Workshop Resources

N.C. Oysters: A Workshop to Chart Future Restoration, Learning from the Past

March 12-13, 2014

Beaufort, NC

Oyster Restoration and Protection Plan for North Carolina: A Blueprint For Action - Second Edition 2008 – 2012 www.nccoast.org (search for Oyster Plan)

A number of efforts including the N.C. Division of Marine Fisheries Oyster Fishery Management Plan, Blue Ribbon Council, Coastal Habitat Protection Plans, the N.C. Division of Division of Water Quality Basinwide and Watershed Plans and research at various universities are underway to restore oyster habitat and protect water quality. Recognizing the recommendations from these plans and that focused action was needed to put them in place the Coastal Federation worked with state agencies, researchers, educators, shellfish harvesters and growers to develop and implement the Oyster Restoration & Protection Plan for North Carolina. The plan links the restoration and protection of the native oyster population with a comprehensive coastal restoration and protection strategy. It takes priority recommendations from the stakeholders and existing plans and puts them into action through partnerships, securing additional funding and with support from the N.C. General Assembly. The planning effort was funded by the N.C. Clean Water Management Trust Fund.

Oyster Restoration Workgroup www.oyster-restoration.org

The Oyster Restoration Workgroup was established to address questions related to shellfish restoration success, especially all pertinent issues associated with the restoration of both intertidal and subtidal oyster reefs. This website was created to: (1) enable visitors to view findings from past meetings and workshops; (2) share and see upcoming events (e.g., workshops, meetings, publications, findings, etc.); (3) obtain contact information for professionals and experts working in the field; and (4) find links to the latest literature, including suggested approaches for measuring restoration success based on a suite of agreed upon goals and associated metrics from a workshop that included a group of restoration practitioners. We are currently working to expand the site with the help of NOAA, TNC and others to meet the needs of the shellfish community. Our hope is that people from around the globe will join the informal group and send us links to their oyster, clam, scallop, and other bivalve ecological restoration and enhancement efforts.

Oyster Habitat Restoration Monitoring Program Manual and Factsheet

www.habitat.noaa.gov (Restoration techniques & monitoring)

www.oyster-restoration.org (link for completed manual)

In late 2011, a group with experience on issues related to oyster restoration from Atlantic, Pacific, and Gulf of Mexico (U.S.) states, directed by a steering committee began a cooperative project to develop a set of standardized monitoring approaches to quantify oyster restoration-related metrics. The ultimate goal of this effort is to allow for more rigorous comparisons among areas and projects. The monitoring metrics and performance criteria were designed to address both the Eastern oyster, Crassostrea virginica, and more generally the Olympia oyster, Ostrea lurida. We valued your feedback and accepted it from all that were interested in the restoration of oyster habitats. We want to ensure that the

document will be practical and will meet the needs of the general restoration community following on previous restoration and monitoring guidance for C. virginica and O. lurida.

South Carolina Sea Grant Oyster Restoration Metrics Workshop 2004

www.oyster-restoration.org (Workshops & Meetings)

The decline of the Eastern oyster, *Crassostrea virginica*, once a dominant feature of most Atlantic and Gulf coast estuaries, has led to large- and small-scale restoration efforts throughout the oyster's range. Successes and failures in reef restoration have varied throughout the region. Understanding why different restoration projects succeed or fail is critical to the future optimal use of limited resources (e.g., shells, manpower) and the deployment of cost-effective, successful reef restoration projects. Communicating the results of ongoing oyster reef construction and assessment efforts also is vital. Leading oyster reef restoration practitioners from throughout the Gulf of Mexico and eastern U.S. coastal states met to discuss restoration goals, site selection parameters, metrics to assess success, and associated monitoring methods at a South Carolina Sea Grant sponsored workshop held in Myrtle Beach in May, 2004. The following document summarizes the results of that workshop, providing a concise and non-technical explanation of the current state of knowledge regarding the why, where, what, and how of oyster reef restoration. It also expands on the workshop results to include information and approaches developed since 2004.

Relevant Literature

Baggett, L.P., S.P. Powers, R. Brumbaugh, L.D. Coen, B. DeAngelis, J. Green, B. Hancock, and S. Morlock, 2014. Oyster habitat restoration monitoring and assessment handbook. The Nature Conservancy, Arlington, VA, USA.

Coen, L.D. and M.W. Luckenbach, 2000. Developing success criteria and goals for evaluating oyster reef restoration: ecological function or resource exploitation? Ecological Engineering 15:323-343.

Coen, L., K. Walters, D. Wilber, and N. Hadley, 2004. A SC Sea Grant Report of a 2004 Workshop to Examine and Evaluate Oyster Restoration Metrics to Assess Ecological Function, Sustainability and Success Results and Related Information, Sea Grant Publication, 27pp.

Brumbaugh, R.D., M.W. Beck, L.D. Coen, L. Craig and P. Hicks, 2006. A Practitioners' guide to the design and monitoring of shellfish restoration projects: an ecosystem services approach. The Nature Conservancy, Arlington, VA., MRD Educational Report No. 22:28pp.

Burrows, F., J.M. Harding, R. Mann, R. Dame and L. Coen, 2005. Chapter 4, Restoration monitoring of oyster reefs, pages 4.2-4.73. In: G.W., Thayer, T.A. McTigue, R.J. Salz, D.H. Merkey, F.M. Burrows, and P.F. Gayaldo, (Eds.), Science-Based Restoration Monitoring of Coastal Habitats, Volume Two: Tools for Monitoring Coastal Habitats. NOAA Coastal Ocean Program Decision Analysis Series No. 23. NOAA National Centers for Coastal Ocean Science, Silver Spring, M.D.

Leonard, D. and S. Macfarlane, 2011. Best management practices for shellfish restoration. Prepared for the ISSC Shellfish Restoration Committee, 42pp. plus appendices

Kennedy, V.S., D.L. Breitburg, M.C. Christman, M.W. Luckenbach, K. Paynter, J. Kramer, K.G. Sellner, J. Dew-Baxter, C. Keller, and R. Mann, 2011. Lessons learned from efforts to restore oyster populations in Maryland and Virginia, 1990 to 2007. J. Shellfish Research 30:719-731.

Powers, S.P., C.H. Peterson, J.H. Grabowski, and H.S. Lenihan, 2009. Success of constructed oyster reefs in no-harvest sanctuaries: implications for restoration. Mar. Ecol. Prog. Ser. 389:159–170.

Powers, S.P. and K.E. Boyer, 2014. Ch. 22. Marine restoration ecology, 495pp-516pp. In: M.D. Bertness, J.F. Bruno, B.R. Silliman, and J.J. Stachowicz, Eds., Marine community ecology and conservation, Sinauer Associates, Sunderland, MA,

Best Management Practices for Shellfish Restoration Prepared for the ISSC Shellfish Restoration Committee Dorothy Leonard and Sandra Macfarlane 10/1/2011
www.oyster-restoration.org (Reports)
The BMPs recommended by workshop participants are grouped under 5 headings:

- protect public health while restoring the environment;
- define goals and objectives of restoration projects;
- expand communication and education;
- expand community-wide restoration and,
- when practical, use noncommercial species in restoration efforts.

Design & Monitoring of Shellfish Restoration Projects
www.oyster-restoration.org (Reports)
This Practitioner's Guide grew out of a workshop convened by The Nature Conservancy and the NOAA Restoration Center in 2005 at the Dauphin Island Sea Lab in Alabama.

Restoration Goals, Quantitative Metrics and Assessment Protocols for Evaluating Success on Restored Oyster Reef Sanctuaries
www.oyster-restoration.org (Reports)

Native Oyster (*Crassostrea virginica*) Restoration in Maryland and Virginia: An Evaluation of Lessons Learned 1990-2007.www.oyster-restoration.org (Reports)

- **Lessons learned from efforts to restore oyster populations in Maryland and Virginia,** 1990 to 2007. J. Shellfish Research 30:719-731
- **An Evaluation of Native Oyster Restoration in Chesapeake Bay 1990-Present**
    - All organizations performing restoration should be much more explicit with regard to the intent of their activities. Clearly articulated goals, whether to support the oyster fishery or for long-term restoration of ecological services or both, are essential. Different endpoints will likely require very different designs for given activities and possibly different methods of sample collection. In particular, for restoration there needs to be a recognition that reefs must be maintained without fishing pressure, and that monitoring of growth and the progression of disease must be continued for sufficient duration to fully assess the efficacy of the restoration activity.
    - There has often been limited or no coordination between those that perform restoration and those that engage in monitoring. Effective restoration will be greatly enhanced by more fully integrated data collection and monitoring of critical parameters. Rigorously planned restoration efforts that meet scientifically valid design, coupled to equally rigorous monitoring and assessment, are needed, and sustained funding must be anticipated to support those monitoring efforts.
    - For all reefs (both those receiving a restoration activity and controls), data collection

should include repeated measures of oyster sizes, abundances (which requires some form of random sampling with effort data), and disease status as well as other goal-specific data. All entities engaged must agree on common parameters that should be monitored and commit to rigorous quality control for all monitoring efforts. It is essential to employ the best use of geo-referencing technology to ensure that all measurements are spatially explicit so that sites can be accurately and easily identified in the future.

- A sound stock assessment program must be established that will detect local and system-wide changes that may be the result of restoration activities. This assessment program should be capable of tracking spatially explicit (i.e., reef-specific) changes in oyster abundance, mean oyster sizes, recruitment, disease levels and mortality.
- Data relative to restoration efforts and associated monitoring should be posted to a central collaborative database. Development of the database should build upon the work of this project and should explicitly identify the potential limitations of contributed data. The database should also be governed by clear guidelines for how and when data are to be provided and be based on clear agreements regarding data availability, sharing and use.
- The metadata analysis strongly suggests that restoration and monitoring efforts need to be organized and coordinated in a much more stringent manner to facilitate the collection of data essential for assessing the efficacy of these efforts. Eleven different agencies and organizations provided data in various formats to the team. The combined efforts are remarkable in many respects and the analyses conducted for this report make clear the many ways that these entities have worked to enhance oyster populations. Given the nature of the data, however, the team could draw few conclusions as to the efficacy of most restoration effort

Maryland DENR Shellfish Program

www.dnr.state.md.us (Fisheries & Oysters)

- 2004 Chesapeake Bay Program Oyster Management Plan
- Evaluating Ecosystem Effects of Oyster Restoration in Chesapeake Bay: A Report to the MD DNR

- Recent History of Shellfish Aquaculture Development in Maryland

  In 2004 the oyster Environmental Impact Statement was initiated to evaluate oyster restoration and industry revitalization alternatives.
  - In 2007 the Oyster Advisory Commission found that the greatest opportunity for expanding the economic production of oysters in Maryland is through privatization and aquaculture.
  - In September 2008, the Maryland Shellfish Aquaculture Plan was developed and published through the Maryland Department of Agriculture (MDA) in consultation with the MD DNR, Maryland Department of the Environment (MDE), Department of Health and Mental Hygiene (DHMH), Maryland Aquaculture Coordinating Council, and the Board of Public Works.
  - Recommendations from this plan and the Oyster Advisory Commission about how to

develop a sustainable shellfish industry while creating opportunity for prospective aquaculture shellfish growers in Maryland waters were implemented into Senate Bill 271/House Bill 312. This bill passed both the houses unanimously and was made into law on March 24, 2009.

- The law outlines the requirements for prospective and current shellfish leaseholders.

Based on the new laws and associated regulations, DNR began accepting applications for commercial shellfish aquaculture bottom leases on September 7th, 2010

- Oyster Advisory Commission's 2008 Legislative Report
  The following recommendations offered in this document by the Oyster Advisory Commission, when taken together, can stimulate and catalyze the needed actions to transform the commercial wild industry and the ecology of the Bay. Actions will be required not only by the State, but also by the communities, the industry, and the public. The State's leadership is needed to ensure that these recommendations, if adopted, receive the funding necessary to ensure the successful fulfillment of these goals. Major recommendations include:
  - Focusing ecological restoration efforts in a largescale, interconnected fashion (river system wide) as the strategy most likely to allow large populations of oysters to persist in the face of disease and other stressors.
  - Implementing a new oyster fisheries management plan, based on maximum fishing mortality rates, improved annual population and habitat surveys and more accurate harvest reporting. Addressing and resolving illegal oyster harvesting from all areas of the Chesapeake Bay especially protected, prohibited and leased areas.
  - Revising restrictive laws and regulations that currently inhibit private cultivation of shellfish. These will include a streamlined and timely permitting process, production standards for use and oversight for sustainable industry growth.
  - Developing a transparent and balanced transition strategy for growing Maryland's oyster industry based primarily on aquaculture that includes education, training and startup funding resources for watermen.
  - Reversing habitat degradation and loss must be a primary focus for both ecologic and economic conditions. The continued degradation of Bay water quality from land based management decisions will further impede Maryland's ability to restore oysters to the Bay.
  - All agencies of the State need to become more influential in informing and educating local decision-makers about the "downstream" implications of their decisions.
  - Increasing and diversifying sources of disease free oyster seed and identifying new sources of substrate to meet future ecologic and economic needs.

The Commission recognizes that a significant increase and sustained financial investment will be required to transition the industry and support the ecologic goals outlined below. The recent 2009 state capital funds, federal crab disaster funding and the annual state and federal support for in the water oyster recovery (sanctuary and public fishery) activities has been and will continue to be vital to reversing the oyster's ecologic and economic decline. In the 2007 Interim Report, the OAC estimated

that $40 million annually will be required to support Maryland's oyster recovery and the transition of the wild fishery to a sustainable aquaculture program for at least the first 10 years.

Chesapeake Bay Oyster Recovery Partnership http://www.oysterrecovery.org

Twenty years ago, the Oyster Recovery Partnership was commissioned as a cooperative coalition of multiple partners that contribute to a large-scale restoration program to plant disease-free oysters back into the Chesapeake Bay. As a result of this successful partnership, nearly 4 billion oysters have been planted on 1,500 acres of oyster reefs and nearly 30,000 bushels of shell have been recycled to provide homes for new oysters. As Maryland's leading nonprofit restoring oysters in the Bay, the ORP also operates the region's Shell Recycling Alliance, supports the state's Marylanders Grow Oysters program and provides shellfish aquaculture and fishery support services. Though great challenges lie ahead, we continue to provide innovative techniques and cutting-edge science to achieve greater efficiency, effectiveness and collaboration with our partners as we:

- Expand field operations to support the new UMCES Horn Point Lab Hatchery oyster setting pier, capable of producing 2 billion oysters per year;
- Assist mother nature to jump-start local wild oyster populations by rebuilding the network of oyster reefs within entire river systems to assist them in natural expansion;
- Assist in implementing aquaculture projects as a viable addition to a wild fishery, while concurrently supporting the existing wild fishery; and
- Build upon public engagement projects, such as the region's first Shell Recycling Alliance, to actively provide outlets to energize citizens with a desire to positively impact our Bay.

TNC Oyster Restoration Goals Project www.conservationgateway.org (Oyster Goals)

The Oyster Goals project is a two phase collaborative process to help scientists and managers answer the question: how much shellfish reef restoration is enough? In 2009, TNC in partnership with NOAA, NFWF, and large group of shellfish, marine and fisheries scientists, began work on the Oyster Goals Project in 2009. This project (Phases I and II) will develop ecosystem service models which can be used for scaling restoration projects and defining anticipated outcomes, and by providing data in a usable format to allow managers to evaluate restoration priorities.

Shellfish Restoration and Alternative Shoreline Protection Policies of the Southeastern United States: Florida, Georgia, North Carolina and South Carolina 2012

http://masglp.olemiss.edu (TNC Policy Report)

This research was funded by The Nature Conservancy, through its South Carolina Field Office. This report reviews the current regulatory framework in Florida, Georgia, North Carolina, and South Carolina related to shellfish conservation, restoration, and resource management, as well as the use of shellfish for shoreline protection.

The South Carolina Oyster Restoration and Enhancement Program (SCORE)

www.score.dnr.sc.gov

The South Carolina Oyster Restoration and Enhancement Program (SCORE) is a community-based habitat restoration and monitoring program of the South Carolina Department of Natural Resources.

The Virginia Institute of Marine Science www.vims.edu (Research oysters)
Oysters were historically a keystone species in Chesapeake Bay, filtering water and providing habitat for numerous Bay organisms through their reefs. Today they stand at 1% of their original population. Oyster research at VIMS focuses on restoration and aquaculture of the native oyster Crassostrea virginica. VIMS also played a key role in evaluating the potential use of the non-native Asian oyster C. ariakensis.

Generating Enhanced Oyster Reefs in Georgia's Inshore Areas (GEORGIA)
www.oyster-restoration.org (Uploads)
Generating Enhanced Oyster Reefs in Georgia's Inshore Areas (GEORGIA) is community-based oyster restoration effort coordinated by the University of Georgia Marine Extension Service. The primary program goal is to increase oyster reef acreage while educating the public on the importance of oyster reefs in maintaining a healthy coastal ecosystem. The curriculum details a hands-on programs for students in grades five through twelve focusing on oyster reef communities and related restoration efforts.

East Coast Shellfish Growers Association http://ecsga.org/
The ECSGA represents over 1000 shellfish farmers from Maine to Florida. These proud stewards of the marine environment produce sustainable farmed shellfish while providing thousands of jobs in rural coastal towns. The ECSGA informs policy makers and regulators to protect a way of life. For more details on what we do, check out this list of recent initiatives.

NCDENR Division of Marine Fisheries Shellfish Rehabilitation Program: Creating New Fisheries Habitat www.portal.ncdenr.org/web/mf

- North Carolina's Oyster Sanctuary Program
- Cultch Planting Maps and Data 1981-2010
- Estuarine Benthic Habitat Mapping Program — Shellfish and Submerged Aquatic Vegetation
- Oyster Shell Recycling
- North Carolina's Under Dock Oyster Culture Program
- Coastal Habitat Protection Plan
- Shellfish Sanitation and Recreational Water Quality

The North Carolina Shellfish Growers Association http://www.ncagr.gov
NCSGA was founded in 1995 to represent the interests of the many people involved in the shellfish industry. As such it has a rather broad base of members including shellfish farmers, hatchery operators, seafood dealers, educators, researchers, government regulators, and service providers.