2012 Chesapeake Bay Report Card

New Fisheries Indicators

Blue Crab

A winter dredge survey is conducted throughout Maryland and Virginia to assess blue crab (*Callinectes sapidus*) populations. Since 1990, this survey has been estimating crab abundance throughout the Bay. For blue crabs, the number of adult female crabs is important to maintain the population. A target of 215 million adult female crabs as the amount needed to keep a sustainable crab population has been set by the Bay jurisdictions.

Bay Anchovy

A beach seine survey is conducted throughout Maryland and Virginia that estimates bay anchovy (*Anchoa mitchilli*) abundance throughout the Bay and provides a geometric mean of the total number of fish. Data for bay anchovy has been collected Baywide since 1980. For bay anchovies the number of fish is the most important to evaluate the population.

Striped Bass

There are several surveys conducted throughout Maryland and Virginia that estimate striped bass (*Morone saxatilis*) abundance. Striped bass (rock fish) is a long lived fish and has a complex life cycle that includes areas outside the Chesapeake Bay. More analysis is needed before we can include striped bass as a fisheries indicator in the report card.

Virginia Institute of Marine Science

Virginia Institute of Marine Science

Tim Van Vliet
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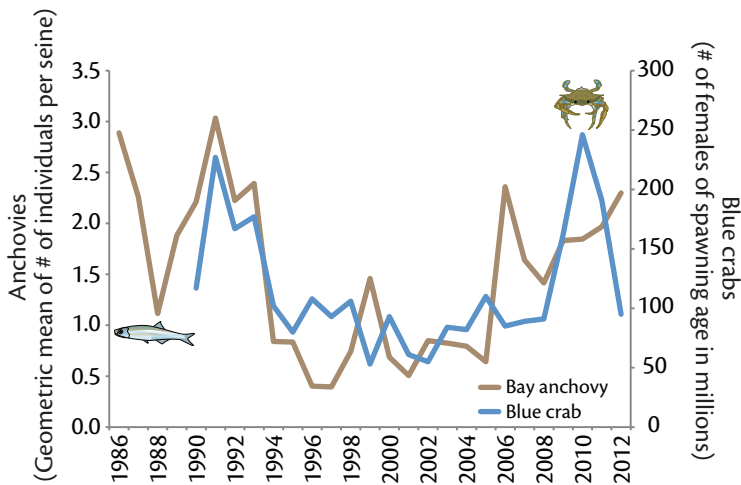
The abundance of Bay anchovies and blue crabs in the Bay has been variable over time.

Oysters

Oysters (*Crassostrea virginica*) are currently at less than 1% of their historic abundance, due to disease, overharvesting, and reduced water quality. While there are programs that monitor regional oyster populations and work to restore oyster reefs, actual data on the Baywide oyster populations is lacking. More data is needed to estimate the health of oysters in Chesapeake Bay.


Oyster recovery efforts including growing spat (baby oysters) and deploying them in the Bay. Photo © Ben Fertig, IAN Image Library.

Blue Catfish

The blue catfish (*Ictalurus furcatus*) is an invasive top predator, introduced to Chesapeake Bay in the 1970's and 80's. Blue catfish can live for more than 20 years, weigh over 130 pounds, and are a major predator and competitor to important Chesapeake fisheries. Their long lifespan, large size, voracious appetites, and increasing population sizes have raised management concerns about the ecological impact of blue catfish on Chesapeake Bay.

Rose Wills
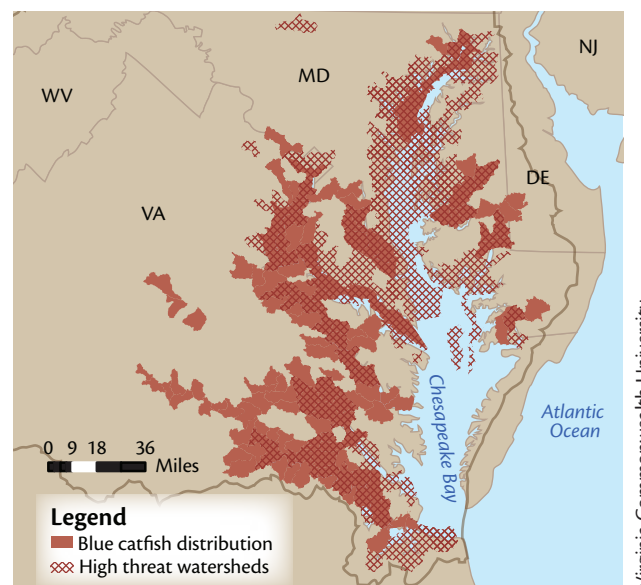
Virginia Commonwealth University

Legend
- Blue catfish distribution
- High threat watersheds

The current distribution of blue catfish and areas where there is a high threat of expansion.
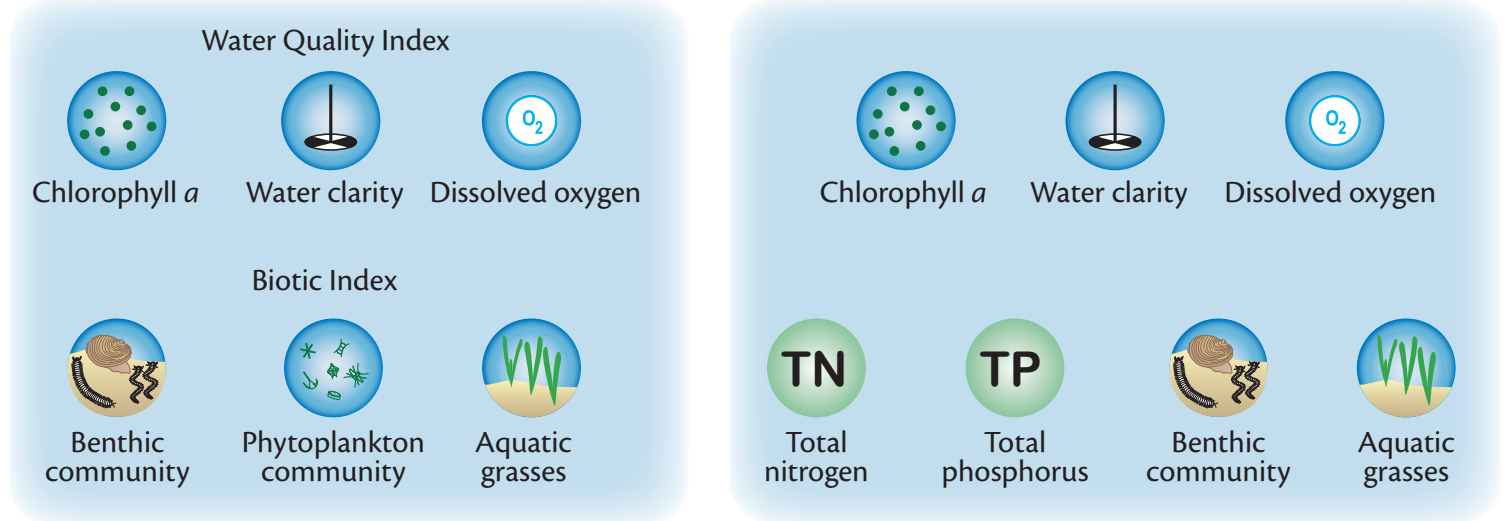
New indicators and methods for the 2012 Chesapeake Bay report card

For the past seven years, three water quality indicators and three biotic indicators have been averaged into a Water Quality Index and a Biotic Index, which have then been averaged into an overall Bay Health Index. This Index has been calculated for fifteen reporting regions and Baywide. For the first time, using 2012 data, five water quality indicators–chlorophyll *a*, dissolved oxygen, water clarity, total nitrogen, and total phosphorus–and two biotic indicators–benthic index of biotic integrity and aquatic grasses–are equally weighted and averaged into an overall Bay Health Index for fifteen reporting regions and Baywide. These new methods leave out the phytoplankton community, which has not been analyzed in Maryland in 2012. It adds total nitrogen and total phosphorus, which are key nutrients in the Bay.

Indicators in the report card this year compared to prior years

Before 2012	2012

Water Quality Index

Chlorophyll *a* Water clarity Dissolved oxygen

Biotic Index

Benthic community Phytoplankton community Aquatic grasses

Chlorophyll *a* Water clarity Dissolved oxygen

Total nitrogen Total phosphorus Benthic community Aquatic grasses

One drawback of the annual reporting framework is the lack of any description of whether Bay health is improving or declining. Each year, the reporting region summaries provide a comparison of the current year with the previous year, but how are the regions doing over the entire period of record? To answer this question, scores for all reporting regions for all previous years (1986 to 2011) were calculated. Then, a trend analysis was performed on these data. The trend analysis takes the entire period of record and calculates a linear regression in the data and assigns a statistical significance of the regression. The significance is based on a p-value of 0.05 (significantly positive or negative), 0.1 (slightly positive or negative), and >0.1 (no trend).

The Mid Bay reporting region is declining in health

The James River reporting region is improving in health
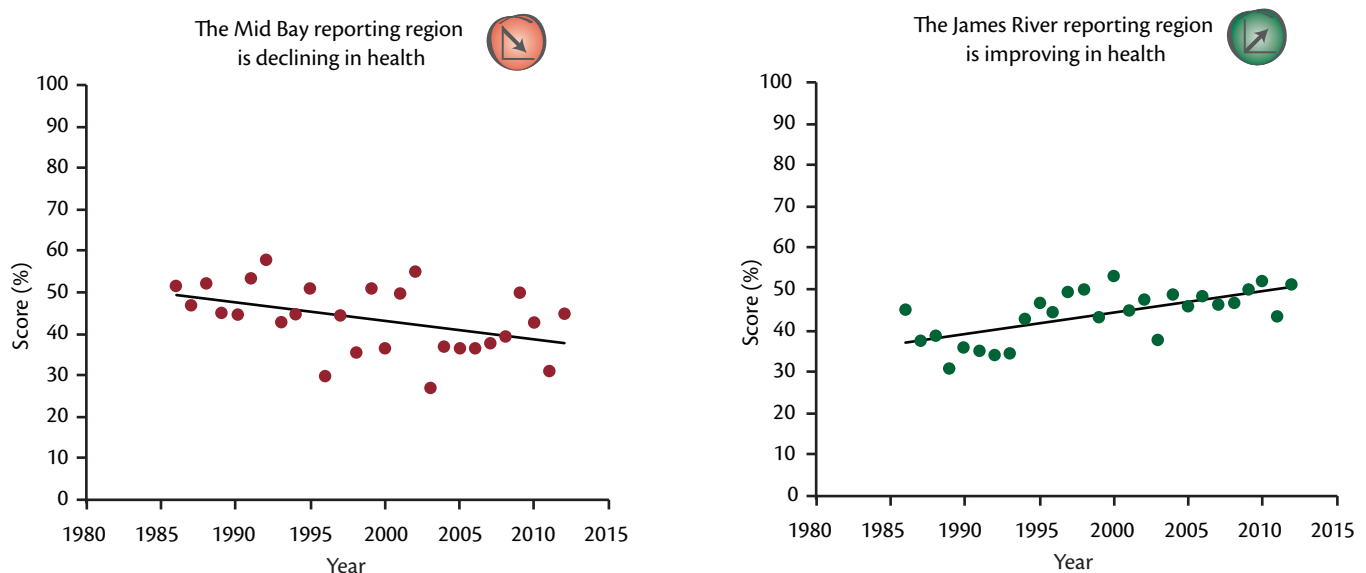
These graphs show two examples of the trend analysis conducted for each reporting region. The dots represent the percent score for each year from 1986 - 2012. The black line shows the linear regression of the data. For the Mid Bay (left), there is a significantly decreasing health trend (p-value = 0.02283). This is the only region with a decreasing trend. The James River (right), is showing a significantly increasing health trend (p-value = 0.00017). The James River is one of four regions that are showing a significant improving trend in health.
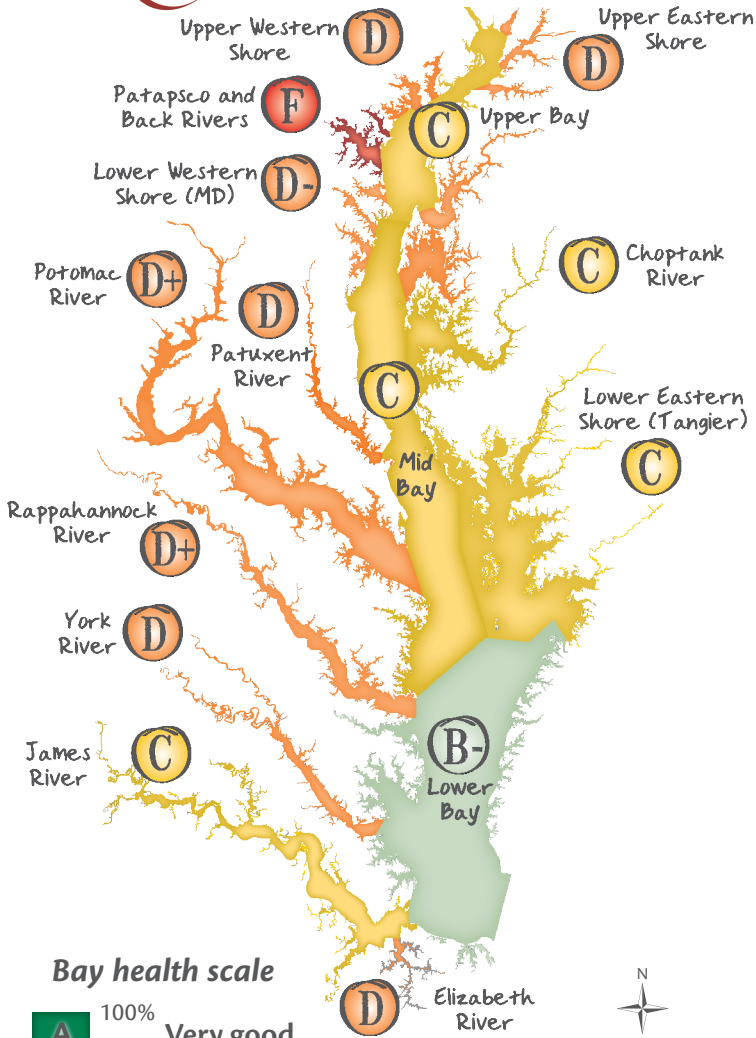
CHESAPEAKE BAY 2012 REPORT CARD

Overall Bay health is made up of seven indicators, which include water quality, nutrients, and biotic indicators. In 2012, the overall Bay health scored a 47%, a C. This is higher than 2011, which was a D+ (See website for the previous years' scores). Out of fifteen reporting regions, eleven had higher scores in 2012 compared to 2011. The highest-ranked region was the Lower Bay, while the Patapsco and Back Rivers region was the lowest-ranked region.
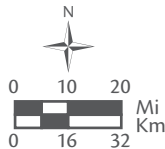
Trends in Bay health were determined by analyzing data for each reporting region from 1986–2012. Overall Bay health is showing no change in health over the period of record. Four out of the fifteen regions had a significantly improving trend. This means that over time the health of these regions has improved. The four reporting regions with significantly improving trends were the Upper Western Shore, Upper Bay, James River, and Elizabeth River. One region, the York River, showed a slightly improving trend, although it was not significant. The Mid Bay region is the only region that shows a significantly decreasing trend, which means Mid Bay health is declining.
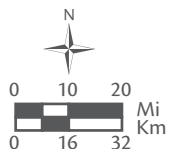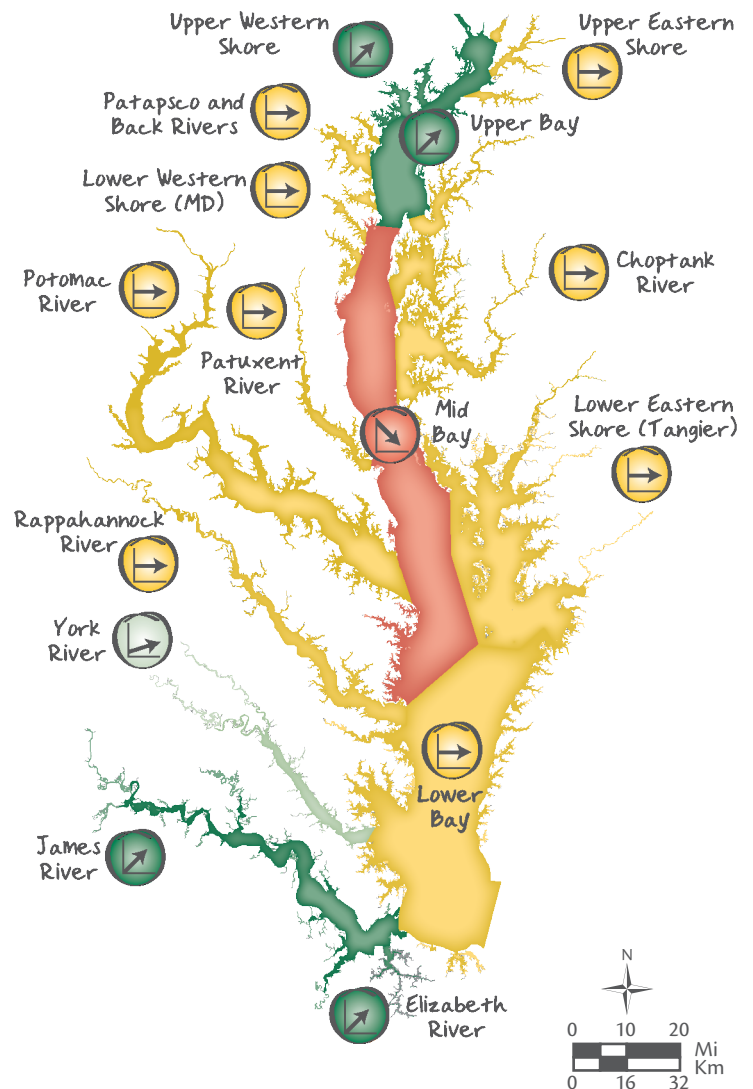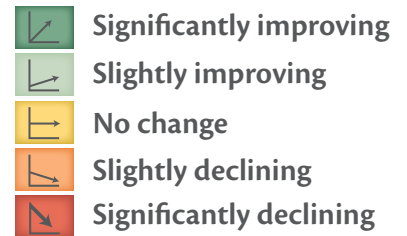
Overall score: C

Overall trajectory:

Bay health trends

- Significantly improving
- Slightly improving
- No change
- Slightly declining
- Significantly declining

Left map (scores):
- Upper Western Shore — D
- Patapsco and Back Rivers — F
- Lower Western Shore (MD) — D-
- Upper Eastern Shore — D
- Upper Bay — C
- Choptank River — C
- Potomac River — D+
- Patuxent River — D
- Mid Bay — C
- Lower Eastern Shore (Tangier) — C
- Rappahannock River — D+
- York River — D
- James River — C
- Lower Bay — B-
- Elizabeth River — D

Bay health scale

A	100% / 80	Very good
B	60	
C	40	Moderate
D	20	
F	0	Very poor

N
0 10 20 Mi
0 16 32 Km

Right map (trends):
- Upper Western Shore — Significantly improving
- Patapsco and Back Rivers — No change
- Lower Western Shore (MD) — No change
- Upper Eastern Shore — No change
- Upper Bay — Significantly improving
- Choptank River — No change
- Potomac River — No change
- Patuxent River — No change
- Mid Bay — Significantly declining
- Lower Eastern Shore (Tangier) — No change
- Rappahannock River — No change
- York River — Slightly improving
- James River — Significantly improving
- Lower Bay — No change
- Elizabeth River — Significantly improving

N
0 10 20 Mi
0 16 32 Km

chesapeakebayreportcard.org

Region Summaries

C → Choptank River

Moderate ecosystem health. Decreases in total phosphorus and aquatic grass scores were offset by large improvements in the remaining five indicators. Benthic community score was the highest out of all regions.

D- → Lower Western Shore (MD)

Poor ecosystem health. Failing scores in several indicators decreased the overall score. Benthic community scores sharply declined.

D+ → Rappahannock River

Poor ecosystem health. While total nitrogen, total phosphorus, and benthic community improved, there were large declines in aquatic grass scores. Other indicators showed minimal changes.

D ↗ Elizabeth River

Poor ecosystem health. There were improvements in all indicators except dissolved oxygen, including large increases in the benthic community score. Over time this region is showing a significantly improving trend.

C ↘ Mid Bay

Moderate ecosystem health. All indicator scores increased except for aquatic grass scores, which declined. Over time this region is showing a significantly declining trend.

C ↗ Upper Bay

Moderate ecosystem health. Improvements in water clarity, total nitrogen, and total phosphorus offset declines in all other indicators. While the trend for this region over the past 27 years is improving, there has been a decline over the past several years.

C ↗ James River

Moderate ecosystem health. All indicator scores improved. This is the only region with an improved aquatic grasses score. Over time this region is showing a significantly improving trend.

F → Patapsco and Back Rivers

Very poor ecosystem health. Although dissolved oxygen scores improved, benthic community scores sharply declined, which worsened overall health. Five out of the seven indicators had failing scores.

D → Upper Eastern Shore

Poor ecosystem health. Large declines in benthic community and aquatic grass scores were offset by strong improvements in dissolved oxygen and total phosphorus. Other indicators showed slight increases.

B- → Lower Bay

Moderately good ecosystem health. There were improved scores for dissolved oxygen, chlorophyll a, and total nitrogen. Other indicators slightly improved or remained the same.

D → Patuxent River

Poor ecosystem health. Improvements in dissolved oxygen, total nitrogen, and total phosphorus scores were balanced by declines in benthic community and aquatic grass scores.

D ↗ Upper Western Shore

Poor ecosystem health. The aquatic grass and benthic community scores sharply declined. While the trend for this region over the past 27 years is improving, there has been a decline over the past several years.

C → Lower Eastern Shore (Tangier)

Moderate ecosystem health. There were large improvements in dissolved oxygen, and benthic community scores, and a decrease in the total nitrogen score. This region had the highest dissolved oxygen score.

D+ → Potomac River

Poor ecosystem health. Declines in benthic community and aquatic grasses were balanced by large improvements in water clarity and total nitrogen. Other indicators also showed strong increases.

D ↗ York River

Poor ecosystem health. Improvements in total nitrogen and benthic community scores led to an increase in the overall score. Over time this region is showing a slightly improving trend.

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2012
Chesapeake Bay
Report Card

This report card was produced and released in July 2013 by the Integration & Application Network, University of Maryland Center for Environmental Science. This report card provides a transparent, timely, and geographically detailed assessment of Chesapeake Bay. The overall health of Chesapeake Bay, determined using water quality, nutrient, and biotic indicators, is moderate. The highest-ranked region was the Lower Bay, while the Patapsco and Back Rivers region was the lowest-ranked region.

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