

# **SUMMARY OF SHELL RETENTION AND RECYCLING PROGRAMS TO INFORM OYSTER RESTORATION AND MANAGEMENT**

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Image courtesy Mississippi Gulf Coast Oyster Shell Recovery Program

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## EXECUTIVE SUMMARY

This report reviews 29 shell recycling programs along the eastern seaboard, Gulf of Mexico and Pacific Coast. The programs encompass a broad range of program structure, funding, infrastructure, personnel and shell source. Most of the programs are managed by non-profit organizations with some run by government entities, corporate sponsors or academic institutions. Despite these differences, their common goal was to obtain sufficient shell for restoration or re-shelling of harvest areas. Replenishing material removed by harvest is a traditional part of oyster fishery management, but shell has become increasingly rare. Oyster harvest has decreased due to depleted stocks and the market for shucked oyster meat, which retains shell with seafood processors, has shifted to demand for oysters in the shell, which are dispersed to restaurants and retail outlets. These shells are not returned to resource as in the past but are often discarded as trash. Recycling programs attempt to divert this valuable resource away from landfills and return them to estuaries. Most programs have a component of community engagement, which include oyster gardening, citizen science and volunteers creating living shorelines using recycled shell. With very few exceptions, restaurants are the primary source of shell for these programs and different incentives have been used to encourage participation in recycling programs. These include reduction of waste removal costs, tax credits for recycling, and ‘green’ or ‘eco’ labeling that enhance the restaurant profile. Other means of shell collection include public recycling sites, receptacles at festivals and other events where oysters are consumed, and in very few cases, purchase of shells from seafood retailers. Storage or ‘curing’ sites are often on public land or property belonging to program partners. The capacity and longevity of these programs is highly dependent on funding, which can come from direct government sources, grants, corporate sponsors, non-profits and private donors. Most programs have a mixed portfolio to provide some security against changes in funding priorities of individual sources.

This report draws from review of the shell recycling programs to provide recommendations to Apalachicola Bay and other programs in Florida. The oyster fishery in Apalachicola Bay in the Florida Panhandle was historically highly productive, providing up to 90% of the oysters in Florida. This fishery declined over time and in 2013 was declared a Federal Fishery Disaster. Restoration was initiated, but harvesting continued, the State re-shelling program was defunded, and the oyster populations continued to decline until 2020 when the fishery was closed for 5 years. Large-scale restoration using limestone will be initiated in 2024, but oyster recovery may be accelerated through deployment of bare shell or the use of spat-on-shell to augment natural recruitment. Both of these options require large quantities of shell. There is currently a small recycling program in Apalachicola, managed by the OysterCorps (part of the AmeriCorps Conservation Corps). This review contains suggestions on how this program can be expanded, or new programs initiated to meet the need for shell cultch in the Florida Panhandle. Legislation introduced or implemented in other State can inform Florida on ways to help ensure oyster shells are not discarded but are used to restore the reefs that are the foundation of estuaries globally.

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## INTRODUCTION

The ecological, economic, and cultural importance of oyster reefs is well understood, but natural events (hurricanes, floods, drought) and anthropogenic stressors (overharvesting, coastal development, poor water quality) have reduced oyster populations to a fraction of their previous abundance (Beck et al 2011, Pine et al 2015). Unlike most other fishery species, oysters create their own habitat. If natural erosional processes and harvesting remove material faster than the oysters can replace it, the inevitable consequence is degradation of the reef structure. To alleviate this problem, ‘re-shelling’ or cultching has been a traditional component of oyster management for almost as long as oysters have been harvested, although when this practice started is unclear.

The widespread decline in the condition of major estuaries (including oyster habitats) in the northeastern US occurred several decades ago (Rothschild et al 1994) and ultimately led to the development of extensive multistate agreements<sup>1</sup> and funding for ecosystem restoration. Oyster populations declined more recently in the Gulf of Mexico, where once thriving oyster fisheries have collapsed, leaving the coastal communities that depend on them in economic straits (Pine et al 2015, Havens et al 2013).

The oyster fishery in Apalachicola Bay Florida provided the economic foundation for Franklin County residents since the mid 1800’s (Swift 1897). Oyster landings data from the Florida Fish and Wildlife Conservation Commission (FWC) shows the fishery increased rapidly from very low post-war harvest into the 1960s and peaked at 3,000 metric tons per year between 1975 and 1985. After Hurricane Elena in 1985, landings fluctuated from ~ 500-1200 metric until the landings declined precipitously in 2012, and in 2013 the Apalachicola Bay wild oyster harvest was declared a Federal Fishery Disaster. Warning signs of a declining resource showed in the catch per trip data, which dropped steeply from 2005 onwards and fisheries independent monitoring that showed a rapid drop in juvenile oysters in 2011. The fishery remained open and despite restoration efforts and reduced daily bag limits, the oyster populations became increasingly depleted until the fishery was closed by the FWC in December 2020 for five years. There were multiple causes of the initial oyster population decline (Havens et al. 2013, Camp et al. 2015), but habitat degradation is a significant problem now. The once vast and productive reefs have been reduced to compacted shell hash with little stable structure for oyster recruitment and growth. Extensive habitat restoration plus improved management practices will be needed to recover a viable oyster fishery (Camp et al. 2015).

Funds from the National Fish and Wildlife Foundation (\$17 million) and Florida State (\$10 million) have recently been committed to Apalachicola Bay oyster restoration, which will take place over the next two years (2024-2026; Devin Resko, FWC, pers. comm.) . There are, however, no dedicated funds for re-shelling or cultch placement after this funding has been spent. If harvesting resumes, a long-term sustainable cultching program will be necessary to maintain reef structure and prevent another population collapse. Oyster habitat management (re-shelling) and restoration require large quantities of shell, which can be obtained from shellfish dealers, but this need also precipitated the initiation of shell recycling programs.

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<sup>1</sup> <https://www.epa.gov/chesapeake-bay-tmdl/chesapeake-bay-agreements>

## OBJECTIVES

The primary objective of this document is to provide an inventory (database) and synthesis report for selected shell recycling programs throughout the U.S., with emphasis on the Eastern Seaboard and Gulf of Mexico. This review is intended to inform potential future shell recycling and re-shelling programs in Apalachicola Bay but is applicable for other regions. The synthesis report includes summaries of the programs by region, the different strategies used by the various programs and an assessment of the positive and negative aspects of each approach. Since this project was intended to provide a summary of selected recycling programs in the U.S. varying by geography and size of the program, not all programs are captured in the database. Some of the data was not available because some programs did not track all of the requested information. The target users of this database and synthesis are oyster restoration practitioners who require shell for their projects, and resource managers who need material for re-shelling programs as part of a fishery management strategy, particularly for Apalachicola Bay and other areas in Florida.

## METHODS

Program information was derived primarily from web-based searches, with some guidance from The Pew Charitable Trusts staff, of a cross-section of shell recycling programs across the country. The inventory includes key elements of each program, such as the focal region, size or extent of the program (based on amount of material recycled), amount and source of recycled shell, program activities, staffing levels and contact information. If the relevant information was not available through the program websites, the program leads were contacted to provide the needed data. Several of the shell recycling programs are part of a larger organization that focuses on restoration, with the shell recycling component providing material for the broader objectives. In these cases, we could not separate some of the shell recycling metrics (e.g., funding, personnel) from the larger program. Consequently, there are some missing data and ‘unknowns’ in the database.

With a few exceptions, shell recycling programs do not have consistent funding and are supported by several funding streams. For example, a grant may have provided funding to initiate the program, which was subsequently supported by donations, corporate sponsorship, or other sources. The funding categories listed include past and present sources, so they may not represent current support.

The shell source category references where the material originates (e.g., restaurants, public recycling) but does not stipulate whether those shells were originally sourced from wild harvest or farmed oysters. Historically, shells came from seafood processors and were all from wild harvest; however, with the decline of wild oysters and expansion of aquaculture it is impossible to determine the original source of the shells.

The program size category was defined by the amount of shell recycled annually somewhat arbitrarily into small (less than 50,000 pounds/22,680 kg), medium (50,000-200,000 pounds/22,680-90,719kg) and large (more than 200,000 pounds/90,719 kg). They were categorized this way to ensure the spectrum of programs was sufficiently captured, and to compare their applicability to Apalachicola Bay, or other regions. However, some of the data on annual or total amount recycled are incomplete or missing, so the amounts may not be completely accurate. The database is current as of August 2023, but since these programs are continuously collecting material, the amounts will become outdated over time.



## DATABASE STRUCTURE

The database component of this project is housed in a Microsoft Excel spreadsheet with three worksheets. The first is labeled Column Definitions and the worksheet shows the column letter, column title and a definition or explanation of the contents of the other worksheets (Tables 1, 2). The second worksheet is labeled Program Summary and contains 13 columns of data for the 29 programs included in the database. This worksheet provides an overview of each program with information presented in categorical format where possible. This enables the user to rapidly filter by category of interest; for example, program type (restoration, shell recycling), personnel (paid staff, volunteers, students), or source of shell (restaurants, events, public recycling stations). The third worksheet is labeled Program Details and contains 28 columns of data on a more comprehensive suite of metrics and links to additional information on the 29 programs in the database. Some of these data columns are also categorical and may be filtered to view by selected parameters.

**Table 1.** Column definitions for the Program Summary worksheet

<b>Column</b>	<b>Column Title</b>	<b>Definition</b>
A	Program Number	Numerical identifier for each program
B	Region	Region of program focus Northeast: Maine to Virginia Southeast: North Carolina to Eastern Florida Gulf of Mexico: West Florida to Texas West Coast: Washington State to California
C	State	State of program focus
D	Water Body	Water body of program focus
E	Program Name	Official name of program
F	Program Initiation	Year of program initiation or funding award
G	Program Status	Active: ongoing Inactive: terminated or suspended
H	Funding Category	Government: Federal, State, Local Grants: Federal, State, Local Corporate sponsors Non-profit Private donations Other (memberships, merchandise, investments)
I	Program Type	Shell recycling Habitat restoration Coastal erosion prevention Water quality enhancement
J	Primary Shell Source	Seafood processors Restaurants Public recycling Events Casinos

K	Program Size	Amount of shell collected annually (pounds/kg) Small: Less than 50,000/22,680 Medium: 50,000-200,000/22,680-90,718 Large: More than 200,000/90,718
L	Personnel	Paid staff Volunteers Partners Contractors Students Others
M	Monitoring	Yes No Unknown

**Table 2.** Column definitions for the Project Details worksheet

Column	Column Title	Definition
A	Program Number	Numerical identifier for each program
B	Region	Region of program focus Northeast: Maine to Virginia Southeast: North Carolina to Eastern Florida Gulf of Mexico: West Florida to Texas West Coast: Washington State to California
C	State	State of program focus
D	County	County of program focus
E	Water Body	Water body of program focus
F	Lead Agency/ Organization	Entity responsible for leading the program
G	Program Name	Official name of program
H	Program Contact	Name of program lead or point of contact
I	Contact Email	Email of program lead or point of contact
J	Contact Phone Number	Phone number of program lead or point of contact
K	Program Initiation	Year that program was initiated.
L	Program End	Year of program termination or suspension
M	Program Status	Active: ongoing Inactive: terminated or suspended
N	Funding category	Government: Federal, State, Local Grants: Federal, State, Local Corporate sponsors Non-profit Private donations Other (memberships, merchandise, investments)
O	Funding Sources	Description of specific funding sources
P	Funding Received	Amount of funding received from primary sources

Q	Program Type	Shell recycling Habitat restoration Coastal erosion prevention Water quality enhancement
R	Primary Shell Source	Seafood processors Restaurants Public recycling Events Casinos
S	Weight (Pounds/Kilograms) of Shells Collected (Program Total/Annually)	Reported quantity of shell collected by program total and annually
T	Habitat Restored Area (A: acres/km <sup>2</sup> ) Length (L: feet/meters)	Reported area or length of restored habitat if restoration is part of the program
U	Program Activity	What activities are conducted or undertaken within this program? For example: shell recycling and distribution, oyster re-seeding, habitat enhancement through planting.
V	Outcomes/Products	What has been the overall outcome and/or products that have come from this program?
W	Personnel	Paid staff Volunteers Partners Contractors Students Others
X	Monitoring Status	Yes No Unknown
Y	Level of Monitoring	Level and frequency of monitoring if applicable Responsible entity if known
Z	Website	Program website
AA	Additional Information	Website links to additional relevant documents
AB	State Policies	State-specific policies that affect the program

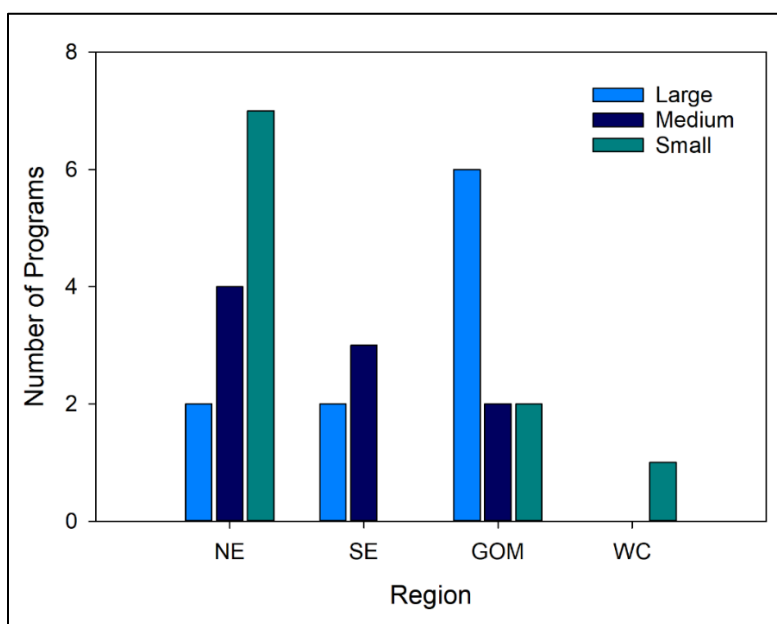
## RESULTS

The review of U.S. shell recycling programs resulted in 29 programs (Appendix 1) with sufficient data to be included in the database. These were divided by region as follows: Northeast (Maine to Virginia), Southeast (North Carolina to East Florida), Gulf of Mexico (West Florida to Texas),



West Coast (Washington State to California). Programs not included in the database were generally small volunteer-based organizations with insufficient data to warrant their inclusion.

Program size (large, medium, small) is represented almost equally (ten, nine, ten respectively) among the 29 programs in the database, but there are notable regional differences (Fig. 1). The northeast region has more programs overall (13) than the other regions, but most of them are small. The Gulf of Mexico has more large programs (six) than the other regions and they were initiated more recently (average 8.25 years ago) than the northeast (22.5 years) or the southeast (17.5 years). On average, the ‘large’ programs have been in operation for ~13 years (#6 ran for 18 years before losing funding), the ‘medium’ for ~9 years and the ‘small’ for ~5 years. The large ‘Save our Shells’ pilot program (#25) in Mississippi was excluded from this calculation since their program was recently established and the size was defined by their recycling targets, not collection amounts. The Chesapeake Bay Foundation (CBF, #3) was also excluded from the calculation since the CBF was started in 1966<sup>2</sup>, but the shell recycling program was established later at an unknown date. Large programs generally received significant start-up funds, or have sustained funding sources, which may have contributed to their success.

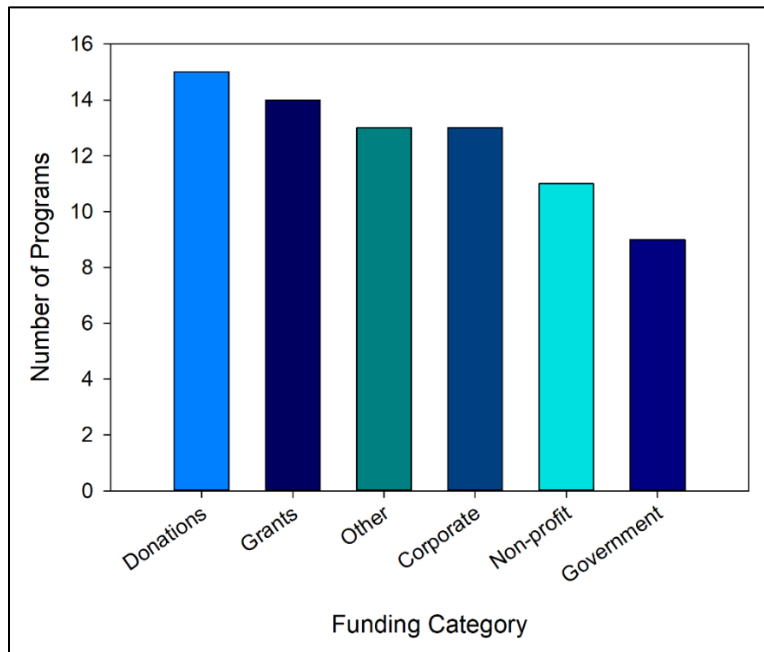


**Figure 1.** Number of programs of different size categories (small, medium, large) by region. NE = Northeast; SE = Southeast; GOM = Gulf of Mexico; WC = West Coast.

Funding for recycling programs comes from a wide variety of sources (Fig. 2) with most programs supported by multiple funding streams. Public and private donations are the most common source of funds, with 14 of the 29 programs receiving some level of support from donations. Other sources include direct government funding through recurring or irregular budget or legislative allocation, grants from federal, state, or local government, funds from non-profit organizations, corporate sponsorship as either direct or in-kind support, and other revenues such as merchandise sales, membership dues, fundraising events and investments. Three of the ‘large’ programs (#6, 17, 25) are funded solely by grants or direct funds from federal or state, and one had a significant corporate

<sup>2</sup> <https://www.cbf.org/about-cbf/history/>

sponsor (#26) to start the recycling program. The remaining six ‘large’ programs received funding from a combination of sources. With two exceptions (#3, 18), the nine ‘medium’ projects also received support from federal, state or local governments, with additional support from corporate sponsors, non-profits and private donations. Three of the ten ‘small’ programs received government funding, five received corporate sponsorship, two received funds from non-profits and four from private donations. Many of the programs had multiple sources of support. While the category of support was relatively easy to find, the funding levels were a challenge to obtain.

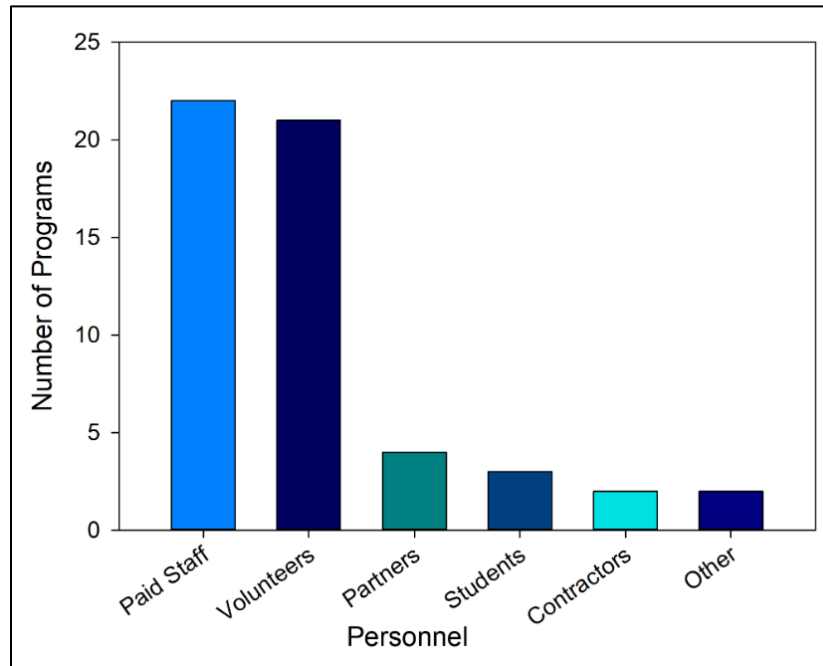


**Figure 2.** Number of programs receiving funding from each category. Note: the number of programs depicted in this graphic (75) exceed the number of programs in the database (29) because most programs receive funding from multiple sources.

Program personnel generally consists of various numbers of paid staff that run the program, with assistance from volunteers. A smaller number of programs include students, contractors (to collect and transport shell) and corporate or restaurant partners that assist with program coordination or shell collection (Fig. 3). Two of the programs in Florida were staffed by the Conservation Corp, which is part of AmeriCorps<sup>3</sup>, a federal volunteer-based program that performs training in community services, including habitat restoration. There are seven programs with only paid staff; which includes partners and paid contractors (#1, 8, 9, 10, 13, 19, 25); five of these were in the northeast region and two in the Gulf of Mexico. They were all primarily funded through federal or state sources except for one that received only corporate sponsorship (#10), and another small program (#13) that received funds from multiple sources. Three programs used volunteers only. Of these, ‘The Cultch Program’ (#6) was a large program funded by the Connecticut State Legislature and led by the CT Department of Agriculture using volunteer oystermen to deploy cultch purchased through shellfish processors. This program is currently unfunded, and operations

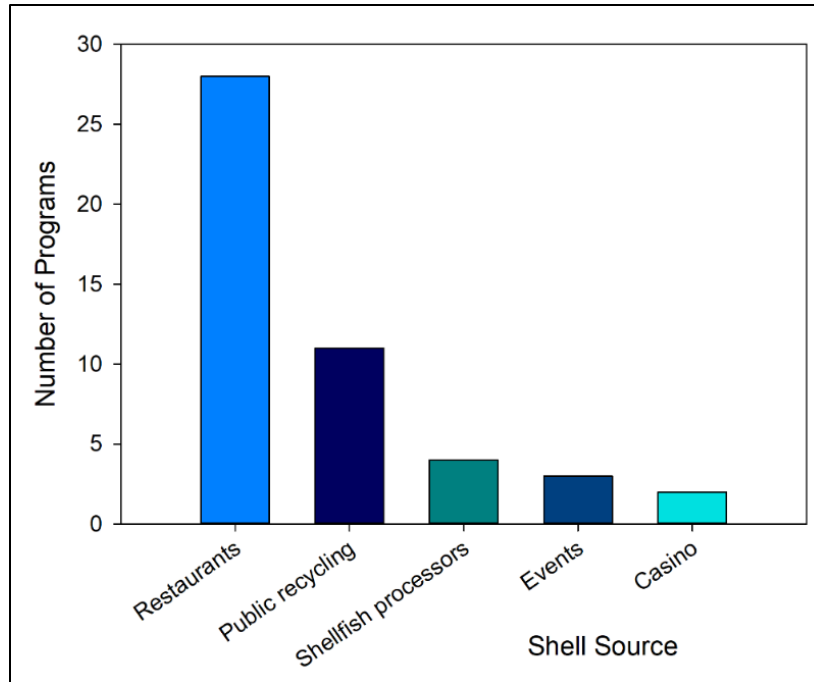
<sup>3</sup> <https://americorps.gov/about>

are suspended. The other two comprise of one small and one medium program that are funded by grants, sponsors, and donors.



**Figure 3.** Number of programs with different personnel categories. Most programs have paid staff, augmented with volunteers, with assistance from partners, students, contractors or others.

Many of the programs in the database obtain shells from multiple sources (17 of 29), but almost all (28 of the 29), regardless of size or funding source, obtain shells from restaurants (Fig. 4). Less than half (11 of 29) the programs have public shell recycling centers, where the public can drop off their shells. These can be part of the municipal recycling program, or an independent location provided through the shell recycling program. Five programs also collected from public events, such as festivals, where recycling bins are deployed for the public to deposit their shells after consuming the oysters. Two programs in the northeast region (#9 in New Jersey, #10 in Maryland) collect shells from casinos through corporate partnerships. One inactive program ‘The Cultch Program’ (#6) only purchased shell from shellfish processors, and the Shell Recycling Alliance (#1) augments their recycled shell with purchased shell to meet their restoration needs. While not strictly ‘recycling’, purchasing shell for reef maintenance and restoration represents another – more traditional - mechanism for obtaining cultch material.



**Figure 4.** Number of programs with different sources of shell. All of the programs in the database collect shell from restaurants, and others from public recycling, shellfish processors, events and casinos.

## OVERVIEW OF ACTIVE PROGRAMS BY REGION

### NORTHEAST (MAINE TO VIRGINIA)

This region has 13 of the total 29 programs in the database and they comprise two large (#1, 6), four medium (#2, 3, 9, 11) and seven small (#4, 5, 7, 8, 10, 12, 13) programs.

#### **Program #1: Shell Recycling Alliance, Oyster Recovery Partnership, Maryland**

The Shell Recycling Alliance falls under the Oyster Recovery Partnership (ORP), which was established in 1994 in response to concerns over the the wide-spread oyster fishery collapse of the Chesapeake Bay (Smaal et al 2018). The ORP is a non-profit organization that helps coordinate, manage and implement Maryland’s oyster restoration program and is one of the longest running and largest oyster restoration efforts in the U.S. (Smaal et al 2018). The 2014 Chesapeake Bay agreement goal is 10 restored tributaries by 2025. So far 5 have been completed at a cost of over \$70 million (T. Price pers. comm). with funding from federal and state sources, plus other grants, donations and investments. ORP’s annual funding is ~\$6-8 million but the cost of the shell recycling program is part of the larger ORP budget and cannot be parsed out.

The Shell Recycling Alliance was established in 2010<sup>4</sup> to reclaim shell from restaurants and seafood processors for restoration. The program currently collects over two million pounds of shell annually. The Alliance members include ~ 200 restaurants in Maryland, Pennsylvania, Virginia, Washington DC, as well as catering entities and shellfish processors. The program also

<sup>4</sup> <https://www.oysterrecovery.org/oyster-restoration-history>

runs 70 public shell recycling sites throughout Maryland. The shell recycling program has three primary collection vehicles (1.5-ton trucks) for shell collections, and two trucks for transporting dumpster containers of shell. The recycled material comprises about 33% of the shell needed for restoration. The remainder is purchased from shellfish processors. Shells are stockpiled at ORP Shell Recycling and Processing Center located at the University of Maryland Horn Point Laboratory. Shells are cured for a year and then containerized and for restoration and seeded with spat by the Horn Point Oyster Hatchery prior to deployment. The public reefs are also replenished by ORP in conjunction with the Maryland Department of Natural Resources by hiring watermen to plant shell and wild seed<sup>5</sup>. Public reef replenishment is funded by State contracts, the Oyster Bushel Tax and Oyster Surcharge on commercial harvesters (Maryland Chesapeake Bay Oyster Management Plan (2019)).

### **Program #2: Billion Oyster Project Shell Collection, Billion Oyster Project, New York**

The Billion Oyster Project (BOP) is a large and financially complex non-profit organization that receives government, foundation, corporate and private grants/contracts/donations as well as revenue from investments. The BOP receives \$180,000 annually from Talisker Whiskey, which is the primary sponsor of the shell recycling program. Shell collection, transportation and curing are covered by these funds, but it is unclear how much of the overall BOP budget is allocated to the shell recycling program. The program manager recruits restaurants, and weekly or bi-weekly collections are performed by contractors, who transport the shells to the Governors Island curing site. After a year of curing, they are used primarily for restoration, but also smaller education projects such as Oyster Research Stations, where live oysters are placed in cages and monitored by students and volunteers. In 2023, the recycling program collected 322,000 pounds of shell from 75 New York City restaurants. Since the program began in 2014 it has reclaimed 2.5 million pounds of shell and introduced 122 million oysters to BOP reef sites in New York Harbor (2023 Annual report<sup>6</sup>). New York City charges by weight for commercial trash collection so free recycling provides a financial incentive to area restaurants. A proposal for shell collection tax credit was submitted to the New York Assembly in 2017 but is still awaiting consideration.

### **Program #3: Save Oyster Shells, Chesapeake Bay Foundation, Maryland and Virginia**

The shell recycling programs in Maryland and Virginia fall under the larger Chesapeake Bay Foundation (CBF), which was established in 1966 in response to a decline in overall ecosystem health. In 2014 the Chesapeake Bay Watershed Agreement was established, under which the Agreement partners (Delaware, Washington DC, Pennsylvania, New York, Maryland, Virginia, West Virginia and the U.S. Environmental Protection Agency) committed to “restore native oyster habitat and populations in 10 tributaries (five in Maryland and five in Virginia) by 2025 and ensure their protection.” The CBF oyster restoration goals revolve around this commitment. To date, hundreds of acres of oyster habitat and have been planted in the Chesapeake Bay with millions spat-on-shell, and additional work ongoing.

The CBF generates significant annual revenues (ranged from ~\$27.7M to ~\$38.5M over past four years), primarily through grants and donations (66%) but also from membership dues, investments, and other smaller sources. The CBF has a number of programs besides oyster restoration, so it is unclear how much of these funds contribute to the shell recycling program. The

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<sup>5</sup> <https://www.oysterrecovery.org/our-work/oyster-restoration>

<sup>6</sup> <https://www.billionoysterproject.org/financials>

CBF has ~230 paid staff in Maryland, Virginia, Pennsylvania and Washington DC and 15 field stations, but the shell recycling programs in Maryland and Virginia rely heavily on volunteers. The Save Oyster Shells program collects oyster shells from restaurants (20 participating in Maryland and 36 in Virginia), events (oyster roasts and festivals) and public recycling locations (17 in Maryland, 23 in Virginia). The shells are collected by CBF staff and volunteers and taken to curing sites. Once cured, the shells are taken to shellfish hatcheries where they are seeded with oyster spat then used for oyster gardening/restoration at various locations across the Chesapeake Bay region. The shell recycling program produces ~124,000 pounds of recycled shells annually.

**Program #4: Massachusetts Oyster Project Shell Recycling, Massachusetts Oyster Project, Massachusetts**

The Massachusetts Oyster Project is a non-profit organization with the focus of restoring native shellfish to the State's estuaries. The project has four components: Restoration of oyster populations, shell recycling, education, advocacy. A pilot shell recycling program was initiated in 2018 but did not become established until 2021 when they recycled ~25,000 pounds of shell from area restaurants. The parent project receives funding primarily from donations but also event income, grants and merchandise. Their revenue in 2022 was \$60,00 with \$15,600 expended on the shell recycling program, which collected 37,841 pounds of shell from 17 restaurants. The program started with one paid coordinator and relied on volunteers to help collect shells from restaurants and transport them to the Wellfleet Transfer Station (Dept. Public Works), where they cured for a year before being used in restoration projects. In 2023, the program received additional funding and increased to 20 participating restaurants over a wider collection area, with additional part-time staff to conduct daily shell collections and planned establishment of a public recycling station.

**Program #5: Nantucket Oyster Recycling Program, Town and County of Nantucket Natural Resources Department, Massachusetts.**

This small program began in 2014 with funding from the Nantucket Shellfish Association to the Natural Resources Department, who runs the program. Staff and volunteers collect shells from the 26 participating restaurants and raw bars. There are also two locations where the public can recycle their oyster and clam shells. Used shells are taken to the Department of Public Works to cure for a year before being used directly for restoration or being seeded with spat at the Brant Point Shellfish Hatchery prior to deployment to boost population recovery. The program recovers approximately 25,000 pounds per year, for a total of about 200,000 since the program began. Restoration and pre- and post-deployment monitoring is conducted by the Nantucket Natural Resources Department following established guidelines.

**Program #6: The Cultch Program, Connecticut Department of Agriculture, Connecticut**

This program began in 1987 and ran until ~2006 with funding from the State of Connecticut under General Statute 26-237a and tax revenue from harvesters taking seed from the enhanced areas. The objective of this program was to re-shell public oyster beds to support fisheries using purchased shell. The cultch material was planted by oyster industry volunteers to maintain healthy oyster reefs but were also removed as juveniles by licensed seed harvesters. This seed was sold to oyster farmers, who grow them to market size for consumption. Since the program's inception, over 3,000 acres of public beds were enhanced with ~323.5 million pounds of shell. The program is currently unfunded.



**Program #7: Oyster Shell Recycling Program, Fairfield Shellfish Commission, Connecticut**

This small program began in 2016 with funding from the Fairfield Shellfish Commission. As with most other programs, this was initiated to provide shell for restoration projects. The project is staffed by Commission personnel and volunteers who collect clam and oyster shells weekly free of charge from local restaurants. In 2022, they began a public recycling program with a shell drop-off location in Fairfield. The shells are cured for 6 months then used for restoration projects. Since the program began in 2016, they have recycled 79,000 pounds of shell, which have contributed to 1,000 acres of restored habitat. As of 2023, this program still appeared to be active although the program link on the Fairfield Shellfish Commission webpage is no longer active. The Collective Oyster Recycling and Restoration (CORR) program is a non-profit organization with the objective of facilitating shell recycling and restoration in Long Island Sound. Information on the Fairhaven program is posted on their website<sup>7</sup>.

**Program #8: Connecticut Shell Recycling, Connecticut Sea Grant, Connecticut**

This is a new program that began in 2023 with \$196,990 in funding from the National Sea Grant and is staffed with Connecticut Sea Grant personnel. This program is being developed in conjunction with the Connecticut Restaurant Association and the Department of Agriculture is working on protocols and regulations for collecting, curing and deploying the shell to area oyster beds. Shell recycling programs are needed in Connecticut to replace the unfunded program previously run by the Connecticut Department of Agriculture (#6).

**Program #9: New Jersey Shell Recycling Program, New Jersey Division of Fish and Wildlife Bureau of Shellfisheries, New Jersey**

This program was initiated in 2019 with funding from the New Jersey Department of Environmental Protection Marine Resources Administration. Additional support comes from corporate sponsors and academic partners. The purpose of the program is to provide material for restoration projects in the Mullica River. The program is staffed by Marine Resources Administration (MRA) personnel, who collect shell weekly from participating Atlantic City restaurants and casinos and transport them to a curing location. The MRA staff conduct pre and post planting assessments and deploy onto oyster habitats using barges. Between 2020 and 2022, the program collected 354,600 pounds of oyster and clam shells for habitat restoration. Monitoring of restored sites is performed by Stockton University partners.

**Program #10: Oyster Shell Recycling, MGM Resorts, Maryland**

This program began in 2018 and is funded and coordinated by MGM Resorts. This program is unique in that it is entirely managed and supported by corporate sponsors. The cost of the program is unclear as the contributions are all in-kind or in-house. The MGM Grand Resort saves oyster shells generated by their restaurants. Their oil supplier and partner RENUoil transports shells from the restaurants to their property, where they are transferred to Western Elite trucks that take them to their facility to cure. When ready for use, Western Elite transports the shells to the Hoopers

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<sup>7</sup> <https://www.corr-ct.org/>

Island Oyster Company shellfish hatchery where they are used to produce spat-on-shell for the Chesapeake Oyster Alliance spat-on-shell program.

**Program #11: The Virginia Oyster Shell Recycling Program, Virginia Commonwealth University Rice Rivers Center, Virginia.**

The Virginia Oyster Shell Recycling Program began in 2013 and relied primarily on public and private donations until 2020 when a grant (\$62,174) from the National Oceanic and Atmospheric Administration (NOAA) provided additional support, which allowed the program to expand and develop an outreach component to enhance participation. The program coordinator is a Virginia Commonwealth University (VCU) faculty, and the program is staffed with VCU students and volunteers. This program collects shell from 22 restaurants and seven public recycling stations across Virginia. Volunteers collect the shell and transport it to the Rice Rivers Center to cure for a year. The shells are then placed in seeding tanks to collect spat before being used to restore oyster populations in the Piankatank River in Chesapeake Bay. The program recycles more than 125,000 pounds of shell per year.

**Program #12: Half Shells for Habitat (H4H), Seatuck Environmental Association, New York**

This program is part of the Seatuck Environmental Association (SEA) and was initiated in 2018. Funding for SEA comes from corporate sponsors, private donations, events and organization revenues, and since 2018 annual revenue has ranged from \$552,148-\$650,076, although it is unclear how much of that goes to the recycling program. Shells are collected by volunteers from 23 participating restaurants and from festivals and other events. The shells are taken to recycling facilities and left to cure for one year and are then used directly for restoration or sent to the East Hampton Town Shellfish Hatchery for seeding with spat. The program has collected over 100,000 pounds of shell to date.

**Program #13: Shell Recovery Partnership, Martha's Vineyard Shellfish Group Inc., Massachusetts.**

The Shell Recovery Program has been running since 2011 as part of the Martha's Vineyard Shellfish Group, which from 2011-2020 received between \$266,338 and \$482,244 annually. It is unclear how much of this is used to fund the recycling program. Funding comes from corporate and non-profit donors, private donations and fundraising events. Program staff collect shells from 8-10 restaurants three times per week between April and October and transport them to a curing location where they remain for one year. Shells are used directly for restoration or sent to the Martha's Vineyard Shellfish Group Hatchery to generate spat-on-shell. The program collects ~ 37,250 pounds of shell per year.

**SOUTHEAST (NORTH CAROLINA TO EAST FLORIDA)**

This region has five of the total 29 programs in the database and they comprise two large (#16, 17) and three medium (#14, 15, 18) programs.

**Program #14: Shuck and Share, Marine Discovery Center, Florida**

This program began in 2014 with a grant from the Indian River Lagoon National Estuary Program (IRLNEP). The Shuck and Share program was developed to provide shell for the Marine Discovery

Center restoration projects. The Marine Discovery Center is funded primarily through the IRLNEP, with additional revenues from other grants. These funds also support the shell recycling program. The Shuck and Share program is coordinated by Marine Discovery Center staff but the program is supported primarily by volunteers. The program currently has 74 participating restaurants across eleven counties and had collected 926,600 pounds of shell by mid-July 2023. The Shuck and Share 'brand' has been adopted by other recycling programs on the east coast of Florida (project #15 and 16). While they share the same name and structure, the programs operate independently.

**Program #15: Florida Oceanographic Society Shell Recycling Program, Florida Oceanographic Oyster Restoration, Florida.**

This program began in 2010 and is part of the Florida Oceanographic Oyster Restoration (FLOOR) and is also a member of the large 'Shuck and Share' partnership, where multiple programs use the same name and logo, but operate independently. Funding for the program comes through the parent Florida Oceanographic Society, which generates \$3.5-\$4.5 million per year from grants and private donations, as well as Oyster Garden revenues. Paid staff include a research associate to coordinate the program and a technician for shell collection, but the program relies on volunteers. The shell recycling was established to provide project restoration materials and is a medium-sized operation, collecting approximately 5,000 pounds/month (~60,000 annually). Restaurants are provided with 2-12 buckets per month, depending on their needs; these are collected/exchanged weekly and taken for drying on wooden tables. After 1-2 months, volunteers bag the shell and when needed for restoration they load and deploy the bags as instructed. **Note:** the FLOOR webpage says the program is not currently collecting shells from partner restaurants.

**Program #16: Restore Our Shores/Shuck and Share, Brevard Zoo, Florida**

The Restore Our Shores (ROS) program was initiated by Brevard Zoo in 2010 and the shell recycling component of the project is a Shuck and Share partner. Funding for the ROS program comes from federal, local and non-profit grants, corporate sponsors and in-kind contributions from local businesses. Shells are obtained from 20 restaurants and at least one shellfish processor. Shells are collected by staff and volunteers and taken to the curing site at Brevard Zoo and are then used for ROS living shorelines, oyster mats and oyster gardening projects. According to their website, the program has collected 8 million pounds of shell to date.

**Program #17: South Carolina Oyster Shell Recycling Program, South Carolina Department of Natural Resources, South Carolina.**

The Oyster Shell Recycling Program is part of the South Carolina Oyster Restoration and Enhancement (SCORE) program, which was initiated in 2001 by the South Carolina Department of Natural Resources (SCDNR). The program receives state funding and is coordinated by a team of staff from the Department of Natural Resources with significant help from volunteers. The program began with public recycling stations, now in 31 locations across 11 counties, and the containers are periodically collected by SCDNR staff and taken to curing sites. The SCDNR shell recycling website lists > 80 restaurants and caterers that are participating in the program. The shells are quarantined for 6 months before being used in restoration, either by SCDNR staff using barges, or by local citizen groups who place them by hand on intertidal reefs. Most of the collected shell goes to state and public shellfish grounds but living shoreline projects are also undertaken.

**Program #18: Oyster Shell Recycling, North Carolina Coastal Federation, North Carolina.**

The North Carolina Department of Marine Fisheries ran a public shell recycling program from 2013-2018 to collect shells for restoration. When this program ended the North Carolina Coastal Federation (NCCF), a non-profit organization, initiated the Oyster Shell Recycling program to provide shells for restoration projects. There are two components to this program; Restaurants to Reefs, which collects shells from seven restaurants and takes them to a curing site, and Recycle for Reefs, which manages 24 public shell recycling locations in seven counties, in addition to three NCCF regional offices. Funding for the program comes primarily from donations, which generates revenues ~\$6-9.5 million annually. The program personnel are paid staff, volunteers and students. Since NCCF took over in 2018, the Oyster Shell Recycling program has collected 546,319 pounds of shell, which is an average of 109,264 pounds per year.

**GULF OF MEXICO (WEST FLORIDA TO TEXAS)**

This region has ten of the total 29 programs in the database and they comprise six large (#19, 24-28), two medium (#21, 23) and two small (#20, 22) programs.

**Program #19: Alabama Coastal Foundation Oyster Shell Recycling Program, Alabama Coastal Foundation, Alabama**

This program began in 2016 with a two-year grant from the National Fish and Wildlife Foundation (\$243,079). Subsequent funding came from donations, non-profits, and other sources, generating annual revenues of ~ \$500,000. The program is staffed by Alabama Coastal Foundation personnel, but shell collections are outsourced to a contractor. Phase I of the recycling program included restaurants from a limited area; Phase II expanded the operational area and shell recycling is now available to all restaurants along coastal Alabama. To date, the program has collected 5.13 million pounds of shell, which are collected from restaurants three times per week by a contractor, who takes them to the storage facility to cure for six months before being used for restoration. The ACF has an advisory committee that assess when and where to use the shells.

**Program #20: Offer Your Shell To Enhance Restoration (OYSTER), Keep Pensacola Beautiful, Florida**

Keep Pensacola Beautiful (KPB) received non-profit grant funding to initiate the OYSTER program in collaboration with the Northwest Florida Aquatic Preserves Program. The level of funding is unknown. The recycled shells were collected from area restaurants by KPB staff and volunteers and taken to unoccupied parking lots in Warrington where they were left to weather for several months. Shells were collected for use in the KPB restoration efforts, which included 45 reefs in shallow water for shoreline erosion prevention, and to facilitate development of oyster habitat. Program personnel were KPB staff and the Conservation Corps of the Emerald Coast.

**Program #21: Offer Your Shell To Enhance Restoration (OYSTER), Conservation Corps of the Forgotten Coast and Apalachicola National Estuarine Research Reserve, Florida**

This medium-sized recycling program began in 2020 with funding from the Northwest Florida Water Management District and The Nature Conservancy's GulfCorps Program (OysterCorps). Top shells removed during shucking are collected twice per week from participating restaurants

by Oyster Corps members and taken to curing facilities, which are provided free of charge by the City of Apalachicola. The program began with nine restaurants, but the number fluctuates depending on funding. To date, ~ 260,000 pounds (annual average of 65,000) of shell have been collected and are being used for living shorelines projects, one of which is adjacent to the Apalachicola National Estuarine Research Reserve.

**Program #22: Community Oyster Reef Enhancement (CORE) Program, Tampa Bay Watch, Florida.**

The CORE program has three components, creating shell bags for oyster habitat restoration, oyster gardening and reefball deployment. The new shell recycling program was established in 2022 to supply shells for the CORE program, with an initial \$50,000 and subsequent \$84,000 from a corporate sponsor (Duke Energy). The parent organization, Tampa Bay Watch, receives \$6-7 million per year from grants and donations but the allocation, if any, to the recycling program is unclear. The CORE program has paid staff and volunteers that carry out the recycling and restoration objectives. Buckets are provided to their seven participating restaurants, collected 2-3 times per week and cured for three months before being used for living shoreline or oyster gardening projects. To date the program has recycled 80,000 pounds of shell and installed miles of living shorelines through multiple projects.

**Program #23: Gulf Coast Oyster Recycling and Renewal: ‘Shuck ‘N’ Save’, START Partnership, Florida**

The shell recycling program was initiated in 2017 by the START partnership, which includes Chiles Hospitality, Manatee County Department of Natural Resources, Gulf Shellfish Institute and University of Florida. The overarching goal of the START group is to enhance oyster populations to remove excess nutrients flowing into the Gulf of Mexico and exacerbating red tides. The shell recycling program was established to provide material for these projects. Funding came from the Tampa Bay Estuary Program (\$5,000) and Chiles Hospitality personnel and volunteers initially helped with shell collection. As the program expanded, they contracted WastePro USA to collect the shells and transport them to a county storage area to cure. The program currently has 8 participating restaurants and collects ~ 80,000 pounds of shell per year. With a recent grant from Florida Department of Environmental Protection (\$950,000), Manatee County will take over the recycling and restoration program.

**Program #24: Offer Your Shell To Enhance Restoration (OYSTER), Choctawhatchee Basin Alliance, Florida**

The OYSTER program was launched in 2010 by the Choctawhatchee Basin Alliance (CBA), which is a non-profit organization under the Northwest Florida State College Foundation, in collaboration with the AmeriCorps Green Team. The program goal was to recycle shells from restaurants for use in living shorelines projects. Program funding comes from grants and donations (including individual and corporate sponsorship) and membership dues. The collection truck and trailer were obtained through an ‘Impact 100 Northwest Florida’ grant. The CBA staff provide participating restaurants with 32-gallon recycling bins, collect them 2-3 times per week and take them to a curing location where they remain for 6 months before being used in restoration. The program also recruits volunteers to supplement staff time. In 2018, the program was recycling over

60,000 pounds of shell per year<sup>8</sup> and places them in cement-reinforced jute bags or prisms for shoreline restoration. To date, the CBA has restored > 0.78 miles (1.25 km) of shoreline, which is monitored by CBA staff.

#### **Program #25: Save Our Shells (SOS), The Nature Conservancy, Mississippi**

This program was funded in 2020 through a RESTORE Act grant (\$649,772) to the Mississippi Department of Environmental Quality (MDEQ), who contracted The Nature Conservancy to manage the program. The funding was for planning and implementation of a shell recycling program. The first phase was spent in planning the program and has been completed. The pilot recycling program was launched in 2023 and is in the start-up phase of recruiting restaurants. This program is classified as large because its target is \$1.62 million pounds per year; however, the target has not yet been realized. The shell will be collected by contractors who will transport the material to a curing facility. The shells will be used by the Mississippi Department of Marine Resources (MDMR) to restore/replenish and monitor oyster reefs in the State.

#### **Program #26: Oyster Shell Recycling Program, Coalition to Restore Coastal Louisiana, Louisiana.**

The Coalition to Restore Coastal Louisiana (CRCL) Oyster Shell Recycling Program began in 2014 with a million dollar grant from Shell PLC, and this funding enables the program to hire contractors to collect the shell five days per week and transport the shell to a curing facility on state property where they remain for at least 6 months. They also manage three public shell recycling stations in New Orleans. The program personnel include paid CRCL staff and volunteers. The collection was initially free for the ~ 25 participating restaurants, however, when funding became limited, the program charged the restaurants \$100 fee per 32-gallon bin, to cover the cost of the shell collection contract (Leija et al. 2022). In 2023, the Governor of Louisiana signed legislation (HB255) allowing restaurants to claim tax credit for recycling their shell (\$1.00 per 50 pounds of shell up to 2,000 pounds annually). This will partially offset the cost of recycling for the restaurants and potentially increase participation. The law comes into effect in January 2024. By the end of 2022, the program had collected ~13 million pounds of shell, which represents approximately 1.4 million pounds per year<sup>9</sup>. The shell is used by CRCL to build living shorelines.

#### **Program #27: Oyster Shell Recycling Program, Galveston Bay Foundation, Texas**

This program began in 2011 as a pilot project in collaboration with Mr. Tom Tollett, the owner of 'Tommy's Restaurant and Oyster Bar' (Leija et al 2022) The program is funded by NOAA through the Texas General Land Office, with additional revenues from corporate sponsors and non-profit donors. The program has a paid director and two assistants who manage and coordinate collections, and volunteers to assist with shell curing. The program collects 32-gallon bins of shell three days each week and replaces them with empty bins. The frequency of visits depends on the weekly volume of shell generated by each restaurant. The program has four shell storage sites, where the shells are piled and turned to cure for at least six months (stipulated by Texas Parks and Wildlife Department) before deployment. The service is free to the restaurants but the savings in waste disposal are not significant in most cases and additional incentives ('eco-friendly' public

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<sup>8</sup> <https://southwalton.lifemediagrps.com/choctawatchee-basin-alliance/>

<sup>9</sup> Louisiana Department of Wildlife and Fisheries Oyster Shell Disposition Survey 2021, P8



perception, minor tax credits) help maintain restaurant participation. The program has expanded steadily since its inception with significant funding and a well-organized structure and strategic plan (Leija et al 2022). The program currently has 37 participating restaurants and has recycled over two million pounds of shell since its inception in 2011. This material has been deployed by paid contractors to reconstruct severely depleted oyster reefs in Galveston Bay and to build 20 miles of living shoreline using volunteers. The shells have also been used for the GBF oyster gardening projects, where shells are tended by waterfront homeowners until spat are large enough to be deployed on the subtidal reefs.

### **Program #28: Sink your Shucks, Harte Research Institute, Texas**

Sink your Shucks began in 2009 and was the first shell recycling program in Texas. It was founded by the Harte Research Institute (HRI) and is run by the HRI Coastal Conservation and Restoration Group, with assistance from the Texas Surf Conservancy. Funding comes from the Texas General Land Office Coastal Management Program, non-profits and corporate sponsors, and the program costs \$80,000-\$100,000 per year to run. The program is operated by staff, volunteers and students from HRI who collect shells from participating restaurants. The shell is taken to a quarantine site owned by the Port of Corpus Christi, where it stays for six months before being used for restoration. To date the program has collected over three million pounds of shell from local restaurants, two million of which have been used to restore over 45 acres of oyster habitat.

### **WEST COAST (WASHINGTON STATE-CALIFORNIA)**

This region has only one small program (#29) of the total 29 programs in the database.

### **Program #29: Wild Oyster Project, Earth Island Institute, California**

This program began in 2018 and is part of the Earth Island Institute (EII) Wild Oyster Project, which is working to restore wild oysters to San Francisco Bay. The EII receives \$20,000-30,000 per year in grants, donations and other income, but it is unclear how much of this is used to fund the recycling program. Seven paid staff work for EII and they depend on volunteers and students for help with their projects. The Wild Oyster Project website is seeking restaurants to recycle oyster shells and is requesting land donation for shell curing. This is a small program that collects about 10,000 pounds of shell per year from five participating restaurants and special events (as of 2021). In 2022, the Wild Oyster Project used 2,000 pounds of shell for a shoreline stabilization project.

## **SUMMARY OF EXISTING PROGRAMS**

Many oyster habitats, from Maine throughout the eastern seaboard and across the Gulf of Mexico, are in a degraded condition and require significant restoration. Although alternative materials have been used, natural shell is still the preferred cultch material, and demand far exceeds supply. The supply limitation is caused in part by changes in the oyster market, which has shifted away from shucked meat to whole oysters. The oyster shells no longer remain at the processing plants where they are readily accessible but are broadly distributed to restaurants and retailers. The shells are usually discarded as trash after the oysters are consumed and this valuable resource is lost. The majority of shell recycling programs reviewed in this summary (17 of 29) are run by non-profit organizations, others (7 of 29) are government programs, and the remainder (5 of 29) are run by

businesses or academic institutions. Despite their differences in operational structure, capacity and funding source, these programs all have the same purpose; to provide shell for habitat restoration and/or re-shelling of harvest areas.

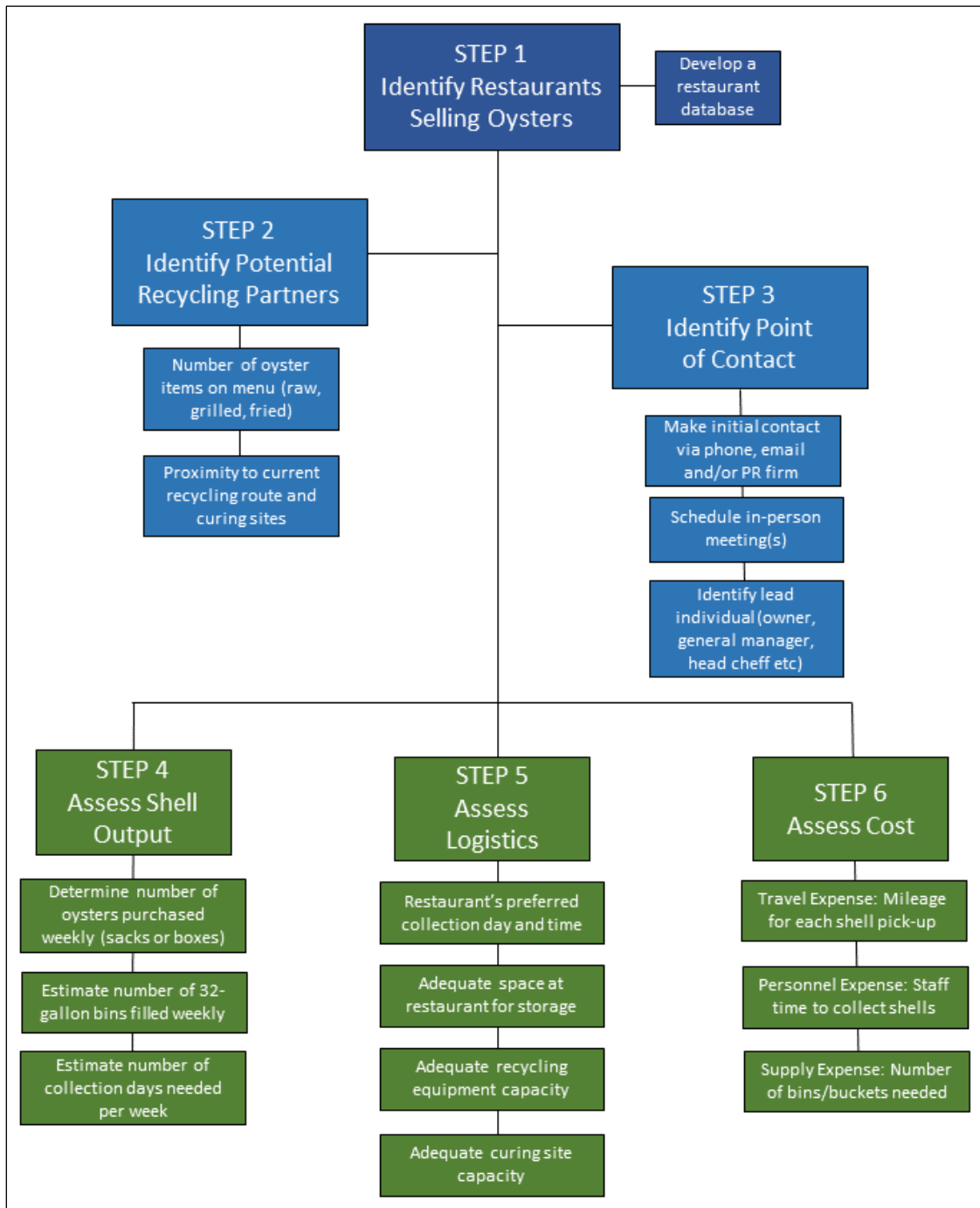
The primary components of a recycling program are logistics (staff, collection and transport vehicles, storage areas), shell sources (restaurants, events, shellfish processors) and funding (government, grants, sponsors, donors). A consistent funding source provides program stability and the capacity to hire staff, contract outside vendors or purchase vehicles for shell collection, and lease storage facilities if necessary. Program stability and longevity also enhances name recognition, increasing outreach opportunities and the program's ability to obtain additional funding and recruit volunteers. With few exceptions, securing funding is an ongoing challenge and most programs have multiple sources of income.

The primary logistical considerations are program staffing and collection, transport, and storage of shell. Most programs have some level of paid staff, which provide a more consistent source of trained personnel than volunteers. This ranges from a skeleton crew that coordinates or collects shell to administrative, technical and outreach personnel in the larger programs. Internal shell collection can range from staff or volunteers driving basic trucks and trailers and hand-loading the materials, to larger more expensive dump trailers that have greater capacity and require less labor. External contracted shell collections are more convenient, use less staff time and avoid vehicle maintenance costs; however, these are more expensive than the internal options unless there are in-kind agreements with waste hauling companies. These choices are generally driven by the threshold cost and convenience of individual programs. Shell storage space is often donated by municipalities, or corporations. Storage/curing sites are often municipal recycling centers, or public locations that are provided in partnership with the program. Other sites include property owned by corporate sponsors (e.g., Brevard Zoo, #16), or land that is donated for use by the entity that owns it. The cost of storage sites was not raised as an issue during the program review.

Every active program in the database for this report collects shells entirely or in part from restaurants, so recruitment and retention of participating restaurants is key to a successful recycling program. This component is arguably more challenging than obtaining funding as it requires commitment to the program in staff time, training and storage space by the restaurants. Recycling shells may reduce their waste fees or provide tax credits, but these financial returns are small and may be completely negated if program fees are charged. The retention of a restaurant partner requires the commitment of management and/or senior kitchen staff to ensure compliance with the recycling requirements, and commitment to the program regardless of financial benefits. Incentives to remain in the program come primarily from various forms of beneficial advertising, outreach, or public relations.

The Galveston Bay Foundation identified three elements of restaurant participation: selection, retention, and incentives. They generated a flow chart of selection criteria (Fig. 5) that allows them to target restaurants that are most likely to be practical sustainable partners and generate enough shell to justify program costs. Some programs obtain shells from seafood processors, but this is generally purchased rather than donated. Some states (e.g., Texas) require shucking houses to return a percentage of the shell to the resource (or a fee equivalent), but even if this is not the case, shell is a valuable commodity and can be sold for landscaping, driveways, chicken feed, etc., which generates more income to the businesses than recycling for restoration.

Those projects with significant consistent funding, such as the Oyster Recovery Partnership (#1) which is an extensive long running program that receives \$6-\$8 million in revenues per year, primarily from federal grants, the Billion Oyster Project (#2), which has consistent corporate



**Figure 5.** Flowchart showing restaurant selection criteria developed by the Galveston Bay Foundation shell recycling program (#27). Figure reproduced from the Galveston Bay Foundation Oyster Shell Recycling Program Strategic Development Plan 2020-2022 (Leija et al 2022).

sponsorship of \$180,000 per year plus other funding, or the SCORE shell recycling program (#17) that is supported by the South Carolina Department of Natural Resources through revenue from Recreational Saltwater Fishing Licenses. In some cases, the programs were initiated by a large

grant or donation; for example, the Gulf Coast Oyster Recycling and Renewal (GCORR, #23) program received \$955,000 from Florida Department of Environmental Protection, or the Coalition to Restore Coastal Louisiana (CRCL, #26), which received \$1,000,000 from Shell to start their oyster shell recycling program. While funding is essential and the larger programs tend to have more income, there are small programs that do not appear to be funding limited. For example, the Seatuck Environmental Association receives over half a million dollars per year, but its recycling program (Half Shells for Habitat, #12) is small (~50,000 pounds per year) and is primarily staffed by volunteers. This may be a choice by the parent organization of where to invest its funding, so the capacity of a program may not necessarily be dictated by funding level.

### CONSERVATION AQUACULTURE

With one exception, the recycling programs in the database accompanying this report recover shells from restaurants. This is the primary source of shell along with public recycling stations and events. However, the rapidly expanding shellfish aquaculture industry is an additional, currently unexploited source of this valuable commodity. Oyster farmers frequently have marginal crop losses and occasionally larger mortality events. The resulting dead oysters are usually dumped, with no benefit to the farmers or the wild oyster habitats. Farmed oysters attract wild spat, which are discarded along with the empty shells and live oysters are culled to generate uniform sizes for market. These byproducts (shell/wild spat/live oysters) could potentially be used for habitat restoration and would have benefits over recycled shells. For example, they could be used directly if restoration is in the same water body as the farm location, and byproducts are often already 'seeded' with wild spat which would be returned to the resource. It may also be more economically viable to pay the farmers for their byproducts rather than collect, clean, cure and transport consumer shell. This would also provide the farmers with an incentive to contribute their byproducts rather than discard them.

In 2020, The Pew Charitable Trusts (Pew) and The Nature Conservancy (TNC) launched the Supporting Oyster Aquaculture and Restoration (SOAR) program to support a resilient oyster industry during the COVID-19 pandemic and leverage aquaculture for direct oyster reef restoration. In 2023, SOAR was expanded with new funding and a new focus on underserved communities. SOAR now has three components: 1) oyster purchase program; 2) shellfish growers resiliency fund; and 3) diversity, equity, inclusion, and justice initiative. To date, SOAR has directly purchased over 3.5 million oysters that were used to restore 40 acres across 25 sites. The rapidly expanding oyster aquaculture industry can meet the market demand for oysters without further depleting wild stocks and provides some of the same ecosystem services as natural reefs. Programs like SOAR can simultaneously advance ecosystem health, a resilient aquaculture industry, and equity for shellfish growers. And while the economic impact the pandemic had on oyster farms has largely abated, the success of SOAR's approach is demonstrating how programs like SOAR can significantly benefit communities and the coastal ecosystems on which they depend, opening the door to the wider potential use of farm byproducts for restoration.

### ESTABLISHING A RECYCLING PROGRAM FOR APALACHICOLA BAY

The Galveston Bay Foundation (GBF) created a Strategic Development Plan (Leija et al 2022) for their shell recycling program (#27), which is available through the program contact. The following sections of this report address the need to layout program goals and the four components that are

identified as ‘limiting factors’ in the GBF program analysis: funding, capacity, shell sources, and use of recycled shell. This section then discusses how these components might be addressed for Apalachicola Bay and concludes with a list of potential options for expanding the existing small-scale program (#21), drawing from observations gleaned from the review of other programs, but recognizing the need for a more comprehensive evaluation of potential alternatives.

## **Program Goals**

The goal of the Apalachicola Bay shell recycling program would be to divert shell from the waste stream and use the shell to augment ongoing restoration, and ultimately to support a re-shelling program for harvest management. The target annual amount of shell recycled would be limited by program capacity rather than demand for material.

In 2019, the FWC received ~ \$20 million in funding from the National Fish and Wildlife Foundation<sup>10</sup> primarily for research and restoration of oyster reefs in Apalachicola Bay, and in 2023 they received an additional \$10 million from the Florida Governors Budget. In the Spring of 2024, the FWC are planning a pilot oyster reef restoration project (~90 acres) using limestone. The objective of this project is to re-build reef structure to create a stable platform for oyster recruitment and as a proof of concept for the larger subsequent restoration under the same funding. These restoration reefs may benefit from augmentation with bare shell and/or spat-on-shell to ‘kick start’ oyster recruitment and population recovery. Shell demand for this approach could be significant. For example, to place 1 inch (2.5 cm) of shell over 90 acres of restored reef would require over 8,000 tons (16 million pounds) of shell.

Management of wild oyster fisheries have traditionally included a reef re-shelling component where shell is returned to the system to replace losses due to harvest. The Apalachicola Bay wild oyster harvest was closed by FWC in December 2020 for five years to allow oyster populations to recover<sup>11</sup>. If harvest re-opened on schedule (January 2026), shell would potentially be needed for an (ideally) ongoing replenishment program. The scale of the fishery would determine the quantity needed for re-shelling.

The quantity of shell needed for these applications far exceeds the capacity of the current program (#21), which recycles ~80,000 pounds/year. To meet potential shell demand, the program would need to expand significantly and/or shell must be obtained from other sources. An analysis of shell supply vs demand will help develop programmatic goals and strategies that ensure sufficient cultching material is available to meet future needs, on an appropriate timeline.

## **SHELL RECYCLING PROGRAM LIMITING FACTORS**

### **Funding**

While some funding streams are more consistent than others, none are guaranteed in perpetuity. Government funding is subject to policy and priority shifts as shown in Connecticut (#6) where the Department of Agriculture re-shelling program ran for decades before the funding was removed from the state budget. Corporate sponsor and non-profit priorities can change, and private donation sources can be inconsistent. The ideal funding scenario would be sufficient recurring funding to cover operational budgets, and an additional portfolio of funders to expand or

<sup>10</sup> <https://www.nfwf.org/sites/default/files/2020-04/fl-apalachicola-bay-oysters-ii-19.pdf>

<sup>11</sup> <https://myfwc.com/fishing/saltwater/commercial/oysters/>

enhance program objectives. A diverse portfolio provides program flexibility and security, and some alternatives for an Apalachicola shell recycling program are listed below:

**Florida State funding:** Until 2013, the Florida Department of Agriculture and Consumer Services (FDACS) operated an oyster reef re-shelling program under Florida statute (FS 597-010-21). This stipulates that 50% of clam and oyster shells from commercial shucking houses were the property of FDACS and could be requested as needed for re-shelling or planting. In 2013, the budget for the program was eliminated from the Florida State budget and FDACS no longer owns the planting equipment (trucks, barges, etc.; P. Sapp, FDACS, pers.comm.). The FWC is responsible for management of the Florida oyster fishery<sup>12</sup> and FDACS is responsible for aquaculture leasing and monitoring water quality associated with harvesting areas<sup>13</sup>. While there is no funding for the re-shelling program, the language remains in the statute, so it is theoretically possible to reinstate a shell reclamation policy if the State Legislature were to approve the funding. However, due to changes in the oyster consumer market and reduced oyster harvest, most of the shucking houses in Apalachicola are closed. Although three seafood retailers still sell oyster meat and retain the shells, reinstating a shell reclamation program may not be produce sufficient material to meet re-shelling needs. Whether this is a viable cost-effective option should be assessed.

**Government grants:** Deepwater Horizon (DWH) Settlement funds have been awarded for shell recycling programs in the Gulf of Mexico. These can be multi-year awards with significant funding (e.g., program #25 in Mississippi). The U.S. Bipartisan Infrastructure Law contains large allocation of funds for coastal restoration and is administered as grants through NOAA. These are a potential source of significant multi-year funding that can be used to initiate a program. Other federal opportunities are available through the Federal grants website<sup>14</sup>. Florida State funding is potentially available directly or indirectly through a state agency if approved by the Legislature but are generally for only one fiscal year.

**Non-profits:** Foundations and other non-governmental organizations frequently provide grant funding opportunities or make donations. These may be generous but are not generally recurring.

**Corporate sponsors:** Business can provide consistent and significant funding, as the program database shows. Sponsorship on the scale of Shell or MGM may not exist in this region but support on a smaller scale is worth exploring, especially in the state capital of Tallahassee. Businesses may sponsor a fundraiser or festival that provides funds and oyster shells.

**Private donors:** For some programs, private donors are the primary source of income, but it takes considerable staff time to cultivate a sufficient fundraising base to support a program. Donors could be solicited from wealthier parts of Franklin County such as St George Island or St. Teresa, or from Tallahassee but the local area has a comparatively small wealth base. Larger population centers in the Panhandle such as Panama City, Destin and Pensacola are a source of potential donors, but would require significant effort to identify and cultivate, particularly since there are oyster restoration efforts in estuaries near those centers.

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<sup>12</sup> <https://myfwc.com/fishing/saltwater/recreational/shellfish/>

<sup>13</sup> <https://www.fdacs.gov/Agriculture-Industry/Aquaculture/Shellfish-Harvesting-Area-and-Aquaculture-Lease-Map>

<sup>14</sup> <https://www.grants.gov/>



***Partner in-kind contributions:*** These can include free or reduced cost shell transport by waste management agencies. This is not uncommon and confers considerable operational cost savings. This area is home to the recycling company, MARPAN Recycling and WastePro waste management, both of whom could be potential partners. Other partners could provide access to curing and storage space, provision of recycling bins, staff time etc. University partners (Florida State University, Florida Agricultural and Mechanical University, Tallahassee Community College’s Wakulla Environmental Institute) could provide student volunteers and grant-writing expertise. These are a few examples, but partners, like donors, need to be cultivated and incentivized.

## **Program Capacity**

Program capacity is a moving target as programs can expand or shrink with resource availability but understanding the limits of program capability is critical for defining goals and strategies during program planning. Personnel source is an important consideration is personnel; many programs rely heavily on volunteers that have to be recruited, trained and managed, all of which take staff time from the program. Paid staff provide a more constant supply of trained personnel but are more expensive. Equipment access can determine shell collection capacity, so a cost-benefit analysis should be completed to decide whether to invest in infrastructure purchase and maintenance, hire contractors or rely on more personnel hours to accomplish program tasks.

There is currently a small shell recycling program in Apalachicola (#21) run by the Conservation Corps of the Forgotten Coast and the Apalachicola National Estuarine Research Reserve. With additional resources, this program could provide the foundation for a strategic expansion to include more shell sources (additional restaurants, public recycling locations, oyster farmers, events) and an outreach program to recruit and incentivize partners and donors.

## **Shell Sources**

Primary sources for most shell recycling programs are restaurants, but these should be recruited strategically to balance the benefits of shell quantity with the cost of collecting the material (see fig. 5). The Apalachicola Bay recycling program: Offer Your Shell To Enhance Restoration (OYSTER, #21) was initiated in 2020 and is funded by the Northwest Florida Water Management District and The Nature Conservancy’s Gulf Corps program. This is a medium-sized program (~80,000 pounds of shell per year) and is staffed by Oyster Corps personnel who collect 5-gallon buckets of shell twice a week from participating restaurants. This program could potentially be expanded with additional funding and would benefit from a strategic plan to recruit and incentivize additional restaurants, seafood dealers and oyster farmers to recycle their shell and farm byproducts. Other programs have installed public drop-off/recycling locations and placed temporary bins at festivals where oysters are consumed. Recycling centers could be initiated at central locations in Franklin County (e.g., Apalachicola, St. George Island, Carrabelle, Alligator Harbor) and surrounding counties, potentially in collaboration with waste management and commercial recycling entities. Recycling bins could be deployed at community events such as the Apalachicola Seafood Festival and the numerous other public events that occur in the local area.

With the rapid expansion of oyster farming in Franklin County and adjacent Wakulla County, using oyster farm byproducts is a promising source of cultch material that has several ecological and economic benefits over cured shell. For example, farmed oysters often have wild spat settled on the shells, and if used for restoration in the same water body as the source, they can

be deployed directly without curing, thereby immediately enhancing oyster populations. The Florida State University Coastal and Marine Lab has placed shell recycling bins near the Alligator Harbor boat launch, close to the oyster leases, with minimal success. Given the non-traditional nature of this shell source significant outreach will be required to engage the farmers, and ultimately for this approach to succeed the farmers would probably have to be reimbursed for their material and time. A cost per unit comparison of cured shell and farmed byproducts would be an important part of the program planning that incorporates this cultch source.

### **Use of Recycled Shells**

Traditional re-shelling programs were usually managed by the state or fishery management agency. Although some closed areas were shelled to preserve broodstock reefs, the main objective of re-shelling was replenishment of public reefs for harvest. Of the 29 shell recycling programs in the database, nine were supported (entirely or partially) directly by government entities, (#2, 5, 6, 7, 8, 9, 17, 21, 28); of these only three (#6, 8, 17) stipulated that shells were used, at least in part, to replenish public harvest areas. The remaining 26 programs did not specify whether the shells would be deployed in harvestable areas; most referred to habitat restoration or living shorelines projects rather than for fishery management. It is important to define the purpose of the recycled shells as this will influence how the program is funded and operated. The oyster habitats in Apalachicola Bay are severely depleted (e.g. Pine et al 2015) and the wild oyster harvest was closed for five years to allow populations to recover. If/when the fishery opens again, re-shelling will be imperative to replace harvested material and significant additional funds will be required to maintain a program that collects sufficient shells for management purposes. The shells recycled by the OYSTER program (#21) are currently only used for living shoreline projects, which are not harvested. If a larger effort were to be established, the goals would need to be clearly defined to identify funding sources to support fishery management as well as habitat restoration.

### **RECOMMENDATIONS FOR APALACHICOLA BAY SHELL RECYCLING**

1. Obtain significant and/or consistent funding to expand the capacity of the current OYSTER (#21) program or establish a new program. Additional funding would increase personnel, purchase more/better equipment, establish and manage public shell recycling centers and deploy shell recycling bins at public events. Funding could also support a spat-on-shell program using recycled shells. Recycling for restoration could come from a variety of sources, but a re-shelling program for public reefs should be supported by recurring funds from the Florida State budget.
2. Recruit an outreach coordinator and develop an education/outreach program to recruit and incentivize more restaurants to join the program, educate the public on the importance of shell recycling and solicit private donations and corporate sponsors.
3. Coordinate with FDACS to retain aquaculture byproducts from oyster farmers for re-shelling and restoration. A purchasing program for farmed oyster byproducts will probably be needed to engage and retain oyster farmers.
4. Work with legislators and relevant management agencies to develop regulations that apply a retention requirement on commercial processors and/or tax incentives for restaurants to recover a portion of shell sold. Prohibiting the use of shell for landscaping has been implemented in

some states, which potentially increases the amount of shell available for oyster resource management.

### STATE LEGISLATURE RELEVANT TO SHELL RECYCLING

The following are a list of regulations within each state's legislature that are pertinent to the retention of shell. These regulations can stipulate the disposition of shell, assign tax credits or other benefits associated with retaining shell for restoration or assign 'harvest taxes' on commercial fishers to offset the cost of re-shelling.

#### **New York State**

New York City has a pay by pound incentive for reducing commercial trash, which includes oyster shells. A legislative bill (A.00092<sup>15</sup>) that would give tax credits for restaurants that donate their shell is currently in the Ways and Means Committee (April 2023).

#### **Maryland**

Maryland House Bill 184: The State has had a shell recycling tax credit set at \$1/bushel up to \$750 since 2013. In 2022, House Bill 184 was replaced with House Bill 1228, which increased the tax credit to \$5/bushel to a maximum of \$1,500/year, and implemented a state grant program to facilitate recycling, restoration and repletion of oyster habitats in Maryland.<sup>16</sup>

Md. Code Regs. 08.02.04.11.C(1) *'A person who catches oysters shall cull the oysters on the natural bar from which they were caught and return every shell to the bar. Any oysters whose shell measures less than 3 inches in length, from hinge to bill, shall be included in the culling and replaced upon the bar from which caught'*

#### **Connecticut**

General Statute 25-237 established a state funded re-shelling program to purchase shells for replenishing public seed oyster beds. The program is currently unfunded.

#### **North Carolina**

According to the NC Department of Environmental Quality, oyster shells are not allowed to be disposed in landfills or be used as groundcover by landscape contractors<sup>17</sup>. This leaves few options for sale of shucked shells and therefore possibly greater incentive to recycle. If similar legislation were introduced in Florida, it would prevent seafood processors from selling their shucked shells as landscaping etc., which currently occurs. This could provide a much greater volume of shell, in one location, that could be collected easily and inexpensively for the recycling program. There are three seafood processors in Apalachicola that sell shucked oyster meat. It is probably unlikely that the Florida Legislature would create a law for such a small benefit, unless this is an issue that could benefit a significant number of counties.

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<sup>15</sup> Bill incorrectly cited as "Bill A.258" on Billion Oyster Project website

<sup>16</sup> <https://legiscan.com/MD/text/HB1228/2022>

<sup>17</sup> <https://www.deq.nc.gov/about/divisions/environmental-assistance-and-customer-service/recycling/general-recycling-information/special-recyclables/oyster-shells#:~:text=Oyster%20shells%20are%20banned%20from,to%20build%20new%20oyster%20reefs>

## South Carolina

Aquaculture permit holders are required to replant 50 bushels of shell per acre each year. They can receive credits depending on whether they plant on lease or state grounds. The South Carolina shell recycling program is funded with revenue from the recreational saltwater fishing licenses.

## Florida

Florida statute FS 597-010-21<sup>18</sup> stipulates that, “...*except for oysters used directly in the half-shell trade, 50% of all shells from oysters and clams shucked commercially shall remain the property of the FDACS when shells are needed and required for rehabilitation projects and planting operations, when there are sufficient resources for handling and planting the shells, and when the shells can be put to practical use.*” This policy hasn’t been implemented since around 2013 because the program funding was removed from the State budget. The reason cited (Portia Sapp pers. comm.) was the lack of sufficient quantities of available shell to support the program. This may have been due to reduction in demand for oyster meat and closure of commercial shucking houses, combined with reduced harvest that consequently reduced the shell available for the program.

## Louisiana

In June 2023, the Governor of Louisiana signed HB255 into law (Act 404), establishing a tax credit for Louisiana restaurants that recycle their shell for beneficial uses. The credit allows reduction in tax liability of \$1 per 50 pounds of shell recycled, to a maximum of \$2,000 per year. This law is expected to be implemented in January 2024.

## Texas

The Texas Parks and Wildlife Code, Chapter 76: Oysters, subchapter A: Public and Private Oyster Beds<sup>19</sup> contains the rules and regulations governing oyster management in Texas. Sections relevant to shell retention are as follows. The language has been abbreviated and paraphrased for brevity.

### **Section 76.020. Oyster shell recovery and replacement program (added in 2011 by SB932):**

(a) The commission may establish a program to require the recovery of oyster shell taken from state waters, and its replacement to maintain or enhance public oyster reefs. (b) The department may accept grants and donations from private or public sources to be applied to the oyster shell recovery and replacement program

**Section 76.021. Oyster shell recovery and replacement program account (added in 2011 by SB932):** The department shall collect a fee of 20 cents or an amount set by the commission, whichever is greater, from a licensed commercial oyster fisherman for each box of oysters harvested by the fisherman from the water of this state.

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<sup>18</sup>[http://www.leg.state.fl.us/statutes/index.cfm?App\\_mode=Display\\_Statute&URL=0500-0599/0597/Sections/0597.010.html](http://www.leg.state.fl.us/statutes/index.cfm?App_mode=Display_Statute&URL=0500-0599/0597/Sections/0597.010.html)

<sup>19</sup> <https://statutes.capitol.texas.gov/docs/PW/htm/PW.76.htm>

**Section 76.0205. Sustainability of the oyster industry (added in 2017 by Texas HB51).** Seafood dealers must (1) distribute oyster shells (or other approved cultch material) representing 30% of the total volume of purchased oysters for the previous year, in an area designated by the TDFW, or (2) pay a fee to the department, equivalent to the amount in 1). This fee shall be deposited in the oyster shell recovery and replacement program account

## **California**

Shells must be cured for two years before it can be utilized in restoration efforts.

## **REFERENCES AND USEFUL LINKS**

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Storymap of oyster management in Florida

<https://storymaps.arcgis.com/stories/1ae74bf238f3416ca259a17a1a45ee12>

No Shell Left Behind – Bringing Shell Recycling Back to Franklin County  
<https://marinelab.fsu.edu/absi/community-engagement/restoremgmt/shellrecycle/>

Chesapeake Bay Watershed Agreement  
<https://www.chesapeakebay.net/what/what-guides-us/watershed-agreement>

SOAR: Supporting Oyster Aquaculture and Restoration  
<https://www.nature.org/en-us/what-we-do/our-priorities/provide-food-and-water-sustainably/food-and-water-stories/oyster-covid-relief-restoration/>



**APPENDIX 1: SUMMARY OF OYSTER SHELL RECYCLING PROGRAMS**

<b>A Program</b>	<b>B Region</b>	<b>C State</b>	<b>D Water Body</b>	<b>E Program Name</b>	<b>F Program Initiation</b>	<b>G Program Status</b>	<b>H Funding Category</b>	<b>I Program Type</b>	<b>J Shell source</b>	<b>K Program size</b>	<b>L Personnel</b>	<b>M Monitoring</b>
<b>1</b>	NE	Maryland Washington DC Virginia	Chesapeake Bay	Shell Recycling Alliance	2014	Active	Grants Non-profit Donations Other	Shell recycling Restoration	Shellfish processors Restaurants Public recycling	Large	Paid staff	Yes
<b>2</b>	NE	New York	New York Bight Long Island Sound	Billion Oyster Project Shell Collection	2014	Active	Government Corporate Donations	Shell recycling Restoration	Restaurants Public recycling	Medium	Paid staff Volunteers	Program dependent
<b>3</b>	NE	Maryland Virginia	Chesapeake Bay	Save Oyster Shells	1966	Active	Grants Donations Other	Shell recycling Restoration	Restaurants Public Recycling Events	Medium	Paid staff Volunteers	Yes
<b>4</b>	NE	Massachusetts	Cape Cod Bay	Massachusetts Oyster Project	2021	Active	Grants Corporate Donations Other	Shell recycling Restoration	Restaurants	Small	Paid staff Volunteers	No
<b>5</b>	NE	Massachusetts	Nantucket Sound	Nantucket Oyster Recycling Program	2014	Active	Government	Shell recycling Restoration	Restaurants Public recycling Events	Small	Paid staff Volunteers	No
<b>6</b>	NE	Connecticut	Long Island Sound	The Cultch Program	1987	Inactive	Government	Shell recycling Restoration	Shellfish processors	Large	Volunteers	No
<b>7</b>	NE	Connecticut	Long Island Sound	Oyster Shell Recycling Program	2016	Active	Government	Shell Recycling Restoration	Restaurants Public recycling	Small	Paid staff Volunteers	Unknown
<b>8</b>	NE	Connecticut	Long Island Sound	Connecticut Shell Recycling	2023	Active	Government	Shell recycling	Restaurants	Small	Paid Staff	Unknown
<b>9</b>	NE	New Jersey	Mullica River	New Jersey Shell Recycling Program	2019	Active	Government Corporate Non-profit Other	Shell recycling Restoration	Restaurants Casino	Medium	Paid Staff	Yes
<b>10</b>	NE	Maryland	Chesapeake Bay	Oyster Shell Recycling	2018	Active	Corporate	Shell recycling	Restaurants Casino	Small	Partners	No
<b>11</b>	NE	Virginia	Chesapeake Bay	The Virginia Oyster Shell Recycling Program	2013	Active	Grant Donations	Shell recycling Restoration	Restaurants Public recycling	Medium	Paid Staff Volunteers Students	No
<b>12</b>	NE	New York	Great South Bay	Half Shells for Habitat (H4H)	2018	Active	Corporate Donations Other	Restoration	Restaurants Events	Small	Volunteers	No
<b>13</b>	NE	Massachusetts	Edgartown Great Pond	Marthas Vineyard Shellfish Group	2011	Active	Corporate Non-profits Donations Other	Shell Recycling Restoration	Restaurants Public recycling	Small	Paid Staff	Yes

14	SE	Florida	Indian River Lagoon	Shuck and Share	2014	Active	Grant	Shell recycling Restoration	Restaurants	Medium	Volunteers	No
15	SE	Florida	St. Lucie Estuary Indian River Lagoon	Florida Oceanographic Oyster Restoration (FLOOR) (Shuck and Share partner)	2010	Active	Grant Donations Other	Shell recycling Restoration	Restaurants	Medium	Paid staff Volunteers	Yes
16	SE	Florida	Indian River Lagoon	Restore Our Shores (Shuck and Share partner)	2010	Active	Grants Corporate Non-profit	Shell Recycling Restoration	Restaurants Shellfish processors	Large	Paid Staff Volunteers Students Partners	Yes
17	SE	South Carolina	Coastal South Carolina	SCORE - South Carolina Oyster Restoration and Enhancement	2001	Active	Government	Shell recycling Restoration	Restaurants Public recycling	Large	Paid staff Volunteers	Yes
18	SE	North Carolina	Coastal North Carolina	Restaurant to Reef Oyster Shell Recycling	2003	Active	Corporate Donations Other	Shell recycling Restoration	Restaurants Public recycling	Large	Paid Staff Volunteers Students	Yes
19	GoM	Alabama	Gulf of Mexico	ACF Oyster Shell Recycling Program	2016	Active	Grant Non-profit Donations Other	Shell recycling Restoration	Restaurants Public recycling	Large	Paid staff Contractors	Yes
20	GoM	Florida	Escambia Bay	OYSTER (Offer Your Shell To Enhance Restoration)	2011	Inactive	Non-profit	Shell recycling Restoration	Restaurants	Small	Paid Staff Volunteers Others	No
21	GoM	Florida	Apalachicola Bay	Save Our Shell OYSTER Shell Recycling Program	2020	Active	Government Non-profit	Shell recycling Restoration Erosion Prevention	Restaurants	Small	Others	No
22	GoM	Florida	Tampa Bay	Community Oyster Reef Enhancement Program (CORE)	2022	Active	Grants Corporate Donations Other	Shell recycling Restoration	Restaurants	Small	Paid staff Volunteers	Yes
23	GoM	Florida	Robinson and Perico Preserves Manatee River	Gulf Coast Oyster Recycling and Renewal (GCORR) Shuck 'N Save	2017	Active	Grant Non-profit Other	Shell recycling Water Quality Enhancement	Restaurants	Small	Volunteers Partners	Yes
24	GoM	Florida	Choctawhatchee Bay	Offer Your Shell to Enhance Restoration (OYSTER)	2010	Active	Grant Corporate Donations Other	Erosion Prevention	Restaurants	Large	Paid Staff Volunteers	Yes
25	GoM	Mississippi	Mississippi Sound	Pilot Oyster Shell Recycling Program (Save our Shells)	2020	Active	Grant	Shell recycling Restoration	Restaurants	Large	Paid staff Contractors	No

26	GoM	Louisiana	Gulf of Mexico	Oyster Shell Recycling Program	2014	Active	Corporate Non-profit Donations	Shell recycling Restoration Erosion Prevention	Restaurants Public recycling	Large	Volunteers Partners Others	Yes
27	GoM	Texas	Galveston Bay	Oyster Shell Recycling Program	2011	Active	Grants Corporate Non-profit Donations	Shell Recycling	Restaurants	Medium	Paid staff Volunteers	Yes
28	GoM	Texas	Mission Aranas Estuary	Sink Your Shucks	2009	Active	Government Corporate Non-profit	Shell recycling Restoration	Restaurants Events	Medium	Paid staff Volunteers Others	No
29	WC	California	San Francisco Bay	Wild Oyster Project	2018	Active	Grants Donations Other	Shell recycling Restoration	Restaurants Events	Small	Paid staff Volunteers Others	Yes

Note: Some descriptions have been abbreviated from the Excel database