

The Development Process and Methods for the Coastal Georgia Report Card

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A general overview

Ecosystem health assessments have become more common in recent years, and report cards are being produced by a variety of groups from small, community-based organizations to large partnerships. Ecological report cards provide a numeric grade or letter that is similar to a school report card, and are considered a public friendly way to provide a timely and geographically detailed assessment of ecosystems or rivers.

As environmental monitoring has been conducted in Coastal Georgia for over 20 years, there is a need to communicate the data collected. Synthesizing and integrating the data into a document that is accessible to the general public and specific groups in the coastal zone informs the community of the health of their local waterways. However, not all the information that is generated by this process can fit into a public-friendly report card. The following pages describe in detail the methods and scoring procedures used to develop the Coastal Georgia report card.

A number of steps were taken in the development of the report card. First a workshop was conducted with several divisions within the Georgia Department of Natural Resources (DNR): the Coastal Resources Division, Wildlife Resources Division, and Environmental Protection Division.

The main goals of this workshop were to determine preferred indicators and potential data sources for those indicators as well as mockup the draft report card and discuss potential content of the report card. After the workshop, numerous conference calls and phone meetings occurred to finalize the indicators, determine sub-regions and sampling sites, establish thresholds, review data analysis and report card scores, and design and produce content for the report card.

The final report card integrates the environmental health of Coastal Georgia into an overall grade. The health for this first report card is based on three indices: human health, fisheries, and wildlife. The human health index is made up of three indicators: enterococcus, fecal coliform, and fish consumption advisories. The fisheries index is made up of three indicators: blue crab, red drum, and shrimp. The wildlife index is made up of six indicators: wood storks, American oystercatchers, sea turtle hatching, sea turtle nesting, right whale calves, and right whale population growth rate. Background information about key features in coastal Georgia, discussion about coastal habitats and development, information about water quality monitoring, details about what the public can do to protect the health of the coast, and activities Georgia DNR is doing were included in the report card document, in addition to the scores and grades.

The Coastal Georgia report card is an annual assessment of health in the eleven counties in Coastal Georgia primarily with data from 2014. The two right whale indicators are scored for the most recent year's data that is available, which is from 2011. In the years that follow, additional indicators will be added to the analysis as well as refinement of thresholds based on local data. Other improvements to the report card, such as new sampling sites or sub-regions, can also be incorporated.

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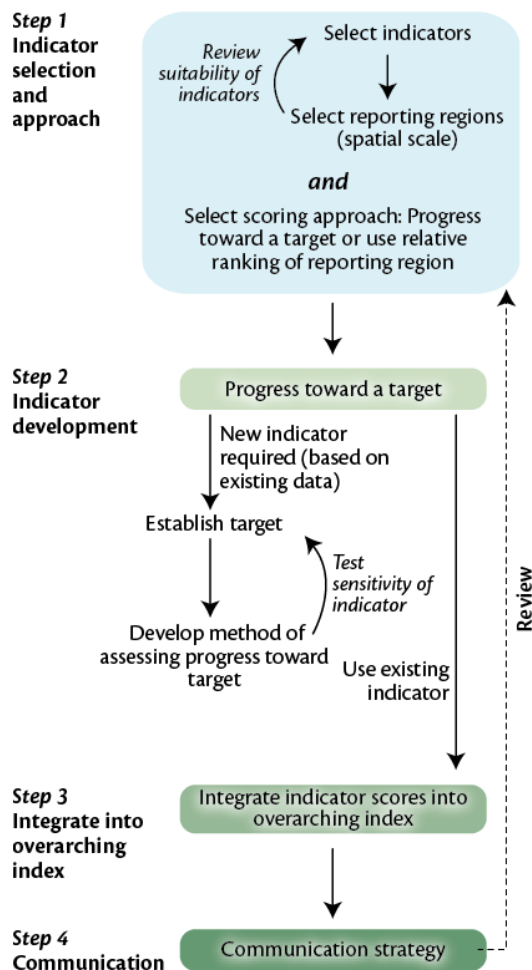
Introduction

Ecological report cards are considered a public friendly way to provide a timely and geographically detailed assessment of ecosystems or rivers. Report cards provide a numeric grade or letter that is similar to a school report card, allowing for quick and understandable results to a broad audience. One key aspect of report cards is that they integrate and synthesize diverse data sources and types. Over the last ten years, report cards have gained popularity as a communication tool in the United States (Chesapeake Bay, Gulf of Mexico, Mississippi River, San Francisco Bay, Willamette River) as well as several international areas (Great Barrier Reef, Australia; Chilika Lake, India; Orinoco River, Colombia).

Existing ecological data collected by government and local community groups mainly from Georgia DNR provide an excellent platform to develop an annual report card that acts to synthesize, interpret, and disseminate this information. Ultimately, the partners of the Coastal Resources Division plan to use this process to improve community and management awareness and understanding of the status of the environment of Coastal Georgia. The primary objectives of this project are to collate data, review indicators, and synthesize both to effectively report the health of Coastal Georgia.

Determining indicators

The figure at right illustrates the process that occurs when producing a report card. There are four main steps: 1) Indicator selection and approach, which includes assessing currently available data as well as the “ideal” datasets, 2) Indicator development, which includes developing targets or thresholds (discussed more in the next section) for each indicator, 3) Integrating indicators into an overarching index, and 4) Communicating the results through a report card product. Fundamentally, all report cards should be based on indicators and indices that are scientifically defensible, preferably peer-reviewed, and transparent. The data and methods underlying the report card should be understandable and clear to all audiences, should they want to drill down from the overall grade to individual metrics that make up indicators or indices.



For the Coastal Georgia report card, a workshop of local experts was convened at the beginning of the project, and one of the main goals of the workshop was to determine potential indicators for the report card (image at right). The workshop started with a full list of available data, such as water quality data, human health data, as well as data of fisheries and many groups of wildlife. As the discussions continued, an ideal list of indicators



that could be included was collated. From there, the spatial and temporal resolutions of the indicators were determined to ensure that there was sufficient coverage of data for use in the analysis. For example, human health parameters, such as enterococcus and fecal coliform, are collected at least once a month, year round. These are robust annual datasets that can definitely be incorporated into the report card. Conversely, water clarity data had low spatial and temporal resolution, so was noted as one that could be incorporated into the report card in the future, if monitoring began in more sampling locations.

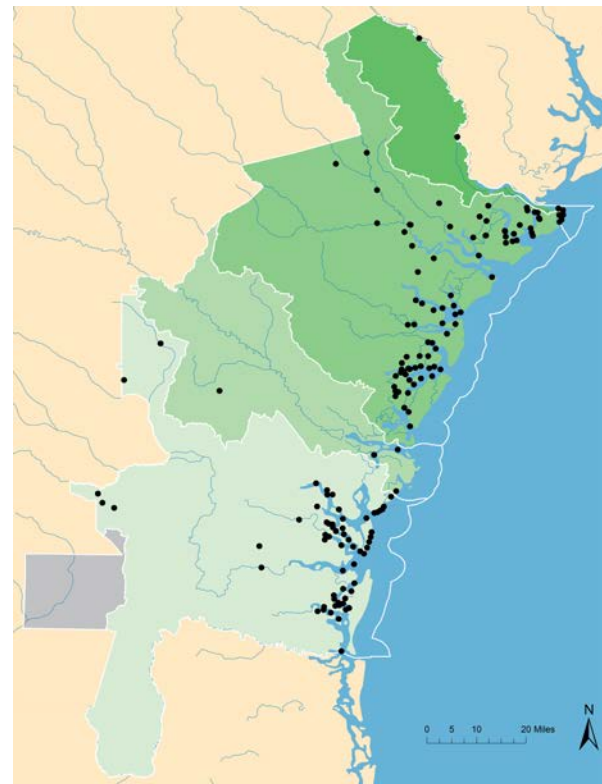
Data sources

The majority of the data in the report card were collected by the Georgia DNR Coastal Resources, Environmental Protection, and Wildlife Resources Divisions.

Sampling site and sub-region determination

Sampling site locations were already determined in this case because of previous years of monitoring data at sampling sites in Coastal Georgia. The only necessary step was to confirm that there were enough sampling sites within each watershed and to determine sub-region areas. Sub-region areas are usually determined based on geographic features (such as geology or land use) or hydrology (such as drainage basin size). For example, if there is an upstream portion, a mixing portion, and a “receiving waters” portion, those could be the three sub-regions. Remember that all sub-regions need to have enough sampling sites to be scientifically rigorous.

The sub-regions for this report card were determined based on five watersheds in the 11 counties that make up the coastal region. The watersheds from north to south



are the Savannah, Ogeechee, Altamaha, St. Mary's/Satilla, and Suwanee. There was only sufficient sampling site coverage within the Ogeechee and St. Mary's/Satilla watersheds, and only for the water quality indicators. Data coverage for the human health, fisheries, and wildlife indicators could not be separated by sub-region because of the type of data collected, and because much of this data applies on a larger scale than at a sample site location (for example right whales). All of the data used in the report card was scored for overall coastal Georgia without being separated by sub-regions. Overall, there is adequate sampling resolution throughout the coastal zone, with those indicators with less than ideal sampling discussed in detail in the following sections.

Indicator relevance

The indicators in this report card help answer the question "How healthy is coastal Georgia?" Each indicator measures a different parameter of the environment that affects organisms that live in the ecosystems of the coastal zone (image at right).

Enterococcus is a key indicator of human health in coastal Georgia. Bacteria occur naturally in both fresh and salt water. Bacteria are also commonly found in the intestines of humans and other warm-blooded animals. Most are harmless to humans

and animals, but some are pathogenic and can cause illness in swimmers. Pathogens can come from the feces of many animals, including wildlife and pets, or from humans, through leaking septic systems and broken sewer lines. Testing for all pathogens is difficult, so we usually test for the presence of indicator bacteria. Indicator bacteria, such as enterococcus, are present in large numbers, so they are easy to find and relatively inexpensive to monitor. This indicator is not harmful itself, but can come from similar sources as pathogens. The presence of enterococcus suggests that harmful pathogens may also be present. During significant rainfalls, there is an increased risk for elevated and unsafe bacteria in natural waters. Enterococcus is used as an indicator of human health in brackish and salt water.

Fecal coliform in oyster harvest areas is a crucial indicator of human health. Bacteria occur naturally in both fresh and salt water. Bacteria are also commonly found in the intestines of humans and other warm-blooded animals. Most are harmless to humans and animals, but some are pathogenic and can cause illness if they are present in shellfish that are consumed by humans. Pathogens can come from the feces of many animals, including wildlife and pets, or from humans, through leaking septic systems and broken sewer lines. This indicator is not harmful itself, but can come from similar sources as pathogens. The presence of fecal coliform in oyster harvest areas suggests that harmful pathogens may also be present.

Fish consumption advisory data is an important indicator of human health. Throughout coastal Georgia key fish species that are commonly eaten by humans are tested for heavy metals and other dangerous chemicals. The primary metals found in fish in coastal Georgia are mercury and arsenic, which, when present at high levels are unsafe for human



consumption. Heavy metals can enter fish through the food chain, as small fish eat plants or benthic organisms that may have taken up metals from contaminated soils or water. When larger fish eat the smaller fish, the amount of metals accumulated in the tissues of the large fish, which are then caught and eaten by humans. Fish consumption advisories are based on the amount of heavy metals that are at low enough concentrations in fish to still be safe for humans to consume.

Blue crabs are a key indicator of the health of fisheries in coastal Georgia. Blue crabs are an important living resource in the coastal zone. They are both a predator and prey in the food web. They use oyster beds and shallow water areas to mate and molt. The blue crab is the largest commercial fishery in Georgia (in pounds harvested) and supports a relatively large, but unsubstantiated recreational component as well.

Red drum is a major indicator of the health of fisheries in coastal Georgia. Red drum is an important living resource in the coastal zone. Red drum is a key top predator and uses areas in coastal Georgia as an important spawning and nursery habitat. This organism is always one of the top three species sought by recreational anglers.

Shrimp are an important indicator of the health of fisheries in coastal Georgia. Shrimp are a key living resource in the coastal zone commercially (most valuable in state), recreationally, and ecologically. They are primary prey items for numerous finfish and invertebrate species.

Birds are important indicators to determine wildlife health in coastal Georgia. Wood stork productivity and American oystercatcher replacement rate are two important indicators for bird species that nest along the coast.

Sea turtles are an important indicator to evaluate wildlife health in coastal Georgia. Sea turtle nesting and sea turtle hatching are two indicators that give representative information on the health of these animals along the coast.

Right whales are an important indicator to examine wildlife health in coastal Georgia. Right whale calf production index and right whale population growth rate are two indicators used to evaluate the health of this species in the waters of coastal Georgia.

Dissolved oxygen (DO) is a key indicator of ecosystem health. Nearly all aquatic animals need adequate DO in the water to survive, even aquatic plants can be harmed if the water around their roots is low in DO. Low dissolved oxygen levels can also cause changes in water chemistry that may trigger the release of nutrients from sediments into the water column. Low DO is often a result of eutrophication-excess nutrients in the water fuel algal blooms, and when the algae die and decompose, the decomposition process depletes DO.

Chlorophyll is a key indicator of estuary health. It is the green pigment that allows plants to convert sunlight into organic compounds during photosynthesis. Of the several kinds of chlorophyll, chlorophyll *a* is the predominant type found in microalgae (phytoplankton) in fresh and saltwater ecosystems. Therefore, chlorophyll *a* is used as a measure of phytoplankton biomass, which is controlled by factors such as water temperature and light and nutrient availability. Phytoplankton serve as a base of the food web in many estuaries. However, too much phytoplankton leads to large algal blooms that can reduce water clarity. Additionally, once an algal bloom dies, the algae cells sink to deeper water, where they decay and deplete waters of oxygen. Lower algae levels promote cleaner, clearer water, more available habitat, and fewer harmful algal bloom effects.

Nutrients are essential to the health and diversity of estuaries. However, excessive nutrients in water systems can lead to harmful algal blooms, which may negatively affect the health of humans and other animals. The primary nutrients of concern are nitrogen and phosphorus. Both are required for plants and animals to grow; however, when in excess, they can cause serious problems. When nitrogen and phosphorus are present in excess, algae overgrowth may occur, resulting in an algal bloom that eventually dies and decays.

The decomposition process depletes dissolved oxygen, which can lead to very low dissolved oxygen levels and subsequent fish kills. Lower algae levels promote cleaner, clearer water, more available habitat, and fewer harmful algal bloom effects.

Water clarity is an important water quality indicator to determine ecosystem health. Water clarity is a measure of how much light penetrates through the water column. It is dependent upon the amount of suspended particles (e.g., sediment and plankton) and colored organic matter present. Clear water is critical for the growth and survival of aquatic grasses, as well as fish, crabs, and other aquatic organisms. However, clear water should not be confused with the color of the water. Blackwater systems, for example, have highly colored water, but that is a natural phenomenon and is not an indication of eutrophication. Poor water clarity is usually caused by a combination of excess suspended sediments from runoff from the land and the growth of phytoplankton, which is fueled by nutrients.

Indicator thresholds and scoring

The indicators that had enough spatial and temporal resolution to use in the 2014 report card were enterococcus, fecal coliform, fish consumption advisories, blue crab, red drum, shrimp, wood stork productivity, American Oystercatcher replacement rate, sea turtle nesting, sea turtle hatching, right whale population growth rate, right whale calf production index, dissolved oxygen, chlorophyll *a*, dissolved inorganic nitrogen, total phosphorus, and water clarity. The majority of these indicators were included in the final report card, but not all.

Once these indicators were identified, targets or thresholds for each indicator were developed. Establishing targets for each indicator can be done by developing thresholds or using management goals. A threshold ideally indicates a tipping point where current knowledge predicts an abrupt change in an aspect or some aspects of ecosystem condition. Thus, from the perspective of choosing meaningful, health-related thresholds, this must be the point beyond which prolonged exposure to unhealthful conditions actually elicits a negative response. For example, prolonged exposure to dissolved oxygen concentrations below criteria thresholds elicits a negative response in aquatic systems by either compromising the biotic functions of an organism (reduced reproduction) or causing death.

More generally, however, thresholds represent an agreed-upon value or range indicating that an ecosystem is moving away from a desired state and toward an undesirable endpoint. Recognizing that many managed ecosystems have multiple and broad-scale stressors, another perspective is to define a threshold as representing the level of impairment that an environment can sustain before resulting in significant (or perhaps irreversible) damage.

When selecting thresholds, it is important to recognize that there are many already available, and more than likely, there are thresholds available for the indicator that is chosen. A good place to start looking for existing thresholds and goals is in other report card methods or scientific reports and publications.

One way to develop threshold values, if none exist, is to relate them to management goals, and these goals can be used to guide the selection of appropriate indicators. Even with the definition of agreed-upon thresholds, there is still the question of how best to use these threshold values in a management context. Recognizing this challenge, thresholds can still be effectively used to track ecosystem change and define achievable management goals. As long as threshold values are clearly defined and justified, they can be updated in light of new research or management goals and, therefore, can provide an important focus for the discussion and implementation of ecosystem management. Alternatively, if stressors are

correctly identified and habitats appropriately classified, there should be multiple attributes (indicators) of the biological community that discriminate in predictable and significant ways between the least and most impaired habitat conditions. Reference communities can then be characterized using these data, which in turn can be used to develop threshold values.

In order to determine thresholds for coastal Georgia, a comprehensive literature review was conducted. Within the literature review, both local and regional studies and reports were examined. Numerous meetings to review threshold determination and analysis were held with staff from Georgia DNR, Coastal Resources Division, Environmental Protection Division, and Wildlife Division. State-wide standards are preferred for use as thresholds, but for most indicators the state did not have an established standard or threshold. The water quality indicators had thresholds available through EPA's National Coastal Assessment. Unfortunately, these thresholds were thought to be too regionally broad to be applied on the local coastal Georgia scale. For human health indicators, federal and state thresholds were available. The fisheries indicators had thresholds based on long-term averages. The wildlife indicators had thresholds based on the literature review, trends data, and expert recommendations. For each indicator, a different threshold, or multiple thresholds, were determined where appropriate.

Enterococcus

The enterococcus threshold was determined using US EPA's Beach Action Value. Beach Action Values (BAVs) are considered conservative, precautionary tools that can be used as a single sample maximum to issue health advisories at beaches. The BAV for enterococcus is 70 CFUs (colony forming units) at the health risk of 1 in 28 persons. For each enterococcus sample, the measurement was compared to the threshold on a pass/fail basis. When enterococcus was >70 CFUs, it equaled a failing score, where as if enterococcus was ≤ 70 CFUs, it equaled a passing score.

Fecal coliform

The fecal coliform threshold was determined using the US Food and Drug Administration's National Shellfish Sanitation Program (NSSP). According to the NSSP the fecal coliform median or geometric mean MPN or MF (mTEC) of the water sample results shall not exceed 14 per 100 ml, and not more than 10% of the samples shall exceed an MPN or MF (mTEC) of 43 MPN per 100 ml. Each sampling site in the oyster harvesting areas of coastal Georgia was used for this analysis. Each sample is compared to the 43 MPN threshold. When fecal coliform was >43 MPN, it equaled a failing score, where as if fecal coliform was ≤ 43 MPN, it equaled a passing score. After all of the samples were scored, then these scores for each site were averaged to come up with the attainment score. If the attainment is $\geq 90\%$, then the overall score for that site is 100%. If the attainment is <90%, then the overall score is 0%. This scoring method was used to incorporate the criteria stipulation that the fecal coliform shall not be above 43 MPN in more than 10 percent of the values. The geometric mean fecal coliform value was then calculated for each sampling site over the entire year. Each geometric mean was compared to the 14 MPN threshold. When fecal coliform was >14 MPN, it equaled a failing score, where as if fecal coliform was ≤ 14 MPN, it equaled a passing score. As long as both scores (for thresholds of 43 MPN and 14 MPN pass), the sampling site gets a passing score. If one or both of the scores fail, the sampling site gets a failing score.

Fish consumption advisories

The fish consumption advisories threshold was determined using the Georgia DNR Environmental Protection Division's State Guidelines for Eating Fish from Georgia Waters. The thresholds used are the different levels of the advisories themselves. There are four categories fish consumption can fall into, No restriction, 1 Meal per Week, 1 Meal per Month, and Do Not Eat. These categories are based on specific levels of arsenic and mercury found in fish tissues of the sampled fish. For each sampled fish, the arsenic and mercury were compared to the categories they fall into, and then each of these categories was assigned an appropriate score. Samples with No Restriction, were given a 100% score. Samples with 1 Meal per Week and 1 Meal per Month were given a 66.7% and 33.3% scores, respectively. Samples with Do Not Eat were given a 0% score.

Blue crabs

The blue crab threshold was determined using historical data in coastal Georgia from the Department's ongoing Ecological Monitoring Trawl Survey (GADNRa, 2015). The blue crab long-term geometric mean was calculated from 1995–2014. This value of 0.7843 crabs per standard 15 minute trawl was compared to the 2014 blue crab geometric mean and then multiplied by 100 to put the value on a 100-point scale.

Red drum

The red drum threshold was determined using GADNR data in from the Coastal Resources Division's Marine Sportfish Population Health Survey (GADNRb, 2015).. The red drum long-term weighted geometric mean was calculated from gill net samples collected during June to August, 2003–2014. This value of 0.8593 fish per net set was compared to the 2014 red drum geometric mean and then multiplied by 100 to put the value on a 100-point scale.

Shrimp

The shrimp threshold was determined using historical data in coastal Georgia from the Department's ongoing Ecological Monitoring Trawl Survey (GADNRa, 2015). The shrimp long-term mean was calculated from 1995–2014. This value of 2.582 kg per standard 15 minute trawl was compared to the 2014 shrimp CPUE (catch-per-unit-effort) and then multiplied by 100 to put the value on a 100-point scale.

Wood stork productivity

The wood stork productivity thresholds are multiple thresholds determined based on the regional productivity range of 1.5 chicks per nest per year and conversations with experts in coastal Georgia. The regional productivity range was set as the lower end of the "B" score and equal interval scoring was used to determine the rest of the threshold levels. The thresholds are as follows: A = >2.0, B = 2.0–1.5, C = 1.5–1.0, D = 1.0–0.5, and F = 0.5–0. The average chicks fledged per nest for entire coastal Georgia over 2014 was compared to the thresholds to calculate an overall score.

American Oystercatcher replacement rate

The American Oystercatcher replacement rate thresholds are multiple thresholds determined based on the replacement rate of 0.32 and conversations with experts in coastal Georgia. The replacement rate was set as the lower end of the "B" score and interval scoring was used to determine the rest of the threshold levels. The thresholds are as follows: A = >0.5, B = 0.5–0.32, C = 0.32–0.2, D = 0.2–0.1, and F = 0.1–0. The average chicks fledged per nest for entire coastal Georgia over 2014 was compared to the thresholds to calculate an overall score.

Sea turtle nesting trends

The sea turtle nesting trends thresholds are multiple thresholds determined based on the National Marine Fisheries Service and US Fish and Wildlife Service recovery goal for loggerhead nesting in Georgia. The recovery goal is a 2% increase over a 50-year period to achieve a total of 2,800 nests. The recovery goal was set as the lower end of the “B” score and equal interval scoring was used to determine the rest of the threshold levels. The thresholds are as follows: A = >2% increase, B = 1–2% increase, C = 0–1% increase, D = 0–1% decrease, and F = >1% decrease. The sea turtle nesting trends value for entire coastal Georgia for 2014 was compared to the thresholds to calculate an overall score.

Sea turtle hatching success

The sea turtle hatching success thresholds are multiple thresholds determined based on the National Marine Fisheries Service and US Fish and Wildlife Service recovery goal for loggerhead hatching in Georgia. The thresholds are as follows: A = >70%, B = 60–69%, C = 50–59%, D = 40–49%, and F = 30–39%. The sea turtle hatching success value for entire coastal Georgia for 2014 was compared to the thresholds to calculate an overall score.

Right whale population growth rate

The right whale population growth rate thresholds are multiple thresholds determined based on recommendations from the National Marine Fisheries Service. The thresholds are as follows: A = $\geq 3.5\%$, B = 2.5–3.49%, C = 1.5–2.49%, D = 0.5–1.49%, and F = <0.5%. The right whale population growth rate value for entire coastal Georgia for 2011 was compared to the thresholds to calculate an overall score. For right whales, the most recent data available is from 2011.

Right whale calf production index

The right whale calf production index thresholds are multiple thresholds determined based on recommendations from the National Marine Fisheries Service. The thresholds are as follows: A = ≥ 0.075 , B = 0.05–0.075, C = 0.025–0.05, D = 0.0125–0.025, and F = <0.0125. The right whale calf production index value for entire coastal Georgia for 2011 was compared to the thresholds to calculate an overall score. For right whales, the most recent data available is from 2011.

Dissolved oxygen

The dissolved oxygen (DO) thresholds are multiple thresholds based on the US EPA’s National Coastal Assessment. The thresholds are <2 mg/l, 2–5 mg/l and >5 mg/l. Each dissolved oxygen sample was compared to these thresholds to calculate the scores. When the DO value was >5 mg/l, it equaled a 100% score. When the DO value was between 2 mg/l and 5 mg/l, it equaled a 50% score. When the DO value was <2 mg/l, it equaled a 0% score. While DO was included and scored in the report card, it was not part of the overall report card score. This is due to difficulties coming to consensus on water quality data and thresholds in coastal Georgia.

Total phosphorus

The total phosphorus (TP) threshold was determined based on the Florida Department of Environmental Protection’s Numeric Nutrient Criteria ([62-302.532 Estuary-Specific Numeric Interpretations of the Narrative Nutrient Criterion](#)). The Numeric Nutrient Criteria separates different areas throughout Florida and gives a specific criterion for each region. The furthest north threshold in Florida, which is the St. Mary’s River/Amelia River region, Lower St. Mary’s is 0.045 mg/l. For each total phosphorus reading, the measurement

was compared to the threshold on a pass/fail basis. When TP was >0.045 mg/l, it equaled a failing score, where as if TP was ≤0.045 mg/l, it equaled a passing score. While TP was analyzed and scored during the development of the report card, it was not included in the overall report card. This is due to difficulties coming to consensus on water quality data and thresholds in coastal Georgia.

Dissolved inorganic nitrogen

The dissolved inorganic nitrogen (DIN) thresholds are multiple thresholds based on the US EPA's National Coastal Assessment. The thresholds are <0.1 mg/l, 0.1–0.5 mg/l and >0.5 mg/l. Each dissolved inorganic nitrogen sample was compared to these thresholds to calculate the scores. When the DIN value was <0.1 mg/l, it equaled a 100% score. When the DIN value was between 0.1 mg/l and 0.5 mg/l, it equaled a 50% score. When the DIN value was >0.5 mg/l, it equaled a 0% score. While DIN was analyzed and scored during the development of the report card, it was not included in the overall report card. This is due to difficulties coming to consensus on water quality data and thresholds in coastal Georgia.

Chlorophyll *a*

The chlorophyll *a* thresholds are multiple thresholds based on the US EPA's National Coastal Assessment. The thresholds are <5 µg/l, 5–20µg/l and >20 µg/l. Each chlorophyll *a* sample was compared to these thresholds to calculate the scores. When the chlorophyll *a* value was <5 µg/l, it equaled a 100% score. When the chlorophyll *a* value was between 5 µg/l and 20 µg/l, it equaled a 50% score. When the chlorophyll *a* value was >20µg/l, it equaled a 0% score. While chlorophyll *a* was analyzed and scored during the development of the report card, it was not included in the overall report card. This is due to difficulties coming to consensus on water quality data and thresholds in coastal Georgia.

Water clarity

The water clarity thresholds are multiple thresholds based on a University of Georgia report of Recommended Indicators of Estuarine Water Quality for Georgia by Joan E. Sheldon and Merryll Alber. The thresholds are >0.5 m, 0.5–0.3 m and <0.3 m. Each water clarity sample was compared to these thresholds to calculate the scores. When the water clarity value was >0.5 m, it equaled a 100% score. When the water clarity value was between 0.5 m and 0.3 m, it equaled a 50% score. When the water clarity value was <0.3 m, it equaled a 0% score. While water clarity was analyzed and scored during the development of the report card, it was not included in the overall report card. This is due to difficulties coming to consensus on water quality data and thresholds in coastal Georgia.

Scoring

Once thresholds have been identified, data are scored using either a pass/fail or multiple threshold method. Ideally, multiple thresholds are used to provide some gradation of results from poor to excellent, rather than just pass or fail, but this may not be appropriate for all indicators.

A pass/fail scoring method is a simple method used to calculate indicator scores based on whether or not an ecologically relevant threshold was met. The process outlined below uses enterococcus as an example, and results are score on a scale of 0 to 100%, where the higher percentage values represent more healthy conditions (see figure below).

1. Sort data by station

Station Name	Date	Enterococcus (MPN)
REIMOLDS PASTURE	4/24/14	63
REIMOLDS PASTURE	5/7/14	38
REIMOLDS PASTURE	6/18/14	83
REIMOLDS PASTURE	7/9/14	3
REIMOLDS PASTURE	8/6/14	15
REIMOLDS PASTURE	9/25/14	51
REIMOLDS PASTURE	10/15/14	140
REIMOLDS PASTURE	10/23/14	12
SEA ISLAND NORTH	4/1/14	2
SEA ISLAND NORTH	5/13/14	510
SEA ISLAND NORTH	5/20/14	10
SEA ISLAND NORTH	6/24/14	2
SEA ISLAND NORTH	7/22/14	2
SEA ISLAND NORTH	8/12/14	2
SEA ISLAND NORTH	9/9/14	10
SEA ISLAND NORTH	10/7/14	5

2. Calculate the score for each data point Ex: If total enterococcus <70 MPN, then Score = Pass (or 100)

Station Name	Date	Enterococcus (MPN)	Threshold (MPN)	Score
REIMOLDS PASTURE	4/24/14	63	70	100
REIMOLDS PASTURE	5/7/14	38	70	100
REIMOLDS PASTURE	6/18/14	83	70	0
REIMOLDS PASTURE	7/9/14	3	70	100
REIMOLDS PASTURE	8/6/14	15	70	100
REIMOLDS PASTURE	9/25/14	51	70	100
REIMOLDS PASTURE	10/15/14	140	70	0
REIMOLDS PASTURE	10/23/14	12	70	100
SEA ISLAND NORTH	4/1/14	2	70	100
SEA ISLAND NORTH	5/13/14	510	70	0
SEA ISLAND NORTH	5/20/14	10	70	100
SEA ISLAND NORTH	6/24/14	2	70	100
SEA ISLAND NORTH	7/22/14	2	70	100
SEA ISLAND NORTH	8/12/14	2	70	100
SEA ISLAND NORTH	9/9/14	10	70	100
SEA ISLAND NORTH	10/7/14	5	70	100






4. Calculate the overall score by averaging all station scores.

Station Name	Station Score	Overall Score
REIMOLDS PASTURE	75	91
SEA ISLAND NORTH	88	
BRADLEY (OSSABAW)	100	
Contentment Bluff Sandbar	100	
Dallas Bluff Sandbar	100	
KINGS FERRY	25	
SKIDAWAY NARROWS	75	
SOUTH OSSABAW	100	
TYBEE ISLAND SOUTH	98	
TYBEE ISLAND MIDDLE	100	
TYBEE ISLAND NORTH	98	
Tybee Island Polk St	91	
TYBEE ISLAND STRAND	96	
BLYTHE ISLAND REG PARK	100	
Jekyll Clam Creek	79	
CONVENTION CENTER	98	
JEKYLL NORTH AT DEXTER LANE	100	
4H CAMP (JEKYLL)	98	
ST. ANDREWS PICNIC AREA	71	
SOUTH DUNES (JEKYLL)	100	
CAPT. WYLLY NEAR BEACHVIEW	100	
SEA ISLAND SOUTH	100	
5th ST. CROSSOVER (SSI)	92	
EAST BEACH OLD COAST GUARD	92	
MASSENGALE (SSI)	94	
12 ST. GOULDS INLET (SSI)	100	
ST. SIMONS ISL LIGHTHOUSE	89	

3. Calculate the station score by averaging the scores for each data point in that station.

Station Name	Date	Enterococcus (MPN)	Threshold (MPN)	Score	Station Score
REIMOLDS PASTURE	4/24/14	63	70	100	75
REIMOLDS PASTURE	5/7/14	38	70	100	
REIMOLDS PASTURE	6/18/14	83	70	0	
REIMOLDS PASTURE	7/9/14	3	70	100	
REIMOLDS PASTURE	8/6/14	15	70	100	
REIMOLDS PASTURE	9/25/14	51	70	100	
REIMOLDS PASTURE	10/15/14	140	70	0	
REIMOLDS PASTURE	10/23/14	12	70	100	

For coastal Georgia, all human health indicators have multiple thresholds except for enterococcus, all fisheries indicators have pass/fail thresholds, and all wildlife indicators have multiple thresholds. By using multiple thresholds when they are available, indicators can be assessed with greater precision than using a pass/fail method (see table below).

Measured indicator value	Multiple Thresholds	Grade	% Score
5	 Pristine condition	A	80–100
4		B	60–<80
3		C	40–<60
2		D	20–<40
1		F	<20
0	Impaired condition		

Once each indicator is compared to a pass/fail or multiple threshold scale, assigned a score, and averaged into a station score if applicable, a grade can be assigned. For the fisheries and wildlife indicators, the grading scale follows a 20-point grade scale of 0–100%, with equal interval breaks (see table at right).

For the human health indicators, the grading scale follows a 10-point grade scale (<60% = F, 60-70% = D, etc.) with uneven interval breaks (see table at right). This scoring scale is different since bacteria and contaminant indicators are directly related to human health and warrant a stricter grading scale. In order to incorporate the human health index into the other two indices, the scores are converted from a 10-point to 20-point scale.

Final grades are equally divided to provide a clearer picture of health (see figure below). Following the typical school grading scale overall (<60% = F, 60-70% = D, etc.) would result in consistently failing grades, which does not provide information about small improvements or declines in ecosystem health. The equally divided grading scale and multiple thresholds allow evaluation of small changes in ecosystem health, even at the very poor, poor, and moderately poor ranges.

Score (%)	Grade	Description
≥0 to <20	F	Very poor
≥20 to <25	D–	Poor
≥25 to <35	D	Poor
≥35 to <40	D+	Poor
≥40 to <45	C–	Moderately Poor
≥45 to <55	C	Moderate
≥55 to <60	C+	Moderate
≥60 to <65	B–	Moderately Good
≥65 to <75	B	Moderately Good
≥75 to <80	B+	Moderately Good
≥80 to <85	A–	Good
≥85 to <95	A	Good
≥95 to <100	A+	Good
=100	A+	Very Good

Score	Narrative
100	Excellent
90.00–<100	Good
80.00–<90	Moderate
70.00–<80	Moderately Poor
60.00–<70	Poor
<60	Very Poor

A ≥80–100%
All human health, fisheries, and wildlife indicators meet desired levels. Indicators in these locations tend to be very good, most often leading to preferred habitat conditions.

B ≥60–<80%
Most human health, fisheries, and wildlife indicators meet desired levels. Indicators in these locations tend to be good, often leading to acceptable habitat conditions.

C ≥40–<60%
There is a mix of good and poor levels of human health, fisheries, and wildlife indicators. Indicators in these locations tend to be fair, leading to sufficient habitat conditions.

D ≥20–<40%
Some or few human health, fisheries, and wildlife indicators meet desired levels. Indicators in these locations tend to be poor, often leading to degraded habitat conditions.

F 0–<20%
Very few or no human health, fisheries, and wildlife indicators meet desired levels. Indicators in these locations tend to be very poor, most often leading to unacceptable habitat conditions.

Final indicators, thresholds, time periods, location, and protocol are listed in the table below.

Indicator	Threshold	Time period	Location	Protocol
Enterococcus	70 CFUs	Year round	Beach sampling sites (CRD)	US EPA's Beach Action Value
Fecal coliform	43MPN and 14MPN	Year round	Shellfish area sites (CRD & EPD)	National Shellfish Sanitation Program
Fish consumption advisories	No restrict, 1 meal per week, 1 meal per month, do not eat	2014	Coastal areas, no open ocean samples (EPD)	GA DNR, Fish Consumption Guidelines
Blue crabs	long-term geometric mean 1995-2014	2014 (March – April)	Coastal trawls	GA DNR EMTS
Red drum	long-term weighted geometric mean 2003-2014	2014 (June – August)	Estuarine gill nets	GA DNR MSPHS
Shrimp (white & brown)	long-term mean 1995-2014	2014 (All Months)	Coastal trawls	GA DNR EMTS
Wood stork productivity	>2.0, 2.0-1.5, 1.5-1.0, 1.0-0.5, 0.5-0	2014	Beach nest locations	1.5 chicks per nest, regional productivity range
American oystercatcher	>0.5, 0.5-0.32, 0.32-0.2, 0.2-0.1, 0.1-0	2014	Beach nest locations	replacement rate of 0.32
Sea turtle nesting trends	>2% increase, 1%-2% increase, 0-1% increase, 0-1% decrease, >1% decrease	2014	Beach nest locations	National Marine Fisheries Service and US Fish and Wildlife Service recov. goal = 2% increase over 50yr
Sea turtle hatching success	>70%, 60%-69%, 50%-59%, 40%-49%, 30%-39%	2014	Beach nest locations	National Marine Fisheries Service and US Fish and Wildlife Service recov. goal
Right whale population growth rate	>=3.5%, 2.5%-3.49%, 1.5%-2.49%, 0.5%-1.49%, <0.5%	2011	Ocean surveys	National Marine Fisheries Service
Right whale calf production index	>=0.075, 0.05-0.075, 0.025-0.05, 0.0125-0.025, <0.0125	2011	Ocean surveys	National Marine Fisheries Service

Quality Assurance/Quality Control

Raw data QAQC

Data spreadsheets are provided to the analysts from the Georgia Department of Natural Resources. These data include all sampling points for all indicators, as well as weather and field notes. The first step is to check over the data for any outliers or flagged data. This is done by graphing the data over time and by sampling site. This is the time that flagged data is noted and correspondence with the data entry person and/or the field monitor is conducted to determine if there was an equipment malfunction or a collection error. Graphing each indicator by site helps to see related patterns in the data. If one site is inconsistent with other sites, such as an increasing value while all other sites are decreasing, it is an indication of suspect data. If the data are then checked and confirmed as correct, this could be a “hotspot” and should be followed up by the organization to determine the problem.

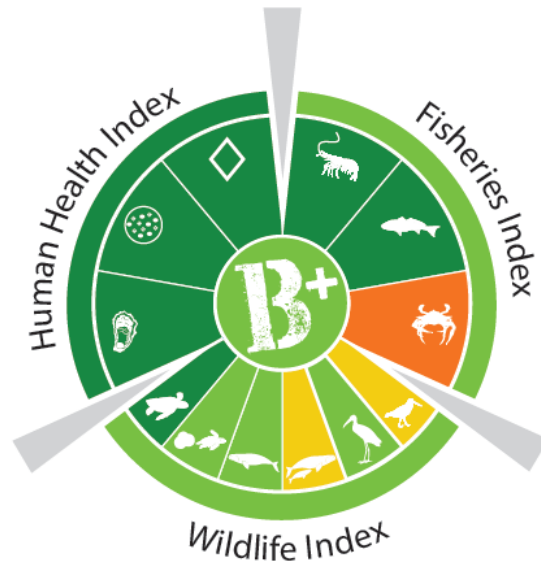
Data analysis QAQC

After data were analyzed, a second person re-checks the data. All numbers are compared to original spreadsheets to make sure there are not any errors transferring data. All calculations are also checked, to make sure equations have been entered in correctly, and applied to the correct cells in the Excel spreadsheet. The current dataset is small enough to check every indicator and every calculation. As datasets become larger and more complex, a subset of data is checked. This is done by comparing the current year’s indicator score to last year’s indicator score. If the score is different by 33% (or a pre-determined amount) between one year and the next, those data are flagged and checked for accuracy. Having proper quality assurance and quality control methods is vital to maintaining the integrity of the data.

Combining indicators into indices

Overarching indices give a much better integrated assessment (and therefore representative score) of an ecosystem’s health than can be achieved using a single metric. These indices comprise multiple metrics that are ranked according to a threshold value and then averaged together. Multi-metric health indices have become commonplace in resource and ecosystem management. The majority of these indices focus on stream macroinvertebrates and fish, but more recently, indices have been developed using various water quality and biotic parameters. There are many parameters that can be included, and all need to be properly evaluated in terms of what they add to the robustness of the indices. Robustness refers to the ability of the indicator or index to perform well under a range of conditions. Although more simplistic indices may lack relevant parameters or the spatial and temporal resolution that make indices more robust or effective for regional comparisons, very complex indices may have indicators that do not necessarily contribute much to the robustness of the index. Hence, the main objective is to select the appropriate type and number of indicators that, when combined in an index, give a robust and accurate representation of an ecosystem’s health and are understandable to the majority of users.

In coastal Georgia, three indices were developed to help synthesize the data and obtain an overall score of the health of the coast. The three indices are a Human Health Index, a Fisheries Index, and a Wildlife Index. The human health indicators are enterococcus, fecal coliform, and fish consumption advisories. The fisheries indicators are red drum, blue crab, and shrimp. The wildlife indicators are wood storks, American oystercatchers, sea turtle hatching, sea turtle nesting, right whale calves, and right whale population growth rate. These three indices combined create the overall coastal Georgia health score.



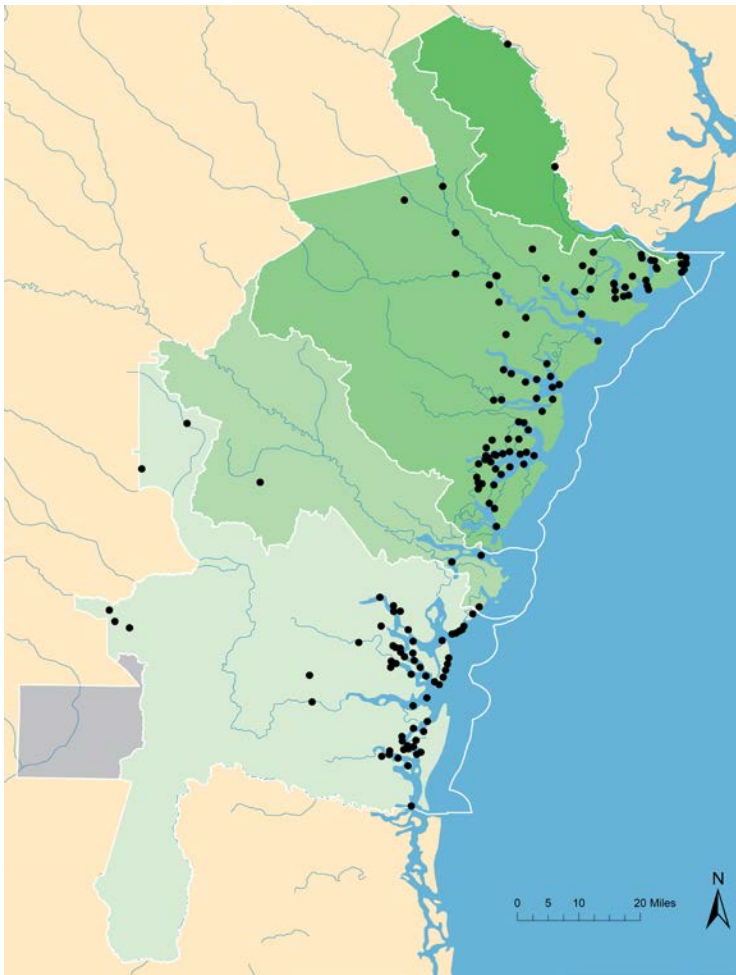
Issues of concern

Watershed and sub-region boundaries

There was some difficulty determining the appropriate watershed boundaries and sub-regions for this report card. The area in which Georgia DNR's Coastal Resource Division collects data and primarily works encompasses 11 counties (see map at right). These county boundaries do not follow the watershed boundaries, which expand further into Georgia than the coastal zone. Additionally, some sampling is conducted by sound systems, with each of the sounds individually separated. There are 9 sound systems in coastal Georgia, and these regions do not include the upland areas. They also did not have enough sampling resolution to use as individual sub-regions for the report card. When the region was broken into the 5 watersheds that lie within the 11 counties, only 2 of the 5 watersheds had adequate sampling resolution. The watersheds from north to south are the Savannah, Ogeechee, Altamaha, St Mary's/Satilla, and Suwanee. There is only adequate sampling resolution in the Ogeechee and St. Mary's/Satilla watersheds as seen in the map below.



Due to issues with water quality thresholds (see below), the indicators in the report card were scored based on the entire 11 county coastal area, without being broken down into separate sub-regions.



Water quality indicator thresholds

Georgia DNR has been monitoring water quality parameters for many years. Most water quality indicators had thresholds available through EPA's National Coastal Condition Assessment. Unfortunately, these thresholds were thought to be too regionally broad to be applied on the local coastal Georgia scale. For this reason, water quality indicators were not included in the report card for 2014. With further analysis on specific thresholds for each indicator that apply directly to coastal Georgia, these indicators will be able to be included in future report cards.

Minimum detection limits for nutrients

In addition to water quality thresholds having inadequate applicability to coastal Georgia, there were also some data collection issues for specifically nitrogen and phosphorus measures. The minimum detection limits (MDL) for ammonia, nitrate/nitrite, total Kjeldahl nitrogen, and total phosphorus were very close or higher than applicable thresholds for total nitrogen, dissolved inorganic nitrogen, and total phosphorus. This applied to both EPD and CRD collected data. Nutrient thresholds from both the National Coastal Condition Assessment and the Florida Department of Environmental Protection Numeric Nutrient Criteria are very close if not higher than the minimum detection limits from EDP and CRD.

Dissolved oxygen inclusion

Although dissolved oxygen was not included in the overall report card scoring, it was scored and communicated in the report card. Dissolved oxygen thresholds were used from the EPA's National Coastal Condition Assessment. The thresholds are < 2mg/l, 2—5 mg/l and >5 mg/l. Each dissolved oxygen sample was compared to these thresholds to calculate the scores. Dissolved oxygen, as well as the other water quality indicators, can be included in the overall report card score with future research on appropriate threshold levels. See the portion of the report card with the dissolved oxygen sampling map at right.



ANALYTE_NAME	EPD ANALYTE_MDL	CRD ANALYTE_MDL
Ammonia	0.03	0.03
Nitrate/Nitrite	0.02	0.05
Total Kjeldahl Nitrogen	0.2	0.3
Total Phosphorus	0.02	0.02

	Good	Fair	Poor
NCA Thresholds - DIN	< 0.1 mg/l	0.1-0.5 mg/l	> 0.5 mg/l
FL DEP Thresholds - TN	<0.27 mg/l		
NCA Thresholds - DIP	<0.01 mg/l	0.01-0.05 mg/l	>0.05 mg/l
FL DEP Thresholds - TP	<0.045 mg/l		

Communication through a report card

Ecological report cards, much like school report cards, provide performance-driven numeric grades or letters that represent the relative ecological health of a geographic region or component of the ecosystem. They are an important tool for integrating diverse data types into simple scores that can be communicated to decision makers and the general public. In other words, large and often complex amounts of information can be made understandable to a broad audience.

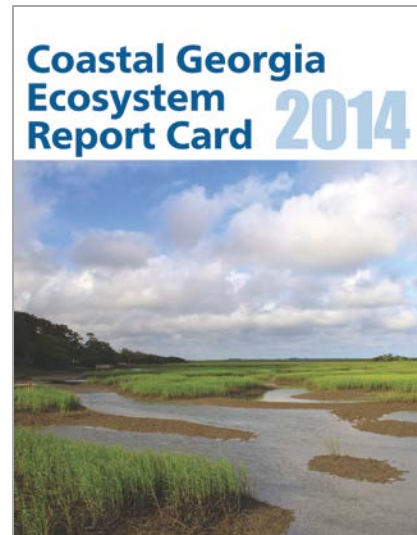
Ecological report cards enhance research, monitoring, and management in several ways. For the research community, they can lead to new insights through integration schemes that reveal patterns not immediately apparent, help to design a conceptual framework to integrate scientific understanding and environmental values, and help to develop scaling approaches that allow for comparison in time. Within monitoring realms, report cards justify continued monitoring by providing timely and relevant feedback to managers and can have the added benefit of accelerating data analyses. For management, they provide accountability by measuring the success of restoration efforts and identifying impaired regions or issues of ecological concern. This catalyzes improvements in ecosystem health through the development of peer pressure among local communities. Report cards also can guide restoration efforts by creating a targeting scheme for resource allocation.

Ecosystem health assessments have become more common in recent years, and report cards are being produced by a variety of groups from small, community-based organizations to large partnerships. Although methods, presentation, and content of report cards vary, the underlying premise is the same: to build community awareness and raise the profile of health impairment issues and restoration efforts.

Some common elements of report cards include

1. A map of the watershed or region
2. A grade stamp
3. The year of the report card
4. A summary of the key features (e.g., ecosystem types, recreation activities)
5. A “What You Can Do” section

For the Coastal Georgia report card numerous meetings were conducted to plan the content, layout, and design of the documents. Many iterations of the report card occurred as the document evolved into its final state. The report card provides background information on the coast, impacts to the ecosystems, discussion about the purpose of creating a report card, information about water quality monitoring, details about what the public can do to protect the health of the coast, and activities Georgia DNR is doing were included in the report card document, in addition to the methods, scores, and grades. This report card provides a much-needed synthesis of monitoring data being collected in coastal Georgia in a visually appealing and engaging manner (see image above). The Coastal Georgia report card includes the five basic elements listed above. In addition, more detailed discussion of some of the indicators in the report card and water quality monitoring is included.



methods

Analyzing data & calculating scores

Environmental report cards are used by resource managers to assess and report on the ecosystem health of a region. Developing rigorous, quantitative assessments provides an accountability that is increasingly beneficial to support environmental protection efforts. A five-step process of developing report cards is used to assess progress: 1) conceptualize, 2) choose indicators, 3) define thresholds, 4) calculate scores, and 5) communicate results.

This report card provides a transparent, timely, and geographically detailed assessment of health in coastal Georgia. Coastal Georgia health is defined as the progress of three human health indicators (enterococcus, fecal coliform, and fish consumption advisories), three fisheries indicators (red drum, blue crabs, and shrimp), and six wildlife indicators (wood storks, American oystercatchers, sea turtle hatching, sea turtle nesting, right whale calves, and right whale population growth rate) toward scientifically-derived thresholds or goals. Each of these groups of indicators are averaged into indices: the human health, fisheries, and wildlife indices. The three indices are combined into the Coastal Georgia Ecological Health Score.

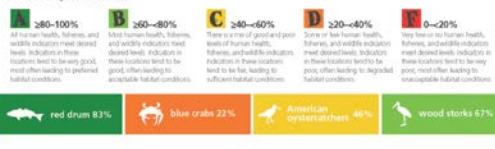


Preliminary analysis of water quality indicators was conducted during development of this report card. While there are thresholds for water quality indicators through EPA's National Coastal Condition Assessment, they do not adequately apply to the unique conditions in coastal Georgia (see page 41 right).

For detailed information on indicators, thresholds, and methodology visit CoastalGaDNR.org/ReportCard.

Grading scale for the indicators

The report card grading scale is a little different from the grading scale you saw in school. We use a 20-point scale to score the indicators, instead of the 10-point scale. Using a 20-point scale for environmental report cards is widely accepted as the best way to communicate health of an ecosystem. By using a scale that is equally divided, small changes in indicators can be more easily seen over time.



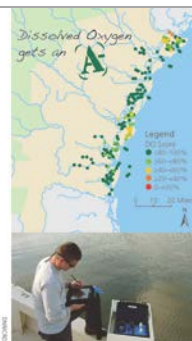
highlights

Water quality & dissolved oxygen

DNR monitors water quality throughout the coastal region. Dissolved oxygen (DO) is one important indicator used to quantify the health of a water body. Low DO is often a sign of degraded water quality. However, some areas in coastal Georgia, especially upriver blackwater creeks and coastal estuaries not fed by freshwater rivers, naturally experience low DO in warmer months without the expected negative effects of algal blooms, fish die-offs, and reduced species diversity observed elsewhere.

A preliminary analysis of DO data from 2014 was conducted for this report card using thresholds established by EPA's National Coastal Condition Assessment. Coastal Georgia's overall DO score is an 81%, or an A.

Additional monitoring and research is underway by DNR to understand how changes in water quality affect these complex systems and to determine other appropriate indicators of coastal health. For more information on water quality in coastal Georgia, please visit: CoastalGaDNR.org/wq.



Dissolved Oxygen station scores in 2014 (top). Water quality monitoring occurs throughout coastal Georgia (bottom).



Fisheries & blue crabs

Fisheries indicators in Georgia are important to analyze as they constitute a huge resource along the coast. While red drum and shrimp had high scores in 2014, blue crabs scored the lowest of any indicator in the report card. The blue crab indicator is based on the number of spawning female crabs during peak egg production. Since 1976, DNR's trawl survey has monitored blue crab abundance from 36 sites located in creeks, sounds, and the ocean off coastal Georgia. This information has been the basis for Georgia's blue crab management.

The spawning stock decline observed in 2014 is similar to the downward trend seen in commercial harvest and catch per unit effort data. Commercial harvest was 43% below the 20-year average and catch per unit effort was 54% below the 14-year average. DNR's trawl survey reported a 65% decline in juveniles in 2014 and an 88% decline from the 20-year mean spawning stock. These declines are most likely due to climatic conditions affecting juvenile recruitment rather than commercial fishing effort. In 2014, spawning and larval recruitment success was affected by cooler than normal fall water temperatures and double the average spring rainfall. DNR staff are working with the Blue Crab Advisory Panel to address these issues.

Although blue crabs declined in 2014, management to improve the resource is promising.



features

Marshes, beaches, & estuaries



Located in the center of the South Atlantic Bight, coastal Georgia is a region rich in history, beauty, and natural wonders. Georgia's coast is bounded on the east by 14 barrier islands which buffer the mainland from the Atlantic Ocean. Most of these islands remain undeveloped and boast pristine beaches perfect for nesting sea turtles and shorebirds.

Five major freshwater rivers feed the Georgia coast, forming an extensive estuarine ecosystem. The 368,000 acres of saltmarsh provide essential nursery grounds for a diverse range of animals including fish, shrimp, oysters, and birds. Saltmarshes protect upland areas from the force of tides and serve as a natural filtration system for pollutants and nutrients that often enter waterways leading to the ocean.

Coastal Georgia's river system is woven together by hundreds of streams, brackish and freshwater marshes, bogs, and swamps that extend far inland. This network delivers vast amounts of freshwater to the coast and creates a range of habitats that support diverse wildlife.

Although relatively undeveloped, the coastal Georgia landscape is changing nonetheless. New residents are drawn by the region's natural beauty and abundance of recreational opportunities. Through a combination of wise management, stewardship, and collaboration, everything we love about coastal Georgia can be conserved for generations to come.

Coastal Georgia is dominated by marshes and wetlands, and provides habitat for birds, shellfish, and sea turtles.

The importance of creating a report card

The Georgia Department of Natural Resources (DNR) is the state agency entrusted to manage Georgia's diverse coastal natural resources. DNR collects data through numerous inventory and monitoring activities conducted along the coast. This report card contains grades for various categories produced by comparing and contrasting data from monitoring activities with known standards and reference points. While this report card does not address every indicator or environmental issue facing the coast, it does provide the public with broad fact-based knowledge about the condition of Georgia's coastal resources.



Monitoring a marsh in coastal Georgia.

health

Moderately good health in 2014



Coastal Georgia received a B+, 76%, a moderately good score. Three indices covering 12 indicators including human health, fisheries, and wildlife data make up the grade for coastal Georgia. Scores ranged widely, with sea turtle nesting trends scoring the highest, at a 100%, or A+, and blue crabs scoring the lowest, a 22%, or D-.

A The human health index scored a 90%, or A, in 2014. Overall, human health indicators are good, meaning that it is generally safe to swim, as well as to eat local fish and shellfish. For more information on fish consumption guidelines visit epd.georgia.gov/fish-consumption-guidelines.








B The fisheries index scored a 68%, or B, in 2014. Overall, fisheries indicators are moderately good, which means that sustainable fishing practices are used and that the coastal environment is able to support most commercial and recreational species. The blue crab indicator fared poorly in 2014 likely due to climate conditions.

B The wildlife index scored a 69%, or B, in 2014. Overall, wildlife indicators are moderately good, suggesting that key species of birds, sea turtles, and whales are being maintained. Populations of these high priority species are being conserved and improved due to attentive and robust management strategies.



involvement

You can help protect Georgia's coastal resources

How you can help	Benefits
 Install a rain barrel for your home to collect water for irrigation.	Conserves water which is essential for healthy productive estuaries.
 Inspect and pump out your septic system every 3-5 years.	Functioning septic systems keep bacteria from entering waterways, which in turn can help reduce beach advisories and shellfish harvest closures.
 Abide by all beach lighting rules and ordinances during sea turtle nesting and hatching season.	Hatchling sea turtles can become easily disoriented and fall to crawl to the water if our homes and flashlights illuminate the beach.
 Know your recreational fishing catch and size limits.	These limits help sustain a healthy population of fish species.
 Buy a Georgia hunting or fishing license.	License fees support research and conservation of coastal species and habitats.
 Pick up after your pets.	Fecal bacteria from pet waste can wash into creeks and rivers, resulting in beach swimming advisories or shellfish harvest closures.
 Participate monitoring and clean-up activities in local waterways.	Citizen data can alert resource managers to potential issues. Visit georgiagadnr.com and riverwise.com/index.htm .


activities

Georgia DNR sustains, protects, & conserves the coast





The mission of the Department of Natural Resources is to sustain, enhance, protect, and conserve Georgia's natural, historic, and cultural resources for present and future generations, while recognizing the importance of promoting the development of commerce and industry that utilize sound environmental practices. Along Georgia's coast, several Divisions of DNR work collaboratively, including the Coastal Resources Division (CoastalGaDNR.org), Wildlife Resources Division (georgiawildlife.org), and Environmental Protection Division (epd.georgia.gov). Together they manage the region's unique natural resources for wildlife habitat, as well as recreational and commercial uses by the citizens of Georgia.

Acknowledgements

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Workshop participants in December 2014 who helped produce this report card.

Conclusions

Overall the monitoring program and resulting data collected in coastal Georgia provided an excellent base from which to produce a report card. The scores and grades were synthesized into a public-friendly document that can inform and engage its readers. Furthermore, the resulting report card is a tangible output of the efforts of the Georgia Department of Natural Resource's three divisions: Coastal Resources Division, Environmental Protection Division, and Wildlife Division, which is important for their continued support in the protection and restoration of the coast.

The process of producing the report card, from the initial workshop to the final stages of the report card, was made possible by the collective efforts of the Georgia Department of Natural Resources Coastal Resources Division, Environmental Protection Division, Wildlife Division, and the Integration & Application Network, UMCES. This effort cannot be understated in regards to finishing the product on time, so that the report card is relevant and topical when released.

In future report cards, with increased sampling sites and new indicators measured, the integrity and quality of the data will increase and provide guidance for management actions. Discussions have already occurred with staff from Georgia DNR to add additional indicators to next year's report card.

Web Resources:

Coastal Resources Division
<http://coastalgadnr.org/>

Wildlife Resources Division
<http://georgiawildlife.org/>

Environmental Protection Division
<http://georgiaepd.org/>

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