Draft

Supplement A to Amendment II of the NC Oyster Fishery Management Plan

Changing Management Measures for Harvest Limits in the Mechanical Harvest Oyster Fishery

See sections 10.1.2 and 10.1.6 in Amendment II to the NC Oyster Fishery Management Plan 2008

September 13, 2010

I. ISSUE

The issue is a proposal to change the management measure setting the harvest limit for the mechanical harvest oyster fishery at 15 bushels per commercial fishing operation to a per license holder limit. This supplement examines possibilities for increasing mechanical harvest limits for oysters and triggering closure of mechanical harvest areas.

II. ORIGINATION

The recent resurgence of oyster landings to pre red tide levels of the late 1980s and higher market demand for oysters have resulted in increased requests for raising the daily harvest limit for mechanically harvested oysters. The Marine Fisheries Commission has also received a petition from oyster dealers and fishermen from Hyde County requesting a change in oyster harvest limits so each licensee can take a harvest limit rather than each fishing operation taking only one limit regardless of the number of licensees on board. Hyde County commissioners support the petition.

III. BACKGROUND

There were no limits on oyster harvest volume until 1947 when a 75-bushel daily limit per vessel was imposed. The 75-bushel per day per vessel harvest limit existed either in statute or rule until 1984 when proclamation authority was established for oyster limits. Between 1984 and 1989, the oyster harvest limit was 50 bushels per vessel per day. An addition to the proclamation authority in 1989 placed an upper harvest limit of 50 bushels of oysters per commercial fishing operation but allowed the director to set lower harvest limits. Harvest limits for the mechanical harvest fishery were 20 bushels per fishing operation from 1990 through spring 1992. Mechanical harvest oyster limits have been set at 15 bushels per fishing operation since the 1992/93 season except for a brief period during the 2004/05 season when the limit was increased to 20 bushels due primarily to large increases in fuel costs. Setting of the oyster harvest limit at 15 bushels for mechanical harvesters (and 5 bushels for hand harvesters) was in response to low population levels observed due to *Perkinsus marinus* (Dermo) induced mortalities. There were no recorded mechanical harvest landings for oysters from Pamlico Sound for the 1995/96 and 1996/97 oyster seasons and the primary reason for the complete lack of landings was high Dermo mortalities for several years preceding those seasons (Figure 1).

The original 2001 Oyster Fishery Management Plan (FMP) adopted a management strategy of implementing harvest management measures until data collection efforts allow for more precise assessment of population parameters and harvest effects. The harvest management measures adopted in the 2001 FMP focused on further designation of areas limited to hand harvest methods using enhancement measures and harvest restrictions to support success of those designations. There was no directive to remove flexibility in setting mechanical harvest limits for oysters.

The 2008 Amendment II to the Oyster FMP contained a plan for setting limits and designating additional harvest limit areas in Pamlico Sound and its tributaries (Figure 2 and Figure 3). Lower mechanical harvest limits of ten bushels per commercial fishing operation were established for the bays and outer banks areas around Pamlico Sound. The traditional mechanical harvest limit for Pamlico Sound waters of 15 bushels per commercial fishing operation was adopted as a management strategy with a recommendation that triggers for setting harvest limits should be established. This supplement discusses information concerning possible changes to harvest limits for Pamlico Sound. Harvest limits for bay and outer banks areas around Pamlico Sound are not addressed in this supplement.

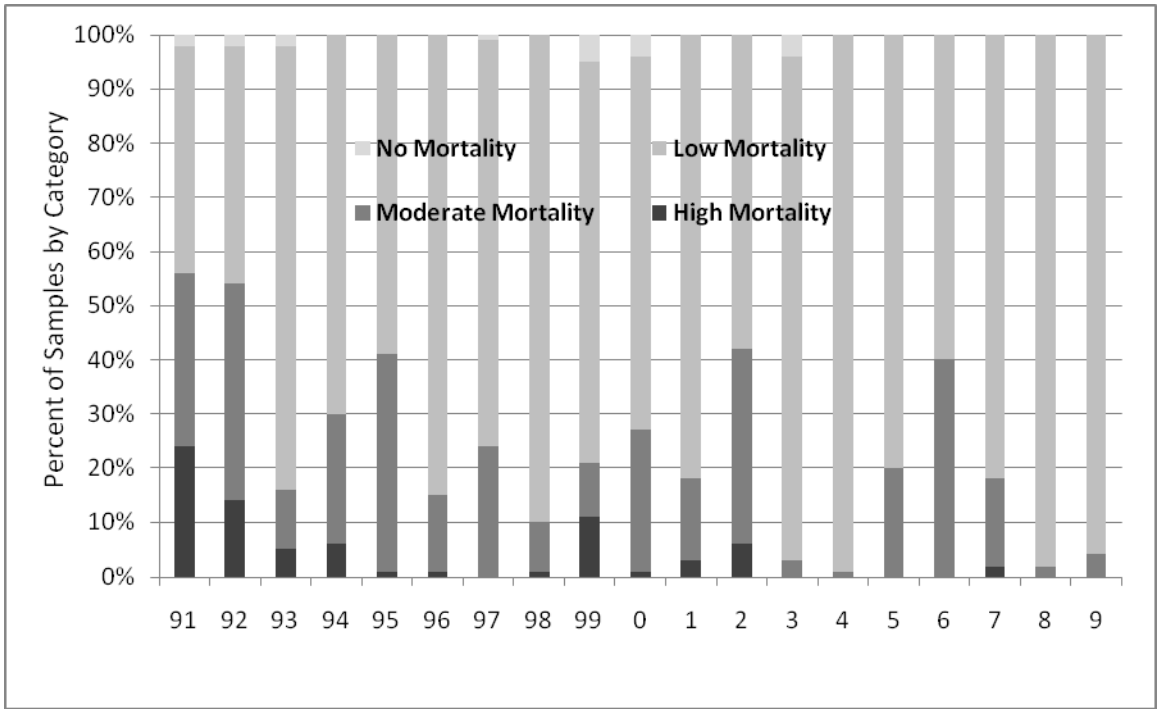

Figure 1. Coast wide results of infection level sampling of the oyster parasite *Perkinsus marinus,* 1991 through 2009.

The sampling described below is an attempt to evaluate the percentage of legal-size oysters in an area as a trigger for closing harvest to protect the resource and the habitat. Recent research has shown that mechanical effort to harvest a bushel of legal-size oysters can be 10 times greater when the numbers of legal oysters are low (T. Alphin, UNCW, personal communication). Data also indicate this same increase in effort required when harvestable oyster abundance is low results in the taking of up to 15 times more cultch material in dredges (Alphin, UNCW, personal communication). This measure of captured cultch material is being used as an indication of dredging effects on oyster habitat. The recent increase in oyster resources in mechanical harvest areas presents an excellent opportunity to observe the effect of different levels of harvest on oyster resources.

During the 2007/08 and 2008/09 oyster seasons, Division of Marine Fisheries staff sampled oyster fishermen using mechanical gear in Pamlico Sound and adjacent bays to gain information on harvest techniques, exact harvest locations and size composition of catches. Using this information, staff selected five representative sampling sites in western Pamlico Sound for monitoring the 2009/10 mechanical oyster harvest (Figure 4). Sampling locations were selected from sites where commercial oystermen were previously sampled in the field. Three of the sites (Gill, Brooks and Spencer) were observed to be consistently worked during the sampling period, while no activity was observed at the other two sites (Sawyer and Foster) and sampling evidence indicated these two sites had been lightly worked, if at all. The same five sites, with one exception, were sampled on each sampling date. The only exceptions occurred when commercial harvest activity precluded sampling on the predetermined location. In that case, a nearby location on the same rock was sampled. Sampling of the two, low harvest activity sites is important because supplemental sampling in other locations during the season indicated several normally harvested sites in western Pamlico Sound had not been harvested and that component should be included in the evaluation of harvest effects for the entire area.

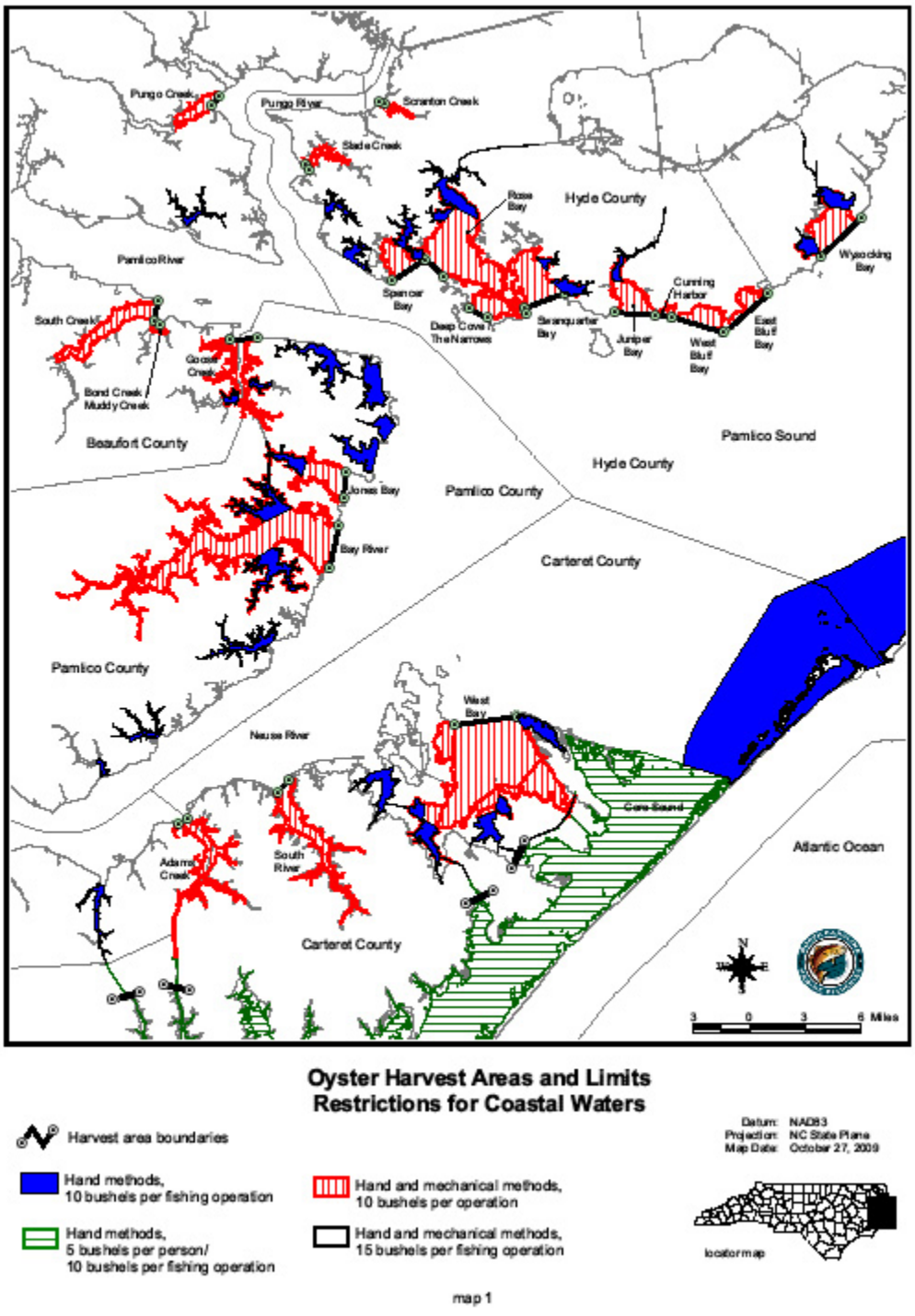

Figure 2. Oyster harvest areas and limits in the southern Pamlico Sound region.

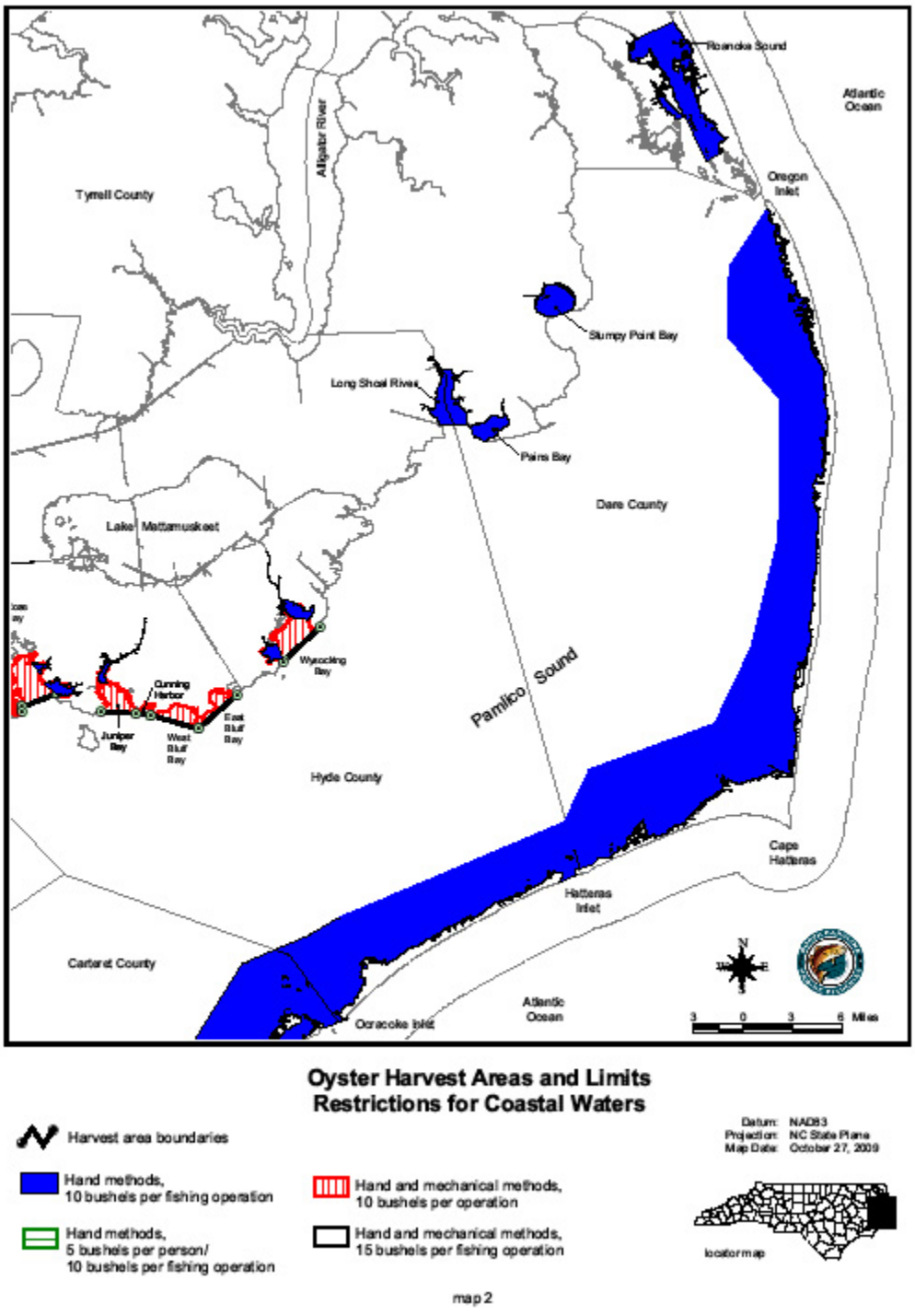

Figure 3. Oyster harvest areas limits in the northern Pamlico Sound region.

Figure 4. Sampling sites utilized in this analysis. Area depicted is the mouth of Pamlico River and a portion of western Pamlico Sound.

A preseason sample of the five sites was obtained on September 23, 2009. Mechanical harvest in the sampling area began in earnest around January 1, 2010 after closure of the Hyde and Pamlico county bays and an area in Great Island Narrows on December 31, 2009. Sampling to monitor the condition of oyster resources in the area began on January 15, 2010. Samples were also collected on 28 January, 12 February, 8 March during the open season and 16 April, 2010, two weeks after the oyster season closed.

All samples were collected with division-owned dredges. Dredge tows were made until at least 100 oysters were collected. In most instances only one tow was required to collect a sample. A total of 100 randomly selected oysters of any size from each site were measured to the nearest millimeter and recorded. The percentage of oysters of legal harvestable size to the total number of oysters sampled was calculated for each site and for the five sites combined for each sampling trip.

Sampling to assess the 2009/10 mechanical harvest season in Pamlico Sound began on January 15, 2010 with 54.5% of the oysters of legal size and ended on April 16, 2010 with 38% of the oysters still of legal size. The average percent reduction among sampling sites in Pamlico Sound is 16.8% with a confidence interval of 5.1%. There were 11 weeks of harvest between the beginning sampling date and end of the oyster season for an average of 1.5% decrease in legal-size oysters per week in this area. This reduction was accomplished with a 15-bushel per commercial fishing operation harvest limit. The percentage of legal-size oysters in the samples decreased with each sampling trip after January 15, 2010.The percentage of legally harvestable oysters sampled on each date is shown in Figure 5 and the overall effect of harvest on each size class is shown in Figure 6.

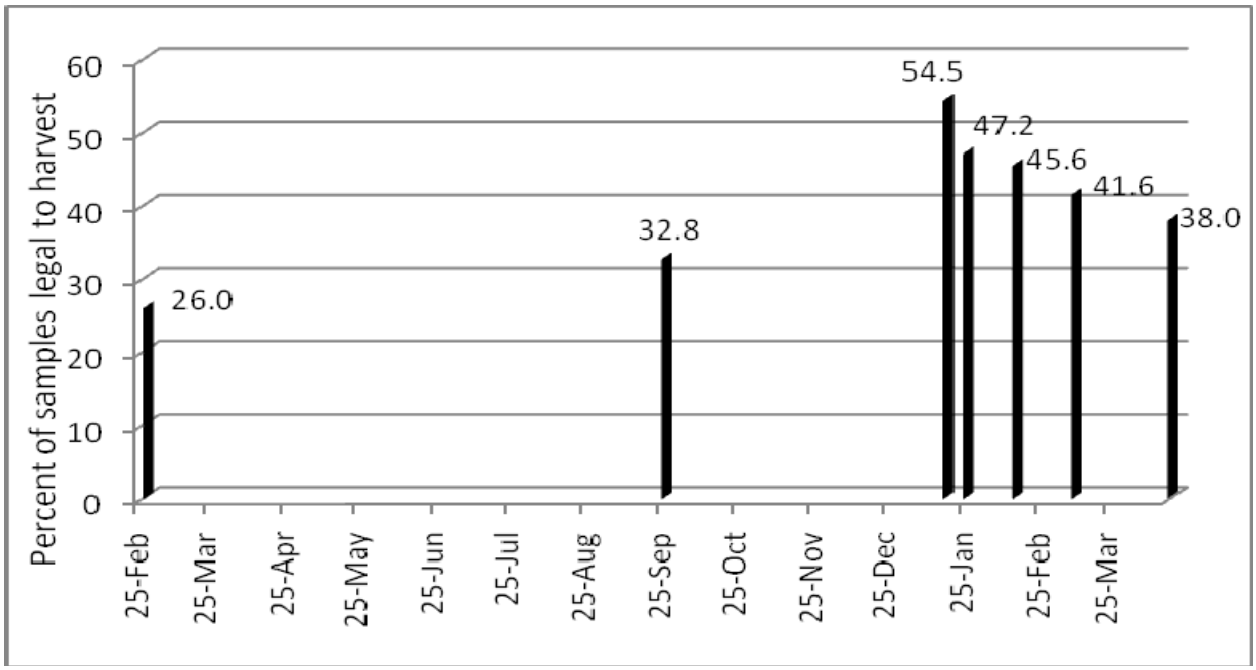

Figure 5. Percent of oysters of legal-size taken in mechanical harvest areas in Pamlico Sound on the dates indicated during the 2009/10 oyster season.

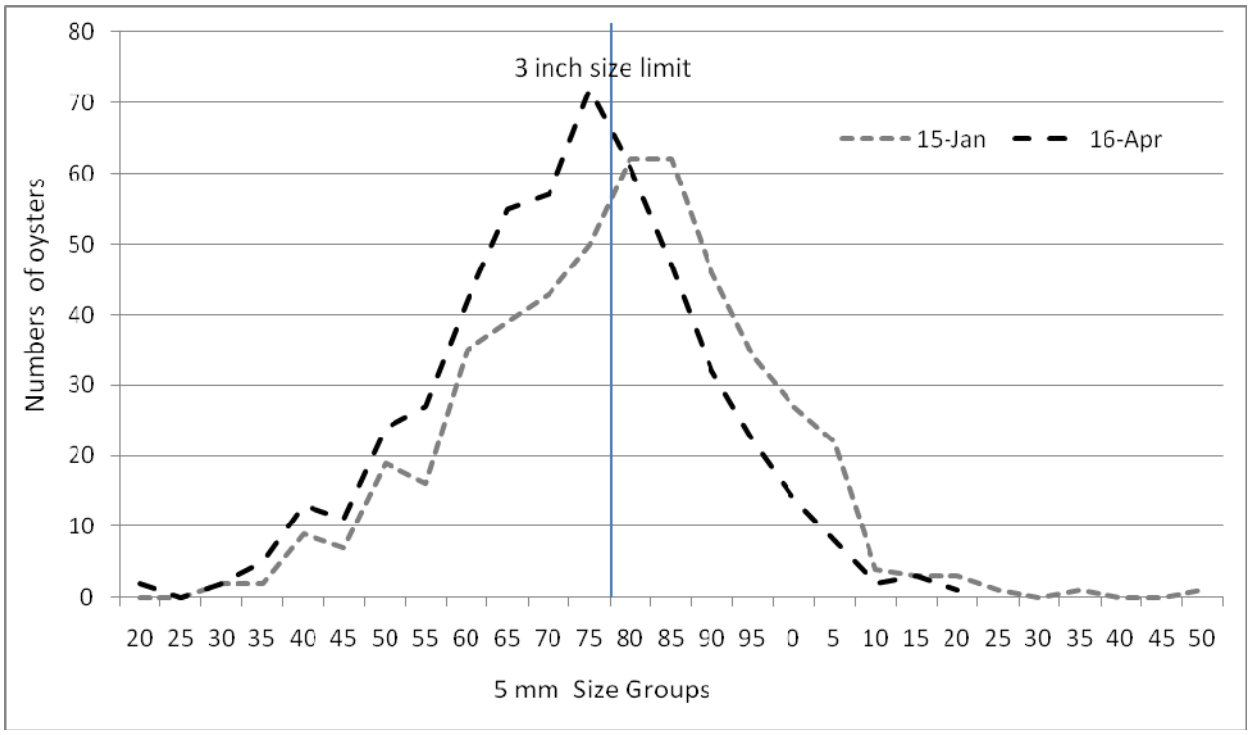

Figure 6. Comparison of size class ranges between early and after season samples of the mechanical harvest oyster fishery in western Pamlico Sound for the 2009/10 oyster season.

Using a simple ratio of percent reduction in legal-size oysters to bushel harvest limit, the ratio of the 16.5% reduction in legal sizes of oysters realized during sampling of oyster dredge harvest in the study area to the 15-bushel limit would yield a projected 22.0% reduction at a 20-bushel limit, a 27.5% reduction at a 25-bushel limit and a 33.0% reduction at a 30-bushel limit (Table 1). Applying the observed ratio predicts remaining amounts of legal-sized oysters between 32.5 and 21.5% for the sampled area (Table 1).

Table 1. Projected levels of harvestable oysters remaining at various harvest limits for the 2009/10 oyster season.

Bushel Limit	Reduction	Ending Percentage
15 (actual)	16.5% (observed)	54.5% - 16.5% = 38.0% (observed)
	Projected values are shown below	Projected values are shown below
20	$16.5\%/15 = X/20, X = 22.0\%$	54.5% - 22.0% = 32.5%
25	$16.5\%/15 = X/25, X = 27.5\%$	54.5% - 27.5% = 27.0%
30	$16.5\%/15 = X/30, X = 33.0\%$	54.5% - 33.0% = 21.5%

The relationship expressed in Table 1 assumes a consistent and increasing relationship between the amount of legal-sized oysters harvested and the harvest limit. This relationship could be affected by lower market demand and prices due to higher supplies. These values also do not take into consideration any increase in effort that may have occurred due to the increase in daily harvest limits or dredge related mortality associated with effort increases. The projections also do not anticipate movement out of the study area by harvesters seeking more productive sites as oyster supplies decrease more rapidly due to higher harvest limits.

IV. AUTHORITY

G.S. 113-134. Rules.
G.S. 113-182. Regulation of fishing and fisheries.
G.S. 113-201. Legislative findings and declaration of policy; authority of Marine Fisheries Commission.
G.S. 113-221.1 Proclamation; emergency review.
G.S. 143B-289.52. Marine Fisheries Commission – powers and duties.
15A NCAC 03K .0201 OPEN SEASON AND POSSESSION LIMIT

V. DISCUSSION

Traditionally management of the mechanical harvest oyster fishery in North Carolina has relied on reports from officers, dealers and fishermen to determine when conditions warrant harvest season closure. There have been occasional field sampling trips to verify reported conditions but most management decisions have been based on factors including the length of time it takes harvesters to get the limit, the number of citations for harvest of undersize oysters, and dealer satisfaction with the quality of the oysters harvested. In addition, the extremely low

harvest levels and effort during the 1990s and early 2000s did not cause much concern about overharvesting in mechanical harvest areas (Figure 7).

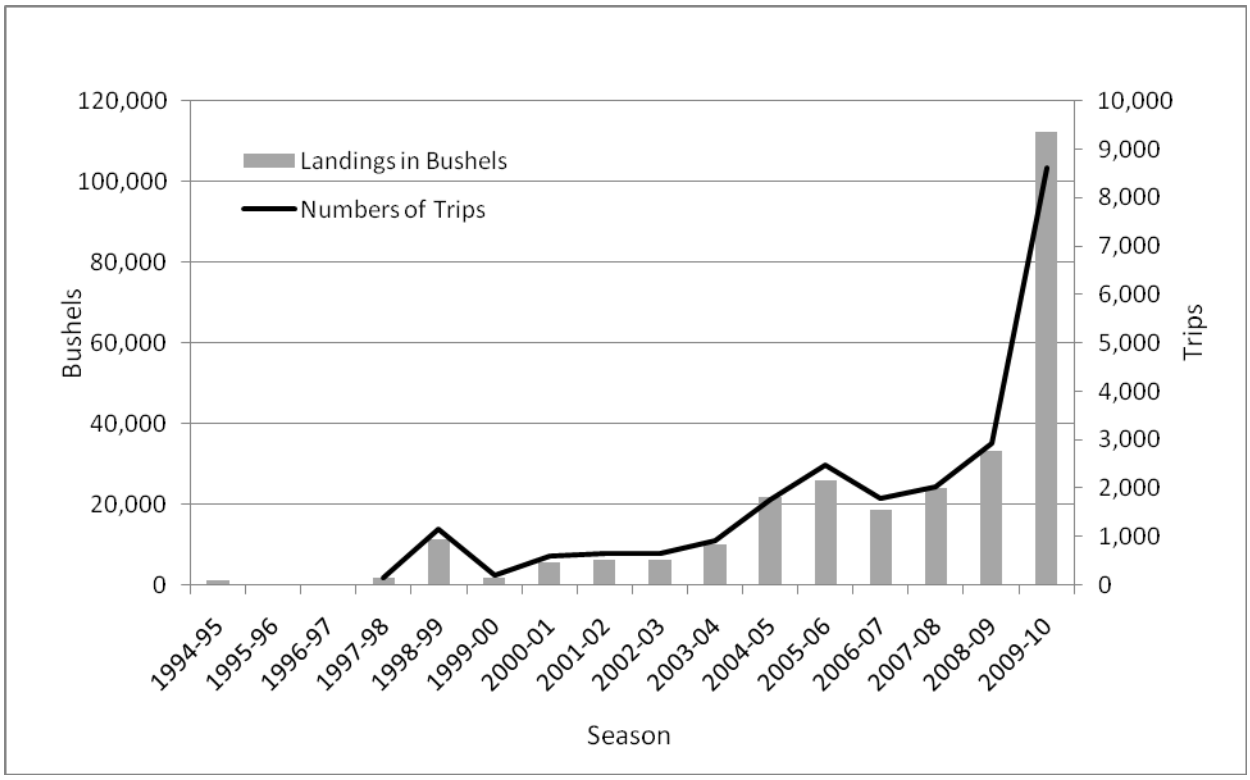

Figure 7. Landings in bushels and harvest trips for the mechanical harvest oyster fishery for the 1994/95 through 2009/10 oyster seasons.

The increase in mechanical harvest oyster landings beginning around the 2004/05 oyster season coupled with the scheduled review of the Oyster Fishery Management Plan that began a year later created new interest in establishing a sampling system and reference points for managing mechanical harvest in Pamlico Sound. Other shallower areas of coastal North Carolina have largely been surveyed and mapped for shellfish concentrations and oyster populations may be able to be assessed through standing stock estimates in these shallow areas in the near future. Methods for assessing oyster populations in the deeper, open waters of Pamlico Sound are not nearly as close to being implemented. Therefore, Amendment II to the Oyster FMP contains a management measure to hold the mechanical harvest oyster limit at 15 bushels per operation and for triggers for harvest closure to be developed. This supplement is a proposal to look at a potential method for triggering closure of mechanical harvest of oysters after allowing for an increase in harvest limits.

Whatever method is chosen for managing mechanical oyster harvest, including status quo, harvest must be monitored by field sampling in active harvest areas at levels at least as intensive as those described for western Pamlico Sound for the 2009/10 oyster season. Excessive harvest can quickly impact oyster stocks and oyster habitat and the open nature of the shellfish license system allows for sudden, large increases in participants. The amount of coordination required to obtain the samples described in assessing the 2009/10 harvest revealed that shellfish personnel have numerous responsibilities during the oyster harvest season that leave little time for additional field work. Thus, identification of personnel and resources for monitoring needs to occur prior to the upcoming harvest

season.

The effect of increasing mechanical harvest limits on ecosystem services provided by subtidal oyster reefs should also be taken into account when considering changes in limits and triggers. Historically reefs were reported to reach 4 m in height. A bathymetric study in the Neuse River found that reefs that were documented to range from approximately 1.8 – 2.4 m tall in 1868, were only 0.3 – 0.9 m in 1993 (Lenihan and Peterson 1998). The historical mounded structure of reefs in Pamlico Sound provided increased habitat complexity for a wide variety of invertebrates and fish and the upper portion of the mounds provided refuge for benthic organisms when lower portions of the reef were hypoxic. Research has shown that oysters at the base of subtidal reefs have a greater proportion of oyster mortality, significantly lower abundance of organisms, and higher incidence of disease occurrence, compared to the crest of reefs 0.9 and 1.8 m tall (Lenihan and Peterson 1998; Lenihan et al 1999). This was attributed to lower water flows, food quality, oxygen levels, and higher sedimentation. This suggests that the higher the reef, the more productive and healthy it will be. Lenihan and Peterson (1998) found the probable cause of the reduction in oyster reef heights in the Neuse River to be due to decades of fishery-related disturbances caused by oyster dredging. Researchers in other areas found that natural and anthropogenic factors were more important components affecting loss of reef height (Powell et al 1995). However, increasing mechanical harvest trip limits could potentially lower reef height more than during past seasons, particularly due to the expected increase in effort. Subtidal reefs remain much lower than they traditionally were. Restoration or maintenance of reef height of some portion of naturally occurring reefs would be beneficial to multiple species. Monitoring of oyster reef height in oyster harvest areas would be a useful tool for assessing oyster habitat health.

The 2008/09 mechanical harvest oyster season closed prior to the regulatory closure date after sampling showed legal harvestable oysters had been reduced to 26% of the oysters on the rocks in the main harvest area. This closure supported a crop of oysters that yielded a112,290 bushel harvest by mechanical methods in 2009/10 (Figure 7 and Table 2). These landings are the highest landings for this fishery since the 1987/88 season and since Dermo parasites began affecting Pamlico Sound oyster populations around 1990. The 2009/10 season closed by rule on March 31, 2010 with 38% of the oysters in the main harvest area still of marketable size indicating harvest levels could have been higher and still maintained the 26% level of 2008/09 when the season was closed by proclamation at an earlier date. Catch per unit effort increased slightly to 13 bushels per trip for the 2009/10 season and there was a large increase in the number of vessels participating from 160 in 2008/09 to 325 in 2009/10. However, 41 of the vessels made only one trip in 2009/10 and 177 vessels had landings on less than 20 of the maximum 102 days available for harvest. The following management options present possible actions for implementing higher harvest under these circumstances.

Marine Fisheries Commission Rule 15A NCAC 03K .0201 gives the director proclamation authority within a set oyster season to specify the quantity of oysters that may be harvested but that amount shall not exceed possession of more than 50 bushels in a commercial fishing operation. This proclamation authority may be used depending on the need to protect small oysters and their habitat, the amount of saleable oysters available for harvest, the number of days harvest is prevented due to unsatisfactory bacteriological samples and weather conditions, and the need to prevent loss of oysters due to parasitic infections. Currently, the Oyster FMP further restricts harvest limits in the mechanical harvest fishery to 15 bushels per commercial fishing operation.

Status quo is a viable option. The 15-bushel mechanical harvest limit is fairly conservative in the effect it has on harvest even though at this lower level limit the harvest season has often been reduced due to low levels of legal-size oysters. The traditional support mechanisms for assessing when to close mechanical harvest are risky because situations that negatively impact the resource typically exist before input advocating closure is received. However, based on landings, the resource exhibited signs of modest recovery using this management strategy.

Table 2. Landings and effort information for the public bottom mechanical harvest oyster fishery 2004/05 through 2009/10.

OYSTER SEASON	VESSELS	TRIPS	POUNDS of meat	BUSHELS	CPUE Bu./trip	Crew % 1 crew/% 2 crew
2004/05	131	1,769	114,587	21,661	12	49/51
2005/06	155	2,476	137,646	26,020	11	45/55
2006/07	134	1,783	98,090	18,543	10	42/58
2007/08	138	2,038	127,669	24,134	12	45/55
2008/09	160	2,918	176,307	33,328	11	44/56
2009/10	325	8,623	594,015	112,290	13	43/57

Another option would be to set a new, higher upper harvest limit through the authority of the FMP but no higher than the 50 bushel per operation limit set in rule. Unless other changes were made, the director would continue to have the authority to limit the length of the season if adverse effects from the level of harvest were realized. Based on the data from 2009/10, the upper harvest limit would likely be 20 or 25 bushels per operation. This upper limit would have been sustainable and kept numbers of legal-size oysters above the 26% level identified for closure of the 2008/09 season. That 26% level supported the harvest of 112,290 bushels in 2009/10. Data on oyster supplies for 2010/11 should be available when this supplement is presented to the MFC in November 2010 and could be used to further define an acceptable upper limit.

Readjusting the maximum mechanical harvest limit up to a certain conservative amount best fits the use of the information gained so far in the attempt to establish viable triggers for managing harvest levels. The data indicate, at high levels of abundance of legal-size oysters, the resource can tolerate harvest limits of 20 to 25 bushels per operation with little harvest-related impact based on the results of dredge studies by other researchers (T. Alphin personal communication) (Table 1). The option chosen would be the highest level of harvesting allowed and the preseason sampling data would be used to set the harvest limit up to that amount. One of the major disadvantages of this option would be the industry would have no information on the harvest limit until sampling was completed in the fall and there would likely be much disagreement over reasonable limits until standards have been proven through field use.

Hyde County fishermen and commissioners propose changing the base unit for assigning the harvest limit from the fishing operation to individual license holders as a means of increasing allowable catches. They also propose a restriction of two of these limits per vessel even if there are more than two license holders on board. Under the current management strategy in the FMP, they assumed that would allow a harvest of 30 bushels per fishing operation per day. However, the intent behind the 30-bushel per operation limit was to eliminate the individual limit and only have the operational one. Therefore, their proposal should be interpreted in the context of the current FMP as a change to 7.5 bushels per licensee; not to exceed 15 bushels per fishing operation. If the restriction on harvest limits is removed from the FMP, the proposed action of setting mechanical harvest oyster limits could be taken under the director's proclamation authority and, if otherwise unrestricted, could be changed to meet the management needs for the fishery. If the proposal on individual limits is made a part of the management strategy in the FMP or set in rule, it could complicate management and result in less flexibility for mechanical harvesters. However, mechanical harvesters complain the change in the limit structure is also being made due to safety issues because the

existing limit does not allow enough income for boat owners to hire a crewman to help with the harvest and provide first aid or rescue if the other crewmember is injured or lost overboard. From 2004/05 through 2009/10 mechanical harvest vessels with only one person onboard comprised between 42% and 49% of the mechanical harvest fleet (Table 2).

Review of the Virginia and Maryland fishery agency web sites revealed that both states have daily per person catch limits for oyster dredge harvest by power vessels. Virginia's limit is 8 bushels per registered commercial fisherman licensee with no maximum per vessel. Virginia also has harvest quotas in some areas that facilitate allowing higher limits. The mechanical harvest limit in Maryland is 12 bushels per person not to exceed 24 bushels per vessel.

There are complicating factors that could have significant effects on any of the proposed management options but especially on those that rely on the percentage of marketable oysters as a trigger for management actions. Oysters recruit and develop in the same areas where oyster harvesting occurs and heavy spat sets, particularly on substantial populations of harvestable oysters, have always been problematic for managers. A heavy spatfall in Pamlico Sound could preclude harvest of major amounts of marketable oysters under the proposed management measures. Conversely, periods of low spatfall could produce sampling results that could allow for increased limits and a lengthy harvest season when oyster resources are composed of sparse concentrations of legal-size oysters. Also, very heavy harvest pressure like that experienced in Great Island Narrows during fall 2009 can inflict heavy dredge-induced damage to the shells of living oysters that will eventually lead to oyster mortality. However, these oysters may still meet the minimum size limit, survive during the harvest season and be major contributors to the percentage of legal-size oysters in an area. If this is the case, areas experiencing this type of damage should be closed to harvest to limit further mortality. The possibility of limiting harvest due to these factors should be made very clear if management option B is selected.

MANAGEMENT OPTIONS/IMPACTS

(+ Potential positive impact of action)
(- Potential negative impact of action)

A. Status quo – Maintain the 15-bushel per operation mechanical harvest limit for oysters

+ Conservative limit that has allowed for oyster recovery
+ Current limit extends the harvest season providing markets with local oysters
± May aid in protecting oyster habitat depending on season closure criteria
- Lack of flexibility in limit does not allow for higher harvests during years with increased production or lower limits when production is poor
- Increasing operating costs make it difficult for harvesters to work under this limit
- Recent increases in oyster resources have created unintended and difficult-to-enforce harvesting situations
- Early season closures have been necessary under this limit

B. Adopt a new, higher upper harvest limit through the authority of the FMP that is less than 50 bushels

+ Provides more flexibility for responding to varying population levels of oysters
+ Provides more flexibility for responding to market conditions
+ Harvest limits can be changed during the season to respond to variable conditions
± Director may use the proposed or improved monitoring scheme to determine harvest limits
± Depending on limit chosen, the director may be subject to pressure from diverse groups trying to influence limits
- Potential for overharvesting the resource
- Potential for habitat impacts

- Higher available limits could lead to early season closure and impacts to markets
- Adequate staff may not be available to conduct the additional sampling required
- Markets would not know levels of harvest to expect due to the option of variable limits

C. Change the mechanical harvest limit, base unit from fishing operation to individual license holder based on a 15-bushel per license holder limit and a restriction of two limits per vessel

+ Addresses harvester's safety concerns over working alone
+ Standardizes how limits are designated between southern area hand and Pamlico Sound mechanical harvesters
± May result in only a reconfiguring of limits to achieve the same overall harvest
- May encourage vessel operators to take persons licensed only for the purpose of increasing the amount they can harvest
- Potential for overharvesting the resource
- Potential for habitat impacts
- Higher available limits could lead to early season closure and impacts to markets

VI. PROPOSED RULES

All of the proposed management options can be accomplished through the use of current proclamation authority for management of the oyster resource. Therefore, no rule changes will be required if one of the above management options is chosen to supplement the Oyster FMP.

VII. MANAGEMENT RECOMMENDATION

PDT Position

MRT Position

DMF Position

Shellfish Position

MFC Selected Management Strategy

VIII. RESEARCH RECOMMENDATIONS

- Further studies on the impacts of oyster dredging on oyster habitat
- Further studies on the effects of dredge weight and size on habitat disturbance and oyster catches
- Determine a protocol and triggers for closures of oyster harvesting areas
- Research providing a more timely management response to harvest pressure
- Evaluate a harvest closure
-Develop a program to monitor oyster reef height
-Evaluate methods to assess oyster resource and habitat condition prior to the season to determine a baseline for harvest levels in a season (e.g. oyster reef height, legal/sublegal abundance and general health of oyster stocks).

IX. LITERATURE CITED

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