UMCES formed in 1925 to provide practical environmental advice
UMCES defines scholarship as discovery, integration, application, and teaching
IAN was created in 2002 to address integration and application
WHO ARE WE?
IAN’s aim is to enable better communication to empower change.
IAN HAS THREE MAIN FOCUS AREAS

- Develop Science Communication products
- Environmental Report Cards
- Science Communication Training
SOLVING, NOT JUST STUDYING ENVIRONMENTAL PROBLEMS

**STUDY**
- Dispassionate
- Embrace complexity
- Publish & funding via peer review
- Getting it right

**SOLVE**
- Passionate
- Simplify
- Publish & funding via stakeholders
- Getting it done
SYNTHESIZING INFORMATION FOR LESS TECHNICAL AUDIENCES

Synthesis

Synthesized data

Visualization

Illustrate key points

Context

So what?
What is an ecosystem health report card?

- Broad-level assessments of a region or system
- Communicate complex information
- Based on real data: transparent and defendable
- Provide accountability
- Engage communities
ECOSYSTEM HEALTH REPORT CARDS ARE AN EFFECTIVE COMMUNICATION TOOL

- Peer pressure is a powerful human motivator

- Educational report cards are a common experience

- Report cards synthesize large amounts of data
OUTCOMES OF ECOSYSTEM HEALTH REPORT CARDS

- Well received and influential
- Comprehensive package – goes beyond simple grading
- Visually appealing
- Being local – sense of ownership
- Educational
REPORT CARDS ADDRESS MANY AUDIENCES

- Top tier = Report card
- 2nd Tier = Newsletter, website
- 3rd Tier = Technical reports, scientific literature
- Base = Data
WE HAVE DEVELOPED REPORT CARDS IN ICONIC REGIONS AROUND THE WORLD
REPORT CARDS ARE A FIVE STEP PROCESS

1. Create a conceptual framework
   Create a framework defining goals and major aspects of each goal that should be evaluated over time.

2. Choose indicators
   Select indicators that convey meaningful information and can be reliably measured.

3. Define thresholds
   Define status categories, reporting regions, and method of measuring threshold attainment.

4. Calculate scores
   Calculate indicator scores and combine into index grades.

5. Communicate results
   Communicate results using visual elements, such as photos, maps, and conceptual diagrams.
We use a partnership approach and want to engage you in this process.

This workshop was led by KCI, University of Maryland Center for Environmental Science, and PSAM supported by the Inter-American Development Bank. Participants included Izidro Paes Leme Arthou, José Paulo Azevedo, Guido Gelli, Marcos Santanna Lacerda, Nair Palhano, Marco Pessoa, Stella Procópio da Rocha, Marcio Santarosa, Mariana Correa dos Santos, Kligon Senra, José Alfredo Sertã, Leonardo Daemon Doliveira Silva, Fátima de Freitas Lopes Soares, Rony Sutter, Luciana Ventura, and Victor Zveibil.

Some workshop participants at Instituto Estadual do Ambiente (INEA) on 25 April 2016.
CONCEPTUAL MAPPING EXERCISE
INITIAL CONCEPTUAL MAPS
GUANABARA BAY
KEY VALUES & MAJOR THREATS
REPORTING REGION DISCUSSION
REPORTING REGIONS: GUANABARA BAY & RIVER BASIN
POTENTIAL INDICATORS FOR GUANABARA BAY

- **DO** (Dissolved oxygen)
- **P** (Phosphorus)
- **NO₃** (Nitrate)
- **NH₄⁺** (Ammonium)
- **Coliforms**

Potential indicators include:

- Chlorophyll
- Phytoplankton
- Marine mammals
- Fish assemblage
- Mangroves
- Water transparency
- Contamination of crabs
- Sea horses

Innovation for a better future
University of Maryland
Center for Environmental Science
POTENTIAL INDICATORS FOR THE GUANABARA BAY BASIN

**DO**  Dissolved oxygen

**BOD**  Biological oxygen demand

P  Total phosphorus

NO$_3$  Nitrate

**Turbidity**

**TDS**  Total dissolved solids

**Air/water temperature**

**Coliforms**

**pH**  pH

Potential indicators for the Guanabara Bay Basin.
INITIAL WORKSHOP NEWSLETTER WILL BE DISCUSSED AFTER LUNCH

- Globally iconic location
- Pressing environmental problems
- Need for scientifically rigorous, transparent assessments to track restoration progress
WE WILL PRODUCE A PRINTED REPORT CARD FOR GUANABARA BAY (LIKE CHESAPEAKE BAY)
WE ALSO WILL ADD THE GUANABARA BAY REPORT CARD TO ECOREPORTCARD.ORG
The website allows people to investigate the data.
How healthy is your Chesapeake Bay?

BY INDICATOR | Nitrogen

- Overall Health Index
- Dissolved Oxygen
- Nitrogen
- Phosphorus
- Chlorophyll a
- Water Clarity
- Aquatic Grasses
- Benthic Community
- Blue Crab
- Bay Anchovy
- Striped Bass

BY REGION |

Scores (%)
- 80 to 100 (Very Good)
- 60 to <80
- 40 to <60
- 20 to <40
- 0 to <20 (Very Poor)
- Not Scored

TRENDS | Nitrogen

The website provides detailed explanations.
THE WEBSITE PROVIDES THE METHODOLOGY

What is the Phosphorus indicator?

Total phosphorus is an indicator of too much phosphorus in the water. Phosphorus attaches to sediment particles, so phosphorus and sediment pollution are linked. Phosphorus is an essential nutrient for all plants and animals. But too much phosphorus in the water causes algae to grow in large, dense algal blooms, which depletes oxygen for fish and other marine organisms.

When sediment runs off land, it can carry nutrients like phosphorus into the water.
How healthy is your Guanabara Bay?
GUANABARA BAY REPORT CARD

How healthy is your Guanabara Bay?

BY INDICATOR

BY REGION | Overall

TRENDS | Overall

[Map and graph showing environmental indicators and trends for Guanabara Bay]
How healthy is your Guanabara Bay Basin?

1986

1. BY INDICATOR |
   - Overall Health
   - Eutrophication
   - Phosphorus
   - Zooplankton
   - Water Clarity
   - Benthic Community
   - Blue Crab
   - Bar Anhaga
   - Siphonacea

2. BY REGION | Overall

3. TRENDS | Overall

Map of Guanabara Bay basin with different regions colored in green, yellow, and blue, indicating health status. Graph showing trends over time.
Guapimirim-Macacu Basin

Coliform: 

Dissolved oxygen: DO

Nitrate: NO₃

Overall Score: ?
GUANABARA BAY IS AN AMAZING PLACE

• Beautiful natural harbor
• It attracts people to live, work, and play
GUANABARA BAY IS VULNERABLE TO HUMAN IMPACT

• Restricted exchange with ocean
• Poor flushing where it is needed most
GUANABARA BAY HAS SOME SIGNIFICANT ENVIRONMENTAL IMPACTS

Visible (e.g. litter)

Invisible (e.g. bacterial contamination)
THERE IS STRONG INTEREST IN IMPROVING GUANABARA BAY (THIS IS WHY WE ARE ALL HERE TODAY)
WE HAVE A UNIQUE OPPORTUNITY TO ACCELERATE GUANABARA BAY RESTORATION
THERE IS A STRONG SCIENTIFIC FOUNDATION FOR GUANABARA BAY RESEARCH AND MONITORING
WE CAN BUILD ON THIS FOUNDATION TO CREATE A SCIENTIFICALLY RIGOROUS, TRANSPARENT PROCESS FOR TRACKING RESTORATION PROGRESS

How healthy is your Guanabara Bay?
WE LOOK FORWARD TO ENGAGING WITH YOU IN THIS PROCESS
Thank You
DEVELOPING A VARIETY OF SCIENCE COMMUNICATION PRODUCTS

Newsletters

Science Journals

Posters

Reports

Books
REPORT CARD EXAMPLES
Report cards are a five step process:

1. **Create a conceptual framework**
   - Create a framework defining goals and major aspects of each goal that should be evaluated over time.

2. **Choose indicators**
   - Select indicators that convey meaningful information and can be reliably measured.

3. **Define thresholds**
   - Define status categories, reporting regions, and method of measuring threshold attainment.

4. **Calculate scores**
   - Calculate indicator scores and combine into index grades.

5. **Communicate results**
   - Communicate results using visual elements, such as photos, maps, and conceptual diagrams.
### Workshop to identify values and threats

- Brings together relevant experts and stakeholders in one place at one time
- Together develop content and structure of report card
- Builds consensus amongst different parties
- Iterative – review and editing during and after workshop

<table>
<thead>
<tr>
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<tbody>
<tr>
<td><img src="image1.png" alt="Image of workshop" /></td>
<td><img src="image2.png" alt="Image of workshop" /></td>
<td><img src="image3.png" alt="Image of workshop" /></td>
<td><img src="image4.png" alt="Image of workshop" /></td>
<td><img src="image5.png" alt="Image of workshop" /></td>
</tr>
</tbody>
</table>
Chesapeake Bay – Build conceptual diagrams

1. Conceptual framework
2. Indicators
3. Thresholds
4. Calculate scores
5. Communicate results
Chesapeake Bay – Indicators measure values and threats

1. Conceptual framework
2. **Indicators**
3. Thresholds
4. Calculate scores
5. Communicate results

**Degraded Bay Health**
- Elevated nutrient and sediment loads
- Water quality: High chlorophyll $a$, Low dissolved oxygen, Poor water clarity (shallow Secchi depth)
- Biotic Indicators: Reduced bay grasses distribution, Low Benthic Index of Biotic Integrity, Low Phytoplankton Index of Biotic Integrity

**Improved Bay Health**
- Reduced nutrient and sediment loads
- Water quality: Low chlorophyll $a$, High dissolved oxygen, Good water clarity (deep Secchi depth)
- Biotic Indicators: Increased bay grasses distribution, High Benthic Index of Biotic Integrity, High Phytoplankton Index of Biotic Integrity
The method of assigning thresholds for each indicator can be based on either, or a combination, of the following:

- Regulatory guidelines (e.g. local or regional water quality guidelines);
- Biological limits (e.g. dissolved oxygen requirements for protection of an important species);
- Socio/economic requirements (e.g. minimal fish stocks determined to be required for sustainable fishery);
- Reference conditions (e.g. historical baseline or nearby system with conditions that would like to be matched);
- Professional judgment
Score Calculation Methods

1. Prepare Data: Calculate annual mean, median (or multi-year rolling mean or median) for each indicator

2. Assess data against thresholds
   - % of measured or interpolated area that meets or does not meet threshold
   - % of sites that meets or does not meet threshold

OR

- % of measured or interpolated area that meets or does not meet threshold
- % of sites that meets or does not meet threshold
1. Conceptual framework
2. Indicators
3. Thresholds
4. Calculate scores
5. Communicate results

Chesapeake Bay Methods

Data integrated
Compared to thresholds
Combined into indices

Water quality
Biotic
1. Conceptual framework
2. Indicators
3. Thresholds
4. Calculate scores
5. Communicate results

<table>
<thead>
<tr>
<th>Score</th>
<th>Grade</th>
<th>Explanation</th>
</tr>
</thead>
<tbody>
<tr>
<td>80-100 %</td>
<td>A</td>
<td>All water quality and biological health indicators meet desired levels.</td>
</tr>
<tr>
<td>60-80 %</td>
<td>B</td>
<td>Most water quality and biological health indicators meet desired levels.</td>
</tr>
<tr>
<td>40-60 %</td>
<td>C</td>
<td>There is a mix of good and poor levels of water quality and biological health indicators.</td>
</tr>
<tr>
<td>20-40 %</td>
<td>D</td>
<td>Some or few water quality and biological health indicators meet desired levels.</td>
</tr>
<tr>
<td>0-20 %</td>
<td>F</td>
<td>Very few or no water quality and biological health indicators meet desired levels.</td>
</tr>
</tbody>
</table>
1. Conceptual framework
2. Indicators
3. Thresholds
4. Calculate scores
5. Communicate results

Cover
Values and threats
Indicators and methods
Scores/Grades
Trends
Credits
Keep evolving

Chesapeake Bay:
- has new indicators
- is now reporting trends
- Includes flow weighted scores
Retrospective on ecosystem report cards

Chesapeake Bay, USA
Moreton Bay report card

- Gradual change
- Reticence to change/sunset indicators
- Delay in reporting
- Graduation?

Moreton Bay, Australia
In summary:

1. Identify values and threats
2. Choose indicators
3. Identify thresholds
4. Calculate scores and grades
5. Communicate results
Mississippi River Watershed Report Card
Mississippi River Report Card

Beautiful, productive, abundant water

The Ohio River Basin is the 400,000 square-mile eastern drainage of the Mississippi River watershed, covering an area from southwestern New York to northeastern Alabama, including parts of 14 states. The basin is dominated by forests, row crops, agriculture, pastureland for livestock, and urban development. Due to its vast resources of coal and water, it is home to 20 million people and produces roughly 25% of the electricity in the United States. At the heart of the basin lies the Ohio River, a 382-mile resource that is one of the major industrialized rivers of the world. With the help of navigation dams, the Ohio hosts the largest inland port in the nation and moves more than 250 million tons of cargo per year. The river provides opportunities for industrial development, power production, commercial navigation, and widespread recreation. The river also serves as the source of drinking water for more than 3 million residents.

Industrialization and urbanization have come at the expense of the river itself, as with most of the great rivers throughout the nation and world. Today, however, due to a conscious effort by state and federal agencies, nonprofit organizations, private businesses, and municipalities, the Ohio River combines economic and development opportunities with recreational and ecosystem goals.

Potential Indicators for the Ohio River Basin

America’s Watershed Report Card is designed to report on the status of achieving six broad goals developed at the America’s Watershed Summit in September 2012. The goals were developed to reflect the things that people value in the watershed. Potential indicators for each goal were determined at the Ohio River Basin workshops. The final list of indicators will be determined by several factors, including data availability and how well they represent the goals.

- Water supply
  - Water availability
  - Depletion/recharge
  - Cuts of water
- Flood control and risk reduction
- Economy
- Ecosystems
- Recreation
- Transportation

Survey results from the Ohio River Basin workshops are summarized from all expert and non-expert participants in the workshops. The number of experts and non-experts varied between goals, and the combined number of experts and non-experts included all workshop participants. The percent rank was calculated from the ranking of each potential indicator following expert group breakout and communication to the overall workshop.

This list of potential indicators is not intended to be comprehensive, but provides examples from what was presented at the workshop.

AmericanWatershed.org/reportcard AmericanWatershed.org/reportcard
Laguna De Bay Report

2013 Laguna de Bay ecosystem health report card

LAGUNA DE BAY

Laguna de Bay scored a low passing mark, 76%, on water quality. The Lake is consistently within the Department of Environment and Natural Resources (DENR) guidelines for class C waters in E. coli, B. cereus, and total coliform. However, it scored 0% in chlorophyll a and 50% in phosphates. Water quality was affected by high population and industrialization.

The lake received an F in fisheries (48%), with 53% 68% and 22% scores in fish species composition, zooplankton ratio, and catch per unit effort (CPUE), respectively. Invasive fish species and competition among species contributed to the low scores.

Even though the DENR guidelines are not met in most water quality indicators, the chlorophyll a, phosphates, and zooplankton ratio scores show that the lake is highly eutrophic. These results have a negative impact on the fisheries of Laguna de Bay. Overall, those scores are not only a cause for concern for fisheries, but the whole community and all the industries supported by the lake.

How are the scores calculated and what do they mean?

The 2013 Laguna de Bay report and measured indicators for water quality and fisheries for the West, central, and East Bay. For water quality indicators were composed of the Department of Environment and Natural Resources (DENR) guidelines for class C waters (suitable for fisheries and recreation) which were then combined and represented as a percent score for each bay. The three fishery indicators were calculated as ratios or percentages that are then combined as a percent score for each bay. The scoring scale follows the same scale used in Philippine smilies.

5% = 100%. All the indicators meet desired levels. Quality of water in these locations tends to be very good, most often leading to good or excellent conditions for aquatic life.

63-91%. Most indicators meet desired levels. Quality of water in these locations tends to be good, often leading to acceptable habitat conditions for aquatic life.

75-82%. There is a mix of good and poor levels of indicators. Quality of water in these locations tends to be fair, leading to sufficient habitat conditions for aquatic life.

10-34%. Some or few indicators meet desired levels. Quality of water in these locations tends to be poor, often leading to degraded habitat conditions for aquatic life.

6-29%. Very few or no indicators meet desired levels. Quality of water in these locations tends to be very poor most often leading to unacceptable habitat conditions for aquatic life.

WEST BAY

The West Bay has the second highest fisheries score at 74.5%. However, it scored 50% in fisheries. It is the highest of all bays. Although it scored 100% in nitrates, 60% and 80% in total coliform, it had the lowest score in phosphates with 22% and 20% in chlorophyll a.

The Central Bay has the highest water quality score at 87%. It scored 90% in nitrate, 60% and 80% in total coliform, and had the second highest score in nitrates. It is the highest of all bays. Although it scored 100% in nitrates, 60% and 80% in total coliform, it had the lowest score in phosphates with 5% and 5% in chlorophyll a.

The East Bay has the highest water quality score at 90%. It scored 90% in nitrates and 60% in total coliform, and had the highest score in phosphates. Although it scored 100% in nitrates, 60% and 80% in total coliform, it had the lowest score in phosphates.

SOUTH BAY

The South Bay has the second highest score in water quality at 97%, with 100% in nitrates, 90% in total coliform, and highest of all bays. It has 0% in phosphates. It had the lowest score in nitrogen, 43%, with the lowest score in nitrates. It is classified as a very low risk in fisheries, although even through a designated fishing ground allocation of 1 fishing per 10 hectares has.
Great Barrier Reef Report Card

Evolution of report cards to include pressure and response indicators

Great Barrier Reef-wide Paddock to Reef conceptual diagram

The Great Barrier Reef catchments are largely dominated by summer monsoonal rains and occasional cyclones delivering sediments, nutrients, and pesticides to the rivers and sometimes, offshore portions of the reef in pulsed flows, which can be affected by water reservoirs and dams. Grazing lands are the largest single land use, and sugarcane, horticulture, and cropping make up other agricultural land uses. Small urban centers are located on the coastal sides. Habitats include wetlands, estuaries, lagoons, reefs, seagrass meadows, mangroves, and coral reefs, and mangroves are present.

Catchment indicators

Cattlemen's water consumption was estimated at 13.3 million tonnes of water per year. Water quality indices revealed elevated concentrations of chlorophyll (a measure of nutrient status) and high variabilities of total suspended sediments.

Marine indicators

Coral: The majority of reef types are in good condition, with some minor degradation. Monotopic abundance, settlement of bivalve, and number of species are high, but some areas show signs of degradation. Changes in the environment, commercial tourism, and fisheries negatively impact coral health.

Water quality: Nutrient concentrations are elevated, affecting water clarity.
Chilika Lake Report Card

Calculating the ecosystem grade for Chilika Lake

Chilika Lake was divided into four reporting zones, each of which received a report card grade. The grades were calculated from the average of water quality, fisheries, and biodiversity indices, comprised of data collected over the 2011-2012 period. Ongoing monitoring will allow grades to be updated on a periodic basis, providing a means to track change over time.

What do the grades mean?

A: 80-100% All water quality and biological health indicators met desired levels. Quality of water in these locations tends to be very good, most often leading to very good habitat conditions for fish and shellfish.

B: 60-80% Most water quality and biological health indicators meet desired levels. Quality of water in these locations tends to be fair, leading to good habitat conditions for fish and shellfish.

C: 40-60% There is a mix of good and poor levels of water quality and biological health indicators. Quality of water in these locations tends to be poor, leading to poor habitat conditions for fish and shellfish.

D: 20-40% Very few or no water quality and biological health indicators meet desired levels. Quality of water in these locations tends to be very poor, most often leading to very poor habitat conditions for fish and shellfish.

E: 0-20% All water quality and biological health indicators did not meet desired levels. Quality of water in these locations is considered unacceptable for all uses.

Overall, Chilika Lake scored a 4 for ecosystem health based on performance of water quality, fisheries, and biodiversity indices.

The Lake as a whole displayed excellent (A) dissolved oxygen concentrations, water clarity, total nitrogen, and salinity. The Lake follows, however, for total chlorophyll concentrations (B), based on desired conditions. Of the ten indicators that were assessed within water quality, fisheries, and biodiversity: 79% in the Central Zone, followed by 76% in the Southern Zone, 71% in the Outer Channel Zone, and 67% in the Northern Zone. A breakdown of these indicators by zone is provided below.

Northern Zone

The Northern Zone displayed excellent results for fisheries, good water quality with the exception of total chlorophyll, and good biodiversity largely due to an absence of dolphin sightings.

Central Zone

The Central Zone displayed excellent results for fisheries, good water quality with the exception of total chlorophyll, and excellent biodiversity highlighted by dolphin abundance and beluga whale diversity.

Southern Zone

The Southern Zone displayed excellent results for fisheries, good water quality with the exception of total chlorophyll, and good biodiversity highlighted by dolphin abundance and beluga whale diversity.

Outer Channel Zone

The Outer Channel Zone displayed good results for fisheries, good water quality with the exception of total chlorophyll, and excellent biodiversity highlighted by dolphin abundance and phytoplankton diversity.

There’s more to this story: Salinity

The four zones used in this Chilika Lake Report Card are based mostly on salinity variations that occur within the Lake. Salinity in the Lake is driven by freshwater flow from the north and west, and total seawater from the east and south. This results in a variation of salinity in the Lake, from freshwater in the north, brackish waters in the center and south, and full saline waters to the east around the islands and outer channel. The boundaries between these zones shift throughout the year, driven by mesoseas and seasonal winds.

During the 1980s, extensive salinity in the Lake was limiting access to the sea, reducing total fishing and decreasing salinity to such an extent that biologically declined and invasive aquatic species proliferated. This had a highly negative impact on the Lake's habitat for wildlife and fisheries resources. In 1992, it was included in the Monsoon Record by Ramgarhia due to changes in the ecologically character. In 2000, CMA opened a new route to restore the lake ecosystems. This new opening increased salinity through but not merging the Lake, vastly improving water quality, ensuring last habitat for important species, enhancing fisheries, and controlling invasive species. Lake salinity and connectivity to the sea are now closely monitored to ensure that conditions do not return to those experienced prior to 2000. The lake was removed from the Monsoon Record due to restoration of the lake ecosystem in 2002.
Gulf of Mexico Report Card

- DPSSIR framework
- Multinational effort

Example component: Birds

Report card prototype

Example component: Seagrass ecosystems

Gulf of Mexico birds

The Gulf of Mexico is a major flyway for migratory birds that provides essential stopover habitat along three major flyways. The Gulf has long, wide-open, and diverse areas of coastal habitats that provide breeding and resting areas for shorebirds, waterfowl, coastal birds, and even fowl. These habitats support the area's diversity of bird species, including Brown Pelicans. Brown Pelicans are known for their food habits that vary from small aquatic animals to marine mammals. The Gulf of Mexico is an important breeding ground for many bird species, and Brown Pelicans are one such species. The population of Brown Pelicans in the Gulf of Mexico is expected to increase in the coming years, with a predicted increase of up to 50% by 2050. This increase is due to the protection and conservation efforts implemented by the Gulf of Mexico Report Card.

Brown Pelican trends

The Brown Pelican is an iconic bird of the Gulf of Mexico, known for its unique appearance and its role in the ecosystem. The Brown Pelican is a large seabird that feeds on fish and other small marine animals, making it an important indicator of the health of the Gulf of Mexico. The population of Brown Pelicans in the Gulf of Mexico has declined in recent years, with a 30% decrease from 2000 to 2015. This decline is thought to be caused by habitat loss, pollution, and overfishing. Conservation efforts are ongoing to address these issues and protect the Brown Pelican population in the Gulf of Mexico.

Seagrass ecosystems

Seagrass ecosystems are vital for the health and survival of many marine species in the Gulf of Mexico. Seagrass beds provide a nursery for young fish and invertebrates, helping them to grow and thrive before entering the open ocean. Seagrass ecosystems also help to protect coastal areas from erosion and provide a source of food for many marine animals. The Gulf of Mexico has a diverse range of seagrass beds, with species such as the Florida Keys seagrass and the Mississippi Sound seagrass. However, these ecosystems are under threat due to pollution, habitat loss, and climate change. Conservation efforts are ongoing to protect and restore seagrass ecosystems in the Gulf of Mexico.

For more information, visit the Gulf of Mexico Report Card website at gulfreportcard.org.
Chesapeake Bay (Chesapeake 2000 Agreement)

• Values to protect
  • Fisheries (fish, oysters and crabs)
  • Recreation
  • Tourism

• Threats
  • Sewage
  • Urban and agricultural runoff
  • Overfishing
  • Loss of habitat
## Report card indicators elsewhere

<table>
<thead>
<tr>
<th>Report Card</th>
<th>Indicators</th>
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<tbody>
<tr>
<td>Chesapeake Bay</td>
<td><strong>Pre 2012</strong> = BIBI, PIBI, aquatic grasses, DO, Chlorophyll, water clarity,</td>
</tr>
<tr>
<td></td>
<td><strong>Current</strong> = BIBI, aquatic grasses, DO, chlorophyll, water clarity, TN, TP,</td>
</tr>
<tr>
<td></td>
<td>Blue Crabs, Bay Anchovy</td>
</tr>
<tr>
<td>Chilika Lake</td>
<td><strong>Water Quality</strong> = Chlorophyll, DO, water clarity,</td>
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<tr>
<td></td>
<td><strong>Biodiversity</strong> = Bird richness and abundance, dolphin abundance, benthic</td>
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<td></td>
<td>infauna diversity,</td>
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<tr>
<td></td>
<td><strong>Fisheries</strong> = total fish catch, fish diversity and fish size</td>
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<tr>
<td>Moreton Bay</td>
<td><strong>Bay</strong> =</td>
</tr>
<tr>
<td></td>
<td><strong>Rivers</strong> =</td>
</tr>
<tr>
<td>Laguna de Bay</td>
<td>???</td>
</tr>
</tbody>
</table>

1. Conceptual framework
2. **Indicators**
3. Thresholds
4. Calculate scores
5. Communicate results
Chesapeake Bay Thresholds (can be seasonal and vary geographically)

- **Chlorophyll a**: $\leq 2.8$ to $\leq 20.9 \, \mu g \, L^{-1}^{(3)}$
- **Dissolved oxygen**: $\geq 1.0$ to $\geq 5.0 \, mg \, L^{-1}^{(4)}$
- **Water clarity**: $\geq 0.65$ to $\geq 2.0 \, m$ Secchi depth$^{(3)}$
- **Bay grasses**: Hectares$^{(2)}$
- **Benthic community**: $\geq 3$ Benthic IBI$^{(5)}$
- **Phytoplankton**: $\geq 3$ Phytoplankton IBI$^{(6)}$