁰. Devices were evaluated with much testing^{81 82} and in 1992 finfish excluders (FED) were required in shrimp trawls. North Carolina was the first state to require FED's in shrimp trawls and detailed specifications on where to place the FED were enacted, based on much research. The approved devices were designed to obtain a 40% reduction of juvenile gray trout in the shrimp trawl catch and also obtained up to a 70% reduction in total juvenile finfish bycatch.

⁷⁶15A NCAC 03L .0103 (g) (2014).

⁷⁷Federal Register 57 FR 57348. Vol. 57. No. 234. Dec 4, 1992.

⁷⁸Branstetter, S. 1997. Bycatch and its Reduction in the Gulf of Mexico and South Atlantic Shrimp Fisheries. Gulf and South Atlantic Fisheries Development Foundation, Inc. 27p +figures and tables.

⁷⁹Hairston, D.L. and R.A Vendetti. 1996. Shrimp Trawl Bycatch Reduction in the Southeastern United States. p.129-136. In: Solving Bycatch: Considerations for Today and Tomorrow. AK-SG-96-03. 336p.

⁸⁰McKenna, S. and A.H. Clark. 1993. An examination of alternative fishing devices for the estuarine shrimp and crab trawl fisheries. Final Report to the Albemarle/Pamlico Estuarine Study, Project No. 93-11. 34 pp.

⁸¹McKenna, S. A. and J. P. Monaghan, Jr. 1993. Gear development to reduce bycatch in the North Carolina trawl fisheries. Completion Report for Cooperative Agreement No. NA90AA-SK052 to Gulf and South Atlantic Fisheries Development Foundation, ContractNo. 43-01, North Carolina Department of Environment, Health, and Natural Resources, Division of Marine Fisheries.

⁸²McKenna, S. A., et al. 1996. Evaluation of trawl efficiency device/bycatch reduction device in estuarine and nearshore waters of North Carolina. Completion Report NOAA, No. NA 47FF0016, North Carolina Department of Environment, Health, and Natural Resources, Division of Marine Fisheries. 37 pp.

#8 “Arguably, the most destructive gear used in N.C. is the trawl”

“Otter trawl doors as wide as a Caterpillar tractor blade are used”

-All trawls are not alike. Trawls, such as certain bottom otter trawls can be a highly destructive gear if used on structured bottom such as reefs and the trawls are designed to dig into the bottom⁸³. Trawls can also be designed to fish up in the water column and not have much interaction with the seafloor bottom. Shrimp trawls are designed to ‘skim along’ the bottom (lightly chained and construction of the net), not plow into the sand/mud⁸⁴. A tickler chain located in front of the net scares/disturbs slower swimming organisms up into the water-column, where they are scooped up by the trawl⁸⁵. Shrimp trawl fishermen actually try to avoid structured habitat (oyster beds) or obstructions because the trawl will likely be damaged or destroyed and results in significant economic loss due to lost fishing time and replacing/repairing expensive gear.

-Most trawls (otter) do use structures that incorporate the friction of the water while towing to spread open the attached net. These structures are called “doors”⁸⁶. The smallest-sized doors that will spread the net are used, because fishermen want to keep fuel costs to the lowest possible level. For shrimp trawls the doors are attached to the net in such a way that they do not dig excessively into the bottom and keep the net close to the bottom (that is where the shrimp are)⁸⁷. The doors are engineered to slide along the bottom seafloor, for if they “dig” into the mud/sand, fuel costs increase dramatically and shrimp catch rates become less efficient.

⁸³National Research Council. 2002. Effects of Trawling and Dredging on Seafloor Habitat. Committee on Ecosystem Effects of Fishing: Phase 1 Effects of Trawling on Seafloor Habitats. Ocean Studies Board. National Academy Press. Washington D.C. 136 p.

⁸⁴ Watson, J.W. et al. 1984. Configurations and Relative Efficiencies of Shrimp Trawls Employed in Southeastern United States Waters. NOAA Technical Report NMFS 3. 12p.

⁸⁵Beardsley, A.J. 1973. Design and evaluation of a sampler for measuring the near-bottom vertical distribution of pink shrimp, *Pandalus jordani*. Fish. Bull. vol. 71. No. 1. p. 243-253.

⁸⁶Food and Agricultural Organization of the United Nations. 2015. Fishing Techniques-Shrimp Outrigger Trawling. www.fao.org/fi;website/FISiteMap.doj.

⁸⁷Watson, J.W. et al. 1984. Configurations and Relative Efficiencies of Shrimp Trawls Employed in Southeastern United States Waters. NOAA Technical Report NMFS 3. 12p.

- Doors of extremely large size can only be effectively pulled by relatively large vessels due to power constraints. Most of the vessels pulling shrimp trawls in the inside waters on North Carolina are between 22-53 ft long. Shrimpers in Core Sound, Pamlico, Pungo, Neuse, Newport and North Rivers are usually less than 40 ft and use relatively small doors⁸⁸.

-The impacts on habitat and on the ecology by trawls in North Carolina have been examined by a few scientists in North Carolina^{89 90}. Studies from East Carolina University found some benefits to certain groups of bottom organisms (creatures living in the mud/sand,) and found some negative impacts (creatures eating small bottom organisms were more abundant in closed areas) ⁹¹. Ecosystem modeling found some ecological characteristics were higher in areas closed to trawling and some were higher in areas open to trawling⁹².

-Studies by researchers in South Carolina could find no significant differences in the species composition, species diversity, and abundance of organisms living in the mud/sand between areas fished with shrimp trawls and areas closed to shrimp trawling⁹³.

⁸⁸ DMF. 2015. Draft Amendment 1. North Carolina Shrimp Fishery Management Plan. N.C. Dept of Environment and Natural Resources, Division of Marine Fisheries, 514 p.

⁸⁹D. Corbett et al. 2004. Potential impacts of bottom trawling on water column productivity and sediment transport processes. NC SeaGrant, Raleigh, NC. No. 01-EP-04, 57 p.

⁹⁰R.A. Deehr. 2012. Measuring the ecosystem impacts of commercial shrimp trawling and other fishing gear in Core Sound, NC using ecological network analysis. PhD Dissertation. ECU. 410 p.

⁹¹ Ibid.

⁹²Ibid.

⁹³Van Dolah, R.F. et al. 1991. A Study of the Effects of Shrimp Trawling on Benthic Communities in Two South Carolina Sounds. Fisheries Research 12: 139-156.