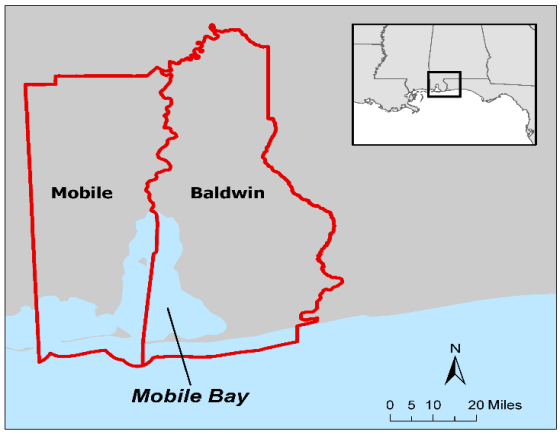
Mobile Bay, Alabama

GEMS



Oyster restoration goals

The Deepwater Horizon Oil Spill Alabama Trustee Implementation Group Draft Restoration Plan II and Environmental Assessment (2018)[1] is the guiding policy document for oyster restoration in Alabama. Goals for the estuary, adapted from the 2018 Plan, include:

- **Deploying different types of cultch material** to facilitate positive settlement and growth of oysters on select reef areas.
- **Identifying water bottoms** in areas of mid-to-lower Mobile Bay capable of supporting oyster cultch.
- **Increasing public awareness** of oyster restoration efforts.

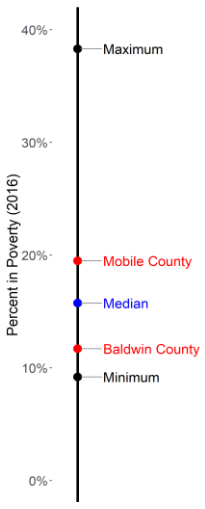
Local projects

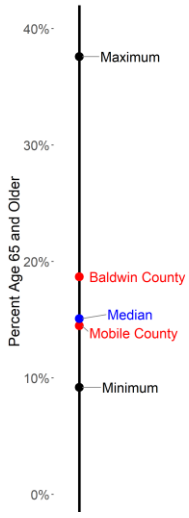
- The **Alabama Department of Conservation and Natural Resources** plans to restore 600 acres of oyster reefs in Mobile Bay, Mississippi Sound and Bon Secour Bay by planting 50,000 cubic yards of cultch[2].
- **The Nature Conservancy** is working with partners to lead efforts to plan, install, and monitor oyster restoration projects in Mobile Bay. As of 2017, these projects covered 9,782 linear meters of constructed oyster substrate[3]. TNC is working with partners and local stakeholders, as well as using mapping tools, to identify the best location and design for these projects to maximize co-benefits, including wave attenuation and protection from coastal erosion.
- The **Mobile Bay Oyster Gardening Program** has produced almost 800,000 oysters[4] and created an interactive oyster scavenger hunt with artwork by local artists and sponsorship by local businesses to support reef restoration.
- The **Oyster Shell Recycling Program**, led by the Alabama Coastal Foundation, has collected more than 6.9 million shells from local restaurants, which will be used to restore oyster reefs in Alabama waters[5].

Note: In the following sections, the line graphs compare the counties surrounding Mobile Bay (as shown in the map above) with all of the U.S. counties that border the Gulf of Mexico. In each graph, the Mobile Bay counties are shown in red, the minimum and maximum of all of the Gulf coastal counties in black, and the median of all Gulf coastal counties in blue.

Demographics

Baldwin County has a lower poverty rate[6] and a higher proportion of older people[7], while Mobile County has a higher poverty rate and a slightly lower proportion of older people, than most Gulf coastal counties.



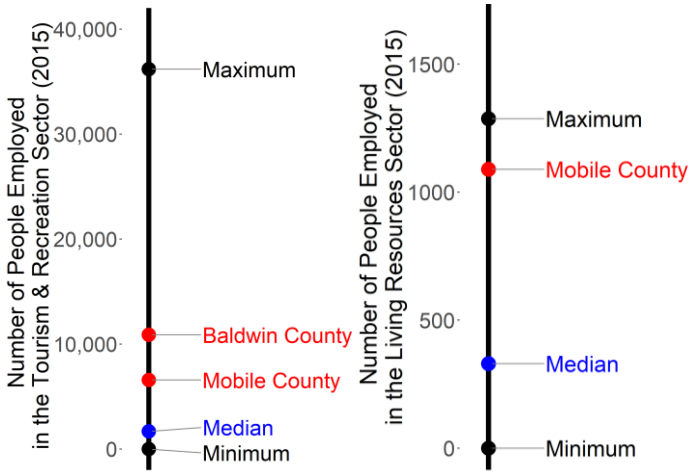


Mobile County has 18.9% food insecurity[13], which is higher than the median Gulf coastal county (14.3%), and Baldwin County has 12.3% food insecurity.

Mobile Bay, Alabama GEMS

Economy

Mobile Bay counties employ **more people in the recreation sector** (includes charter and recreational fishing, boat tours, marinas, campsites, hotels, and restaurants), and Mobile County employs **more people in the living resources sector** (includes commercial fishing, aquaculture, seafood processing, and seafood markets), than most Gulf coastal counties[9].



The recreation sector makes up 7.1% of GDP in Baldwin County, and 1.1% of GDP in Mobile County.

The living resources sector makes up 0.18% of GDP in Mobile County[10].

Note: Economic data on the living resources sector for Baldwin County are not available due to confidentiality issues.

Recreation

Saltwater fishing is a recreational activity related to healthy estuaries that is popular among residents and visitors of Alabama. According to a 2011 survey[11]:

134,000 people participated in saltwater fishing in Alabama.

Saltwater anglers spent an average of **$108 per person on fishing trips and equipment.**

Saltwater anglers spent about **1.5 million days fishing,** or about **11 days per angler.**

Red drum were particularly popular among saltwater anglers.

Oyster farming in Alabama

Since 2009, oyster farms have become a rising trend in Alabama[12]. The 2018 Plan[1] lists one of its goals as constructing an oyster hatchery at the Claude Peteet Mariculture Center to encourage oyster recruitment in Mobile Bay.

As of 2016…

18+ acres
Used for oyster aquaculture

14+
Oyster farms in Alabama

$1.9 million+
Farm-gate value of Alabama oyster commercial operations

References

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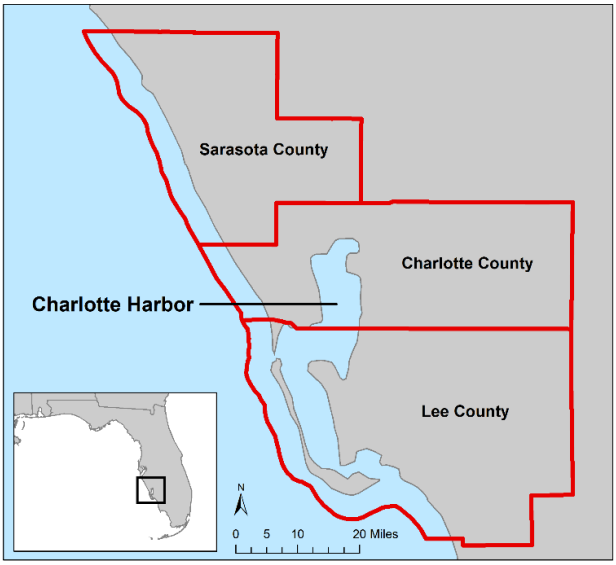
Charlotte Harbor, Florida

GEMS



Oyster restoration goals

The Charlotte Harbor National Estuary Program (CHNEP) Oyster Habitat Restoration Plan (2012) is a guiding policy document for oyster restoration in the Charlotte Harbor estuary[1].

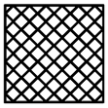
Goals for the estuary, adapted from the 2012 Plan, are to:

- **Map** oyster habitats by type by 2020
- **Design, implement and monitor** the success of pilot oyster restoration projects in a variety of habitats in 50% of the CHNEP estuary strata by 2020
- **Increase public awareness** of the ecosystem value of native oyster habitats by including community stewardship components in each oyster restoration project
- **Assist partners in seeking funding opportunities** (state, federal and organizational) to support oyster habitat restoration projects

Restoration techniques and materials

Appropriate restoration strategies for the area, identified in CHNEP's Oyster Habitat Restoration Plan, include the use of:

Bagged, caged, or loose cultch (including a variety of cultch types)



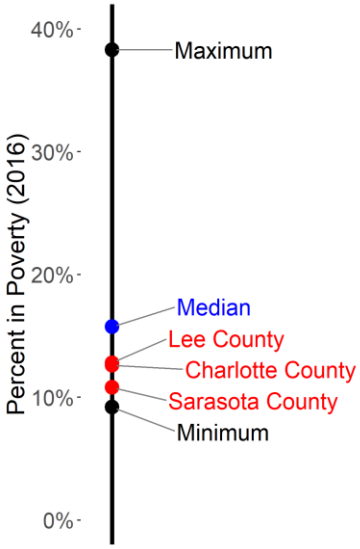
Oyster mats

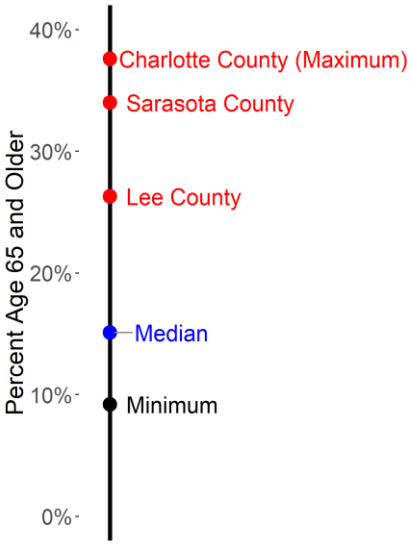
Other methods (vertical stakes, cement reef/oyster balls)

Note: In the following sections, the line graphs compare the counties surrounding Charlotte Harbor (as shown in the map above) with all of the U.S. counties that border the Gulf of Mexico. In each graph, the Charlotte Harbor counties are shown in red, the minimum and maximum of all of the Gulf coastal counties in black, and the median of all Gulf coastal counties in blue.

Demographics

Charlotte Harbor counties have a lower poverty rate[6] and a higher proportion of older people than most Gulf coast counties[7].



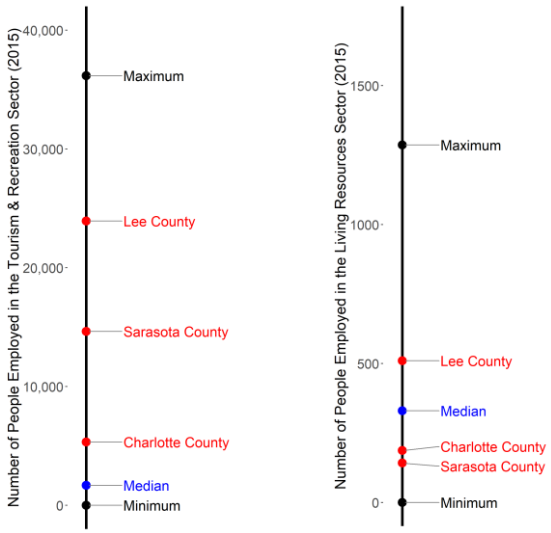


Charlotte Harbor counties have food insecurity rates between 12.7% and 13.6%, which is lower than the median Gulf coast county (14.3%)[8].

Charlotte Harbor, Florida GEMS

Economy

Charlotte Harbor counties employ more people in the tourism sector (includes charter and recreational fishing, boat tours, marinas, campsites, hotels, and restaurants) and fewer people in the living resources sector (includes commercial fishing, aquaculture, seafood processing, and seafood markets) than most Gulf coast counties[4].



The recreation sector makes up between 3.6% and 4.5% of GDP in Charlotte Harbor counties[5].

The living resources sector makes up less than 0.05% of GDP in Charlotte and Lee counties.

Recreation

Recreational activities related to healthy estuaries are popular among Florida residents and visitors to Charlotte Harbor counties[9]:

	Participation in the last 12 months among…
Saltwater beach activities (non-fishing) 	Residents: 79-87% Visitors: 55-60%
Saltwater boat fishing 	Residents: 21-42% Visitors: 11-47%
Wildlife viewing 	Residents: 24-34% Visitors: 21-33%

Harmful algal blooms

A persistent red tide has caused ecological, recreational, and economic issues in Charlotte Harbor counties since fall 2017[10]. Caused by the algae *Karenia brevis*, red tides form offshore, but it is thought that nutrients from human-related sources can worsen them once they reach the coast[11].

Reported fish kill events in Charlotte Harbor counties[12]

300+ July-August 2018

53 all of 2017

…including gamefish (tarpon and snook) and other marine wildlife (manatees and sea turtles)

Many shellfish harvesting areas have been closed and beach advisories posted in response to the red tide. Toxins from red tides can cause human health effects from skin contact, inhalation, and ingestion[11].

References

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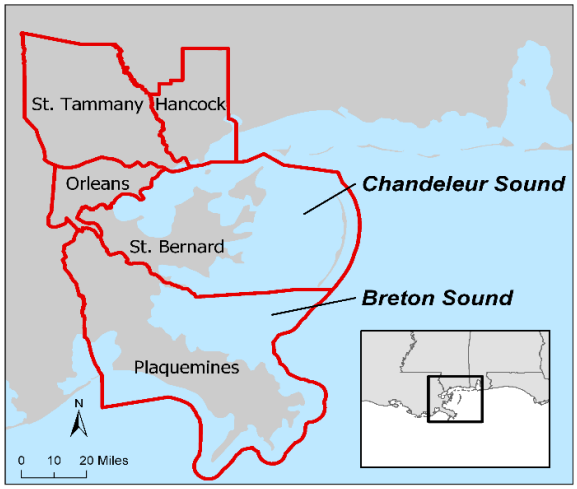
Chandeleur-Breton Sounds, Louisiana GEMS



Oyster restoration goals

The Strategic Framework for Oyster Restoration Activities by the Deepwater Horizon Oil Spill Natural Resource Damage Assessment Trustees sets goals for oyster restoration in Louisiana[1].

The goals from this framework are:

- Restore **oyster abundance and spawning stock** to support a regional oyster larvae pool sufficient for healthy recruitment levels to oyster reefs.
- Restore **resilience to oyster populations** that are supported by productive larval source reefs and sufficient substrate in larval sinks.
- Restore a diversity of **oyster reef habitats**.

Restoration strategies

Appropriate restoration strategies for the area, identified by the Louisiana Department of Wildlife and Fisheries (LDWF), include[2]:

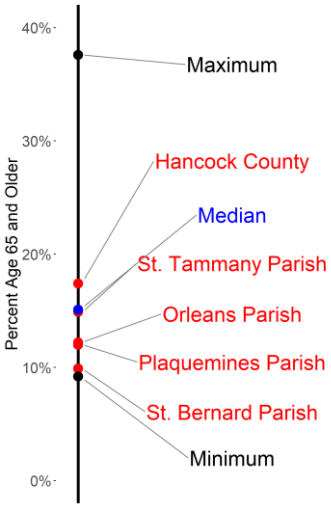
Cultch planting: A cultch plant on the public oyster seed grounds in St. Bernard Parish cost $1.4 million construct in 2011 and produced approximately $14 million worth of oysters during a 5-day harvest season in 2015.

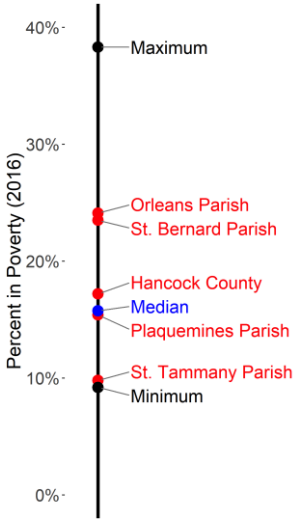
Reef construction from recycled shells: Since 2014, the Oyster Shell Recycling Program has collected over 3,000 tons of oyster shells from restaurants to construct oyster reefs. The first reef was completed in 2016 in St. Bernard Parish's Biloxi Marsh.

Note: In the following sections, the line graphs compare the counties surrounding Chandeleur-Breton Sounds (as shown in the map above) with all of the U.S. counties that border the Gulf of Mexico. In each graph, the Chandeleur-Breton Sound counties are shown in red, the minimum and maximum of all of the Gulf coastal counties in black, and the median of all Gulf coastal counties in blue.

Demographics

In general, Chandeleur-Breton Sound parishes have **a lower proportion of older people**[5] and a **higher rate of poverty**[6] than most Gulf coastal counties.



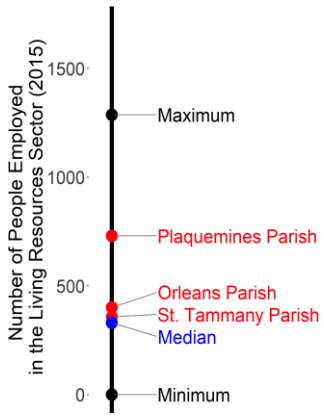


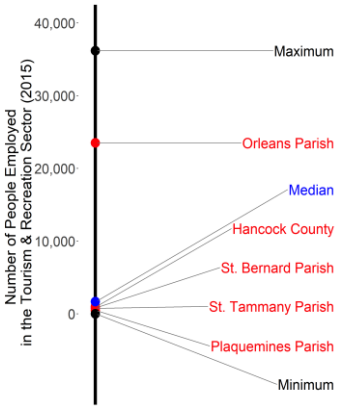
Hancock County has a food insecurity rate of 14.4% and Orleans Parish has a food insecurity rate of 22.8%, which are higher than the median Gulf coastal county (14.3%)[7]. Plaquemines, St. Bernard and Tammany parishes have food insecurity rates between 9.3% and 13.9%.

Chandeleur-Breton Sounds, Louisiana GEMS

Economy

Orleans, Plaquemines, and St. Tammany parishes **employ more people in the living resources sector** (includes commercial fishing, aquaculture, seafood processing, and seafood markets), and Chandeleur-Breton Sound parishes generally **employ fewer people in the recreation sector** (includes charter and recreational fishing, boat tours, marinas, campsites, hotels, and restaurants), than most Gulf coastal counties[10].





The living resources sector makes up 0.17% and 0.08% of GDP in Plaquemines and Tammany parishes, respectively[11].

The recreation sector makes up 0.23% to 5.2% of GDP in Chandeleur-Breton Sound parishes.

Note: Economic data on the living resources sector for Hancock County, Orleans Parish and St. Bernard Parish are not available due to confidentiality issues.

Recreation

Recreational activities related to healthy estuaries are popular among residents and visitors of Louisiana. According to a 2011 survey[15]:

Saltwater anglers spent an average of **$321 per person** on fishing trips and equipment.

196,000 people participated in saltwater fishing in Louisiana.

Popular fish species include the red drum and the seatrout.

97,000 people participated in waterfowl hunting in Louisiana.

Hypoxia in Chandeleur and Breton Sounds

Since 2008, monitoring in Chandeleur and Breton Sounds has revealed the development of seasonal bottom hypoxia[3], or deficiency in the amount of dissolved oxygen. This can have far-reaching impacts on fisheries.

Hypoxia in Louisiana waters has been shown to:

- Increase the price of large brown shrimp relative to small brown shrimp.[12]
- Affect brown shrimp spawning and migration patterns.[13]
- Negatively impact brown shrimp catch.[14]

References

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Back Bay of Biloxi, Mississippi GEMS

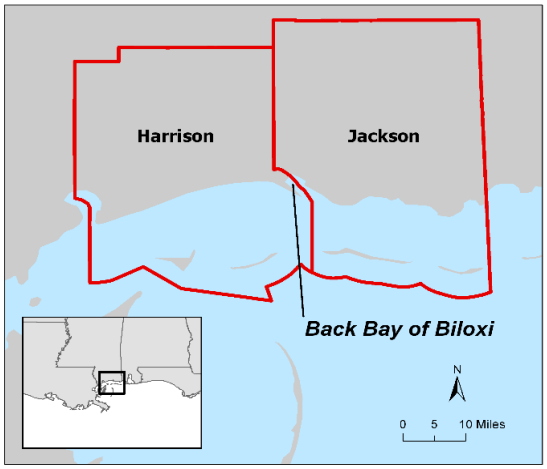
Restoration goals: One million sacks of oysters by 2025

The Mississippi Gulf Coast Restoration Plan (2016) by the Mississippi Department of Environmental Quality (MDEQ) and the National Fish and Wildlife Foundation (NFWF) set goals for oyster restoration in Missisippi[1]. The goal for the Mississippi Sound (which includes the Back Bay of Biloxi), according to the 2016 Plan, is to **increase oyster reef productivity** and **produce one million sacks of oysters** (300 oysters per sack) annually by 2025.

30% (300,000 sacks per year) will be produced by private leases.

70% (700,000 sacks per year) will be produced by public reefs.

12,000 acres of public oyster area are needed to meet the public reef goal at the aggressive harvest rate of 20%.



Harvesting practices

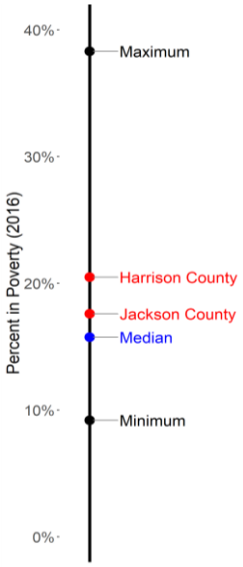
The 2016 Plan also includes recommendations made by the Governor's Oyster Council in regards to harvesting practices[1]:

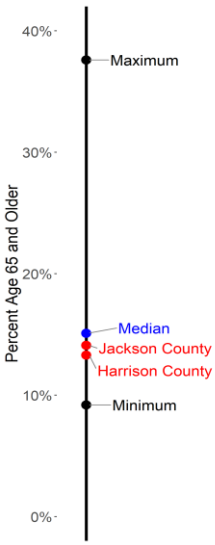
- **Implement new management activities for oyster harvests,** such as management practices and metrics to assess reef health, a no-net change based model to establish quotas that allow for sustainable fisheries, and/or enforcement of harvesting Best Management Practices.
- **Establish a shell recovery program** and a program that estimates the annual number of oysters available for harvest.

Note: In the following sections, the line graphs compare the counties surrounding Back Bay of Biloxi (as shown in the map above) with all of the U.S. counties that border the Gulf of Mexico. In each graph, the Back Bay of Biloxi counties are shown in red, the minimum and maximum of all of the Gulf coastal counties in black, and the median of all Gulf coastal counties in blue.

Demographics

Harrison and Jackson counties have a higher poverty rate[2] and a slightly lower proportion of older people than most Gulf coastal counties[3].



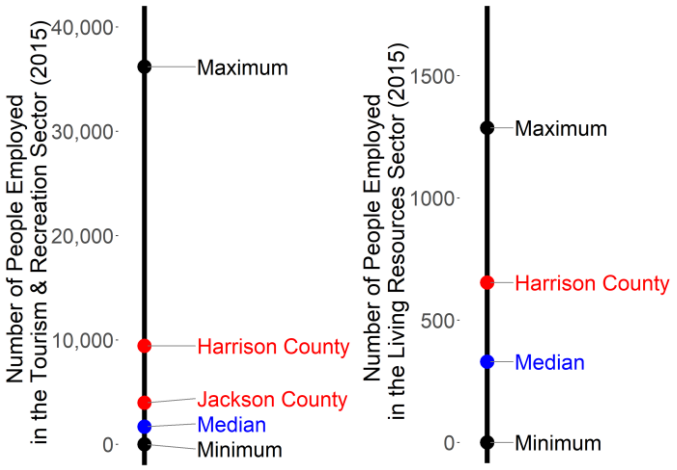


Harrison County has 17.9% food insecurity and Jackson County has 15.3% food insecurity, which are higher than the median Gulf coastal county (14.3%)[9].

Back Bay of Biloxi, Mississippi GEMS

Economy

Harrison and Jackson counties employ **more people in the recreation sector** (includes charter and recreational fishing, boat tours, marinas, campsites, hotels and restaurants), and Harrison County employs **more people in the living resources sector** (includes commercial fishing, aquaculture, seafood processing and seafood markets), than most Gulf coastal counties[5].



The recreation sector makes up 3.5% and 1.8% of GDP in Harrison and Jackson counties, respectively[6].

The living resources sector makes up 0.42% of GDP in Harrison County.

Note: Economic data on the living resources sector for Jackson County are not available due to confidentiality issues.

Recreation

Saltwater fishing is a recreational activity related to healthy estuaries that is popular among residents and visitors of Mississippi. According to a 2011 survey[7]:

120,000 people participated in saltwater fishing in Mississippi.

Saltwater anglers spent an average of **$369 per person on fishing trips and equipment.**

Saltwater anglers spent about **2.3 million days fishing,** or about **19 days per angler.**

Red drum were particularly popular among saltwater anglers.

Economic impacts of oyster reefs in Mississippi

Oyster reefs in the Mississippi Sound have significant economic value[1]. The recent decline in oyster harvests can be attributed to:

- Intensive fishing efforts
- Dredging
- Urban and industrial development
- Altered hydrological regime

Year	Oyster harvest (lb)	Commercial value
2000	3.5 million	$6 million
2013	500,000	$1.5 million

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10: "Oyster" icon by Buckley Powell from the Noun Project.

11: "Fishing" icon by Nikita Kozin from the Noun Project.

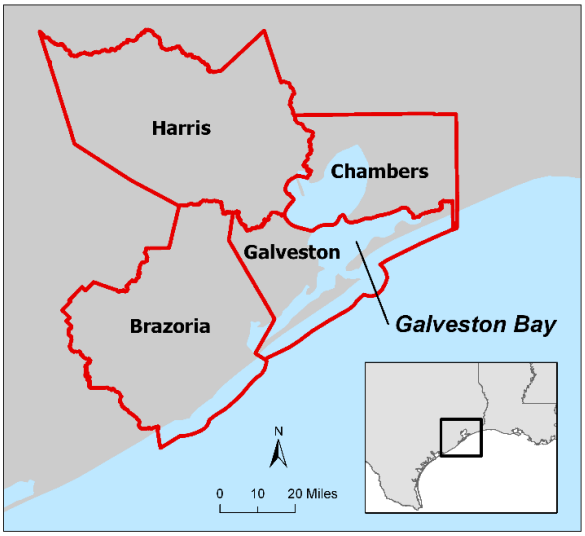
12: "Fishing" icon by Janira Keana from the Noun Project.

13: "Fish" icon by Christine Komatsu from the Noun Project.

14: "Net" by Stanislav Cherenkov from the Noun Project.

Galveston Bay, Texas

GEMS



Oyster restoration goals

The Texas oyster fishery is primarily managed by the Texas Parks and Wildlife Department in accordance with the Texas Oyster Fishery Management Plan (1988) and the Parks Wildlife Code[14].

Many coastal restoration plans, including the Texas Coastal Resiliency Master Plan (2017), provide guidance for oyster restoration in Texas[1]. The Galveston Bay Plan (1994, currently being updated) by the Galveston Bay National Estuary Program sets an objective for the bay to maintain an oyster population of at least half of the 1983-1993 average[15]. Three actions are outlined to accomplish this:

- Requiring commercial oyster harvesters to return oyster shell to the bay
- Promoting the development of oyster reefs using alternate substrate materials
- Protecting a portion of oyster reefs in preserves or research areas

Oyster shell recycling

Galveston Bay Foundation's (GBF) Oyster Shell Recycling Program has recycled 845 tons of oyster shells as of September 2018[16].

In 2011, GBF began recycling oyster shells through a partnership with Tommy's Restaurant and Oyster Bar[3].

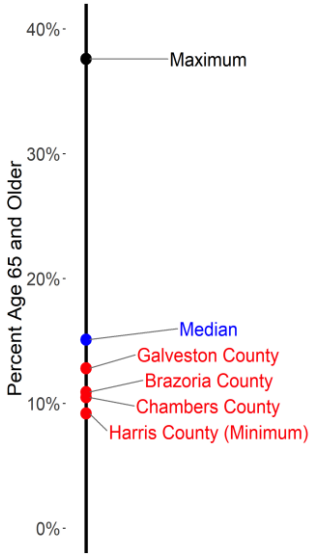
As of 2017, GBF partnered with six restaurants and stored recycled shells at three curing sites[3].

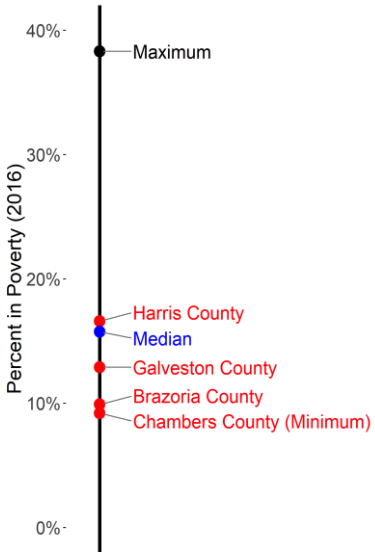
The reclaimed shells serve as new oyster habitat, enhancing local oyster populations.

Note: In the following sections, the line graphs compare the counties surrounding Galveston Bay (as shown in the map above) with all of the U.S. counties that border the Gulf of Mexico. In each graph, the Galveston Bay counties are shown in red, the minimum and maximum of all of the Gulf coastal counties in black, and the median of all Gulf coastal counties in blue.

Demographics

Galveston Bay counties have a **lower proportion of older people**[7], and generally have a **lower rate of poverty**[8], compared to most Gulf coastal counties.





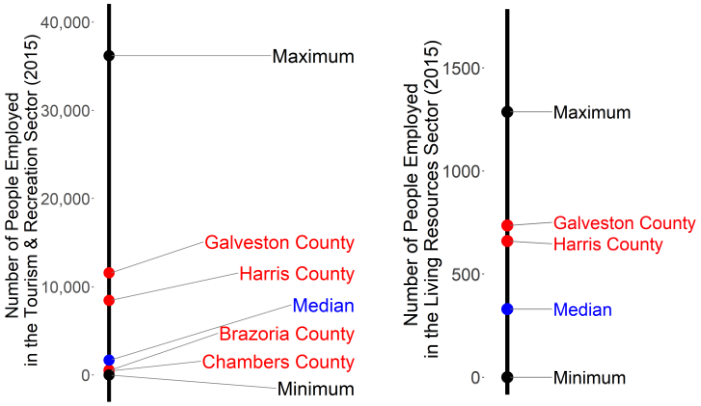
Galveston Bay counties have food insecurity rates between 14.5% and 17%[9], which are higher than the median Gulf coastal county (14.3%).

Galveston Bay, Texas

GEMS

Economy

Galveston and Harris counties employ more people in the recreation sector (includes charter and recreational fishing, boat tours, marinas, campsites, hotels, and restaurants) and in the living resources sector (includes commercial fishing, aquaculture, seafood processing, and seafood markets) than most Gulf coastal counties[12].



The recreation sector makes up
0.08% to 3.8% of GDP in Galveston Bay counties[13].

The living resources sector makes up
0.16% of GDP in Galveston County.

Note: Economic data on the living resources sector for Brazoria, Chambers and Harris counties are not available due to confidentiality issues.

Recreation

Recreational activities related to healthy estuaries are popular among residents and visitors of Galveston Bay. According to recent reports:

In 2018, **More than 84,000 pleasure boats** were registered in Galveston Bay counties[6].

Popular fish include the Atlantic croaker, sand sea trout, southern flounder, red drum and spotted sea trout[5].

There are **over 600 bird species and over 20 potential birder attractions** around Galveston Bay[5].

Oyster harvest in Galveston Bay

Galveston Bay's oyster fishery contributes
$9 million
to the Texas economy in an average year[2].

Galveston Bay oyster landings accounted for
47-50%
of total Texas oyster landings, by weight and value, between 2007 and 2016[2].

Oyster harvest in Galveston Bay has dropped by
more than 80% since the mid-2000s
due to sedimentation from hurricanes, predation, disease, fishing pressure, and drought.
Low salinity due to severe flooding in 2017 caused high oyster mortality, further reducing the 2018 harvest[17].

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