Redesign of Chesapeake Bay Program indicator structure and communication strategy: Goals, rationale and Products

Indicator Redesign Taskforce draft briefing paper

Ben Longstaff
EcoCheck
(NOAA-UMCES Partnership)

Background

Confusing, even incorrect public messages related to the state of Chesapeake Bay and the associated restoration activities have been very prominent in the news media over the past year. In part, this is attributable to the manner in which the Chesapeake Bay Program indicators are structured, organized and communicated. For example, the current indicators framework has little to no hierarchy, few overarching indices and does not make a distinction between indicators used for assess 'state of the Bay', 'state of the Bay restoration' and stressors on the Bay. In addition, the current indicators are strictly presented in a stand alone style (don't tell a complete story) and are often only available a long time after the monitoring was conducted. By providing a new framework for the Bay Program's indicators and strongly linking this framework to a new communication strategy, we expect our indicators to communicate clear messages to increase public and political understanding of Chesapeake Bay's health and the associated restoration activities.

The Indicator Redesign Taskforce (IRT) was assembled to provide a vision for the CBP indicators and the manner in which they are communicated. In doing so, the IRT is initiating and steering the necessary changes through the Monitoring and Analysis Sub-committee. The IRT recognizes that the proposed changes need to be expedient, based on a long term vision and be robust and defendable. This document summarizes the goals, rationales and products associated with the IRT's proposed indicator structure and communication strategy.

Indicator framework

Goals

Provide a framework that facilitates easy access and interpretation of Chesapeake Bay Program indicators by:

(1) Providing a hierarchy based on the level of detail required, from broad overall levels/conditions to geographically specific details;
(2) Minimizing the potential for confusing indicators that relate to State of the Bay, the State of the Bay restoration and those factors that act as Bay stressors;
(3) Facilitating the interpretation and communication of indicator interconnectivity through the development and presentation of storylines;
(4) Closely aligning with the Bay Program's overall communication strategy; and
(5) Finally, this framework must be relatively simple, avoiding numerous categories or complex relationships.

Proposed Framework

The proposed framework uses a matrix that groups the indicators by functional role and then place each indicator into a hierarchy of detail/synthesis within that functional role. The functional role groupings separate indicators into the primary use, whether the indicator is used to communicate the state of the Bay ecosystem, the state of Bay restoration or the influence of a stressor on the Bay's health. Within each grouping the Task Force proposes that the indicators are ordered into a hierarchy based on the degree of synthesis and detail required.

Indicator functional groupings

It is proposed that all indicators be divided into one of three groups based on their function within an adaptive management framework: what restoration actions are taking place, how do these actions influence the stressors on the Bay and, in turn, how does all this affect the Bay's health.

Chesapeake Bay and Watershed Restoration: All indicators used to measure and communicate specific actions being undertaken to improve the health of Chesapeake Bay.

Chesapeake Bay and Watershed Stressors: All indicators used to measure conditions and factors that are affecting the Bay's health. (This group does not explicitly include climatic factors, but some aspects are implicit through the affect on loads.)

Chesapeake Bay Ecosystem Health: All indicators used to assess the ecosystem health of Chesapeake Bay and its tidal tributaries. It is recognized that a similar grouping of indicators are required for the non-tidal waterways and local watersheds, but the Task Force does not recommend including this fourth functional grouping within the current framework until a clear hierarchy of indices/indicators can be mapped out with the supporting monitoring and reporting programs in place.

Indicator hierarchy

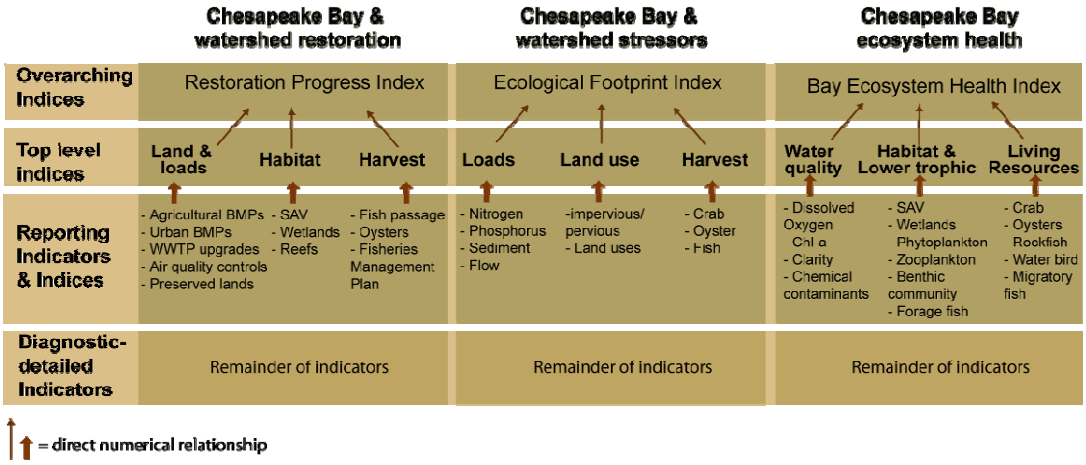
Within each functional group it is proposed to separate indicators into *reporting* and *diagnostic-detailed* indicators.

Reporting indicators: A small number of indicators which effectively communicate the key messages of the functional group. All reporting indicators are further divided into one of three categories in recognition of the diversity within each functional group. We have attempted to use similar categories in each group to facilitate interconnectivity of indicators and, therefore, the development of storylines reaching across the groups of indicators. The reporting indicators form the basis for two upper levels of indices – Top Level Indices and Overarching Indices.

- *Top level indices* are a single value index for each indicator category – e.g, the Water Quality Index under the Chesapeake Bay Ecosystem Health functional group – derived from the underlying reporting indicators. These indices serve as a mid-level of synthesis between the numerous reporting indicators (3 to 6 in number) and the overarching indicator.
- *Overarching indices* are a single value index for each of the three functional groups derived from synthesis of respective three top level indices. These indices serve as the highest level of information synthesis enabling rapid communication and understanding the 'big picture'.

Diagnostic-detailed indicators: Indicators that either facilitate the interpretation of the reporting indicators and the associated integrated indices or address topics of special

interest that don't fit directly under the top level indices. Diagnostic-detailed indicators are not used in the generation of top level or overarching indices.



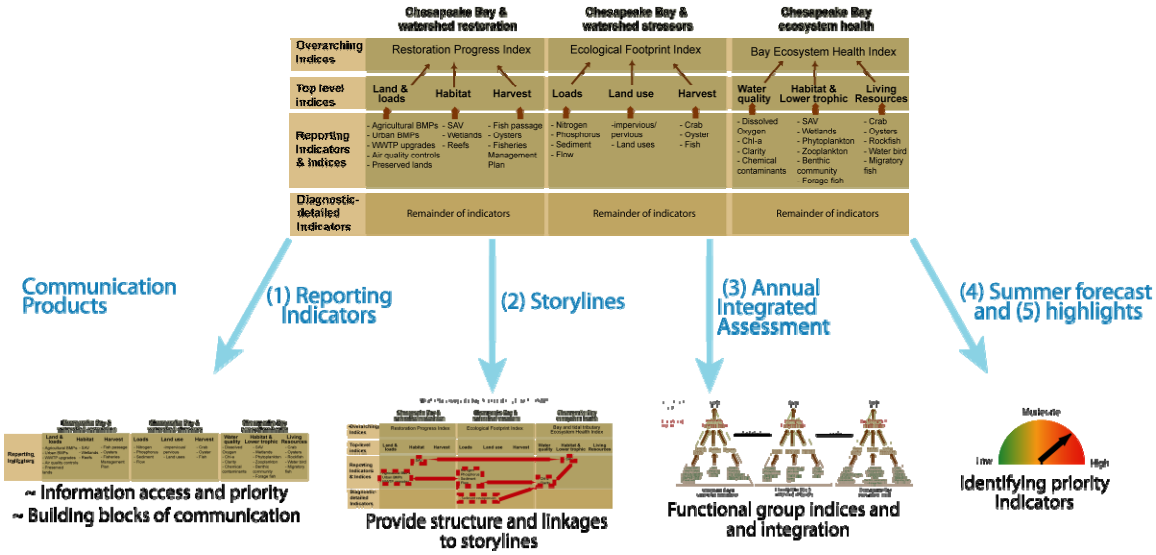
Overall framework proposed for Chesapeake Bay Program indicators.

Products

No specific products. The framework forms the basis of all other reporting products, including reorganization of the CBP website.

Linking the indicator framework to the communication strategy

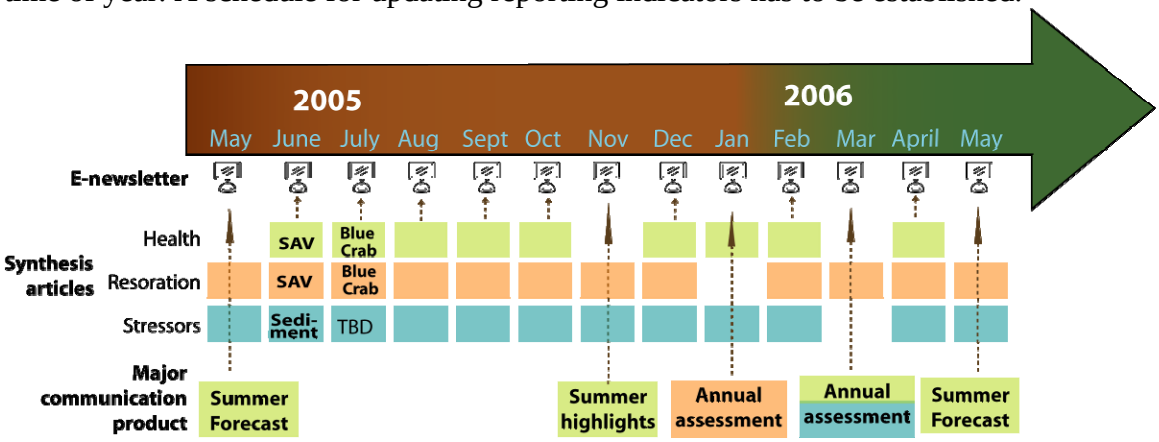
There are five main interrelated communication products that indicator framework supports. These being; reporting indictors, storylines, annual integrated assessment, summer forecast and summer highlights. The following figure illustrates how the framework supports and aids the communication products.



How the indicator framework supports the proposed communication products

The annual integrated assessment, summer forecast and summer highlights have defined reporting times each year. A schedule has also been developed for the inclusion of

storylines into the e-newsletter - so that storyline are reported at the most appropriate time of year. A schedule for updating reporting indicators has to be established.



A schematic of the annual reporting cycle over the coming 12 months.

The remainder of this document provides the goals, rationale and products for each of the reporting products.

Reporting Indicators

Goals

1. Establish a relatively small number of indicators which can be used to simply and effectively communicate the most pertinent information relating to the state of the Bay, state of Bay restoration and Bay stressors;
   - This suite of indicators should present: (a) Current conditions (most recently obtained data); (b) how current conditions relate to past conditions; (c) how current conditions relate to established objectives/criteria.
   - All reporting indicators should be presented at appropriate temporal and spatial scales (local and bay wide scales).
   - All reporting indicators need to be available in appropriate timeframes. As the reporting indicators will form the basis of the annual integrated assessment, all reporting indicators (or most thereof) will eventually need to be available by March of the following year.
2. Identify any deficiencies in current monitoring activities and provide a rationale basis from which to provide and implement solutions. This may include altering current monitoring programs (number, location of sites, parameters measured) or addition of new monitoring activities or parameters (e.g. addition of wetlands monitoring).

	Chesapeake Bay & watershed restoration			Chesapeake Bay & watershed stressors			Chesapeake Bay ecosystem health		
	Land & loads	Habitat	Harvest	Loads	Land use	Harvest	Water quality	Habitat & Lower trophic	Living Resources
Reporting Indicators & Indices	- Agricultural BMPs - Urban BMPs - WWTP upgrades - Air quality controls - Preserved lands	- SAV - Wetlands - Reefs	- Fish passage - Oysters - Fisheries Management Plan	- Nitrogen - Phosphorus - Sediment - Flow	-impervious/ pervious - Land uses	- Crab - Oyster - Fish	- Dissolved Oxygen - Chl-a - Clarity - Chemical contaminants	- SAV - Wetlands - Phytoplankton - Zooplankton - Benthic community - Forage fish	- Crab - Oysters - Rockfish - Water bird - Migratory fish

Proposed list of reporting indictors and associated groups. Final list still needs to be developed by the appropriate committees and workgroups.

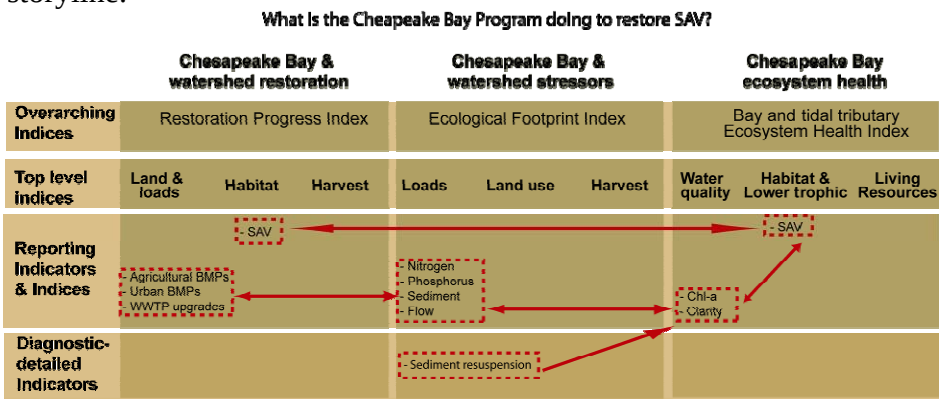
Products

- Provide maps, graphs, tables and associated explanatory text for the selected reporting indicators. These products will form the basis of the indicator web pages, storylines and the annual integrated assessment. To develop the products, each parameter will be analyzed and presented in multiple ways to conform to the goals of providing: (a) current condition; (b) current conditions relative to past conditions; and (c) current conditions relative to established goals/criteria.
- All products need to be up-to-date, timely, produced at both local and Bay scales and when appropriate presented using spatial interpolations. In addition, all products need to be consistent in the manner in which they are presented to facilitate interpretation and understanding.

Storylines

Storylines describe the interrelationships of resources and/or issues among and within the indicator functional groups (health, stressor, restoration). Storylines encompass: (a) stories of interconnectedness; (b) stories in various time frames; and (c) stories in various geographic context. Storylines address the basic questions such as "what is the problem?" (health), "Why is it a problem?" (stressors), How is the problem being handled? (restoration).

Storylines must be tailored to the specific audience. Big picture storylines which provide context for understanding for all audiences will be targeted to the interested public. Then, specific stakeholder audiences will also require specific targeted response strategies and supporting data. Audiences should be understood to bring a fundamental question to their interaction with our storylines; therefore many storylines will be based on the questions that are asked by the audience. Data/Indicators should be the building blocks of stories: stories interpret data < & > data illustrates and substantiates stories – the indicator framework should facilitate the interconnectedness between all the different indicators within a storyline.



Example of how indicator framework can facilitate the development of storylines

Readers/Investigators should be expected to bring questions ranging from broad to specific, and we should provide structure that allows them to "drill down" to the appropriate level of information that addresses their need, including for spatial context.

Goals

1. Develop a series of storylines that address the questions most frequently asked (FAQs) by the target audience or the questions that the relevant experts think should be asked.
2. Provide storylines at appropriate time of year – i.e. when most relevant to the target audience.
3. Develop an up-to-date library of storylines by continual updating existing storylines and adding new storylines.

Rationale

1. Most direct method of fulfilling the known needs of the target audience.
2. Effective approach for explaining / educating public about the interconnectivity between restoration activities, stressors of the Bay and Bay ecosystem health.

Products

Develop a library of storylines based on the frequently asked questions. A storyline should be a standalone article of defined length and format (say 2-4 pages) that answers the FAQ. The storylines must be based on up-to-date monitoring data, use appropriate figure, text and diagrams. All storylines need to provide links and reference to further information and data. The e-newsletter schedule will be used to develop the first round of storylines.

Summer Forecast

"Ecological forecasts predict the effects of biological, chemical, physical, and human-induced changes on ecosystems and their components. These forecasts do not guarantee what is to come; instead, they offer scientifically sound estimations of what is likely to occur. Ecological forecasts help resource managers better understand their options and the likely effects of their decisions. They help managers anticipate the consequences of their actions. Developing and testing ecological forecasts highlight uncertainties and weaknesses, and thereby help science managers set research, monitoring, modeling, and assessment priorities."

Goals

1. In late spring each year, develop a forecast of the summer conditions for a variety of key indicators using established relationships with winter/early spring flow, prior year's living resource population and distribution and loading data with weather forecasts
2. Develop an improved predictive capacity by incrementally adding predictions of different indicators and reducing uncertainties of current indicators.
3. Effectively communicate the predictions and associated uncertainties to the Chesapeake Bay community.

4. Challenge the fisheries resource management/scientific communities to provide for spring forecasts of striped bass, crabs, oysters and any other key species over the coming summer/fall harvest seasons.

Rationale

1. Provide context for understanding summer conditions
    a. Establish the importance of weather and flow in creating environmental conditions that affect water quality, living resources and habitats
    b. Educate the public about the various external factors that will affect the actual conditions and contribute to the uncertainties in predictions
2. Provide guidance for Chesapeake restoration efforts
    a. Establish the importance of targeting restoration efforts in locations/times that environmental conditions will favor restoration success
    b. Educate the public about the need to rebuild not just populations and habitats, but also to rebuild ecosystem resilience, the ability of intact ecosystems to withstand perturbation
3. Establish a proactive communication and education program
    a. Utilize the 20+ years of monitoring data and other data sources to develop credible and robust predictive capacity
    b. Create public anticipation for annual predictions while maintaining credibility (data-based predictions)

Products

1. E-newsletter overview/teaser: 1/4page
2. Newsletter/article: 1 page for each environmental variable + intro page. Each page to contain: (a) Conceptual diagram – explain relationships underpinning the forecast; (b) 2-3 important figures and photos; and (c)Explanatory text - what the forecast is, how generated, uncertainties, how may differ depending on summer conditions.
3. Technical supporting documentation: explains how the forecasts were calculated. Includes analysis, figures etc.
4. Media release
5. Following the release of the forecast the actual conditions need to be tracked and explained any discrepancies. This could be communicated in a similar manner as the forecast itself. E-newsletter overview/teaser linking to a summary page – i.e. summary page for each parameter describing and illustrating current conditions and how they relate to the forecasted conditions.
6. Updated CBP web site page ‘summer forecast’ that contains all the information related to the forecast - overall explanation, newsletter, technical documents, media release, links to tracking conditions etc

Summer Highlights

Goals

1. In autumn each year, review the Bay and tidal tributaries prior spring and summer’s environmental conditions and highlight the most significant developments:

- Include meteorological events like droughts, precipitation events and large storms and hurricanes.
- Include unusual biotic events like introduced species, bloom events, dispersal events.
- Provide a short background explanation for the events highlighted (e.g., historical data, causal factors).

2. Compare the summer forecasts (made in late spring) with the actual conditions obtained, providing explanations for discrepancies.
3. Effectively communicate summer highlights in a timely manner to the Chesapeake Bay community.

Rationale

1. Provide context for understanding summer events
    a. Establish the importance of both natural and anthropogenic influences in creating environmental conditions
    b. Educate the public about the various natural and anthropogenic factors that affect Chesapeake Bay
2. Provide updates on Chesapeake restoration efforts
    a. Provide a rapid data analysis, rather than waiting for the finalized data review and reporting that takes up to a year to complete
    b. Educate the public about the role of natural variability and anthropogenic influences on Chesapeake Bay
3. Establish a proactive communication and education program
    a. Utilize data from the extensive monitoring network (and 20+ years of monitoring data) to highlight the importance of collecting and analyzing good data
    b. Create public anticipation for annual summer highlights, particularly the comparison with predictions—it will be better to conduct a rigorous self-analysis, rather than relying on external groups.

Products

1. E-newsletter overview/teaser: 1/4page
2. Newsletter/article (4 pages): wrap-up of forecast / explain deviations from forecast; summarize and explain notable events.
3. Supporting documentation: any further information relating to the summer conditions and the associated forecast.
4. Updated CBP web site page ‘summer highlights’ - contains all the above information related to the summer conditions

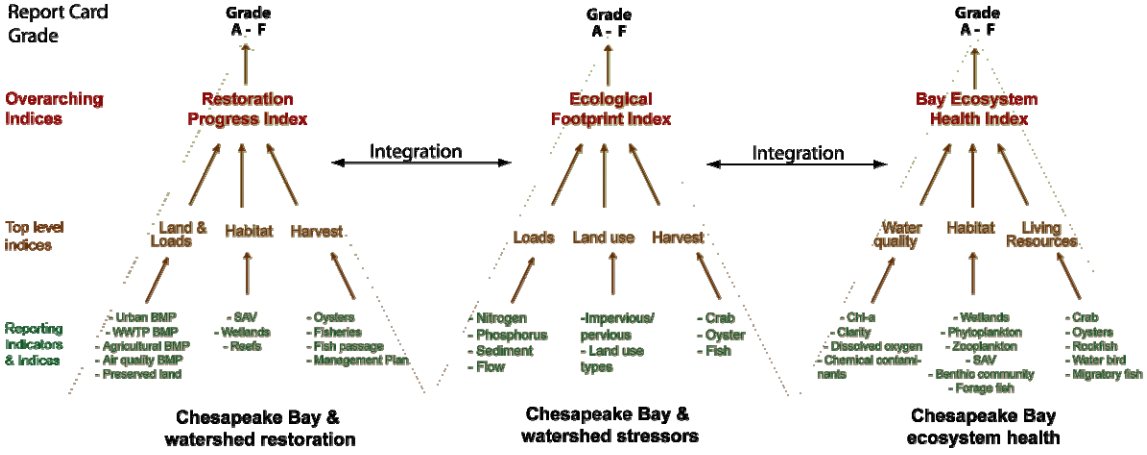
Annual Integrated Assessment

Goals

1. In the first quarter of each year provide a synthesis of the previous years Bay restoration effort, Bay stressor and Bay ecosystem health. This synthesis will be based on the reporting indicators and the associated top-level and overarching indices. This synthesis will provide: (a) a package of analysis and interpretation for each individual functional groups (restoration, stressors, health); (b) an

assessment that integrates between the functional groups through statistical analyses and empirical relationships. This assessment aims to provide the connection between restoration activities and the ecosystem health of the Bay.

2. Report and communicate monitoring results in timeframes that are more applicable to target audience and stakeholder needs rather than when the monitoring results become available.
3. Conduct analysis and reporting at a frequency that facilitates communication of both intra- and inter-annual variability and the associated drivers.
4. Generates anticipation of results and ensures maximum impact rather than providing a trickle of information over the year.
5. Reach closure on the past years monitoring results before the annual communication cycle restarts with the summer forecast.



Conceptualization of annual integration assessment approach

Rationale

1. Provide context for understanding the environmental conditions in Chesapeake Bay and restoration progress
    c. Establish the importance of interannual variability in creating environmental conditions that affect water quality, living resources and habitats
    d. Educate the public about the various external anthropogenic and natural factors affecting Chesapeake Bay
2. Provide an explicit linkage between management objectives (e.g., Chesapeake 2000) and actual progress in Chesapeake Bay restoration
    e. Integrated assessments will help focus future research priorities, monitoring needs and management actions
    f. Educate the public about the role of assessment and feedback to management and research activities
3. Establish a proactive communication and education program
    g. Utilize the integrated assessments to develop credible and robust assessments that are based on the best scientific information and synthesis available

h. Create public anticipation for annual integrated assessments (as in an annual health check), distinguishing the integrated assessment (geographically explicit, scientifically-rigorous, data intensive) from other qualitative approaches (Chesapeake Bay Foundation report card).

Products

In addition to the products associated with each of the major functional groups (below) it will be necessary to provide a range of products that summarizes the integrated assessment.

Annual Restoration Progress

Goals - Annual Restoration Progress

1. In January each year collate and synthesize the previous year's most important restoration actions.
    a. Assess established reporting indicators (loads and land, habitat, harvest)
    b. Develop top-level and overarching indices.
    c. Compare assessments both geographically and over time (annual assessments).
2. Provide timely feedback to on-the-ground regulatory, cooperative and voluntary implementation efforts and support taking action where restoration efforts need accelerating or initiating.
3. Provide timely analysis and synthesis necessary for integrated assessment. That is, build the capacity to relate and communicate the linkages/relationships between restoration action, Bay stressors and changes in Bay ecosystem health.
4. Set the stage for communicating the state of the Bay ecosystem health which will be released within the following two months.

Products - Annual Restoration Progress

1. E-newsletter overview/teaser: 1/4page
2. Article/newsletter (4 pages): Provides synthesis of the previous year's restoration activities at whole Bay and reporting regions scale (Tributary Strategy). Use top-level and overarching indices to develop synthesis.
3. Package of figures, tables, maps, indices and explanatory text that supports newsletter. All analysis to be based on the reporting indicators and associated indices. All products need to be presented in a manner which can be used and understood by the target audience (interested public, managers and policy makers).
4. Updated CBP web site page 'Annual Restoration Progress" - contains all the above information related to the annual restoration progress.
5. Press release.

Ecological Footprint (Stressors) Assessment

Goals - Ecological Footprint (stressors) Assessment

1. Coincident with the annual health check, conduct an annual assessment of key Bay stressor indicators.

- Assess established reporting indicators (loads, land use and harvest)
- Develop top-level and overarching indices.
- Compare assessments both geographically and over time (annual assessments).

2. Develop an improved capacity to assess Bay stressors by: a) improving the timeliness of various data processing steps and b) developing additional key indicators.
3. Effectively communicate the assessment to the target audience using spatially explicit maps, easy to interpret figures, tables and text.
4. Develop the capacity to relate annual changes in ecosystem health to annual changes in Bay stressor indicators.

Products - Ecological Footprint (stressors) Assessment

1. E-newsletter overview/teaser: 1/4page
2. Article (4 pages): Provides synthesis of the previous year's ecosystem footprint/stressors monitoring results at whole Bay and reporting regions scale (Tributary Strategy). Use top-level and overarching indices to develop synthesis.
3. Package of figures, tables, maps, indices and explanatory text that supports article and helps interpret the ecosystem health assessment. Analysis to be based on the reporting indicators and associated indices. All products need to be presented in a manner which can be used and understood by the target audience (interested public, managers and policy makers).
4. Updated CBP web site page 'Ecosystem footprint assessment' - contains all the above information related to the annual restoration progress.

Annual Ecosystem Health Check

Goals - Annual Bay Ecosystem Health Check

1. In early spring each year, conduct an annual assessment of key indicators/ reporting indicators and indices to provide an integrated assessment of Chesapeake Bay ecosystem conditions
    a. Assess key water quality parameters (e.g., dissolved oxygen, chlorophyll *a*, water clarity), living resources parameters (e.g., fisheries catch independent data on oysters, blue crabs, rockfish), habitat parameters (e.g., submerged aquatic vegetation, marshes, shoreline intactness).
    b. Develop an integrated ecosystem health assessment for the bay and its tidal tributaries using the various key parameters.
    c. Create a ranking valuation scheme to compare assessments both geographically and over time (annual assessments).
2. Develop an improved assessment capacity by a) improving the timeliness of various data processing steps and b) developing additional key indicators.
3. Effectively communicate the integrated assessments with spatially explicit maps and rigorous scientific assessments to the Chesapeake Bay community.

Products - Annual Bay Ecosystem Health Check

1. E-newsletter overview/teaser: 1/4page

2. Health Check Card/newsletter (4 pages): Provides synthesis of the previous year's ecosystem health at whole Bay and reporting regions scale (major tributaries/CBP segments). Use top-level and overarching indices to develop grades (A-F)/ratings.
3. Package of figures, tables, maps, indices and explanatory text that supports and was the basis of the Health Check grades. All analysis to be based on the reporting indicators and associated indices. All products need to be presented in a manner which can be used and understood by the target audience (interested public, managers and policy makers).
4. Press release.
5. Updated CBP web site page 'Annual Ecosystem Health Check" - contains all the above information related to the health check.