

North Carolina

Fishery Management Plan

Amendment 1

Bay Scallops



November 2010

Amendment 1 to the Bay Scallop Fishery Management Plan

Investigating adaptive management of bay scallop harvest based on measures of abundance¹

Issue

Develop adaptive bay scallop harvest limits based on varying levels of annual abundance.

Background

The harvest season for bay scallops in North Carolina has remained relatively unchanged since the 1920s with a few short openings due to social or predator interaction concerns (Gutsell 1928; NCDMF Proclamations). The main harvest season begins in January when peak landings occur and then landings slowly diminish as the season progresses to the last Friday in May. This fishery is typically confined to Core, Back, and Bogue sounds. Periodic expansions of the population based on commercial landings have occurred in the lower portion of the New River, in eastern Pamlico Sound, the White Oak River, Topsail Sound, and the Intracoastal Waterway of Onslow County (NCDMF 2007). Recreational harvest is allowed at the same time as the commercial season and is managed with daily harvest limits. No data are available on recreational harvest estimates at this time.

Bay scallop management is now guided by the Bay Scallop Fishery Management Plan (FMP), which was finalized in November 2007 (NCDMF 2007). The goal of the 2007 Bay Scallop FMP is to implement management strategies that restore the stock, maintain sustainable harvests, maximize the social and economic value, and consider the needs of all user groups. Prohibited take began in 2006 and continued until 2008 as part of the FMP until a fishery independent sampling indicator could evaluate recruitment into the population and ultimately determine if the fisheries could be reopened. A prohibited take strategy was initiated because widespread low levels of scallop abundance indicated scallop populations should be protected until sampling showed that populations were recovering. It is not the reduction in abundance but the lack of recovery in the last two decades to annual commercial harvest levels prior to the red tide event in 1987-1988 that is of concern to managers (Figure 1). Although prolific spawners like scallops can repopulate quickly, scientists now believe their numbers can get so low that recovery can be prolonged if they are not allowed undisturbed opportunities to multiply (Arnold et al. 1998).

¹ PDT recommendation 4/14/10
NCDMF recommendation 4/26/10
First presented to MFC 5/13/10
AC recommendation 5/17/10
Final AC recommendation 7/20/10
Final NCDMF recommendation 7/22/10
MFC preferred management options 8/12/10
DENR and JLCSA review 9/15/10
MFC Final adoption 11/4/10

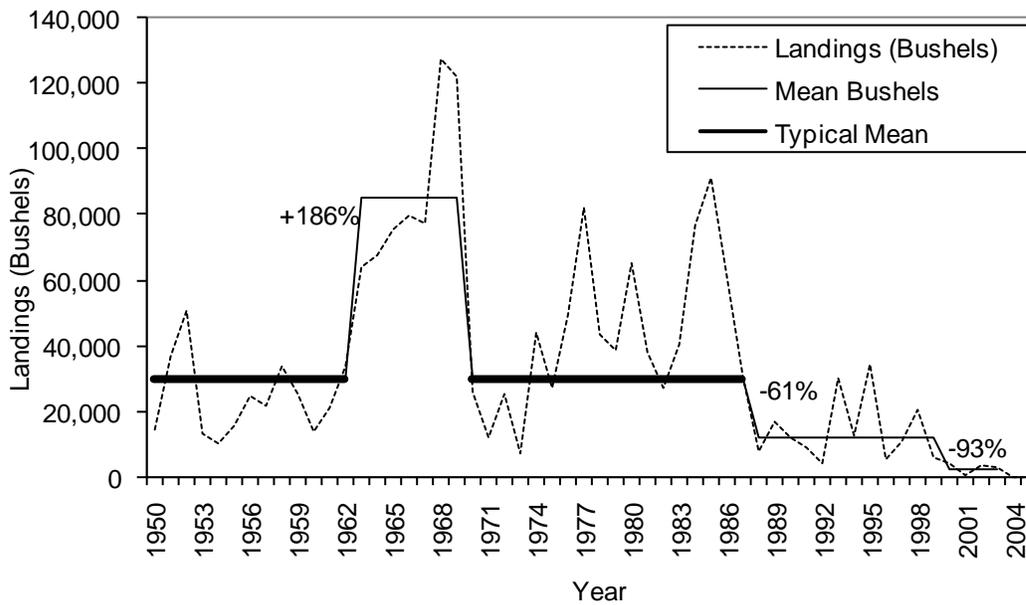


Figure 1. Overall statewide landings of bay scallops from 1950 to 2005 showing significant deviations from the “typical” mean of 29,732 bushels.

North Carolina Division of Marine Fisheries (NCDMF) staff sample bay scallops quarterly in Bogue, Back, and Core sounds using a scallop dredge at fixed areas. Staff also sample eastern Pamlico Sound using a quadrat of one square meter in size since 2008. Scallop dredge sampling at fixed areas in the New River and Topsail Sound began in October 2009. Expanding the sampling coverage or number of stations in all areas will improve estimates of bay scallop abundance. As bay scallops expand and retract from year to year, broader coverage of these areas will help identify more precisely what is happening to the population before entering the harvest season.

Data on scallop abundance from the fishery independent sampling are evaluated annually as directed by the FMP. Fishery independent sampling in Core, Bogue, and Back sounds began to show an increase in abundance beginning in 2008. The public also began to notice increased numbers of scallops in Core, Bogue, and eastern Pamlico sounds and contacted the NCDMF about opening the scallop season in 2009. A standardized scallop population level indicator was selected as a target for reopening the harvest season by the N. C. Marine Fisheries Commission at its January 2009 meeting. This target was based on NCDMF sampling that occurred between the months of October and December in 1984 and 1985 for Back, Bogue, and Core sounds (Table 1). The year reflected in Table 1 is the sampling year which occurs the calendar year before the allowed harvest season.

Table 1. Annual standardized catch-per-unit-effort [lnCPUE (ln(scallops/min))] of bay scallops sampled in Back, Bogue, and Core sounds, 1984-1985 from the October – December time period. Also showing the lnCPUE₁₉₈₄₋₁₉₈₅ target level used to determine opening the harvest season. Year indicates sampling year which is used to determine the harvest season in the next calendar year.

| Year | Back Sound | Bogue Sound | Core Sound |
|-----------------------------|------------|-------------|------------|
| 1984 | 2.62 | 1.61 | 1.60 |
| 1985 | 1.43 | 3.05 | 1.84 |
| 1986 | | | |
| 1987 | -0.23 | 0.73 | 1.15 |
| 1988 | 0.14 | -1.11 | 2.44 |
| 1989 | | 1.73 | |
| 1990 | | | |
| 1991 | | | |
| 1992 | | | |
| 1993 | | | |
| 1994 | | | |
| 1995 | | | |
| 1996 | | | |
| 1997 | | | |
| 1998 | -0.92 | 2.23 | 0.38 |
| 1999 | -1.14 | 1.19 | -0.30 |
| 2000 | 1.74 | -1.21 | -0.22 |
| 2001 | | | |
| 2002 | -0.12 | 1.39 | -1.29 |
| 2003 | -0.64 | -0.57 | -1.46 |
| 2004 | -1.32 | -0.90 | -1.82 |
| 2005 | -1.09 | -1.53 | -0.91 |
| 2006 | -1.54 | -1.02 | -2.30 |
| 2007 | -2.00 | -1.57 | -1.24 |
| 2008 | -1.41 | 1.21 | 2.94 |
| 2009 | -1.31 | 1.34 | -1.01 |
| lnCPUE ₁₉₈₄₋₁₉₈₅ | 2.02 | 2.33 | 1.72 |

NCDMF sampling collects bay scallops using a scallop dredge at select fixed stations in Core, Bogue, and Back sounds. One station equals a sample with multiple tows occurring at each station. Most tows have small or zero catch and only a few tows exhibit large catches, which is usual for most independent surveys. A constant of 0.1 was added to all tows with zero catch since the natural log of zero is undefined. An index of bay scallop abundance per minute was then calculated for each individual tow since there was varying tow times in the time series. The natural log (ln) was applied to the number of scallop per minute at the tow level and averaged to produce a standardized Catch Per Unit Effort (lnCPUE) to each sample, making each station comparable. This standardized CPUE also reduces bias in samples with different number of tows, varying tow times, and smoothes the data to reduce overestimating the average caused by only a few samples with large amounts of scallops in the catch. If the data were analyzed at

the sample level and not at the tow level first the average could be overestimated or underestimated, by tows with very large or no scallops in the catch.

It was decided that if the independent sampling levels reached or exceeded the target lnCPUE for the 1984-1985 time period in Core, Bogue, or Back sounds then a limited harvest season could occur in these areas.

Target levels allowing harvest in 2009 were reached in Core Sound, but not in Bogue and Back sounds (Table 1). Eastern Pamlico Sound was also opened because no historical data were available to determine a population level indicator and evidence showed scallops were relatively abundant in this region. In the past, bay scallop harvest in Pamlico Sound played a small role in overall commercial landings. A total of 5,801 bushels of bay scallops were commercially harvested in 2009, 69% of the commercial landings came from Core Sound and the remaining 31% were harvested from Pamlico Sound.

Only Pamlico Sound was opened during the 2010 bay scallop harvest season because the January 2010 sampling estimate was the highest on record and well above the level used to determine opening the season in Pamlico Sound in 2009 (Table 2).

Table 2. Standardized catch-per-unit-effort (lnCPUE) of bay scallops sampled in areas of eastern Pamlico Sound February 2008 to January 2010.

| | lnCPUE ln(Scallops/m ²) |
|----------|--|
| Feb 2008 | -0.66 |
| Jan 2009 | -0.18 |
| Oct 2009 | -1.33 |
| Jan 2010 | 0.32 |

Commercial and recreational fishermen shifting into shellfish fisheries such as the bay scallop fishery concerns managers. The current commercial license system consists of the Standard Commercial Fishing License (SCFL) with a cap on the number of licenses available. A free shellfish endorsement is available to SCFL holders who are North Carolina residents to allow fishermen the flexibility of participating in shellfish harvest in addition to other fisheries. However, shellfish fisheries have more open access. Unlike the SCFL, a \$25.00 commercial shellfish license is available to any North Carolina resident to harvest and sell shellfish and has no cap on the number of licenses that may be issued. Recreational shellfish harvesters may also purchase this license in order to harvest commercial quantities for their personal consumption. In the 2009 fiscal year (July 1, 2008 – June 30, 2009) the number of shellfish licenses has increased by 25% from the previous fiscal year (Table 3). This is the highest increase in the number of commercial shellfish licenses issued from one year to the next since the beginning of the new license system in July 1999. It is possible that as bay scallops improve, commercial fishing effort may increase because of this open access license.

The bay scallop fishery occurs in the winter months when many other commercial fisheries are slow. When bay scallops are available, commercial fishermen can get a good price for them, regardless of the amount they can land (NCDMF 2007). The number of people who harvest bay scallops for recreational purposes during the open season is unknown and like recreational finfish fisheries have shown, could have the potential to expand as more people move to our coastal waters.

Table 3. Total number of shellfish licenses issued for FY2000 – FY 2009. NCDMF License Program. *The license fiscal year is from July 1 to June 30 of each year.

| Fiscal year* | Total number of shellfish licenses issued |
|--------------|---|
| 2000 | 2,098 |
| 2001 | 2,176 |
| 2002 | 2,304 |
| 2003 | 2,131 |
| 2004 | 1,835 |
| 2005 | 1,623 |
| 2006 | 1,529 |
| 2007 | 1,626 |
| 2008 | 1,706 |
| 2009 | 2,129 |

Current Authority

15A NCAC 03K .0501 BAY SCALLOPS - SEASONS AND HARVEST LIMITS
 15A NCAC 03K .0502 TAKING BAY SCALLOPS AT NIGHT AND ON WEEKENDS
 15A NCAC 03K .0503 PROHIBITED BAY SCALLOP DREDGE

Discussion

Due to numerous complaints to the NCDMF about the management of bay scallops, the N.C. Marine Fisheries Commission at its meeting in Kitty Hawk on March 23-25, 2010 gave approval for consideration of an amendment to the Bay Scallop Fishery Management Plan. An amendment of a FMP is required when changes to any recommendations or management strategies contained in an FMP are deemed necessary by the N. C. Marine Fisheries Commission (NCMFC 2009). This issue paper is an attempt to build progressive harvest triggers based on varying scallop abundance levels into the previous set fishery independent sampling targets for Back, Bogue, and Core sounds and explore options in other areas of the state. This proposal directly changes a management strategy in the 2007 Bay Scallop FMP and requires further development through the FMP amendment process. The FMP amendment process allows for several opportunities across the state for public input through advisory committee meetings before any changes to the management strategy are warranted by the NCDMF and the N.C. Marine Fisheries Commission

Selection of a target, without progressive triggers, for determining opening and closing the bay scallop harvest season is an uncompromising approach to manage these fisheries and does not allow the flexibility to open the fisheries as the bay scallop population recovers. Bay scallop abundance is highly variable in all areas each year and the impacts to the recreational and commercial fishermen are felt strongly in the local regions when harvest remains closed. Allowing progressive triggers to determine gradual harvest effort could allow for limited bay scallop harvest while maintaining the FMP goal of rebuilding the stock to pre-red tide abundance levels.

Various time series were explored for determining the target opening indicator to manage the bay scallop stocks for long term sustainability. The 1984-1985 time series was selected for Bogue, Core, and Back sounds, the main harvest areas, because it reflected abundance levels prior to the red tide event in 1987-1988, when the typical average annual harvest was about 30,000 bushels of scallops (Figure 1).

There have been concerns raised by the public that the established targets for Core, Bogue, and Back sounds are too high and attaining population levels before the red tide is no longer possible because of changes in water quality, habitat, and predation pressure. In 2008, the annual InCPUE for Core Sound exceeded the target level based on the 1984-1985 time series. Bogue Sound bay scallop abundance is improving, however Back Sound continues to remain low (Figure 2).

Unlike Bogue, Back, and Core sounds, the target opening level for eastern Pamlico Sound was set by default by opening the area in 2009 based on only one sampling estimate in January 2009. A longer sampling time series in Pamlico Sound is necessary to determine if this opening target is appropriate. Adaptive management targets and progressive triggers are also desired for all areas south of Bogue Sound but limited sampling cannot determine target abundance indicators and will require more time to build a sampling time series for these regions.

Progressive harvest triggers can be established based on 50%, 75%, and 125% of the average InCPUE (i.e.: InCPUE X 50%) and where they fall relative to the target for administering different harvest effort for Bogue, Back, and Core sounds (Figure 2 and Table 4). Suggested harvest effort for the four levels of bay scallop abundance could include specific trip limits, gears, days of the week, and seasons.

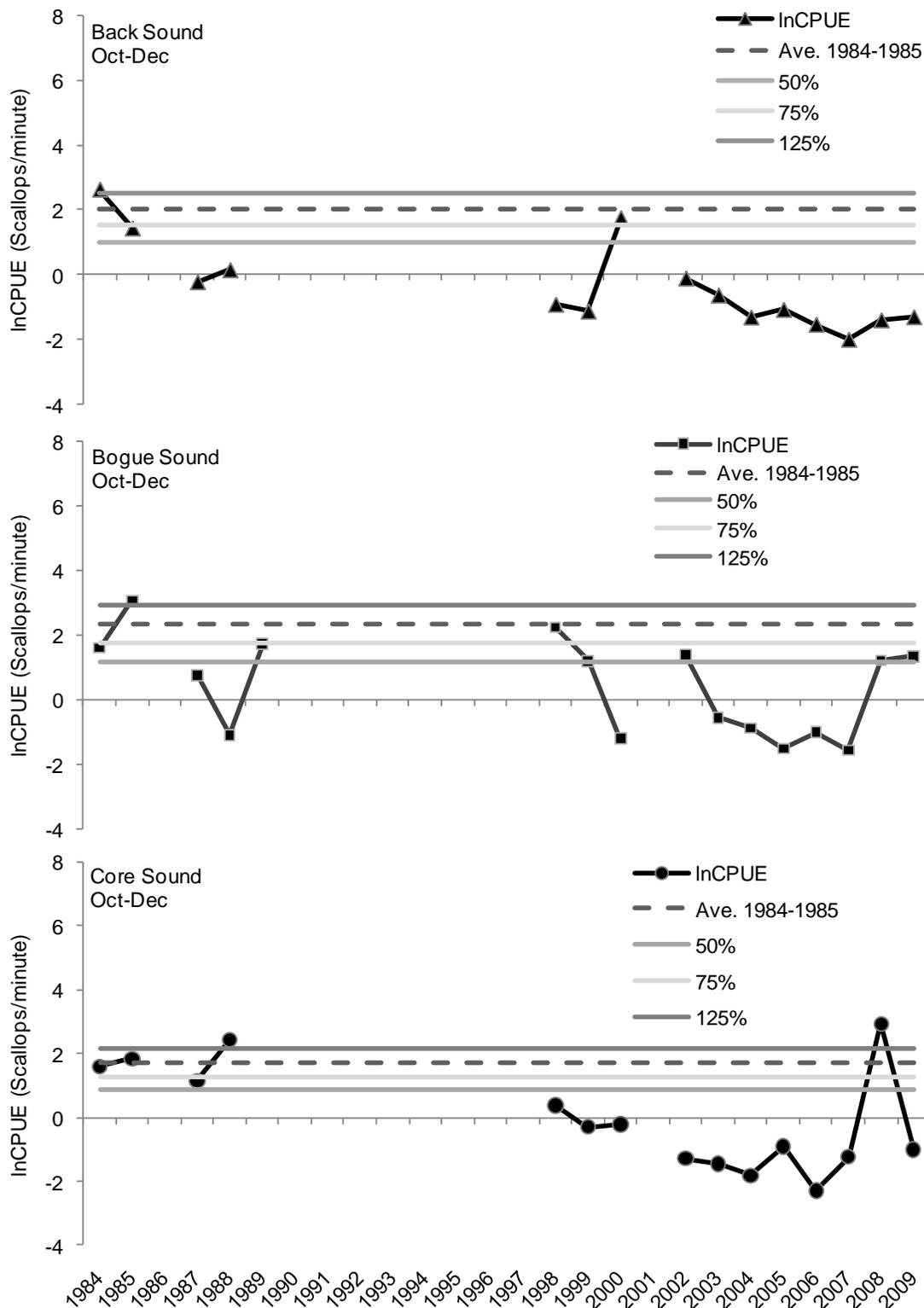


Figure 2. The mean number of scallops (InCPUE)(scallops/minute) for Back, Bogue, and Core sounds during the October-December sampling time period and average InCPUE (target) for the 1984-1985 period showing progressive triggers at 50%, 75%, and 125% of the target. Year indicates the sampling year which is used to determine the harvest season in the next calendar year.

Table 4. The target and progressive triggers based on the InCPUE for the October – December 1984-1985 time period for Back, Bogue, and Core sounds and the target and progressive triggers for Pamlico Sound based on the January 2009 InCPUE.

| | Back Sound | Bogue Sound | Core Sound | Pamlico Sound |
|--|---------------|----------------|---------------|------------------|
| Target InCPUE _{2009 (Jan)} | | | | -0.18 |
| Target InCPUE _{1984-1985 (Oct)} | 2.02 | 2.33 | 1.72 | |
| Progressive trigger 50% | 1.01 | 1.17 | 0.86 | -0.27 |
| Progressive trigger 75% | 1.52 | 1.75 | 1.29 | -0.23 |
| Progressive trigger 125% | 2.53 | 2.91 | 2.15 | -0.14 |

The main harvest season begins the last Monday in January and is allowed through the last Friday in May although commercial landings drop off considerably by the month of April (NCDMF 2007). Suggested adaptive management levels based on the progressive triggers for each area are presented in Table 5 and Table 6 for commercial and recreational harvest of bay scallops merely as a starting point to begin discussion on how to proceed with these measures. Concern for habitat loss makes scallop dredging an intensely managed portion of the fishery in the past and typically scallop dredges were only allowed to harvest bay scallops two days a week. No dredging was allowed in Bogue Sound from 1993 to 1997 and beginning in 2000 scallop dredges were delayed to harvest later in the season after the scallops were taken out of the shallow waters by hand harvesters. The intention of delaying harvest to dredges was to reduce prop scarring and dragging dredges through grassbeds (submerged aquatic vegetation) in the shallow water areas because scallops will likely already be removed by hand harvesters. The daily maximum allowed harvest is 20 U. S. standard bushels per person per day with a maximum of 40 U. S. standard bushels in any combined commercial fishing operation per day (15A NCAC 03K .0501). Separation of the gears and user groups to particular days of the week allows for easier enforcement of the regulations.

These management measures will come under review beginning in 2012 under the normal 5-year review of the FMP. Selected management measures of bay scallops may be further restricted through proclamation authority by the fisheries director in order to address concerns that may develop within a bay scallop harvest season, such as habitat impacts (i.e.: prop scarring in grassbeds). Proclamation authority allows the director the flexibility to adjust the season, trip limit or allowed gears based on conditions experienced within the current fishing season.

Table 5. Suggested adaptive management measures for opening the bay scallop commercial fishery based on progressive triggers derived from the InCPUE_{1984-1985 (Oct-Dec)} target indicators for Core, Bogue and Back sounds and the InCPUE_{Jan 2009} target indicator for Pamlico Sound.

| Progressive triggers and target | Trip limit | Days open in the week | Allowed gears | Season |
|--|--|-----------------------|--|---|
| Less than 50% of target | No allowed harvest | | | |
| 50% or greater of target but less than 75% of target | 5 bushels per person per day not to exceed 10 bushels per fishing operation | Mon, Wed, and Fri | By hand, hand rakes, hand tongs, dip net, and scoops | Last Monday in January to April 1st |
| 75% or greater of target but less than 100% of target | 10 bushels per person per day not to exceed 20 bushels per fishing operation | Mon, Wed, and Fri | By hand, hand rakes, hand tongs, dip net, and scoops | Last Monday in January to April 1st |
| 100% or greater of target but less than 125% of target | 15 bushels per person per day not to exceed 30 bushels per fishing operation | Mon, Wed, and Fri | By hand, hand rakes, hand tongs, dip net, and scoops | Last Monday in January to April 1st |
| 125% or greater of target | 15 bushels per person per day not to exceed 30 bushels per fishing operation | Mon, Wed, and Fri | By hand, hand rakes, hand tongs, dip net, and scoops | Last Monday in January to April 1st. |
| | 15 bushels per person per day not to exceed 30 bushels per fishing operation | Tues and Thurs | Bay scallop dredges as described by rule 15A NCAC 03K.0503 | Delay opening until first full week in March after hand harvest removes scallops from shallow waters to April 1st |

Table 6. Suggested adaptive management measures for opening the bay scallop recreational fishery based on progressive triggers derived from the InCPUE_{1984-1985 (Oct-Dec)} target indicators for Core, Bogue and Back sounds and the InCPUE_{Jan 2009} target indicator for Pamlico Sound.

| Progressive triggers and target | Trip limit | Days open in week | Allowed gears | Season |
|--|---|-------------------|--|-------------------------------------|
| Less than 50% of target | No allowed harvest | | | |
| 50% or greater of target but less than 75% of target | 1/2 bushel per person per day not to exceed 1 bushel per recreational fishing operation | Sat and Sun | By hand, hand rakes, hand tongs, dip net, and scoops | Last Monday in January to April 1st |
| 75% or greater of target but less than 100% of target | 1/2 bushel per person per day not to exceed 1 bushel per recreational fishing operation | Sat and Sun | By hand, hand rakes, hand tongs, dip net, and scoops | Last Monday in January to April 1st |
| 100% or greater of target but less than 125% of target | 1 bushel per person per day not to exceed 1 bushel per recreational fishing operation | Sat and Sun | By hand, hand rakes, hand tongs, dip net, and scoops | Last Monday in January to April 1st |
| 125% or greater of target | 1 bushel per person per day not to exceed 1 bushel per recreational fishing operation | Sat and Sun | By hand, hand rakes, hand tongs, dip net, and scoops | Last Monday in January to April 1st |

Management Options and Impacts

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

Management Recommendations

1. Status quo (Continue with only the target opening indicators without progressive triggers for adaptive harvest)
 - + Insures sustainable population levels are in place when the fishery is open
 - No flexibility in allowing limited levels of harvest as a population recovers within a harvest area
 - No economic benefit to communities until the target is reached or exceeded

2. Consider adaptive management measures based on pre-determined progressive triggers for Core, Bogue, and Back sounds
 - + Management is based on sustainability of the bay scallop population
 - + Allows the flexibility of limited levels of harvest based on different population levels
 - + Economic benefits to communities before the target level is attained
 - Potential to set progressive triggers too low resulting in unsustainable management

3. Consider adaptive management measures for Pamlico Sound based on limited sampling
 - + Economic benefits to the communities
 - + Allows the flexibility of limited levels of harvest based on different population levels
 - May not be an appropriate target estimate to determine sustainable management measures

4. Use pre-determined target and progressive triggers from Bogue Sound for opening areas south of Bogue Sound. Consider adaptive management measures based on sampling in the areas south of Bogue Sound once a time series of three consecutive years of fishery independent sampling is available to determine a target opening level
 - + Management is based on sustainability of the bay scallop population
 - + Allows the flexibility of limited levels of harvest based on different population levels
 - + Economic benefits to communities
 - Potential to set target and progressive triggers too low resulting in unsustainable management

5. Continue to leave areas south of Bogue Sound closed to bay scallop harvest but in the meantime consider adaptive management measures once a time series of three consecutive years of fishery independent sampling to determine a target opening level
 - + Management based on sustainability of the bay scallop population
 - + Allows the flexibility of limited levels of harvest based on one different population levels
 - Potential to set target and thresholds too low resulting in unsustainable management
 - No allowance for harvest
 - No economic benefit to the communities

MFC Preferred Management Strategy

- Same as the Bay Scallop Advisory Committee and the NCDMF

Bay Scallop Advisory Committee and NCDMF

- Select adaptive management measures of 50%, 75%, and 125% of the selected target of $\ln\text{CPUE}_{1984-1985 (\text{Oct-Dec})}$ for Back, Bogue, and Core sounds to open the fisheries. Harvest levels are shown in Tables 7 and 8.
- Consider adaptive management measures using of 50%, 75%, and 125% of the selected target of $\ln\text{CPUE}_{\text{Jan } 2009}$ for Pamlico Sound to open the fisheries. Harvest levels are shown in Tables 7 and 8.
- Use pre-determined target and progressive triggers from Bogue Sound for opening areas south of Bogue Sound and the harvest levels as shown in Tables 7 and 8. Consider adaptive management measures based on sampling in the areas south of Bogue Sound once a time series of three consecutive years of fishery independent sampling is available to determine a target opening level.

Table 7. The Bay Scallop Advisory Committee and NCDMF selected adaptive management measures for opening the bay scallop commercial fishery based on progressive triggers derived from the InCPUE_{1984-1985 (Oct-Dec)} target indicators for Core, Bogue and Back sounds and the InCPUE_{Jan 2009} target indicator for Pamlico Sound.

| Progressive triggers and target | Trip limit | Days open in the week | Allowed gears | Season |
|---|--|---------------------------|---|---|
| Less than 50% of target | No allowed harvest | | | |
| 50% or greater and less than 75% of target | 10 bushels per person per day not to exceed 20 bushels per fishing operation | Mon and Wed | By hand, hand rakes, hand tongs, dip net, and scoops | Last Monday in January to April 1st |
| 75% or greater and less than 125% of target | 10 bushels per person per day not to exceed 20 bushels per fishing operation | Mon, Tues, Wed, and Thurs | By hand, hand rakes, hand tongs, dip net, and scoops | Last Monday in January to April 1st |
| 125% or greater of target | 10 bushels per person per day not to exceed 20 bushels per fishing operation | Mon, Tues, Wed, and Thurs | By hand, hand rakes, hand tongs, dip net, and scoops | Last Monday in January to April 1st |
| | 15 bushels per person per day not to exceed 30 bushels per fishing operation | Mon and Wed | Bay scallop dredges as described by rule 15A NCAC 03K. 0503 | Delay opening until first full week in March after hand harvest removes scallops from shallow waters to April 1st |

Table 8. The Bay Scallop Advisory Committee and NCDMF selected adaptive management measures for opening the bay scallop recreational fishery based on progressive triggers derived from the InCPUE_{1984-1985 (Oct-Dec)} target indicators for Core, Bogue and Back sounds and the InCPUE_{Jan 2009} target indicator for Pamlico Sound.

| Progressive triggers and target | Trip limit | Days open in week | Allowed gears | Season |
|---------------------------------|---|--------------------------|--|-------------------------------------|
| Less than 50% target | No allowed harvest | | | |
| 50% or greater of target | 1 bushel per person per day not to exceed 1 bushel per recreational fishing operation | Thurs, Fri, Sat, and Sun | By hand, hand rakes, hand tongs, dip net, and scoops | Last Monday in January to April 1st |

Research Recommendations

- Expand on the current bay scallop fishery independent sampling to improve estimates of the population abundance and spawning condition of the stock.
- Conduct research to study the impacts of scalloping activities on bay scallop habitat.

History Note

The Bay Scallop Advisory Committee was reconvened on May 17, 2010 to provide initial input on preferred adaptive management measures and harvest levels for Amendment 1 to the Bay Scallop FMP (See Appendices 1 and 2 for their initial preferred harvest levels to the progressive triggers). The initial NCDMF preferred adaptive management measures included progressive triggers and harvest levels as shown in Tables 5 and 6.

Further input was gathered from public comments, the MFC regional advisory committees, the MFC Shellfish Advisory Committee, and the MFC Habitat and Water Quality Advisory Committee from June 10 – July 12, 2010. An overview of the comments and recommendations are shown in Appendices 3 – 5.

The Secretary of DENR submitted the amendment to the Joint Legislative Commission on Seafood and Aquaculture and was reviewed by this Commission on September 15, 2010 with no questions or further comments.

Literature Cited

Arnold, W. S., D. C. Marelli, C. P. Bray, and M. M. Harrison. 1998. Recruitment of bay scallops *Argopecten irradians* in Floridan Gulf of Mexico waters: scales of coherence. Marine Ecology Progress Series. 170: 143-157.

Gutsell, J. S. 1928. Scallop industry of North Carolina. Report of the U. S. Commissioner of Fisheries, Part I. Appendix V: 172-197.

North Carolina Division of Marine Fisheries (NCDMF). 2007. North Carolina Fishery Management Plan for Bay Scallops. North Carolina Department of Environment and Natural Resources. North Carolina Division of Marine Fisheries. Morehead City, NC. 198 pp.

North Carolina Marine Fisheries Commission (NCMFC). 2009. Guidelines for North Carolina Fishery Management Plans 5/28/2009. North Carolina Department of Environment and Natural Resources. Morehead City, NC. 26 pp.

Appendix 1. The Bay Scallop Advisory Committee adaptive management measures for opening the bay scallop commercial fishery based on progressive triggers derived from the $\ln\text{CPUE}_{1984-1985 (\text{Oct-Dec})}$ target indicators for Core, Bogue and Back sounds and the $\ln\text{CPUE}_{\text{Jan } 2009}$ target indicator for Pamlico Sound selected on May 17, 2010 for review through public meetings.

| Progressive triggers and target | Trip limit | Days open in the week | Allowed gears | Season |
|---|--|---------------------------|---|---|
| Less than 50% of target | No allowed harvest | | | |
| 50% or greater and less than 75% of target | 5 bushels per person per day not to exceed 10 bushels per fishing operation | Mon, Tues and Wed | By hand, hand rakes, hand tongs, dip net, and scoops | Last Monday in January to April 1st |
| 75% or greater and less than 125% of target | 10 bushels per person per day not to exceed 20 bushels per | Mon, Tues, Wed, and Thurs | By hand, hand rakes, hand tongs, dip net, and scoops | Last Monday in January to April 1st |
| 125% or greater of target | 10 bushels per person per day not to exceed 20 bushels per | Mon, Tues, Wed, and Thurs | By hand, hand rakes, hand tongs, dip net, and scoops | Last Monday in January to April 1st |
| | 15 bushels per person per day not to exceed 30 bushels per fishing operation | Mon and Wed | Bay scallop dredges as described by rule 15A NCAC 03K. 0503 | Delay opening until first full week in March after hand harvest removes scallops from shallow waters to April 1st |

Appendix 2. The Bay Scallop Advisory Committee adaptive management measures for opening the bay scallop recreational fishery based on progressive triggers derived from the $\ln\text{CPUE}_{1984-1985 \text{ (Oct-Dec)}}$ target indicators for Core, Bogue and Back sounds and the $\ln\text{CPUE}_{\text{Jan 2009}}$ target indicator for Pamlico Sound selected on May 17, 2010 for review through public meetings.

| Progressive triggers and target | Trip limit | Days open in week | Allowed gears | Season |
|---------------------------------|--|-------------------|--|-------------------------------------|
| Less than 50% target | No allowed harvest | | | |
| 50% or greater of target | 1 bushel per person per day not to exceed 1 bushel per | Fri, Sat, and Sun | By hand, hand rakes, hand tongs, dip net, and scoops | Last Monday in January to April 1st |

Appendix 3. Overview of the Bay Scallop Advisory Committee and NCDMF draft recommendations, and public comments and recommendations provided by the MFC regional advisory committees, the MFC Shellfish Advisory Committee, and MFC Habitat and Water Quality Advisory Committee.

| Agency/Advisory Committee | Selected recommendations | | | | Public comment |
|--|---|---|---|--|---|
| | Core, Bogue, and Back sounds | Pamlico Sound | Areas south of Bogue Sound | Other items | |
| Division of Marine Fisheries 4/26/10 | Select adaptive management measures of 50%, 75%, 100%, and 125% of the selected target of InCPUE _{1984-1985 (Oct-Dec)} for Back, Bogue, and Core sounds to open the fisheries. Harvest levels are shown in Tables 5 and 6. | Consider adaptive management measures using of 50%, 75%, 100%, and 125% of the selected target of InCPUE _{Jan 2009} for Pamlico Sound to open the fisheries. Harvest levels are shown in Tables 5 and 6. | Use pre-determined target and progressive triggers from Bogue Sound for opening areas south of Bogue Sound and the harvest levels as shown in Tables 5 and 6. Consider adaptive management measures based on sampling in the areas south of Bogue Sound once a time series of three consecutive years of fishery independent sampling is available to determine a target opening level. | | |
| Bay Scallop Advisory Committee 5/17/10 | Select adaptive management measures of 50%, 75%, and 125% of the selected target of InCPUE _{1984-1985 (Oct-Dec)} for Back, Bogue, and Core sounds to open the fisheries. Harvest levels are shown in Appendices 1 and 2. Passed unanimously. | Consider adaptive management measures using of 50%, 75%, and 125% of the selected target of InCPUE _{Jan 2009} for Pamlico Sound to open the fisheries. Harvest levels are shown in Appendices 1 and 2. Passed unanimously. | Use pre-determined target and progressive triggers from Bogue Sound for opening areas south of Bogue Sound and the harvest levels as shown in Appendices 1 and 2. Consider adaptive management measures based on sampling in the areas south of Bogue Sound once a time series of three consecutive years of fishery independent sampling is available to determine a target opening level. Passed unanimously. | | No one from the public attended the meeting. |
| Northeast 6/10/10 (Same as Bay Scallop AC recommendation) | Support the Bay Scallop AC – adaptive management measures for opening commercial and recreational fishery. Passed unanimously. | Support the Bay Scallop AC – adaptive management measures for opening commercial and recreational fishery. Passed unanimously. | Support the Bay Scallop AC – adaptive management measures for opening commercial and recreational fishery. Passed unanimously. | Re-enforce the need for recreational shellfish license data collection and fee designated to shellfish research. Passed unanimously. | Two members from the public were in attendance. No comments were generated from the public. |
| | | | | Support DMF research recommendations. Passed unanimously. | |

Appendix 3. Continued.

| Agency/Advisory Committee | Selected recommendations | | | | Public comment |
|---|--|---|--|--|---|
| | Core, Bogue, and Back sounds | Pamlico Sound | Areas south of Bogue Sound | Other items | |
| Central 6/21/10 (Combination of Bay Scallop AC and DMF recommendations and change base years for target level) | Support the concept of the tiered adaptive openings but strongly recommends the target opening level (lnCPUE) for Bogue, Back, and Core sounds be adjusted to the survey mean (lnCPUE) of the years 1989-2009 after the red tide, rather than the presented target based on years 1984-1985. Passed unanimously. | Support the DMF target LnCPUE based on Jan 2009 for Pamlico Sound. Passed unanimously. | Use the Bogue Sound target (1989-2009) for the area to south of Highway 58 bridge until a time series of 3 consecutive years of fishery independent sampling is available. Passed unanimously. | Endorse the distinct management areas (Bogue, Back, Core, Pamlico sounds, and south of Highway 58 bridge) and support the target opening level (lnCPUE) be set separately for each area. Passed unanimously. | No one from the public provided comments on Amendment 1 of the Bay Scallop FMP. |
| | Support for the commercial fishery the adaptive management measures shown in Table 5 (DMF recommendation but change base years as indicated in their first motion) to help with the recovery of the bay scallops. Passed unanimously. | Support for the commercial fishery the adaptive management measures shown in Table 5 (DMF recommendation but change base years as indicated in their first motion) to help with the recovery of the bay scallops. Passed unanimously. | Support for the commercial fishery the adaptive management measures shown in Table 5 (DMF recommendation but change base years as indicated in their first motion) to help with the recovery of the bay scallops. Passed unanimously. | | |
| | Support for the recreational fishery the adaptive management measures shown in Appendix 2 (Bay Scallop AC recommendation but change base years as indicated in their first motion). Passed unanimously. | Support for the recreational fishery the adaptive management measures shown in Appendix 2 (Bay Scallop AC recommendation but change base years as indicated in their first motion). Passed unanimously. | Support for the recreational fishery the adaptive management measures shown in Appendix 2 (Bay Scallop AC recommendation but change base years as indicated in their first motion). Passed unanimously. | | |
| Shellfish 6/28/10 (Same as Bay Scallop AC recommendation) | Support the Bay Scallop AC – adaptive management measures for opening commercial and recreational fishery. Passed unanimously. | Support the Bay Scallop AC – adaptive management measures for opening commercial and recreational fishery. Passed unanimously. | Support the Bay Scallop AC – adaptive management measures for opening commercial and recreational fishery. Passed unanimously. | | |
| Inland* 6/29/10 (Developed their own harvest levels and considered additional items) | Recommend eliminating the 50% to 75% trigger for both the commercial and recreational harvest. Harvest levels are shown in Appendices 4 and 5. Passed unanimously. | Recommend that harvest in Pamlico Sound be closed until DMF has appropriate sampling and sufficient data to establish an appropriate target. The motion passed with five in favor and one opposing. | Recommend that no bay scallop harvest be allowed south of Bogue Sound until DMF has at least three years of independent sampling data and DMF feels that an adequate time series has been established to set a trigger. The motion passed with five in favor and one opposing. | Recommend expanded research on bay scallops in NC. The motion passed unanimously. | |

Appendix 3. Continued.

| Agency/Advisory Committee | Selected recommendations | | | Public comment |
|--|------------------------------|---------------|----------------------------|---|
| | Core, Bogue, and Back sounds | Pamlico Sound | Areas south of Bogue Sound | |
| Mr. Henry Frost and Mr. Joey Frost 6/30/10 | | | | <p>Hand harvest is more harmful to the grass and the small scallops than dredges because people need to tramp around for many hours to get their limit while dredges can go through in a few hours and catch their</p> <p>Rakes dig into the grass more than the dredge and prop scarring does not occur with the dredge harvesters.</p> <p>Fishermen need higher daily harvest limits not more days in the week to make it worth their while to go fishing.</p> <p>The bottom should be worked regularly to stay alive.</p> <p>The target level is set too high for the industry to harvest and process that much.</p> |
| Dr. Pete Peterson 6/30/10 | | | | <p>Fishermen need a higher daily harvest allowance to cover transportation costs.</p> <p>My data suggests that the spring spawn likely does not contribute much to the bay scallop population because of high mortality caused by small predators. Although there are some years in which the spring spawn may help add to the population but not consistently every year.</p> <p>Scallops should be harvested in the spring.</p> <p>Grass dislodged because of dredging activity is not as much of a problem.</p> <p>The seagrass beds are not as good condition now as they were in the past.</p> <p>It is critical that we have a small study to compare the effects of hand harvest and dredge impacts to the grass beds.</p> <p>I think that opening at 50% is still too stringent and that the fisheries should be opened at a lower threshold due to the variability in the abundance of bay scallops from year to year.</p> |

Appendix 3. Continued.

| Agency/Advisory Committee | Selected recommendations | | | | Public comment |
|---|--|--|--|---|---|
| | Core, Bogue, and Back sounds | Pamlico Sound | Areas south of Bogue Sound | Other items | |
| Southeast 7/6/10 (Same as DMF recommendation) | Support the DMF recommendation – adaptive management measures for opening commercial and recreational fishery. Passed unanimously. | Support the DMF recommendation – adaptive management measures for opening commercial and recreational fishery. Passed unanimously. | Support the DMF recommendation – adaptive management measures for opening commercial and recreational fishery. Passed unanimously. | Comments not a motion. DMF should track the use of the commercial shellfish license specific to bay scallop harvest and a recreational shellfish license is needed. | No one from the public provided comments on Amendment 1 of the Bay Scallop FMP. |
| Habitat and Water Quality 7/12/10 (Same as Bay Scallop AC recommendation) | Support the Bay Scallop AC – adaptive management measures for opening commercial and recreational fishery. Passed unanimously. | Support the Bay Scallop AC – adaptive management measures for opening commercial and recreational fishery. Passed unanimously. | Support the Bay Scallop AC – adaptive management measures for opening commercial and recreational fishery. Passed unanimously. | Research should be conducted before the 5-year review in 2012 to study the impacts of scalloping activities on bay scallop habitat. Passed unanimously. | No one from the public provided comments on Amendment 1 of the Bay Scallop FMP. |

*The Inland Advisory Committee provided more specific harvest levels, seen in Appendices 4 and 5.

Appendix 4. Suggested harvest levels for opening the bay scallop commercial fishery based on progressive triggers from the Inland Advisory Committee on June 29, 2010.

| Progressive triggers and target | Trip limit | Days open in the week | Allowed gears | Season |
|--|--|-----------------------|--|---|
| Less than 75% of target | No allowed harvest | | | |
| 75% or greater and less than 100% of target | 10 bushels per person per day not to exceed 20 bushels per fishing operation | Mon, Wed, and Fri | By hand, hand rakes, hand tongs, dip net, and scoops | Last Monday in January to April 1st |
| 100% or greater and less than 125% of target | 15 bushels per person per day not to exceed 30 bushels per fishing operation | Mon, Wed, and Fri | By hand, hand rakes, hand tongs, dip net, and scoops | Last Monday in January to April 1st |
| 125% or greater of target | 15 bushels per person per day not to exceed 30 bushels per fishing operation | Mon, Wed, and Fri | By hand, hand rakes, hand tongs, dip net, and scoops | Last Monday in January to April 1st |
| | 15 bushels per person per day not to exceed 30 bushels per fishing operation | Tues and Thurs | Bay scallop dredges as described by rule 15A NCAC 03K.0503 | Delay opening until first full week in March after hand harvest removes scallops from shallow waters to April 1st |

Appendix 5. Suggested harvest levels for opening the bay scallop recreational fishery based on progressive triggers from the Inland Advisory Committee on June 29, 2010.

| Progressive triggers and target | Trip limit | Days open in week | Allowed gears | Season |
|--|---|-------------------|--|-------------------------------------|
| Less than 75% of target | No allowed harvest | | | |
| 75% or greater and less than 100% of target | 1/2 bushel per person per day not to exceed 1 bushel per recreational fishing operation | Sat and Sun | By hand, hand rakes, hand tongs, dip net, and scoops | Last Monday in January to April 1st |
| 100% or greater and less than 125% of target | 1 bushel per person per day not to exceed 1 bushel per recreational fishing operation | Sat and Sun | By hand, hand rakes, hand tongs, dip net, and scoops | Last Monday in January to April 1st |
| 125% or greater of target | 1 bushel per person per day not to exceed 1 bushel per recreational fishing operation | Sat and Sun | By hand, hand rakes, hand tongs, dip net, and scoops | Last Monday in January to April 1st |