NC Oyster Blueprint 2021-2025

Cultch Planting Strategy

DRAFT Recommendations, May 2020

Goal:

Use cultch planting to replenish and enhance oyster habitat for commercial harvest and ecological benefits.

Background:

Cultch Planting through 1988

North Carolina has worked to increase oyster production in the estuarine waters for more than a century. Initial management efforts by the North Carolina Division of Marine Fisheries (DMF) focused on regulating harvest methods and amounts. From 1889 to 1908, yearly harvests of oyster typically exceeded 500,000 bushels. Around 1910, harvest levels dropped significantly to less than 263,000 bushels, resulting in a new initiative by the state's Fisheries Commission Board beginning in 1915 to rebuild oyster stocks by planting shells for substrate and seed oysters.

The state planted about between 10,000 and 12,000 bushels of shell each year from 1915 to 1920. Additional funding then allowed the state to plant around 100,000 bushels of seed oysters and substrate in the early 1920's. Harvest statistics show a rebound in landings from 1923 to around 1931 with landings ranging between a high of 441,307 bushels to a low of 326,659 bushels. Then from 1932 to 1934 landings dropped again, reaching a low of 271,192 bushels.

In 1934, the state conducted the largest annual oyster enhancement project in North Carolina by planting 825,000 bushels of seed oysters and 78,567 bushels of shells. These planted areas were closed until 1936. Oyster landings more than doubled from 271,192 bushels in 1934 to 651,050 bushels in 1936. In this case, the 1934 restoration efforts likely provided for substantially increased harvest landings.

Records do not indicate that any significant investments were made to rebuild oyster stocks for the next decade, and during this period landings declined significantly, except for one bump in landings at the end of World War II in 1945. Then Governor Cherry created a special oyster commission in 1946. The legislation resulting from the oyster commission's recommendations contained landmark changes in oyster management. The renewed enhancement effort was known as the Oyster Rehabilitation Program. Provisions were made for an ongoing, large-scale shell and seed oyster planting program on natural oyster rocks, an oyster tax to support the program, a requirement that 50 percent of the shell from shucking operations be contributed to the program, a 50 cents per bushel tax on shell stock shipped out-of-state, and a $100,000 appropriation to initiate the program.

Plantings during the first ten years of the program totaled 838,000 bushels of shell and 350,734 bushels of seed oysters. By the mid 1950's appropriations were exhausted, landings and oyster

tax collection had not increased. Landings during this period fluctuated between 149,489 and 331,472 bushels.

Prior to 1954 fishermen were employed to carry out enhancement activities. In 1954 the state purchased a 40-foot wooden barge and began to deploy material on its own.
In 1956, a request for an $80,000 annual appropriation was presented to the N.C. General Assembly to increase oyster enhancement efforts to 500,000 bushels per year. This request was approved. The state reported that repeated severe hurricane activity negated most of the oyster rehabilitation efforts conducted since 1947 (Munden, 1981). Oyster landings remained above 200,000 bushels each year until 1962. They have never reached that level of harvest again.

In 1972, the program transitioned and acquired barges, support equipment and staff to run the program itself. The fleet of vessels used by the program continue to expand and get larger for the next couple of decades. New attempts to rebuild oyster stocks were undertaken with increased appropriations in 1972, 1977, and 1979. The rehab program received a grant from the Coastal Plains Regional Commission in 1980 along with state appropriations that allowed it to pay for its operations. These funds allowed the state to buy two large surplus military landing crafts that it put into service to deploy shells. In 1980, 257,900 bushels of substrate was planted, and with the additional grant funds, upped its deployment to a high of 456,710 bushels of substrate in 1981. The program continued with state appropriations deploying around 250,000 bushels of substrate each year until it was revised by the legislature in 1997. Landings during this period peaked in 1987 at 226,283 bushels. From then they dropped significantly, reaching a low point in 1994 of 34,420 bushels. Landings never went above 100,000 bushels after 1988 through 2008.

<u>Modern Cultch Planting Program: 1998 – to date</u>
The revised Shellfish Rehabilitation Program began in 1998 with an annual budget of approximately $268,650. Until fiscal year 2015-2016, annual funding was limited to approximately $300,000 to purchase and transport cultch material for harvestable oyster reefs. This funding allowed for annual development of 30-40 acres of harvestable reef sites. In fiscal year 2015-2016, funds for cultch planting were increased to approximately $600,000, with another increase to a total of approximately $900,000 in fiscal year 2016-2017. In subsequent years, annual appropriations for the program have increased substantially to over $1 million in some years to cover the cost of substrate, staffing and vessels. Increases in appropriations have resulted in substantial increases annual deployments and investments in much needed modernization of fleet equipment.

Methods of oyster rehabilitation through cultch planting has remained quite consistent since 1998. Planting sites are selected based on criteria including bottom type, salinity, currents, historical production, input from local fishermen, and effects of fishing operations in the area. DMF continues to successfully utilize shell and marl, nearly all of which is deployed by the DMF Cultch Planting Program vessel crews and heavy equipment operators. However, other methods have been explored with varying levels of success. These alternate methods include

hiring fishermen to gather and transplant seed oysters and hiring marine contractors to supplement deployments. Efforts to increase the size of planting sites in recent years have reduced the total number of sites planted per year, but the integrity and effectiveness of the sites seem to have improved. Today, cultch sites range from 0.1 to 10 acres.

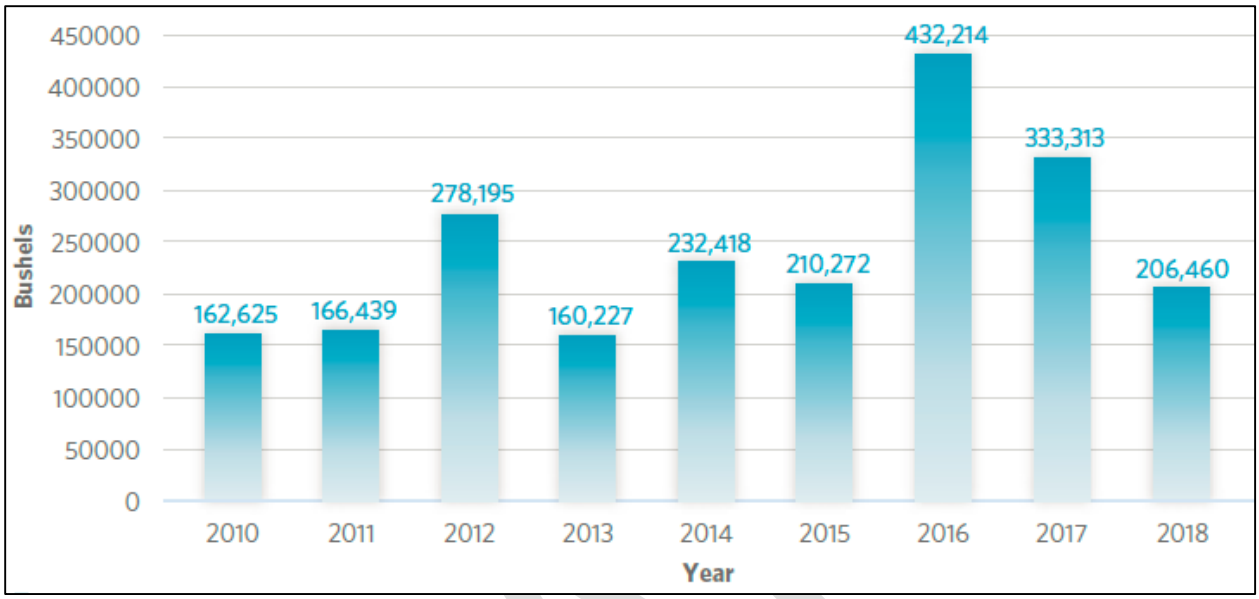

Figure 1. Amount of cultch deployed annually by DMF from 2010-2018. 2018 State of the Oyster Report

Monitoring

For a period of three years post-construction, DMF monitors each cultch planting site to observe trends in population demographics (annual recruitment, size frequency, and population density). Long term monitoring of cultch planting sites is not conducted due to funding and staffing limitations, though long-term datasets are always more desirable for evaluating trends. Despite limited resources, DMF has recruited and funded university partners to provide analysis of cultch site performance. Recently published literature from NC State University provides the most detailed evaluation of population demographics at cultch planting reefs in North Carolina, as compared to naturally occurring reefs and sanctuary reefs (protected from harvest). In that report, researchers found that total mean population density for cultch-planted sites is 247 oysters per square meter. Some sites are exceptions, presumably due to low spat fall, catastrophic events, or depletion. Size structure at harvested reef sites like cultch planting reefs is truncated compared to sanctuaries and expectedly, harvested reefs host fewer legal sized oysters. Cultch reefs successfully host 4.5-times more legal oysters than natural reefs where no restoration effort has occurred. On average at cultch sites, 27 of the 247 oysters per square meter are large enough (≥3 inches) to legally harvest (Peters et al. 2017).

Using an estimate of 27 legal oysters per square meter, a conservative estimate is that cultch sites host approximately one bushel of harvestable product for every 11 square meters of surface area (~300 oysters per bushel) at any point outside of harvest season. Based on that

estimate, one acre of harvestable cultch reef should yield approximately 368 bushels of oysters (~110,369 individual legal oysters). Estimating the number of oysters produced over the lifespan of a cultch reef proves difficult, as reefs take several years for oysters to mature (harvested in the third year, for example), may only last approximately five years, and may be harvested multiple times during their lifespan. Under those assumptions, and in an oversimplified example, five years of planting 40 acres annually will make 200 acres of habitat but 240 acres of area available for harvest (again, considering reefs may be harvested multiple times). The following is an example of this scheme:

	Planted Acres	Acres with Harvestable Oysters
Year 1	40	0
Year 2	40	0
Year 3	40	40
Year 4	40	80
Year 5	40	120
Year 6*	40	120

In the above example, oysters are not large enough for harvest until year three (from the year one sites). In year four, both year one and two sites are producing legal sized oysters. In year five, sites from years one-three are producing oysters for harvest (120 acres). In year six, sites from year one may no longer exist, but sites two-four are producing. In this simplified scheme, the total habitat area available for annual harvest never exceeds 120 acres, but since habitats are available for harvest in years' prior, the harvested acreage is cumulative. Year six is not included in the oyster production estimates below.

Return on Investment

At a cumulative 240 acres of harvested area, 88,320 bushels of oysters are estimated to be available to the fishery for harvest over the five-year period, given 27 legal oysters per square meter. Not considering the fish production value, water filtration value, or other ecosystem service value of the habitat, the market value of oysters provided by 200 acres of constructed habitat over five years is estimated to be $6,624,000 at $75 per bushel. Typical investment for NCDMF to construct 40 acres using 250,000 bushels is approximately $795,000 ($1.90/bushel for limestone marl and $1.25/bushel to deploy). Based on reef demographics in published literature and construction cost estimates, the five-year investment cost of $3,975,000 is met with a direct return potential of $6,624,000; a ~167% return in harvest value alone.

It is important to recognize that this return on investment is only realized if the reefs are entirely exploited during the five-year period. History has taught us that harvest trends more closely follow patterns of socioeconomics and can be correlated market, regulatory, and environmental factors, more so than biological productivity. Therefore, it is important to draw a clear distinction between annual harvest levels and reef productivity or success. Regardless of harvest levels and subsequent annual market value, oyster reefs developed by cultch planting have indirect and likely immeasurable monetary value, providing water filtration, fish

production (recreational and commercial), and other ecosystem benefits which positively impact tourism and overall environmental health.

Cultch Planting Studies

DMF is undertaking an internal review of the Cultch Planting Program to assist in: drafting new strategies for cultch site management; determining the net benefit of cultch sites (dollar value and biological value); and what is the effect of mechanical harvest on oyster resources at cultch sites. This review will also examine potential additional methods to traditional cultch planting to include: fewer but large reef sites in mechanical harvest areas (Pamlico Sound); follow traditional methods in bays and rivers (many small sites); and pursue management measures to monitor, maintain, and regulate mechanical harvest reefs over time.

In 2016 RTI International conducted released a report, commissioned by the Albemarle Pamlico National Estuary Partnership, "Economic Analysis of the Costs and Benefits of Restoration and Enhancement of Shellfish Habitat and Oyster Propagation in North Carolina". The report found that for small cultch planting projects, it is more time and cost-effective for DMF to complete them instead of contractors (based on NCDMF vessel operational costs and contractor willingness). Large-scale projects are also considerably more cost-effective, but may require considerably more time. For example, 30,000 tons of material (668,000 – 1.1M bushels, ~145 acres) will take contractors four months to complete. NCDMF could complete the same work in approximately three years, but at a considerably lower cost due to the availability of equipment resources. The report recommended that NCDMF hire contractors to complete large-scale projects when time is an important consideration. However, DMF oversight of deployment, timelines, and the cost of monitoring contractors should all be considered when estimating costs and working with contractors. More analysis should be completed to determine the breakpoint at which it becomes more effective to hire contractors.

Recommended Actions

Listed below are the draft recommended actions for inclusion in the 2021-2025 Blueprint. They build on the hard work of DMF and stakeholders. Please consider these recommendations for their potential, and provide input on how they can be implemented.

1. Conduct Cultch Planting Program Study. DMF will work with key stakeholders to develop a five-year strategy (2022 to 2026) for the deployment of adequate substrate (cultch) so that North Carolina promotes the growth of healthy and productive oysters. The strategy will:
    a. Analyze of strengths and weaknesses of existing procedures, policies, rules, and laws that govern or affect the existing Cultch Planting Program in North Carolina.
    b. Analyze quantitatively existing programmatic data
    c. Summarize cultch planting programs in other states and countries, including a comparison of how these entities (i) fund their programs, (ii) types, volume and density of substrate deployed, (iii) how substrate is deployed and managed, and

(iv) benefits documented as well as an estimated cost-benefit analysis of each program studied.

d. Analyze how to expand federal funding to help pay for deploying cultch in North Carolina.
e. Examine environmental policies and permits that govern deployment of cultch in North Carolina and how they can be improved; i.e. incorporating the use of crushed concrete into DMF's permit.
f. Identify strategies, resources and statutory changes needed to incorporate the use of private contractors to support and expand cultch planting efforts.
g. Incorporate substrate budget and enhancement plans from Habitat Management Strategies to ensure cultch planting efforts reflect regional habitat needs and regional harvest pressure to maintain oyster population.
h. Identify the statutory amendments and appropriations that will be needed to implement the report's recommendations.
    i. Ability to establish longer term contracts and purchasing agreements for appropriate reef building materials and work with contractors.
    ii. Ability to carry over funding from multiple fiscal years.
    iii. Resources required to implement and maintain long-term monitoring.

2. <u>Incorporate Cultch Planting Program evaluation recommendations into program development and implementation.</u>
    a. Ensure cultch planting efforts reflect regional habitat needs and regional harvest pressure to maintain oyster population.
    b. Establish and maintain siting and monitoring parameters at long-term sentinel sites for cultch sites similar to the oyster sanctuary program. Maintaining long-term monitoring will be dependent upon available resources.
    c. Continue to test and evaluate cultch planting strategies of:
        i. larger sites
        ii. "rotational harvest" on cultch sites
        iii. varying reef heights/thickness, volume of material in the right locations on a regional scale
        iv. remote setting "spat on shell" for seeding of cultch sites
        v. creating metrics for appropriate sites, acreage, size, type, and amount of materials required.
    d. Continue to document, disseminate and highlight ecosystem services provided by the cultch planting sites.

3. <u>Plant cultch to build 200 acres of harvestable oyster habitat over 5 years.</u> Maximize DMF's current cultch planting capacity to build an average of 40 acres of cultch reefs annually over five years. This comes with a goal to increase internal and external DMF capacity to eventually be able to build 100 acres of cultch reefs annually.

During the next five years DMF will test and evaluate rotationally harvested oyster areas using a portion of the 200 acres of cultch reefs in the Pamlico Sound while maintaining cultch planting efforts in other high harvest areas of the coast.

The intent of the proposed rotational harvest management strategy is to maximize the harvest "bang" for the dollar spent by managing harvest and physically maintaining the reefs for maximum oyster productivity. This will involve regular monitoring, periodic closures and routine enhancements to certain sites in Pamlico Sound which will depend upon availability of resources.

The expected results would provide sentinel sites for monitoring effects of mechanical harvest pressure; give DMF the opportunity to study return on investment; and give focus to the Cultch Panting Program. This would also enable the application of routine habitat enhancement as a fisheries management strategy; provide a new strategy that will enable the temporary closing of sites for rotational harvest; and improves enhancement efficiency by applying long term maintenance of existing sites (no material lost to soft bottom, etc.). The strategy can easily operate within existing USACE permits and CAMA exemptions. DMF can likely enhance these sites without the requirements or added expense of external contracting (RTI International 2016).

During this five year period, DMF will:

a. Plan/implement reefs that maximize harvest and ecosystem services;
b. Use science to inform siting and management for long-term maintenance and oyster productivity; and
c. Carefully consider management/enforcement of closed area.
d. Select 'sentinel' sites for long-term monitoring

References

Peters, Jason W., David B. Eggleston, Brandon J. Puckett, and Seth J. Theuerkauf. 2017. "Oyster Demographics in Harvested Reefs vs. No-Take Reserves: Implications for Larval Spillover and Restoration Success." *Frontiers in Marine Science* 4: 326. https://doi.org/10.3389/fmars.2017.00326.

RTI International. 2016 "Economic Analysis of the Costs and Benefits of Restoration and Enhancement of Shellfish Habitat and Oyster Propagation in North Carolina." *Prepared by* Callihan, Ryan, Brooks Depro, Daniel Lapidus, Tim Sartwell, and Catherine Viator. *RTI International Final Report*, 38.