

Tapping the Indicators Knowledge-base:
“Lessons learned” by developers of environmental indicators

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Introduction

1.1. The Project

Over the past fifteen years environmental indicator development has grown from the province of only a few farsighted groups to a subject that is of increasing interest to a large and diverse assortment of federal, regional, state, and local agencies and NGOs. The Gulf of Maine Council has recently initiated a project to develop an indicator-based “State of the Gulf” report and, aware that many other organizations have already completed similar projects, wishes to capitalize on the existing knowledge-base. This report was thus commissioned to compile the “lessons learned” by those who have previously delved into the territory of environmental indicator development. The experience and knowledge of individuals involved in the development, reporting, and application of environmental indicators throughout Canada and the U.S. was tapped into through a series of informal interviews. This report highlights both the disparate processes followed by those responsible for indicator development, and the wisdom these individuals have gathered through executing their projects. While the recommendations of indicator developers are included throughout, and a special section on recommendations for Gulf of Maine indicator development follows, this report is not intended to offer concrete answers to the question of how specific regions should go about developing indicators. It is instead intended to raise awareness of the various paths that groups have chosen when faced with similar challenges, and to summarize some of the knowledge that has been gained through following these paths.

1.2. Methodology

Indicator projects were selected for inclusion in this report based upon two primary criteria: the quality of the report and its relevance to indicator development in the Gulf of Maine. The pool from which environmental indicator-based reports were selected did not, however, encompass all such American and Canadian projects, but only those that had distributed reports to the Maine State Planning Office or were recommended by members of Gulf of Maine Council working groups. Once an appropriate project was identified an interviewee was sought out who had been personally involved in environmental indicator and report development, preferably throughout the length of the process. A standard questionnaire was created to address issues of potential interest for those embarking on indicator development projects, and was used as the basis for all interviews.

It should be noted that interview answers were not fact checked, and that interviewees frequently offered estimates of financial and staffing figures. Also, all answers represent the thoughts and opinions of individuals rather than of entire agencies or organizations. The intent of this report is not, therefore, to offer a technical analysis of indicator reporting, but to provide insight into the experiences of knowledgeable persons. Interview summaries, with full answers for each survey question, can be found in the supplement to this report.

1.3. Sources of information

The majority of information reported in this document was gathered from a series of eleven interviews conducted with individuals involved in environmental indicator development throughout the United States and Canada. The reports selected for inclusion range in scale from national projects (*The U.S.'s State of the Nation's Ecosystems* and *Canada's Environmental Signals*), to regional, binational coalitions (*Georgia Basin-Puget Sound Environmental Indicators Report* and *The State of the Great Lakes*), to those that address specific states or natural systems (*The Florida Assessment of Coastal Trends* and *The Quoddy Report*).

As this report is intended to specifically support the development of indicators for the Gulf of Maine, particular attention was paid to indicator and environmental health projects within this region. Due to this emphasis, less

stringent criteria was applied to indicator development projects within the Gulf of Maine, allowing the inclusion of a few groups that have either not yet completed the indicator development process, or have created non-indicator based “state of the environment” reports.

Information incorporated into this document was also drawn from the indicator-based reports themselves, as well as supplemental reports and reviews recommended by the interviewees and others. Lastly, the proceedings of a “lessons learned” session, held at the 2003 Coastal Zone Management conference and based upon the survey questionnaire, have also been incorporated into the report.

1.4. Acronyms Used in this Report

- **CBEP:** Casco Bay Estuary Project
- **CBP:** Chesapeake Bay Program
- **EC:** Environment Canada
- **EPA:** Environmental Protection Agency (U.S.A.)
- **EPIC:** Environmental Protection Indicators for California
- **FACT:** Florida Assessment of Coastal Trends- a thrice released report produced by the Florida Coastal Management Program
- **GOM:** Gulf of Maine
- **GOMC:** Gulf of Maine Council
- **NHEP:** New Hampshire Estuaries Project
- **SOLEC:** State of the [Great] Lakes Ecosystem Conference- produces the *State of the Great Lakes* reports

2. Developing indicators

2.1. Scope of the indicator-development projects drawn on for this report

The scope of the projects for which surveys were conducted varied considerably in terms of the staff, budget, and length of time expended by the responsible individuals and groups. No project was completed in less than a year, several were completed over the course of two to three years, and one (the Heinz Center’s *State of the Nation’s Ecosystems*) required five years for completion. The Heinz Center, it should be noted, produced a prototype of drafts of three of its six ecosystem-based subsections after only two years. These time periods do not include previous efforts if more than one edition of a project’s report has been completed.

While complete budget information was unavailable for several of the reports, most efforts seem to have cost between one hundred to two hundred thousand dollars (not including considerable donated time and resources), although several cost considerably more. The Heinz Center once again topped the other reports in resource expenditure with a budget of \$3.5 million, which will be increased to approximately \$5 million for the report's second edition.

2.2. Selecting “ideal indicators”

Once the decision has been made to develop indicators for a region or ecosystem, groups charged with the task generally select one of two broad methods for compiling a list of potential indicators. The first method, made use of for reports such as [Long Island] *Sound Health 2001* and the *Georgia Basin-Puget Sound Environmental Indicators Report*, begins with the compilation of all applicable monitoring data collected in the region under examination. Groups making use of the second method, such as those that developed the *Environmental Protection Indicators for California (EPIC)* and the *State of the Nation's Ecosystems Report*, usually begin by “brainstorming” the indicators that would ideally be developed to optimally fulfill the mission of the project- i.e. a product that meaningfully assesses current environmental conditions in a specified region. Groups making use of this second method also tend to divide into two general classes: those who initially list indicators that meet or contribute to goals laid out in regional management plans and those that gather experts together to list all environmental issues facing their region. A variation on the former approach is to rephrase monitoring goals as questions and then to create “candidate” indicators to answer them - i.e. is eutrophication increasing in GOM estuaries? Indicator: percent of estuaries over time negatively affected by eutrophication.

While most reports did take into account existing data at some stage of their indicator selection process, the Heinz Center's *State of the Nation's Ecosystems Report* quite intentionally did not. The coordinators of this effort explicitly wished to develop a set of indicators that would accurately gage the health of U.S. ecosystems, regardless of whether relevant monitoring programs had previously

been established. All working groups developing indicators for the report were required however, to define axes (time periods, unites, geographic areas covered) for each indicator, regardless of whether any data actually existed. In this way the data gaps highlighted by the report can more easily be targeted by research efforts.

2.3. Developing final indicators

It is not uncommon for groups to emerge from the initial stage of indicator development with a list of 100 (and in one case over 800) “candidate” indicators. The criteria used to scale down these lists tends, not surprisingly, to vary depending on the initial process used- i.e. projects that initially focused on available data might consider, among other factors, management goals and vice versa. The EPIC project, for example, used an extensive set of criteria- including whether relevant data existed, how responsive the candidate indicators were likely to be to change in the relevant system, and how meaningful the potential data were likely to be in a decision making process- to winnow down its long initial list of “ideal” indicators. The number of indicators selected for full development by the surveyed projects ranged from six to over one hundred. It should be noted that no two groups adopted identical processes and that most resembled mosaics of those described above.

Developers for both the EPIC project and the Florida Coastal Management Program, which produced the *FACT* report, made use of a hierarchical system by which candidate and final indicators were ranked (I, II, III) in accordance with the extent and quality of available monitoring data. This ranking system allowed the groups to easily target data gaps for potential future iterations. The Chesapeake Bay Program’s “library” of indicators, as well as those used in the *FACT* report, were similarly categorized by the type of phenomenon they were intended to measured (i.e. agency actions, changes in the ambient environment, etc...).

The New Hampshire Estuaries Project has chosen a rather unique and, according to project developer Phil Trowbridge, highly successful procedure for developing indicators. After matching existing data with ideal indicators selected for their ability to answer management questions, Phil Trowbridge researched and wrote a technical report for each of the four subjects into which the forty remaining

indicators had been divided. These technical reports, which detailed the meaning and usefulness of each indicator, as well as offering extensive tables of data, were then used to select twelve indicators that told the most meaningful story about the region. These final twelve indicators will be included in the *State of the New Hampshire Estuaries Report* due to be published in October of this year- three years after the beginning of the selection process.

2.4. Organizing the development process

Most interviewees reported that their organizations divided potential and developed indicators into categories based on the types of issues they addressed (i.e. water quality, living resources, land use etc...). This division of indicators at times took place prior to the “potential” list compilation, as in the case of SOLEC where the Great Lakes Region was immediately divided into zones such as open water habitat, terrestrial habitat, and land use, and, in other cases, only once the potential indicators had been assigned to working groups for full development.

The most common method of delegating the work of indicator development was to create sub-committees based on indicator categories. *The State of the Great Lakes Report*, *the State of the Nation’s Ecosystems*, *The Georgia Basin-Puget Sound Ecosystem Indicators Report*, and the *EPIC* report are all examples of products for which indicator development was conducted simultaneously by subject-specific working groups. In several other instances however, including the *New Hampshire Environmental Indicators* reports and *Two Hundred Years of Ecosystem and Food Web Changes in the Quoddy Region*, just a few individuals were responsible for the majority of research and indicator development. In most cases coordinating or management committees were established to organize and structure the process of indicator and report development.

In a few cases portions of the development work, or even entire projects, were delegated to secondary institutions. Notable examples of this are the U.S. federal government’s selection of the Heinz Center to create the *State of the Nation’s Ecosystems*, and the grant given to the Florida State University Center for Public

Management to develop the first iteration of the *FACT* report. The New Hampshire Estuaries Project has, in a slightly different vein, contracted with both a communications expert and a graphic designer to translate selected portions of their technical documents into the final *State of the Estuaries Report*.

2.5. Data limitations

Nearly all of the surveyed developers reported that they had encountered substantial gaps in the data available to support ideal, or even necessary, indicators. *The State of the Nation's Ecosystems*, for which indicators were developed regardless of the existence of appropriate monitoring programs, reported insufficient national monitoring for almost half of its indicators. Groups that have developed monitoring programs to fill data gaps, such as the CBP and SOLEC, still frequently find that their budgets do not allow them to create data sets for all indicators of interest.

Even where data sets exist to support selected indicators, they do not always exist in an ideal form. Some projects found that many data sets had to be dismissed due to their inability to meet quality assurance standards- which must, according to Nita Sylvester of the EPA's CBP office, be set and met in order to avoid reporting indicators that are not scientifically legitimate. For projects that address multiple states, provinces, or nations, and even for locally monitored issues for projects that do not, differences in regional monitoring protocols have seriously limited supporting data even for indicators in which wide interest has been manifested. Over time the CBP, which initially encountered extensive challenges with regional protocol inconsistency, has successfully pressed to have the programs that monitor the Chesapeake Bay region organize their protocols and agree on important definitions (such as ecological health) as a single region rather than by state.

Problems occurring due to regional protocol inconsistency are matched by those involved with locating data sets that have been maintained over sustained periods of time using consistent monitoring protocols. Groups developing reports such as *Two Hundred Years of Ecosystem and Food Web Changes in the Quoddy*

Region, for which data was sought to describe past ecosystem conditions, naturally face this problem to a greater degree than most. Occasionally data sets for an issue that has been tracked over time, but for which monitoring protocols have changed, can be salvaged using an “offset.” Carmen Milanes, a key player in the development of the EPIC report, noted that, while having high quality, relevant data is very important, it is also necessary to remain flexible enough to include less than perfect data if they nevertheless provide a reasonable approximation of “what’s going on.”

2.6. Number of indicators developed

Two primary factors are generally considered when deciding the appropriate number of indicators to develop. The first is the extent of staff and budgetary resources associated with the project. The Georgia Basin-Puget Sound Environmental Indicators working group for instance, chose to reduce to six its already quite data-constrained list of potential indicators in the belief that this was a reasonable number to “tackle” in a first iteration with limited budget and staff. This group plans to double its developed indicators for use in the report’s next iteration.

The second consideration, which, for some groups, is only acted upon when developing indicator-based products, is the interest and attention span of the targeted audience. The first two iterations of the *FACT* report, for instance, featured nearly one hundred indicators, a number that was reduced to thirty-three in the most recent edition. This reduction was one aspect of an effort to make the report more appealing to general managers and policy makers.

Similarly, the Heinz Center project coordinators, after producing a prototype featuring drafts of three of the six ecosystem chapters, realized that if no restrictions were placed on the number of indicators included, their final report would be of a length unlikely to read by managers and policy makers. Though the sub-committees in charge of each ecosystem did eventually reduce their indicators to the target of eighteen or fewer, this process of reduction was quite difficult, according to project manager Robin O’Malley. The subcommittee scientists and academics were particularly resistant to scaling down the indicator suites based on the demands of

accessibility. This resistance was only overcome when managers in each group stated definitively that they, or their bosses, would not read a report that exceeded a certain length.

The creators of both the *State of the Great Lakes* reports and the *EPIC* report have experienced governmental pressure to decrease the number of indicators tracked by their projects. In the former case the impetus for the pressure has been the belief of officials that having too many indicators will render the project inaccessible to all but those who specialize in relevant fields. In the latter case pressure stems from the impression that “when [other] states have had too many indicators, the quality of the indicators has been questioned and Legislatures have tended to shy away from using them” (California Legislative Analyst’s “Analysis of the 2003-04 Budget Bill”). The interviewees from both projects expressed the belief that indicators necessary to the assessment of important issues should not be excluded, and that accessibility problems can be addressed by limiting the indicators included in products tailored for particular audiences.

2.7. Scale of indicator usefulness

While it would, in many cases, be ideal for indicators to be equally useful and meaningful at the state or regional and local levels, this is, as several of the interviewees noted, quite difficult to achieve. Ralph Cantral, who directed the Florida Coastal Management Program during the development of the *FACT* report, noted that their indicators, while praised as offering useful information on the state level, had not been found particularly useful at the local level. It is possible that developing indicators that assess the “big picture” condition of an ecosystem precludes the possibility of making these indicators truly relevant on a very local scale. The CBP has received increased demands in recent years for indicators that address local areas, as bay-wide indicators have not proved highly relevant at the “tributary” level.

2.8. Consultation and outreach

Almost all groups surveyed for this report consulted scientists, managers, and academics at some point in their process. For a few reports, such as the Heinz Center's *State of the Nation's Ecosystems*, a wide variety of individuals- scientists, managers, business leaders and academics- were included in *all* stages of the development process. Other groups, such as SOLEC and the Georgia Basin-Puget Sound working group, populated their issue-specific indicator subcommittees with the most knowledgeable individuals available in all fields. For the most recent iteration of the *FACT* report an advisory committee- including scientists, academics, and state managers- was imbued with extensive power to shape both the content and format of the report. For other projects, with less diverse individuals involved in the development process, experts were consulted for data and interpretation support. Several interviewees noted that they wished they had consulted a wider range of individuals from the beginning of the development process. This was particularly true for groups that wished to make their products more useful in management and policy decision-making.

2.9. Recommendations for improving the indicator development process

Several interviewees suggested that it was important to stress, to all involved in the development processes, the amount of time and effort required to develop indicators and indicator-based products. According to Phil Trowbridge, project developer for the NHEP, the initial stages of the process tend to be the most time consuming, and it is important to encourage developers not to feel overwhelmed and rush through important decisions. The extended amount of time required for developing indicators and preparing the report was cited by both Mark Tedesco, Director of the EPA Long Island Sound Office, and Carmen Milanés, of the California Office of Environmental Health Hazard Assessment, as among the greatest challenges encountered during the process of developing their products.

Ralph Cantral suggested that indicators should be carefully selected with an eye to the prospects for long term monitoring, as sustained trends tend to be of considerably more use to managers, as well as more scientifically valid, than

isolated periods of monitoring. He noted, however, that if indicators were not producing meaningful results they should be replaced.

3. Indicator-based “State of the Environment” products

3.1. Audience

While the experiences and opinions of those interviewed for this report were frequently quite diverse, nearly every individual noted that it was essential to consider the needs, interests, and abilities of targeted audience(s) when preparing indicator-based products. For instance, the style and formatting that is appropriate for a report geared towards specialist managers and scientists is quite different than that which is appropriate for a mass audience. Attention to audience can, according to interviewees, allow the same “library” of indicators to communicate on a wide variety of levels. Interviewees also noted that gathering input early in the process from those in the desired audience, allowed the selection of indicators to be tailored to the interests and needs of those for whose use they were intended. The Puget Sound Action Team, for instance, reported at the “lessons learned” session that they conducted focus groups to assess the effectiveness of their products, while other groups distributed surveys to members of targeted audiences to gather similar information.

3.2. Types of reports

As a prerequisite for inclusion in this paper, groups from which representatives were interviewed had to have developed, or be in the process of developing, documents that would describe the environmental condition of a particular ecosystem, region, or set of regions. Just as the groups went about the indicator development process in a variety of ways however, there was also no consensus on the optimal manner in which to present developed indicators to targeted audiences.

A number of projects created glossy booklets that were divided into sections based on the various issues addressed (water quality, habitat dispersal, land use etc...). Depending on the audience for which the report was designed these

booklets ranged from twenty-five to three hundred pages in length, with the amount of included detail and technical information varying accordingly. Another style of report is the “tabloid” format used by the Long Island Sound Study and for the *Quoddy Report*. “Tabloid” products generally makes use of a storybook format into which indicators, with easy to understand graphs, are inserted. This style has the advantage of being easily distributed to a mass audience as a newspaper supplement (a distribution method that, according to Mark Tedesco of the EPA Long Island Sound Office, has the additional advantage of inspiring news coverage in the papers carrying the supplement).

The desirability of closely tailoring environmental indicator-based publications to the audiences for which they are intended has led many groups to create multiple products describing the health, or aspects of the health, of the region under consideration. In fact, most interviewees reported that their groups had produced at least two reports- one designed for a managerial or scientific audience and one designed for less engaged individuals. While having a shorter “synthesis” document can be quite useful, and can significantly broaden the appeal of the project, it is important, according to Robin O’Malley, to include enough information to make even the most popular documents meaningful. Even in cases where a single document was created, a web-based technical supplement was generally available to those interested in the full extent of the indicator data. The most extreme example of this multi-product method is the Chesapeake Bay Program, which has developed, over the past decade, a “library” of more than ninety indicators which are used in various combinations to create audience tailored reports. Around twenty of the CBP’s indicators are usually included in publications oriented to the general public.

3.3. Recommendations for creating a useful and popular report

A number of interviewees noted the value of “layering” the information included in the report so that the needs of individuals who desired only a basic overview as well as those who are interested in a more technical account can be met

simultaneously. This can be accomplished by introducing each indicator with a basic overview of its importance and status before delving in to more detail.

Bruce Wulkan and Kathy Taylor, of the Puget Sound Action Team, noted, at the “lessons learned” session, that their organization has found that the general public responds more favorably to “thumbs up/down” or grade “A-F” ratings than they do to detailed charts and text describing the status of indicators. The difficulty with this approach is that monitoring information does not always lend itself to a concrete rating. There can be, as was pointed out at the “Lessons Learned” session, a very thin line between grabbing the attention of the public and offering them biased or unscientific information.

Indicator-based “state of the environment” reports covering numerous issues (water quality, land use, habitat etc...) can at times seem somewhat scattered if connections are not drawn between the various components. According to both EPIC and Heinz center developers, creating an “issue framework” which ties together all disparate categories of indicators and contributes to the organizational process, while potentially challenging, can be quite useful to both developers and readers.

4. The impact of indicators and indicator-based reports

4.1. Audience response

The interviewees, almost without exception, reported that their indicators and products had garnered at least favorable and sometimes very favorable reactions from the audiences at which they were targeted. Responses were often anecdotally collected, however, rather than elicited through any formal response mechanism. The Heinz Center and the Georgia Basin-Puget Sound working group, both implemented very low maintenance feedback mechanisms- a response email address for the former and a comment card for the latter. Both groups found that they received positive, though quite superficial, feedback through these systems. Robin O’Malley, project manager for the Heinz Center’s *State of the Nation’s*

Ecosystems, suggested that for the report's next iteration an agency might be hired to conduct surveys of those who had received the report

While negative responses were seldom received, some interviewees noted that certain audiences had not responded to the report at all. Kerri Henry, who worked to develop Canada's *Environmental Signals*, noted that the report, while warmly received and incorporated into the curriculums of many educators, did not garner any perceptible notice from the policy makers for whom it was intended. Kerri Henry and her colleagues believe that including policy targets or goals in the discussion of each indicator would increase the interest of decision makers.

4.2. Impacts on policy and decision making

The majority of interviewees, particularly those whose projects had been completed only recently, could not cite any specific instances where indicators, or the reports for which they were developed, were explicitly used as the basis for policy or management decisions. One exception to this general rule was the use of *FACT* coastal access indicators by state legislators to support the passage of pro-access legislation. Examples were also frequently offered of increases and redirection of funding in response to indicator development and indicator-based products. This type of impact generally took the form of either a renewal and increase of budget for the indicator project itself (Heinz Center's *State of the Nation's Ecosystems*, Chesapeake Bay Program indicator project) or the targeting of resources to fill identified data gaps (*Georgia Basin-Puget Sound Environmental Indicators, State of the Nation's Ecosystems*). Similarly the "State of the Great Lakes" interviewees noted that their project had led to the redirecting of management and economic resources to formerly neglected environmental issues. Several interviewees also noted an increased public interest in the issues highlighted in the indicator report.

In instances when useful new data sets have been developed, as with the Casco Bay Estuary Project's monitoring program, the attention of related agencies has sometimes been attracted. The Maine DEP, for instance, made use of the CBEP's data on dissolved oxygen to reclassify certain sectors of the Casco Bay.

Interviewees frequently mentioned that the impacts of both indicator development and “state of the environment” reports might manifest themselves only over long periods of time. It was also argued that managers and policy makers were unlikely to concretely cite indicators and state of the environment reports as the cause of specific decisions. Finally, the SOLEC interviewees noted that attempting to track whether the numerous managers in the Great Lakes region were specifically basing their decisions on SOLEC indicators would be a resource and time consuming process.

4.3. Suggestions for increasing the impact of indicator-based documents on management and policy decisions

Numerous suggestions were made during the interviews of how “state of the environment” reports could be tailored and applied to have a greater impact on management and policy decisions. A selection of the suggestions follows.

1. Each document should have a summary specifically designed for managers and policy makers (see the State of the Great Lakes report for an excellent example). Several interviewees considered summarizing the thrust of indicator trends essential to making documents, especially those with more exhaustive detail, useful to managers and decision makers. Joseph P. Dudley criticized the *State of the Nation’s Ecosystems Report*, in an otherwise fairly favorable review, for lacking an executive summary that offered a “big-picture” of ecosystem conditions.
2. In a similar vein, several interviewees noted that it was important for products targeted at managers and policy makers to be clear and direct, and to prominently feature information likely to be useful in the decision making process. A few individuals, such as Ralph Cantral, former director of the Florida Coastal Management Program, also suggested offering concrete linkages between the indicators and management decisions or programming (such as increased funding for coastal access).
3. While the Heinz Center project developers have intentionally left their indicators un-interpreted- in the belief that this is the only way to create an

entirely unbiased resource- most groups emphasized the importance of contextualizing indicators in order to make them useful for managers and policy makers, as well as the general public. The Florida Coastal Management Program, for instance, shifted the format of the most recent *FACT* report to “walk” readers carefully through the meaning, status, and interconnectedness of their indicators.

4. Several interviewees (Mark Tedesco, Robin O’Malley) noted that if they could start over again they would incorporate in their processes input from the targeted audience, particularly managers, on how the indicators could best serve their needs. Incorporating this input early on would potentially allow the indicators themselves to be tailored to the needs of managers.

5. Several individuals noted the importance of advocating for the use of indicators with managers and policy makers after reports have been released. As Robin O’Malley pointed out, even excellent data will not automatically be incorporated into decision-making processes, but must be integrated through discussion and formal mechanisms.

5. **Gulf of Maine Specific Recommendations**

5.1. **Choosing Indicators**

Indicator developers whose agencies or organizations had previously created regional management plans generally considered the objectives set out in these documents at some point in the development process. A few groups initiated the development process by referring to management plans and considering which ideal indicators would best further management objective, while others used the relatedness of a potential indicator to management goals as a secondary criteria for selection. Regardless, the intent of linking indicators to management objectives is to ensure the creation of indicators that will be actively useful in managing regional resources.

Recommendation: The management objectives set out in the 2001-2006 GOM Action Plan should in some way considered during indicator development for the region.

5.2. Number of Indicators Developed

Like most of the groups upon whose projects this report is based, the GOMC will likely consider both the resources at their disposal and the interests of the targeted audience when considering how many indicators to develop.

The closest model for the GOMC to emulate in indicator development might initially appear to be the *Georgia Basin-Puget Sound Environmental Indicators* report, due to its emergence out of a binational committee focused on developing a first set of indicators for a complex, transboundary coastal ecosystem. This process however, which resulted in the development of six indicators, was fettered by challenges that the GOMC may have previously overcome. The Georgia Basin-Puget Sound working group had great difficulty dealing with differences in management, science, and even culture in the Canadian and U.S. agencies, and was greatly constrained by the lack of previous regional data collection or management coordination. While the GOMC should probably not attempt anything quite as ambitious as 90+ indicators developed for the binational “State of the Great Lakes” report, the third iteration of which will appear this fall, an appropriate number of indicators would probably fall somewhere in between.

The necessity of limiting the number of indicators due to considerations of audience accessibility depends upon both the targeted audience and the style of report to be created. If multiple products are created, for which the content can be tailored to audience interests, the need of limiting the general set of indicators developed is greatly reduced. It is also possible that the Council will find that the availability of consistently collected, regionally aggregated data will do the work of limiting the number of indicators developed.

Recommendation: Focus on a number of indicators that is manageable considering the budget and staff resources available to the GOMC. While it is highly advisable to consider audience accessibility when selecting indicators for

inclusion in products describing the status of the GOM, this should not too strictly constrain the overall number developed.

5.3. Making Choices

As reported by many of the interviewees, the choices made during the process of selecting and developing indicators may not be agreed upon by all individuals involved in the process. According to Phil Trowbridge, project developer for the NHEP, tension has arisen in the process of developing the New Hampshire estuary indicators due to misunderstandings about the criteria by which decisions have been made. He suggests that explicitly stating the logic behind all decisions, particularly those that exclude certain types of indicators or input from the process, might reduce such misunderstandings.

Recommendation: (1) Clearly state the logic behind choices and selections so that misunderstandings do not occur between those involved in the process, or with those whose advice has been solicited. (2) Take the time to come to consensus on important decision and interpretations so that the entire project can “speak with one voice.”

5.4. Making Use of the Gulf of Maine Council

The working group and steering committee assigned the task of developing indicators, and creating a *State of the Gulf* report, for the GOM region, are in the fortunate position of having the structure and human resources of the Council at their relative disposal. The existence of this body offers the GOMC developers an initial advantage over groups, such as the Georgia Basin-Puget Sound working group, which had very little history of transnational environmental cooperation upon which to build. Al Jamal, Canadian co-chair for this group, particularly noted the time and frustration associated with learning to negotiate the various governmental procedures of the U.S. and Canada. The fifteen years of cooperation between both the member states and provinces and the two federal governments should be capitalized upon to create a document that is as accessible and useful as possible to the binational audience. Members of the council and its working groups

should be tapped for what types of information, and presentation formats, would be the most useful to individuals in their particular fields of expertise.

Several interviewees noted the importance of advocating for the use of indicators with managers and policy makers, or even of setting up formal mechanisms through which indicators can be incorporated into decision-making processes. The GOMC, in that its members include many of those involved in creating management policy, seems uniquely situated to insure the incorporation of its indicators into the management of the intended natural system.

Recommendation(s): (1) Make use of the knowledge-base of the GOMC for both negotiating state, provincial, and federal bureaucracies and for gaining insight into the types of information most useful to individuals working within the Gulf of Maine. (2) Create a mechanism by which policymakers and managers within the Gulf of Maine Council are actively reminded to make use of the developed indicators and to report on instances where indicators are used.

5.5. Audience and intent

Nearly every individual surveyed for this report affirmed the need to consider the intended audience during the development process. The audience to which a report, and the indicators that populate it, is addressed should clearly reflect the intent of the project, be it to create an educational resource or to influence policy. Several interviewees noted the importance of not only tailoring the report to the desired audience, but also shaping its content to fit their needs and interests.

Recommendations: (1) Discuss and come to a consensus on the specific audience(s) for which the report is intended. (2) Survey members of these targeted audience(s) to assess which types of information would be of most use to them.

5.6. Report format (s)

As mentioned above, many indicator development projects have concluded with the creation of both a technical and a more widely targeted document. Given that the document is meant to be the basis for a conference of engaged individuals the most apt product style might be a glossy report with a widely accessible format,

including all or most of the indicators and basic data. A technical supplement, whether web or print based, might be advisable to cater to the scientific and specialist management communities.

Recommendation: (1) Consider audience needs, interests, and knowledge when considering the type of document to create. (2) Carefully tailor documents to audience, and prepare multiple products, or technical supplements, if necessary.

5.7. Feedback

While almost every interviewee surveyed for this report responded that their product had been positively received, almost none could refer to anything but the most anecdotal evidence. Particularly if more iterations of a report are planned, it would be valuable to cull as much information as possible about how the targeted audiences responded to the document and its contents.

Recommendation: Create a formal mechanism for feedback (be it a comment card or a follow up survey) to encourage readers to make known their response to the report.

5.8. Science and Indicators

As suggested by Ralph Cantral, scientists can often be quite skeptical about using indicators to link policy and management to changes in the environment. Indicators can only demonstrate a correlative, rather the scientifically causal, relationship between specific policies and programs and the state of the environment. If “performance indicators” are to be included in those developed for the GOM, this probable tension should be acknowledged from the beginning and noted in reports.

Recommendation: Clarify with both the managers and scientists involved in the process that performance indicators are only intended to evoke correlative relationships.

5.9. Miscellaneous

The three interviewees for the *State of the Great Lakes Report*, Dr Paul Bertram (EPA, Great Lakes National Program Office), Paul Horvatin (EPA, Great Lakes National Program Office), and Dr. Harvey Shear (Regional Science Advisor, Ontario, EC), have volunteered to travel to any indicator related GOMC conference to present on the development of indicators for the Great Lakes Region.

Recommendation: At a stage somewhat further along in the process, it might be useful to invite the interviewees to present at a meeting or, alternatively, set up a conference call to the same purpose. Capitalize on their expertise to negotiate inevitable rough spots in the process.

6. Acknowledgments

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session); **Harvey Shear**, Ontario regional science advisor, Environment Canada (*State of the Great Lakes*); **Nita Sylvester**, EPA Chesapeake Bay Program Office (Chesapeake Bay Program Indicators); **Kathy Taylor**, Puget Sound Action Team (“lessons learned” session); **Mark Tedesco**, director, EPA Long Island Sound Office (*Sound Health 2001*); **Phil Trowbridge**, project developer, NHEP (*New Hampshire Environmental Indicators*); **Bruce Wulkan**, Puget Sound Action Team (“lessons learned” session) Thanks also to **Ralph Cantral**, **David Keeley**, and **Elizabeth Mills** who organized and moderated the “lessons learned” session, and to **Josh Atwood** who assisted with the interviews

7. Report Summaries

Reports within the Gulf of Maine

➤ NHEP Environmental Indicator Reports

Produced by: The New Hampshire Estuary Project, part of the EPA’s National Estuary Program (NEP).

Description: This preliminary set of four reports (land use and development, shellfish, species and habitats, and water quality) was intended to summarize all available data for each indicator drawn from the NHEP monitoring plan.

Apparent Intended Audience: The reports are clearly designed to facilitate the development of a state of the environment report, rather than act as an education or policy formation tool, in that the data is set out in an extended form with very little narration.

Location: Copies of all four reports can be found online at:

<http://webster.state.nh.us/nhep/Monitoring/monitoring.htm>

➤ State of the [Casco] Bay Report

Produced By: The Casco Bay Estuary Project, part of the EPA’s National Estuary Program (NEP).

Description: This outreach publication summarizes the results of the CBEP monitoring programs in a storybook format. It is not a true indicator based report.

Apparent Intended Audience: Blooming with colorful graphics, and opening with an overview of basic concepts (“what is an estuary”) this report is designed as both an educational tool and an informational guide for those little versed in environmental issues.

Location: The report can be found online at:

<http://www.cascobay.usm.maine.edu/BayReportFinal.pdf>

- The Quoddy Report/ Two Hundred Years of Ecosystem and Food Web Changes in the Quoddy Region (2002)

Note: *The Quoddy Report* summarizes, in a widely accessible manner, the technical *Two Hundred Years*...report.

Produced by: The Conservation Council of New Brunswick

Description: *Two Hundred Years of Ecosystem and Food Web Changes in the Quoddy Region*, is not an indicator-based report but rather undertakes the ambitious task of assembling as complete a picture as possible of the current Quoddy ecosystem and outlining the changes that have occurred over the past two centuries. The much shorter Quoddy report summarizes some of the highlights of the longer report in an engaging storybook format.

Intended Audience: The summary report is clearly designed for wide accessibility, while the technical report is directed at scientists and managers.

Location: A copy of either report can be ordered by contacting Janice Harvey at ccnbharvey@nb.aibn.com, or by phone, (506) 466-4033; or Sandra at (506) 458-8747, or from the Conservation Council's website (see below). There is a fee of \$10 for the technical report.

<http://www.web.net/~ccnb/publications/bookstore/publications.html>

Beyond the Gulf of Maine Region

- Environmental Protection Indicators for California (2002)

Produced by: The California Environmental Protection Agency (Cal/EPA), and the California Resources Agency

Description: The EPIC report has been issued as both a glossy, 28 page booklet filled with colorful charts and photographs, and a 300 page technical report which fully assesses 80+ indicators. The reports are broken down into seven subcategories for which sets of indicators have been developed.

Apparent intended audience: The condensed report is quite clearly intended for public dispersal as an education aid. The longer report is intended for both the scientific and environmentally engaged management communities.

Location: Both the extended and distilled versions may be accessed from the EPIC webpage: <http://www.oehha.ca.gov/multimedia/epic/2002epicreport.html>
- Environmental Signals (2003)

Produced by: Environment Canada

Description: This project pulls together, and supplements, previous issue-specific documents into a single broad national environmental indicator-based report. National in scale, the information outlined in "Environmental Signals" tends to be quite limited, as few trends are monitored consistently across Canada. Both a shorter, synthesis style report and a longer technical report were developed, although they were produced by different departments of EC.

Location: www.ec.gc.ca/soer-ree/English/default.cfm

- Florida Assessment of Coastal Trends (FACT) - 2000
Produced by: Florida Coastal Management Program
Description: This 148 page glossy report presents 33 indicators (scaled back from over 100 in previous iterations) on several topics relevant to coastal management.
Apparent Audience: The audience is explicitly coastal managers and policy makers, and steps have been taken to improve the usefulness of the document to these groups.
Location:
A copy of the report can be found at the following website:
<http://www.dep.state.fl.us/secretary/legislative/coastal/publications/FACT2000.pdf>

- Georgia Basin-Puget Sound Ecosystem Indicators Report (Spring, 2002)
Produced by: The Transboundary Georgia Basin-Puget Sound Environmental working group
Description: This document offers a concise evaluation of the state of the transboundary Georgia Basin-Puget sound ecosystem. Its six indicators run the gamut from trends in inhalable particulates in air to levels of persistent organic pollutants found in harbor seal tissue.
Apparent intended audience: This report seems designed to offer accessible information to policy makers and managers, in that it has distilled regional environmental quality to six indicators, yet does not shy away from discussing specific measurements at length.
Location: The report can be accessed online through the following website:
<http://wlapwww.gov.bc.ca/cppl/gbpsei/>

- Sound Health 2001: Status and Trends in the Health of Long Island Sound
Produced by: The Long Island Sound Study- “A partnership of federal, state, and local, government agencies, private organizations, and educational institutions”
Description: This tabloid style report focuses on four main management questions which reflect the mission of involved agencies and groups. The questions are answered using subtopics and indicators.
Apparent intended audience: A fairly general audience is intended, as suggested by both the format and the “what you can do section.” The report was distributed as an insert in New York and Connecticut newspapers.
Location: A copy of the 2001 report can be found in the State of the Gulf Summit folder. The website of the Long Island Sound Study follows:
<http://www.epa.gov/region01/eco/lis/index.htm>

- The State of the Chesapeake Bay: A Report to the Citizens of the Bay Region (2002)
Produced by: The Chesapeake Bay Program- a regional partnership of federal, state and local agencies

Description: This sixty page report, organized into 6 chapters (Life in the Bay, Water Quality, Looking Ahead, etc...), looks at the progress that has been made towards achieving goals set out in the *Chesapeake 2000*. A subsection of the CBP's indicator library is used to mark this progress.

Apparent intended audience: This report is clearly intended to allow policy makers and the general public to assess the progress of the Chesapeake Bay program towards its stated goals.

Location: http://www.chesapeakebay.net/pubs/sob/sob02/sotb_2002_final.pdf

➤ The State of the Great Lakes 2001

Produced by: The State of the Lakes Ecosystem Conference (SOLEC)

Description: This 92 page report offers an assessment of the condition of both each great lake and the region as a whole. The indicator-based portion of the report is broken up into habitat type (near-shore, coastal wetlands, etc...) and human impact/implication (land use, health). The report includes a section titled "implications for managers" that sets out the various ways in which managers in the Great Lakes region can both use and contribute to indicator based assessment. The following web link connects to this section.

<http://binational.net/sogl2001/04eng.pdf>

Apparent intended audience: Due to its length (92 pages) and scientific content this report seems geared toward those individuals who manage the area under examination.

Location: The full report can be downloaded from the following web address: http://binational.net/solec/doc/SOGL%2001/English/GL_ENGaccessible.pdf. The various segments of the report may be more easily accessed however from its website: <http://binational.net/sogl2001/download.html>.

➤ State of the Nation's Ecosystems Report

Produced by: The Heinz Center

Description: This report, produced in both full length and summary forms, provides an overview of indicators appropriate to assessing the health of six major categories of ecosystems. The report focuses on the indicators required to accurately describe the condition of each ecosystem type, rather than on the data already available at a national level. This approach allows the Heinz Center to offer information on data gaps that must be filled before a system of national outcome-based management can be implemented.

Apparent intended audience: The report is primarily intended for policy makers in Washington and beyond.

Location: The report can be downloaded off of the Heinz Center webpage: <http://www.heinzctr.org/ecosystems/report.html>.

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