

State of the Bays 2025 Appendix

This document serves as a resource to further describe data sources and methodology used to develop the State of Bays report web platform.

Habitats

Oyster Reefs

Oyster reef locations and extent data were obtained from [side-scan sonar mapping conducted in 2020-2021](#). Prior to 2021, dedicated oyster or bottom mapping efforts were limited; therefore, data were sparse. The most comparable dataset was from a project led by the Florida Department of Agriculture and Consumer Services (FDACS) in 2009-2010 prior to the Deepwater Horizon (DWH) Oil Spill. The FDACS mapping effort used navigational charts and local knowledge instead of sonar methodology but does provide an idea of reef extent prior to the decline of the oyster resource after the DWH oil spill (due to unregulated harvest, not oil exposure). Acres calculated from the 2009-2010 shapefile likely represents an overestimation of reef extent because fine-scale side-scan sonar was not used, and extent was based on generalized locations. Data availability prior to 2009-2010 is sparse and unreliable due to differing methodology, therefore, were not used in this report.

In January 2022, FDACS expanded the prohibited shellfish harvest area in the Pensacola Bay system in response to fecal coliform monitoring data trends, ultimately affecting aquaculture operations. Currently, FDACS is the only organization that has the necessary certifications to sample fecal coliform concentrations (frequency: 2x/month) for the purpose of opening or closing designated shellfish harvest areas. PPBEP compiled FDACS water quality data from 1985-2022 and binned the data in 5-year increments to indicate how average fecal coliform concentrations have changed over time. FDACS thresholds for fecal coliform concentrations are shown in Table 1.

Table 1. Florida Department of Agriculture and Consumer Services (FDACS) thresholds for fecal coliform concentrations in waters designated for shellfish harvest.

Category	Thresholds
Low	Geometric mean <14 CFU and 31% of samples are 0
Moderate	Geometric mean <14 CFU and 31% of samples are >0.0 but ≤10.0
Moderately high	Geometric mean = 14 CFU or greater or 31% of the samples are >10.0
High	Geometric mean = 14 CFU or greater and 31% if the samples are >10.0

Seagrass

Seagrass location and extent data that were digitized as GIS shapefiles were compiled from 1940-2022. Most of the shapefiles were obtained from the Florida Fish and Wildlife Conservation Commission (FWC) GIS Department. FWC stores the most recent mapping products on their [Seagrass Habitat in Florida](#) GIS database. Spatial data from mapping efforts that were conducted exclusively in Alabama were obtained from partners at The Nature Conservancy, Alabama Chapter. A GIS shapefile from the most recent 2017 Roadblocks to Seagrass Recovery project was obtained directly from FWC's Fish and Wildlife Research Institute (FWRI) staff. 2022 shapefiles were obtained directly from the Dauphin Island Sea Lab. Individual shapefile citations are in the GIS Citation section below.

Wetlands

Wetland location, type, and extent were obtained from [U.S. Fish and Wildlife Service's National Wetlands Inventory](#) (NWI). While the most recent available update is from 2019, NWI does not analyze images every year. Therefore, the wetland extent data available for the Pensacola and Perdido Bays watersheds represents a range of years from the 1970s to the 2010s (most recent). Thus, when calculating wetland changes through time, we opted to use the [National Land Cover Database](#), which analyzes the entire United States for each update. NWI has more wetland categories than the NLCD, which is why we opted to show the maps with the NWI data. We recognize the limitations with these datasets, but these data provide a general overview of the wetland extent throughout the watersheds.

Longleaf Pine Forests

PPBEP acquired data license agreements from the Florida Department of Agriculture and Consumer Services (FDACS), Florida Forest Service (FFS), and Florida Natural Resources Inventory (FNAI) for access to the Longleaf Pine Ecosystem Geodatabase (LPEGDB) v.4 and the Southeast Longleaf Ecosystem Occurrences Geodatabase (LEO_GDB) v1.2.

The LPEGDB is a spatial database that will serve as the central repository for data on the distribution and ecological condition of longleaf pine ecosystems in Florida. The database includes data provided by many partner agencies and organizations as well as new field assessment data collected for this project. The LEO_GDB is a collaborative partnership between FNAI and the Longleaf Alliance to document longleaf pine locations and ecological condition across the southeastern United States. This effort will input LPEGDB data into LEO phase 2 to streamline where longleaf location data are stored. Click [here](#) for more information.

While there are other indirect measures of longleaf location (e.g., fire occurrence maps), PPBEP chose to only include data layers with verified longleaf location.

Habitat Change

To determine how habitats are changing in the watersheds, we obtained land use land cover data from the [National Land Cover Database](#). PPBEP staff compared percentages of land cover* categories across years to evaluate how land uses and cover are changing through time.

** Difference between land use and land cover: Land use describes how a land is used (e.g., tree farming or wildlife preserve). Land cover refers to different types of land (e.g., forested, agriculture, urban). Multiple land uses may be present in the same category of cover of land (e.g., forested areas can be used for tree farming or wildlife preservation).*

Water Quality

Total nitrogen, total phosphorous, chlorophyll-*a*, dissolved oxygen, and turbidity data were compiled from multiple sources including the [U.S. Environmental Protection Agency's Water Quality Portal \(WQP\)](#), the [Florida Department of Environmental Protection's Watershed Information Network \(WIN\)](#) database, and [Escambia County's Water Quality and Land Management Division's Surface Water Quality Public Data Portal](#). Data were obtained from multiple databases and organizations because 1) not every group uploads data to the public repositories like the WQP and 2) there is a time lag between data analysis and when an organization uploads data to a repository.

Data were cleaned using the following steps:

- Removed continuous sonde data
- Removed duplicates
- Standardized site names, surface measurements, units, and methods
- Exported data from all databases or directly from partner agencies/organizations in late 2024;
 - Data available from 2000-2024 were used in the analyses
- Calculated daily averages for each sampling location or site
- Clipped and aggregated data in ArcMap 10.5.1 to four bay segments for both Pensacola and Perdido Bay systems.
 - See Figures 1 and 2 of the Pensacola and Perdido Bay segments used in the State of the Bays report.

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Figure 1. Bay segments for the Pensacola Bay watershed including East Bay, Escambia Bay, Pensacola Bay, and Santa Rosa Sound.

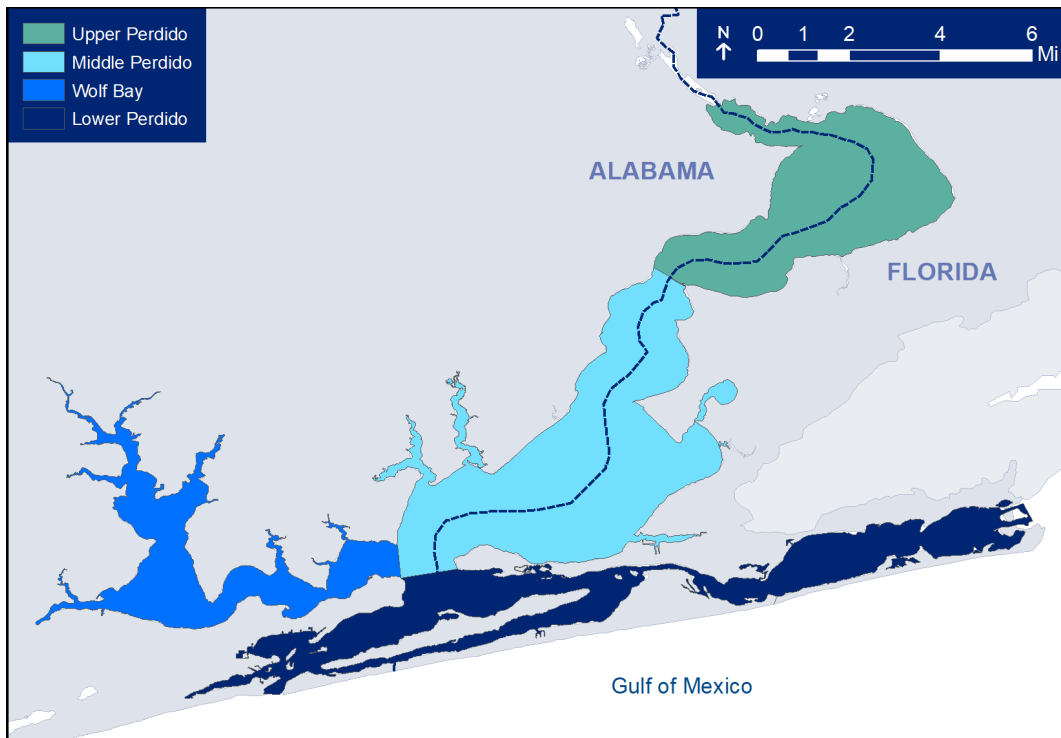


Figure 2. Bay segments for the Perdido Bay watershed including Upper Perdido, Middle Perdido, Wolf Bay, and Lower Perdido.

Table 2. Threshold concentrations used to determine water quality conditions. **Indicates a minimum threshold concentration – all other indicators have maximum threshold concentrations.* Total nitrogen, total phosphorous, and chlorophyll-*a* thresholds were modified from the [Florida Department of Environmental Protection’s Numeric Nutrient Standards for Estuaries and Coastal Segments – Rule - 62.302.532](#). Dissolved oxygen and turbidity thresholds were obtained from [U.S. Environmental Protection Agency’s Surface Water Quality Standards Chapter 62-302.533](#).

Threshold Concentrations						
Watershed	Bay Segment	Total Nitrogen (mg/L)	Total Phosphorous (mg/L)	Chlorophyll- <i>a</i> (ug/L)	Dissolved Oxygen (mg/L)*	Turbidity (NTU)
Pensacola	East Bay	0.83	0.084	4.0	4	29
	Escambia Bay	0.56	0.076	6.8	4	29
	Pensacola Bay	0.77	0.084	6.0	4	29
	Santa Rosa Sound	0.41	0.022	3.4	4	29
Perdido	Upper Perdido	1.27	0.102	11.5	4	29
	Middle Perdido	0.97	0.103	7.5	4	29
	Wolf Bay	0.97	0.103	7.5	4	29
	Lower Perdido	0.78	0.110	6.9	4	29

Bacteria

Beach Advisories

PPBEP staff requested data from the Florida Department of Health's (FDOH) Florida Healthy Beaches Program including beach advisories, enterococcus concentrations, and maximum threshold information directly from FDOH. For Alabama beach advisories, enterococcus concentrations, and maximum threshold information, staff acquired directly from the [Alabama Department of Environmental Management's \(ADEM\) and Alabama Department of Public Health's \(ADPH\) Coastal Alabama Beach Monitoring Program website](#). Both programs started sampling in 2006 and most sites had complete datasets through 2024 (FL data) and half of 2024 (AL data) with the exception of the following sites: Emerald Promenade (2006-2011 data missing), Juana's Beach (2021-2024 data missing), Perdido Key State Park (2021-2024 data missing), and Johnson's Beach (2006-2015 data missing). The total (i.e., sum) numbers of days a beach was under advisory was calculated for each swimming beach and presented as bubble maps for each watershed. Average enterococcus concentrations per year were calculated for each swimming beach to show trends through time.

Table 3. Enterococcus thresholds (enterococci/100 mL) as set by the Coastal Alabama Beach Monitoring Program and the Florida Healthy Beaches Program, respectively.

	Alabama	Florida
Good	-	0-35
Moderate	-	36-70
Poor	>104	>71

Sanitary Sewer Overflows

PPBEP staff requested and acquired sanitary sewer overflow (SSO) data directly from ADEM and DEP partners including reported incidences, gallons spilled, and cause of the spill. SSO data ranged from 2014-2024.

Data were cleaned using the following steps:

- Aggregated data by location if reported address was identical
- Clipped data in ArcMap 10.5.1 to Pensacola Bay or Perdido Bay watersheds
- Average volume and total volume spilled per location was calculated

Wildlife

Manatees

PPBEP and Dauphin Island Sea Lab's (DISL) Manatee Sighting Network initiated a data sharing agreement in 2020. This agreement allows DISL and PPBEP to share information regarding manatee sightings in the Gulf region, specifically for the Pensacola and Perdido Bays watersheds. Opportunistic manatee sighting data is shared via a quarterly data pull report from the Dauphin Island Sea Lab's (DISL) Manatee Sighting Network (MSN) Database (1912-2022). Use of these data is dependent on the use of the following citation:

Carmichael RH, Hieb E, Aven A, Taylor N, Seely C, Delo J, Pabody C (2024). Dauphin Island Sea Lab's Manatee Sighting Network Database (1912-2024). Dauphin Island Sea Lab, Alabama, USA.
<https://data.disl.edu/dataset/the-west-indian-manatee-population-in-mobile-bay-al-and-surrounding-waters-1912-2021> (last accessed 24 Jan 2025).

Fisheries

PPBEP staff requested fisheries data from [Alabama Department of Conservation Natural Resources' \(ADCNR\) Marine Resources Division \(MRD\) fisheries and assessment monitoring program \(FAMP\)](#). The current trawling program provides monthly community-level data critical for ecosystem-based management within Alabama's inshore waters. MRD consistently samples at 8 sentinel sites across the Perdido Bay System. Perdido Pass was not included in this report. The trawl program dataset ranged from 1984-2023.

DISL established a trawl survey program in 2006 to evaluate juvenile fish communities in seagrass beds throughout lower Perdido Bay, Big Lagoon, lower Pensacola Bay and Santa Rosa Sound using a 16' otter trawl. Due to a lack of consistent funding, gaps in monitoring have occurred. From 2022 to the present, PPBEP has provided funding support for the annual trawl survey (September/October) to ensure the continuation of consistent monitoring. The trawl program dataset ranged from 2006-2023.

PPBEP staff requested fisheries data from Florida Fish and Wildlife Conservation Commission's (FWC) [Fisheries Independent Monitoring \(FIM\) Program](#). Santa Rosa Sound is included in FWC's Fort Walton seasonal FIM sampling (July – December), which also includes Choctawhatchee Bay, and the data ranged from 1992-2023. Throughout the duration of the FIM program, site selection and sampling protocols evolved based on project goals. There was a monitoring gap in Santa Rosa Sound between 1998-2016 due to capacity and shifting agency priorities.

Data were cleaned using the following steps:

- Removed species that were not selected for by the gear type (16' otter trawl), were not identified down to species (e.g., family, suborder, class, etc.) or unidentified to allow for a fair comparison across trawl programs
- Removed trawls that were labeled as "bad" tow quality
- Removed trawls that did not have a value for effort (distance towed) provided
- Aggregated data by bay segment
- Average species richness (number of unique species per tow) per bay segment per year was calculated
- Average Catch Per Unit Effort (CPUE – individuals per kilometer towed) per bay segment per year was calculated for select species of interest (Spotted Seatrout, Gray Snapper, and Brown Shrimp)



Figure 3. Bay segments for the Perdido Bay watershed including Upper Perdido, Middle Perdido, Wolf Bay, Lower Perdido, and Little Lagoon.



Figure 4. Bay segments for the Pensacola Bay watershed including Pensacola Bay and Santa Rosa Sound.

References:

Fisheries Independent Monitoring Program, Florida Fish and Wildlife Conservation Commission (<https://myfwc.com/research/saltwater/fim/>, data publicly available <https://data.florida-seacar.org/programs/details/69>)

Condition Icon Criteria

Conditions icons (improving, stable, declining, critical, and undetermined) were based on data availability and comparisons between the most recent datasets (last 2-3 years) for each indicator.

- Oyster reefs - compared 2010 to 2021 data along with local knowledge about the expansion of the FDACS prohibited harvest area
- Seagrasses - compared 2010 to 2017 (Pensacola Bay, Santa Rosa Sound, and Big Lagoon) and 2015 to 2020 (Lower Perdido)
- Wetlands - compared the ~20-year change (2001-2021) to the recent 3-year change (2019-2021) from the NLCD
- Longleaf pines - no historical data for comparison and were classified as undetermined due to lack of data
- Habitat change - compared the ~20-year change (2001-2021) to the recent 3-year change (2019-2021)
- Water quality – compared data for total nitrogen, total phosphorus, chlorophyll-*a*, turbidity, dissolved oxygen from 2021 to 2024
- Beach advisories - compared enterococcus concentration data from 2021 to 2024
- Sanitary sewer overflows (SSOs) - compared total volume of wastewater spilled from 2021 to 2024
- Manatees - compared number of sightings from 2021 to 2024
- Fisheries - compared species richness from 1984 to 2023

As PPBEP continues to build our program, we hope to foster collaborative partnerships across the watersheds to encourage more consistent monitoring and data collection through time to better understand the improvements or declines to the systems.

ArcMap References

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General shapefiles

Counties. TIGER/Line. 2015. Nation, U.S., Current County and Equivalent National Shapefile. Accessed November 2020.

USA States. Esri; U.S. Department of Commerce, Census Bureau; U.S. Department of Commerce (DOC), National Oceanic and Atmospheric Administration (NOAA), National Ocean Service (NOS), National Geodetic Survey (NGS) 2012. USA States. Accessed February 20, 2022.

USA Major Rivers. 2010. Esri; Rand McNally; Bartholemew and Times Books; Digital Chart of the World (DCW); U.S. National Geospatial-Intelligence Agency; i-cubed. 2010. USA Major Rivers. February 20, 2022.

USA Detailed Streams. USGS, Esri. 2020. USA Detailed Streams. https://services.arcgis.com/P3ePLMYs2RVChkIx/arcgis/rest/services/USA_Detailed_Streams/FeatureServer. Accessed February 20, 2022.

Oysters

Florida Department of Agriculture and Consumer Services. 2009-2010. Oyster mapping from navigational charts and local knowledge.

Johnson, G. 2021a. Escambia Bay & Pensacola Bay intertidal oyster reef mapping & assessment. Marine Research Ecological Consulting. Submitted to Pensacola and Perdido Bays Estuary Program.

Johnson, G. 2021b. Escambia Bay & Pensacola Bay subtidal oyster reef mapping & assessment. Marine Research Ecological Consulting. Submitted to Pensacola and Perdido Bays Estuary Program.

Johnson, G. 2021c. Pensacola East & Blackwater bays intertidal & subtidal oyster reef mapping & assessment. Marine Research Ecological Consulting. Submitted to The Nature Conservancy.

Seagrass

Unknown. 1940. Perdido Bay Florida Seagrass. Layer provided by the Florida Fish and Wildlife Conservation Commission Geographic Information Systems (GIS) Department. Accessed September 2022.

Unknown. 1960. Untitled. Layer provided by the Florida Fish and Wildlife Conservation Commission Geographic Information Systems (GIS) Department. Accessed September 2022.

Unknown. 1979. Perdido Bay Florida Seagrass. Layer provided by the Florida Fish and Wildlife Conservation Commission Geographic Information Systems (GIS) Department. Accessed September 2022.

Unknown. 1980-1985. Florida Panhandle Benthic Habitats. Layer provided by the Florida Fish and Wildlife Conservation Commission Geographic Information Systems (GIS) Department. Accessed September 2022.

Unknown. 1987. Perdido Bay Florida Seagrass. Layer provided by the Florida Fish and Wildlife Conservation Commission Geographic Information Systems (GIS) Department. Accessed September 2022.

U.S. Geological Service. 1992. Northwest Florida Benthic Habitats. Layer provided by the Florida Fish and Wildlife Conservation Commission Geographic Information Systems (GIS) Department. Accessed September 2022.

Unknown. 2001. Untitled. Layer provided by the Florida Fish and Wildlife Conservation Commission Geographic Information Systems (GIS) Department. Accessed September 2022.

U.S. Geological Service. 2003. Florida Panhandle Benthic Habitats (FWC/FWRI). Layer provided by the Florida Fish and Wildlife Conservation Commission Geographic Information Systems (GIS) Department. Accessed September 2022.

The Nature Conservancy Alabama. 2008. Perdido Bay Submerged Aquatic Vegetation. Accessed September 2022.

The Nature Conservancy Alabama. 2008. Orange Beach Submerged Aquatic Vegetation. Accessed September 2022.

Florida Fish and Wildlife Conservation Commission's Fish and Wildlife Research Institute. 2010. Panhandle_2010. Layer provided by the Florida Fish and Wildlife Conservation Commission Geographic Information Systems (GIS) Department. Accessed September 2022.

Gulf Islands National Seashore. 2011. National Park Service. Layer provided by the Florida Fish and Wildlife Conservation Commission Geographic Information Systems (GIS) Department.

The Nature Conservancy Alabama. 2015. SAV Summer polygons. Accessed September 2022.

Florida Fish and Wildlife Conservation Commission. 2017. Pensacola 2017 Seagrass Cover. Accessed October 2022.

The Nature Conservancy Alabama. 2019-2020. Lower Perdido. Accessed September 2022.

The Dauphin Island Sea Lab. 2023. Pensacola and Perdido Bays 2022 Seagrass Extent. Accessed March 2025.

Wetlands

USFWS (U.S. Fish and Wildlife Service). 2019. National Wetlands Inventory. <https://data.nal.usda.gov/dataset/national-wetlands-inventory>. Accessed December 2021.

Longleaf Pine Forests

Alabama longleaf pines. 2022. Florida Natural Resources Inventory (FNAI) and Longleaf Alliance. Southeast Longleaf Ecosystem Occurrences Geodatabase (LEO_GDB) v1.2. Accessed November 17, 2023.

Florida longleaf pines. 2018. Florida Department of Agriculture and Consumer Services Florida Forest Service. Longleaf Pine Ecosystem Geodatabase (LPEGDB) v.4. Accessed November 17, 2022.

Habitat Change

USGS (U.S. Geological Survey). 2021. National Land Cover Database.
<https://www.usgs.gov/centers/eros/science/national-land-cover-database>. Accessed June 2025.

Conservation Lands

U.S. Geological Survey (USGS) Gap Analysis Project (GAP), 2024, Protected Areas Database of the United States (PAD-US) 4.1: U.S. Geological Survey data release, <https://doi.org/10.5066/P96WBCHS>. Accessed March 5, 2025.