

**Gill Net Operation Disturbance in Primary Nursery Areas
ISSUE PAPER**

April 7, 2008

I. ISSUE

Gill net operators using bottom disturbing gear in PNAs to cause fish to move and become entangled in gill nets.

II. ORIGINATION

Public complaints to Marine Patrol, Director, and MFC Chairman

III. BACKGROUND

Nursery area designation and purpose

The North Carolina Division of Marine Fisheries conducted trawling surveys in the early 1970s to inventory the state's estuarine resources. The result of these surveys was the identification of estuarine areas that consistently supported populations of juvenile shrimps, crab, and finfishes. The Marine Fisheries Commission (MFC) adopted regulations in August 1977 to protect these estuarine areas, known as Nursery Areas. Nursery areas are defined in rule 15 NCAC 3I .0101(b)(20)(E) as: "...Those areas in which for reasons such as food, cover, bottom type, salinity, temperature and other factors, young finfish and crustaceans spend the major portion of their initial growing season."

The Division recognizes two types of nursery areas: Primary Nursery Areas (PNA) and Secondary Nursery Areas (SNA).

Primary Nursery Areas (PNAs) are defined by rule 15 NCAC 3I .0101(b)(20)(E) as: "... those areas in the estuarine system where initial post-larval development takes place. These areas are usually located in the uppermost sections of a system where populations are uniformly very early juveniles." Populations of economically important species in these areas are composed almost uniformly of early juveniles during the spring recruitment period from March to June. Trawls, long haul seines, swipe nets, dredges, as well as any mechanical methods for clams or oysters are prohibited in PNAs. The Division does allow shellfish leases in PNAs but harvest by mechanical means is not allowed. Additional rules protecting PNAs were created with the establishment of the Coastal Area Management Act (CAMA) of 1974. CAMA provided rules for coastal development, such as prohibiting new dredging of channels, canals and boat basins in primary nursery areas, and extending the area of rule application from 75 ft landward from the shoreline to 575 ft landward of the shoreline. Construction of marinas that require dredging is also prohibited in PNAs. The Environmental Management Commission (EMC) also gives PNAs the supplemental water classification of High Quality Waters (15A NCAC 2B .0101(e)(5) and different water quality measures may be applied in those areas. There are 76,718 acres of PNAs, with 58,136 (75%) in the southern district (south of White Oak River).

Secondary Nursery Areas (SNAs) are defined by rule 15 NCAC 3N .0102(c) as: "... those areas in the estuarine system where later juvenile development takes place. Populations are usually composed of developing sub-adults of similar size which have migrated from an upstream primary nursery area to the secondary nursery area located in the middle portion of the estuarine system." These areas are located adjacent to PNAs, are generally deeper and contain mixed populations of large juveniles, sub-adults, and adults. Trawls are prohibited in SNAs. There are also a group of areas delineated as Special Secondary Nursery Areas (SSNAs). The director may open these areas to shrimp and crab trawling from August 16 through May 14.

In the original 1977 rule (3B .1404) that described the Scope and Purpose of Nursery areas, the following language was included: "Nursery areas are necessary for the early growth and development of virtually all of North Carolina's important seafood species. Nursery areas need to be maintained, as much as possible, in their natural state, and the populations within them must be permitted to develop in a normal manner with as little interference from man as possible. In order to protect the integrity and resources of nursery areas, *it is necessary to prohibit the use of bottom-disturbing gears*, and severely restrict or prohibit excavation and or filling activities". The rulebook was recodified in 1991 and it was determined that certain language, such as the aforementioned, was "policy" and not rule and DMF was instructed to delete from the current Scope and Purpose rule (03N .0101). As previously

noted, Rule 03N .0104 prohibits specific gears in PNAs (trawl net, long haul seine, swipe net, dredge, or mechanical methods for clams or oysters).

Consistency with Permit Reviews

The DMF has authority to review permit applications that may affect any fish habitats of coastal fishes in the State (NCDMF 2007). The fishes of concern to DMF depend on different habitats at different stages in their life history. Thus, all the habitats collectively are necessary for successful completion of fish life cycles, all are interconnected, and all are of concern in the DMF permit application review process. DMF staff is well aware of the relationships of marine and estuarine resources and their habitats and water quality, especially following adoption of the Coastal Habitat Protection Plan (Street et al. 2005) by the MFC, EMC, CRC, and DENR in December 2004. However, quantifying those relationships and functions on a site-specific basis is extremely difficult. The DMF permit reviewers have developed moratorium periods for in-water work in all areas to reduce negative effects on critical fish life history activities, including anadromous fish spawning migrations and nursery functions, and primary nursery area functions. The moratorium periods vary somewhat geographically as follows:

Area		Anadromous fish moratorium period	PNA moratorium period
Southern	Camp Lejeune and south	1 February – 30 Sept	1 April – 30 Sept
Central	Camp Lejeune to Neuse River to Ocracoke Inlet	1 February – 30 Sept	1 April – 30 Sept
Pamlico	Neuse River to Long Shoal River, including the Neuse basin above New Bern and all of the Tar-Pamlico basin	1 February – 30 Sept	1 April – 30 Sept
Northern	North of Long Shoal River and the Roanoke River basin	15 February – 31 Oct	1 April – 30 Sept
Outer Banks	North from Ocracoke Inlet	N/A	15 February – 30 June

Certain activities may occur in PNAs outside of the moratorium period and include installation of piers, pilings, boat ramps, DOT bridge activities, and canal maintenance dredging. A turbidity curtain is specified to limit impacts. As professional biologists, DMF staff personnel who review applications for habitat alteration projects rely on policies of the DMF and the MFC, as well as on their best professional judgment. That judgment is based on the individual’s training, available data and reports, and experience. In order for DMF permit review comments to be taken seriously by the other DENR and federal agencies, the actions of the MFC in regards to allowed fishing activities in these sensitive habitats and the types of comments and recommendations that are brought forward in the permit review process by the DMF must be consistent.

Fishing Activity in PNAs

If not specifically prohibited other types of fishing are allowed in PNAs. Nursery areas are common sites for hook and line fishing, as well as gill netting, crabbing, oystering or clamming by hand. The harvest of “adult” finfish or shellfish resources is not incompatible with the original purpose of nursery areas as long as the fishing operations do not negatively impact the development of juvenile populations. Most designated nursery areas are shallow muddy tidal creeks, bordered with wetlands. Some shell bottom and SAV may also occur within the PNA.

In November 2007 the Division was made aware, through public complaints, of the practice of some gill netters dragging cinder blocks along the bottom to “scare” fish and hence become entangled in adjacent gill nets. Gill netters had previously been known to use loud noises (banging on side of boat, M-80s, etc.) for the same purpose. This new technique in sensitive nursery areas is contrary to the scope and purpose of the PNAs but there is no longer a rule that can be cited to make the activity unlawful.

MFC rules focus on restricting the use of highly destructive bottom disturbing gear from most structural habitats such as oyster reefs or SAV beds. Soft bottom habitat, because of its low structure and dynamic nature, has historically been considered the most appropriate location to use bottom disturbing gear. The gears with the most severe impacts, such as clam kickers, hydraulic dredges, crab dredges, otter trawls, and long haul seines are

recognized as being damaging to shallow benthic habitats and are not allowed in Primary Nursery Areas. Another factor taken into consideration for gear prohibitions in nursery areas was potential bycatch of juveniles (trawls and long hauls).

Potential Habitat Impacts from Fishing Activity

A legislative report to the Moratorium Steering Committee (MSC 1996) compiled a list of the gears used in North Carolina waters and their probable impacts. In this report, long haul seines are reported as a gear of concern in PNAs. Gears reported as having severe habitat impacts to oyster beds and SAV included bull rakes, clam kickers, crab dredges, hydraulic clam dredge, and oyster dredges. Patent tongs were rated moderate, and bay scallop dredges, long haul seines, and clam rakes were considered to have low or unknown impacts. Impacts from otter trawls were dependent on type of trawl (crab, shrimp) and substrate type. Significant impacts were noted for heavily chained crab trawls or using over oyster reefs. Estuarine gill nets were listed as having negligible habitat impacts because they are stationary and don't disturb the bottom. However, dragging of a chain, cinder block, or other weights along the bottom, in conjunction with fishing the gill net, converts this passive operation into a small mobile bottom disturbing one. One could expect the impacts from this operation to be of similar nature to that occurring in a small trawl or toothless scallop dredge, but may be of a smaller scale, due to smaller weight and size of the chains or blocks, and smaller footprint disturbed (approx. 1 ft wide vs. 26' wide for a recreational trawl). Because there are no studies looking at this specific gear use, one can examine what is known about impacts to shallow soft bottom habitat from small trawls or scallop dredges. Of note is the gill net operation is intentionally stirring up the sediment in order to move fish and to cloud the water in order to make it more difficult for fish to detect the net. The heavier the towed object is (up to 29 pounds for a cinder block, with other devices in the 5-10 pound range), the more sediment disturbance.

The Coastal Habitat Protection Plan (2005) reviewed the impacts of bottom disturbing gear to fish habitats. The extent of habitat damage from various fishing gears depends on the habitat complexity, type of gear, severity of the gear to the benthos, and extent of contact (Auster and Langton 1999; DeAlteris et al. 1999). Bottom disturbing gear has a greater impact on highly structured habitats, such as hard bottom, oyster reefs, and SAV than less structured habitats such as soft bottom. However, smaller scaled features in soft bottom habitat can also be degraded, but to a lesser extent. Mobile bottom disturbing gear, because of its greater extent of bottom coverage, would impact a greater area than fixed or hand gears. In subtidal soft bottom, fine muddy substrates are impacted more and recover slower than coarse sandy substrates (Collie et al. 2000). Deeper areas also recover slower than shallow dynamic bottom.

Small estuarine bottom trawls include doors approximately 20 x 40" in size and weighing about 35 lb each, a weighted line and tickler chain (6 ounces per foot), and a net. Trawl doors can cut into the substrate more than other parts of the gear, varying from 1" – 1' deep, depending on the water depth, gear weight, bottom firmness, and trawling speed (ASMFC 2000). Effectively rigged, doors should skim the bottom with the objective to hold the net close to the bottom but not dig in. If the doors plow the bottom, it causes the operation to burn more fuel. Bottom trawling across soft bottom can reduce habitat complexity by removing or damaging small epifauna and structure, removing benthic invertebrates which produce structure such as tubes and burrows, and smoothing sediment ridges and contours (Auster and Langton 1999). Loss of these small features degrades refuge and foraging conditions for small juvenile fish. Where trawling is a common activity, the diversity and abundance of some benthic organisms is reduced, potentially impacting the diet available to juvenile and adult fish (Auster and Langton 1999).

Sediment resuspension can result in increased turbidity, resuspension of nutrients, and toxins (DMF 1999). Larvae and juveniles, especially filter feeding species, are more sensitive to elevated turbidity than adults (West et al. 1994). Increased suspended sediments have been documented to cause clogging of gill surfaces and mortality. In a eutrophic system, an increased supply of nutrients can stimulate algal blooms or hypoxia (Corbett et al. 2004; DMF 1999; Paerl et al. 1998). Corbett et al. (2004) found that the most consistent impact of trawling was a 1.5 to 3 fold increase in concentrations of total suspended solids. However, in evaluating how trawling-generated sediment resuspension compared to wind-generated sediment resuspension, a study in South Creek, NC found that wind events had a greater influence resuspending organic nutrients, sediment and chlorophyll *a* concentrations than trawling (Corbett et al. 2004). Resuspension of contaminated sediments and subsequent increased bioavailability of toxins, such as pesticides or heavy metals, into the water column can negatively affect development of larval and juvenile organisms (Kinnish 1992; DMF 1999). Early life stages (embryos and larvae) of fish are most susceptible to toxins (Funderburk et al. 1991; Rice et al. 2001). Visible indications of heavy contamination are development of

lesions, deformities, and tumors on fish or high mortality rates of larvae. Heavy metal contamination of sediments has been documented to result in elevated trace metal concentrations in benthic feeding striped mullet, shrimp, oysters and flounder (Kirby et al. 2001; Livingstone 2001).

Scallop dredges are toothless dredges composed of chain weighing less than 50 lbs. Bay scallop dredges are designed to glide along the substrate, usually SAV, to scoop up bay scallops lying on the surface. The toothless chain dredge has been documented to significantly reduce biomass and shoot density of eelgrass (Fonseca et al. 1984) but the effect on unvegetated bottom was not examined. The dragging of the dredge would resuspend sediments temporarily and reduce structural complexity.

Other gears allowed in PNAs include hand clam rake, bull rake, and oyster/clam tongs. Hand gears can also cause varying amounts of damage, but generally to smaller areas than mechanical or mobile gears. Clam tongs, similar to oyster tongs, are a pair of rakes attached to the end of two long poles which are fastened together like a pair of scissors. A bull rake is a large heavy clam rake having 18 to 24 teeth and a basket attached behind the teeth to catch the harvested clams. Because of the long teeth, bull rakes can penetrate deep into the sediment and cause substantial bottom disturbance in the area that it works, much more than a regular clam rake. Bull rakes and large clam tongs can uproot SAV and cause substantial damage to grass beds, while hand rakes are smaller and lighter in weight, and cause less damage (Thayer et al. 1984). A comparison of the impact of bull rakes and hand rakes on SAV found that a bull rake removed over 80% of the shoots, roots, and rhizomes in a completely raked area, while a hand rake removed 55% of shoots and 37% of roots and rhizomes (Peterson et al. 1983). There is no information available on the effect of bull raking on soft bottom habitat.

IV. AUTHORITY

G.S. 113-182. Regulation of fishing and fisheries.

- (a) The Marine Fisheries Commission is authorized to authorize, license, regulate, prohibit, prescribe, or restrict all forms of marine and estuarine resources in coastal fishing waters with respect to:
- (1) Time, place, character, or dimensions of any methods or equipment that may be employed in taking fish;
 - (2) Seasons for taking fish;
 - (3) Size limits on and maximum quantities of fish that may be taken, possessed, bailed to another, transported, bought, sold, or given away.

V. DISCUSSION

Evaluating the impact of a habitat change from bottom disturbance to various life stages of fishes is directly related to the dependence of that life stage on that particular habitat. The demersal nursery stage of many estuarine-dependent fish has been described as a "recruitment bottleneck", since success in the nursery area greatly determines the success of the overall population. (Auster and Langton 1998). Juvenile fish using these nursery areas are critically dependent on them to survive, grow, and successfully recruit into the adult population and eventually a fishery. The impact of a certain bottom disturbing activity would be expected to be greater in nursery areas than in adult habitat areas because of the greater sensitivity and habitat dependence of larval and juvenile fish. The impact of bottom disturbance associated with the described gill net practices on the productivity, structural integrity, and ecological function of Primary Nursery Areas is unknown, but is expected to be greater than in areas primarily utilized by adult fish.

Marine Patrol field officers in the Central and Southern Districts were surveyed to determine how prevalent this use of bottom disturbing devices in PNAs is. The officers described the devices as chain (1-3 feet long, 5-10 lbs), window weights (shape torpedo), anchor (fouled w/chain) and used most of all boat and motor itself to run along side or inside net. The gill net fisheries where disturbance (noise or bottom) was used included:

- Spot fishing (<1" 1/2 gill net) summer-fall
- Mullet fishing (< 1" 5/8) summer
- Mullet fishing (< 2" 1/4 fal
- Flounder fishing (>5" 1/2) summer-fall
- Specked trout(<2") winter

Based on their responses, the bottom disturbance technique is most prevalent in the Southern District and moderately used in the Neuse River and areas in Pamlico and Hyde counties. This is due to several factors: 1) the proportionally larger area of the Southern District that is designated as PNA (44% in southern area versus <1% in remainder of state), 2) the requirement for RCGL netters in the southern area to attend their nets (by actively moving fish into the nets, less time spent on the water, and 3) more populated shorelines where the noise disturbance techniques would be too noticeable and controversial.

In comparing the relative impact of this technique to other allowed gears in PNAs, the use of bull rakes has been suggested as also impacting the bottom. Bull rakes are used to harvest clams and from 2004-2007 account for 24% of the state clam harvest (107,000 lb). Eighty percent of the bull rake landings come from the southern area (other 20 % from Bogue and Core sounds). It is unknown what proportion of these landings are from PNAs. The principle harvest location is New River, accounting for 57%. Clams by this method are taken every month of the year in fairly equal amounts, with April being the highest month at 12%. If this issue is broadened to consider excluding bull rakes or any other bottom disturbing gear in PNAs, there will be other economic factors and participants to consider.

Additional research is needed to specifically assess and quantify the impacts of the various bottom disturbing gears in North Carolina (DMF 1999). Key questions include:

- Is the magnitude of the disturbance generated by the gear significantly greater than that resulting from natural sources?
- What is the intensity, duration and spatial scale of the gear disturbance?
- What is the depth of penetration of the gear into the sediment and the effect on the sediment composition?
- What effect is the activity having on growth, mortality, recruitment of benthic invertebrates, microalgae, and juvenile finfish?
- What is the impact of the gear on secondary primary productivity?

This issue was initially brought before the MFC at the January 2008 MFC meeting. After a brief discussion concerning the extent of the practice in the southern area of the state where 44% of the area is designated PNA, the issue was referred to the MFC Habitat and Water Quality Advisory Committee (AC) for further discussion. The MFC Habitat and Water Quality Advisory Committee met March 31, 2008 to discuss the Issue Paper. Also Commissioner Beresoff was able to attend and brought several devices as examples of the range of towed devices employed in gill net operations in the southern part of the state. The devices ranged in weight from 20 to 7 pounds with horizontal dimensions from ~4 feet to 1 ½ feet. The heaviest device was a towed bar with 3 lengths of chain hanging from the bar, the lightest device was just a towed bar and the final device was a clump of chain attached to a knotted rope (weight ~15 pounds). Gill netting in the southern area must accommodate tidal influence so this active netting technique allows the nets to be set and taken up prior to being exposed at lower tides, as well as the catch efficiency is higher, allowing less net to be set. It was estimated the catch of passive gill netting might only be ¼ of this active technique. The tidal scouring also results in coarser sandy sediment and along with the more common shell hash, the PNA sediment characteristics in many southern PNAs are different from the soft muddy detritus found in the more northern PNAs. The AC noted the following in their deliberations on the Issue:

- Regional PNA ecological differences (tidal versus not, sediment resuspension oxygen demand, prevalence of active netting)
- Unknown the extent of damage done by the various towed devices
- Boat motors (commercial or recreational) in shallow areas or severe weather would appear to be equally detrimental
- Lack of data to judge if this is a “big or little” problem
- Millions of research dollars that would be needed to prove consequence to resident juvenile populations
- Need to maintain credibility in reviews of developmental activities in PNAs
- Prohibiting technique may lead to increase in gill net bycatch if more net is set to offset restriction

The AC unanimously supported Option B and Option D. It was noted that Option D would be occurring as part of the planned revision to the CHPP in 2009.

Management Options

(+ Potential positive impact of action)

(- Potential negative impact of action)

- A. Status quo, but undertake studies to determine the extent of bottom disturbance caused by the devices being used in association with gill net operations.

- + Improved data to distinguish significance of habitat disturbance.
- + More time to investigate fully all ramifications of possible rule changes.
- + No economic impact to ongoing fisheries
- Apparent harmful fishing practice allowed to continue in PNAs
- Additional funds/resource needed to design and carry out studies.
- Decreased effectiveness of permit comments

- B. Take rule actions to only address the aspect of bottom disturbance associated with gill net operations in PNAs.

The Director has proclamation authority for gill nets granted in rule 03J .0103 (b)

(b) The Fisheries Director may, by proclamation, limit or prohibit the use of gill nets or seines in coastal waters, or any portion thereof, or impose any or all of the following restrictions on the use of gill nets or seines:

- (1) Specify area.
- (2) Specify season.
- (3) Specify gill net mesh length.
- (4) Specify means/methods.
- (5) Specify net number and length.

The argument might be made that the cinder block dragging is part of the means and methods. However, legal advice was that interpretation was beyond the scope of existing proclamation authority. In order to address all aspects of a gill net "operation" (b) could be modified accordingly. If the disturbance is not part of a fishing operation, the DMF would not be able to address (outside of MFC jurisdiction).

- + Addresses the specific problem that was initially requested for resolution.
- + Relatively straight forward rule change could resolve.
- + No economic impact to ongoing fisheries other than gill nets
- Other possible harmful fishing practices allowed to continue.
- Not fully compatible with the spirit of CHPP
- Decreased effectiveness of permit comments.

- C. Take rule actions to address all aspects of bottom disturbance associated with any fishing activity in PNAs [sub-options: could include different restrictions by time and area based on fish utilization (see dredge moratoria table) and prevalent bottom types].

Another applicable approach is to amend the current rule 03N .0104 to address all bottom disturbing gear or provide Director proclamation authority to address fishing practice carried out in critical fish habitat.

- + Consistent approach for all fisheries.
- + Relatively straight forward rule change could resolve.
- + Maintain effectiveness of permit comments
- Economic impact to historically allowed fisheries.
- Data insufficient to fully justify

- D. Undertake thorough review of all fishing activities in the various CHPP habitats in the scheduled revision of the CHPP to be completed by the end of 2009.

- + Addresses the specific problem that was initially requested for resolution.

- + Could with consistent approach, improve effectiveness of permit comments.
- + No economic impact to ongoing fisheries while review is ongoing
- Possible harmful practices allowed to continue while review is ongoing.
- Better data is still needed and just a review won't address that shortcoming
- Delays for several years the resolution to the problem, CHPP approval and APA process.

VI. EXAMPLES POTENTIAL RULE(S)

OPTION B

**SUBCHAPTER 03J - NETS, POTS, DREDGES, AND OTHER FISHING DEVICES
SECTION .0100 - NET RULES, GENERAL**

15A NCAC 03J .0103 GILL NETS, SEINES, IDENTIFICATION, RESTRICTIONS

(b) The Fisheries Director may, by proclamation, limit or prohibit the use of gill nets or seines in coastal waters, or any portion thereof, or impose any or all of the following restrictions on ~~the use of gill nets or seines~~ net or seine fishing operations:

- (1) Specify area.
- (2) Specify season.
- (3) Specify gill net mesh length.
- (4) Specify means/methods.
- (5) Specify net number and length.

AND / OR –NEW SUBPARAGRAPHS (sets standards what can be used in a gill net operation as a mobile device and prohibits mobile devices in gill net operations in certain areas):

It is unlawful in a gill net or seine operation to drag or tow any device, gear, or object in addition to the gill net or seine when the device, gear or object exceeds 10 pounds total weight. Only one such device, gear, or object may be used per operation.

It is unlawful in a gill net or seine operation to drag or tow any device, gear, or object in addition to the gill net or seine in Primary nursery areas described in 15A NCAC 03R .0103 (1) through (9), permanent secondary nursery areas described in 15A NCAC 03R .0104 (1) through (4), and trawl net prohibited areas described in 15A NCAC 03R .0106 (1) through (7).

FOR OPTION C

15A NCAC 03N .0104 is proposed for amendment as follows:

3N .0104 PROHIBITED GEAR, PRIMARY NURSERY AREAS

- (a) It is unlawful to use any trawl net, long haul seine, swipe net, dredge, or mechanical method for clams or oysters, for the purpose of taking any marine fishes in any of the primary nursery areas described in 15A NCAC 03R .0103.
- (b) The Fisheries Director may, by proclamation, specify means and methods for the taking of fish in the primary nursery areas described in 15A NCAC 03R .0103.

OR

3N .0104 PROHIBITED GEAR, PRIMARY NURSERY AREAS

It is unlawful to use any trawl net, long haul seine, swipe net, dredge, or mechanical method for clams or oysters, drag, tow, or use any device, gear, or object that disturbs the bottom, for the purpose of taking any marine fishes in any of the primary nursery areas described in 15A NCAC 03R .0103.

*History Note: Authority G.S. 113-134; 113-182; 143B-289.52;
Eff. January 1, 1991;
Amended Eff. September 1, 1991;
Recodified from 15A NCAC 3N .0004 Eff. May 1, 1997;
Amended Eff. May 1, 1997.*

VII. RECOMMENDATION

DMF recommends this issue be taken before the MFC Finfish and Regional Advisory Committees for further input. MFC should consider Notice of Text at June MFC meeting.

VIII. LITERATURE CITED

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NOTICE OF TEXT ATTACHMENT

#6 – Explain Reason for Proposed Action:

15A NCAC 03X .#### NAME OF RULE