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Lessons Learned Developing the Universal Best Management Practices Index for the Deepwater Horizon Endangered Species Act Biological Assessment

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ABSTRACT 300228:

In an oil spill emergency situation, how do you simultaneously protect listed species, track important events, and plan for a post-emergency Endangered Species Act Biological Assessment? This was the daunting question faced by hundreds of environmental regulators, field biologists, and technology developers during the Deepwater Horizon (DWH) Incident Response. With the help of mobile technology, legacy expertise, and a dedicated field presence, they answered with a system of Best Management Practices (BMPs). During the response, factors such as urgency, expansive geography, response duration, and technical experience disparity threatened to compromise the integrity of the BMP datasets. Because of these factors, over one hundred separate BMP lists were issued, and highly accurate field data collection was often sacrificed for after-hours web entry or paper records. For the purposes of the Endangered Species Act Biological Assessment, the Universal BMP (UBMP) Index was created to retroactively track the implementation of these various lists and properly credit responders with conservation efforts. The development of this index yielded lessons from practical BMP implementation and documentation in a response environment to constructing sophisticated database architecture needed for consumption. Here we present the evolution of UBMPs, their role in the Effects Analysis of the Deepwater Horizon Biological Assessment, and a plan for a better way.

INTRODUCTION:

Environmental monitors on a spill response have complicated jobs. They are essentially liaisons between the resources and the responders. During the DWH Incident Response, environmental monitors stepped out onto the sandy shores of the Gulf of Mexico to face a maze of challenges. They had to consider not only the primary goal of the response – to clean up the oil - but also the physical habitat features, the species that utilize them, and even the intangible resource attributes the habitat provides. This job was complicated indeed.

Luckily, the environmental monitoring teams had strategic allies in the Environmental Unit of Unified Command, United States Fish and Wildlife Service and National Marine Fisheries Service (Services). The Services worked to standardize their efforts into succinct, meaningful conservation measures. Conservation measures are usually agreed upon during consultation with the Services in advance of projects that have a likelihood of adversely affecting listed species. Although there was some effort to define conservation measures in the National Oil and Hazardous Substances Pollution Contingency Plan, those recommendations were not tailored enough to encompass the activities that ensued in response to the spill. Furthermore, an implementation strategy was not fully conceived in advance. In the rush of the first weeks of the response, many of the pre-planned conservation measures were either overlooked, or their implementation was not well documented. Undaunted, the Services issued recommendation lists on the fly as needed. Whether it was pile driving to secure boom, laying sorbent materials on the beach to clean up crude, or flying a helicopter survey, the Services leveraged the necessary expertise and met the challenge. The leadership of the Environmental Unit and the Services worked to integrate the adherence to conservation measures as a standard operating procedure in response activities. During this effort, the name of the lists was changed to Best Management Practices (BMPs) to ease their transition into standard practice. This huge achievement set into motion conservation collaboration throughout the entire area of response. The BMPs became a fixture in daily activities and were there to stay.

It would be nice if that were the whole story. That would be simple. That would be easy to analyze. Of course, neither oil spill response nor ecology is simple. The variables are vast and numerous. The implementation of the BMPs did accomplish goals such as standardizing environmental monitor recommendations, accounting for species needs, and helping to conserve habitat without halting the response. However, the schemas used to distribute BMP recommendations and to document BMP implementation were somewhat illogical. As the various operation or habitat specific lists BMP recommendations grew, a quiet puzzle began to unfold. Many operations share common resource risks, and therefore common conservation measures. However, the lists were issued by individuals from separate branches, from separate times, and on an as-needed basis. Every list had overlaps in content, and each list had its own numbering system. Some people prefer bullets and sub-bullets, some Roman numerals, and some a straight one to ten. At the time when these lists were dispensed, this was a non-issue. For the most part, for the pressing need at that time, the customized BMP lists served their purpose. Future analysts however, would have a stake in the way this information was organized, and they were not so lucky.

PROCESS:

Developing the Universal BMP Index:

To date, the most comprehensive analysis of BMP records has been for the United States Coast Guard (USCG) Biological Assessment (BA) for the Deepwater Horizon Incident Response, which is being completed to fulfill the requirements of Section 7 of the Endangered Species Act (ESA). This assessment must show the likelihood of effects from response related actions to federally listed species and their habitat. To clarify, it is not an assessment of the effects of the oiling itself, but the actions taken by the federal action agency, USCG, to clean it up. The figure below (Figure 1) illustrates a portion of the BMP analysis challenge confronted by the BA team. Excerpts from four separate BMP lists are shown here. Each of these BMPs relates to minimizing vehicular speed during on shore operations. One BMP even references another BMP list, which contains a BMP related to speed minimization, among others. Sound confusing? It was.

ENV0009 – Minimizing Impacts to Wildlife During Nighttime Cleanup Operations

20. At no time should equipment be operated at speeds that exceed a fast walk (< 5 mph).

Section 7 Federal Agency Action - Endangered Species Act Compliance Checklist

BMP 6			All onshore work should be conducted during daylight hours except within 24 hours of projected oil landfall. If nights operations are necessary, confine operations to landward of the intertidal zone and follow ENV0009: Minimizing Impacts to Wildlife during Nighttime Cleanup Operations

Driving on Beach Habitat Best Management Practices (BMPs)

5. Drive slowly. Travel should be slow enough to observe any bird eggs, chicks, or sea turtle hatchlings in the vehicle's line of travel. Be aware that bird chicks often feed along the water's edge. They may freeze in place rather than run away when ATVs or other vehicles approach.

Sea Turtle Nest Protection Protocols for Cleanup Crews on Florida Panhandle, Alabama, and Mississippi Beaches (Ver. 3 11 July 2010)

- Sea turtles may still be nesting or hatchlings may emerge after sunrise, so it is imperative that clean-up crews watch for nesting and hatchling turtles while they are on the beach and immediately cease activities in the immediate area and report the event to the individual identified on the attached list (or his/her designee). Clean-up vehicles should travel slowly to enable a better opportunity to spot turtle crawls and avoid colliding with nesting and hatchling turtles.

Figure 1 - Comparison of BMPs from varying lists which address the same concept, minimizing speed.

It is clear by the language of these BMPs and the titles of the lists that these BMPs were designed to meet slightly different needs. One is for avoiding sea turtles. Another is for general beach driving and minimization of bird disturbance. But are their motivations really that different? In order to set up a feasible analysis plan for the BA, it had to be assumed that the intent of these BMPs was the same. That assumption does not preclude the possibility that each BMP did not have a singular intent. Indeed, some BMPs address several potential stressors. The solution to this confusion was to generate a new list, the Universal BMP (UBMP) Index. Each UBMP in this index addresses a singular concept that can be easily connected to actions and their consequences at the resource level. The UBMP that captures the recommendation to minimize speed is as follows:

"Vehicles should travel slowly. Operate equipment at appropriate speeds (< 5mph)."

This simplified version was then related to its parent BMPs through an original referencing system. Each reference contains dual attributes, one to identify the list it came from and one to identify where in the list it occurred. Additionally the former, known as the BMP Checklist Identifier, contains other attributes in a separate dataset which document the date range and locations that original recommendation list was implemented in.

Generating and Utilizing Deepwater Horizon BMP Checklist Data

On the response, BMPs were eventually distilled into two primary checklists containing slightly more than 50 BMPs. The checklist format was chosen to initiate data generation to document implementation of individual BMPs. The list for Louisiana differed from that of the eastern states (Mississippi, Alabama, and Florida) due to the increased variety of habitat types and the increased intensity and complexity of operations in Louisiana. Prior to the distribution of these standardized checklists, BMP recommendation lists were usually attached to Shoreline Treatment Recommendations (STRs). The STRs were essentially operational permits to work, and ESA Section 7 liaisons designated the applicable BMPs before concurring with the STR. STRs were also addressed as a separate portion of the BA analysis, and the BMP lists that were attached were documented using the BMP Checklist Identifier. This helped the BA team to give credit for at least some awareness of BMPs in operations prior to the implementation of BMP checklist documentation.

At first BMP checklists were collected in simple Word documents or even on paper at the end of each workday. Eventually, environmental monitors were migrated to professional grade mobile GPS devices to document BMP implementation (Image 1). Thus, a data model was set into motion. While the BMPs were used to effectively communicate recommendations, the schema used to capture BMP implementation had significant shortcomings in documenting what actually occurred. Pressure from the users and a lack of understanding of the purpose of the data drove the developers to bend the data model to meet the immediate desires of the user base. Never underestimate the power of individual motivation in a response environment or the difficulty in balancing that which is desired against truly unmet needs.

The transition from filling out Word document lists to completing BMP checklists to using handheld GPS devices rumbled like an earthquake in the culture of the environmental monitoring teams. Suddenly they were restricted to a more rigid form entry with drop down menus and data validation. They were relegated to a schedule of uploading data and mired by a stylus on a touch screen keyboard. This was not conducive to what they saw as their role in the documentation – to complete a running narrative of daily environmental observations. At that moment, they were somewhat correct. Checklists were used to identify issues with BMP implementation, so details could be helpful. However, environmental monitors were also required to complete daily logs (ICS 214s). The format of the 214s was more appropriate as a means of documenting extensive details. The true function of the checklist was documentation of implementation. Moreover, its function was the documentation of the date and location of non-implementation. Furthermore, the primary future use of the data would be to complete the effects analysis of the ESA BA, even though this long-range view had not yet come into focus.

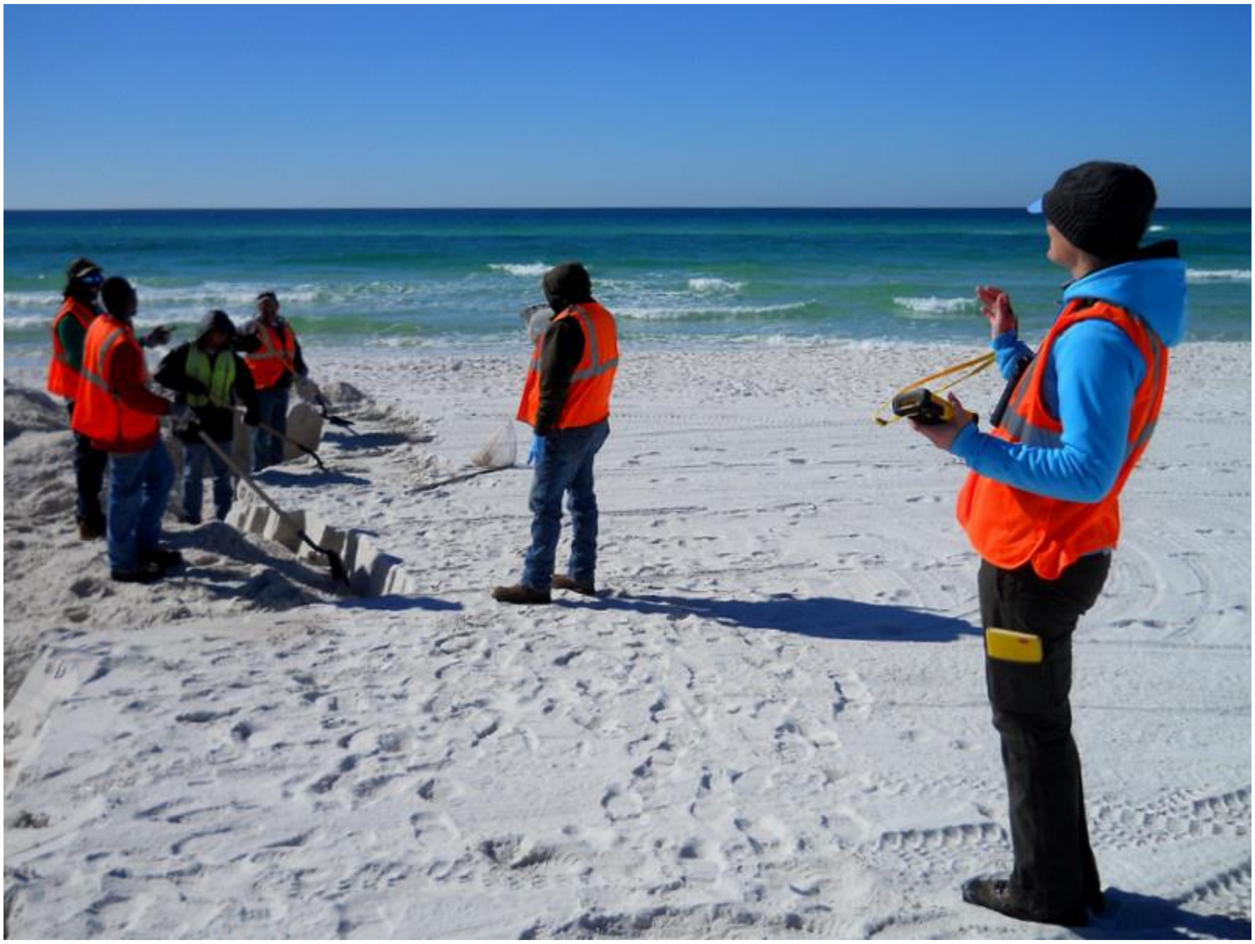

Image 1 - Environmental monitor, Lynn Ashton, enters BMP Checklist data on Trimble Nomad for response operation in Florida. (Jessica Odell Anderson, 2011)

The backlash against the new devices and their data model included varied complaints. Users claimed that the stylus entry was too labor intensive and time consuming. This was despite the fact that the devices were equipped with smart predictive text that learned commonly used entries, including whole phrases. Users demanded a way to enter their comments via their computers instead. Developers answered with a web entry site, which was initiated as a means for users to edit the entries they had made in the field. The developers did not anticipate what followed. The majority of users chose the path of least resistance and completed their BMP documentation records entirely via the web entry. They hand punched their coordinates from unknown sources and added lengthy diatribes of non-standardized comments through their keyboards.

This muddling of the content of the data was compounded by what was known as corrective actions. BMPs could not always be implemented as written. For example, one BMP called for a ten-foot buffer from the toe of the dune. In some areas of the shoreline, there are pinch points that made this buffer impossible. Corrective actions were required if BMPs were not implemented. So, if a BMP such as the dune buffer BMP was not implemented exactly as written, it was documented as not implemented for the entire day. The details of the required corrective action, such as proceeding in single file or avoiding vegetation to the greatest extent practicable, were then explained in the free form comments field. Corrective actions, therefore, essentially provide a means for the application of surrogate, non-standard BMPs as determined by the environmental monitor on duty at the time of non-implementation. This corrupts the data with secondary and tertiary custom BMPs, which cannot be known except by reading through the comments on a case-by-case basis. Additionally, in cases where a BMP was not necessarily applicable, it would be sometimes be checked as not implemented. This is shown in the excerpt from an actual BMP record below.

Comments	State	Branch	BMP2	BMP2_COMMENTS	BMP2_CA_TAKEN
Offshore on water recovery	Louisiana	Hopedale	N	No dead turtles observed	NA

Figure 2 - BMP checklist record showing misuse of non-implementation documentation

BMP 2, featured in the record above, stated the following:

"Retrieve injured/dead/oiled sea turtles using the sea turtle At-Sea Retrieval Protocol"

Without reading the comment, the record at its easily queried face value could be interpreted as a refusal of that day's operators to retrieve injured, dead, or oiled sea turtles. It is also important to note, that each environmental monitor was required to complete one checklist for each unique operation they observed that day. In the BA effects analysis, this results in the distribution of the effects of non-implementation over the entire day's operation. In the pinch point example, that could mean that the singular incident at the pinch point is extended into miles of beach. This misrepresentation of what actually occurred could potentially show dune intrusion in beach mouse critical habitat, which would be a significant problem.

DISCUSSION:

Remember the primary complaint of the environmental observers? BMP checklist and comments entry through the device was too time consuming. Their perception that detailed comments were needed was partially a result of the data model and user interface they were given. The pressure to elaborate on scenarios could be reduced if the data model were adjusted to emphasize incidents of concern. If users were required to only document occurrences of non-compliance, the data would be clearer. Non-implementation would be assigned only to areas where it actually occurred, and the data would no longer demonstrate an exaggerated view of adverse effects. This would also eliminate the need for lengthy comments. A simple record of non-implementation would likely suffice. If BMPs are rigid (such as certain distances in buffers), and non-implementation is more likely, corrective actions could be predetermined. In the dune buffer example, elements of corrective actions could be offered in follow up field entries. Did responders travel in single file to minimize impacts to vegetation? Did responders avoid trampling on vegetation directly? Following these strands of logic in advance may be a worthwhile endeavor for the experts tasked with drafting the original BMPs. However, this must be done in collaboration with a data management team so that the desirable and the feasible are appropriately balanced. Analysis of the comments from the DWH BMP checklist data could reveal some of the more common corrective actions that may be useful in future planning.

Collaboration with data management professionals must not stop at designing the user interface. It is also imperative to define an appropriate method of consumption and storage of the data. The BMP checklist data from the response is arduous to manipulate because it is all pivoted. This means that information which should be separated into individual rows which could be culled using standard query language is packed into one big record. Pivoted data is non-ISO standard and requires significant detangling to begin analysis.

CONCLUSION AND LESSONS LEARNED:

It is difficult under the looming urgency of response to prioritize database architecture. Although there is room for improvement, the efforts of the Environmental Unit to implement and document BMPs were unprecedented. Using table joining techniques and other queries, the BA team is leveraging what is available to generate an accurate representation of what occurred.

The following recommendations are offered as a means of improving the precision of future analyses:

1. Generate a plan that balances the desirable with the feasible, accounting for the pressure to be efficient in the field.
2. Design BMP lists in advance that adhere to the UBMP principles of singular intent and simple language. Do not reference BMP lists within one BMP.
3. Eliminate the option to design corrective actions on the fly. If BMPs are rigid, consider predetermining secondary and tertiary options. These could be selected in a standardized menu when entering the data.
4. Re-orient the user responsibilities to account for precise locations of incidents of non-implementation so that negative effects are not exaggerated by broad default distribution.

By leveraging the lessons learned on the Deepwater Horizon Incident, the response community can help alleviate some of the pressure for future environmental monitors and software developers. The goal here is not to create a rigid plan, but to design the architecture needed to adapt to the needs of a response. By applying the pressure now to complete these thought experiments, a BMP documentation strategy can provide the tools to help future responders file organized chaos into clear and appropriate structure.