

## **STAC Briefing Report – ECOSYSTEM datasets**

Nearshore Ecological Data Atlas

March 14, 2012

Oregon is currently engaged in a coastal and marine spatial planning (CMSP) process that will lead to the identification of areas within the territorial sea suitable for ocean energy development. During this process, the Oregon Department of Fish and Wildlife (ODFW) is responsible for providing pertinent ecological information and identifying the most important ecological areas, relative to Statewide Planning Goal 19, which should be protected from future development. ODFW's ecological information being used in the marine spatial planning process is a portion of the data in the Nearshore Ecological Data Atlas (NEDA), a collection of spatially explicit datasets. NEDA will be an important resource for use in current and future statewide planning and management efforts. While the current planning process is expected to be completed in 2012, we (ODFW) intend to continue work on NEDA, adding datasets and analyses for years to come.

More specifically, NEDA is a collection of ecological data sets (biological, oceanographic, physical habitat) that are displayed and analyzed in a spatially explicit way. The NEDA datasets that are part of the Territorial Sea Plan (TSP) Part 5 planning process and that can be shared with the general public (i.e. all non-confidential data) are displayed on [Oregon Marine Map](#), and many are available for download on [Oregon Ocean Info](#). As a planning resource, NEDA will serve the following purposes:

1. Identify existing information relevant for Goal 19 protection and CMSP
2. Make existing information accessible to public and managers in a spatially explicit format
3. Prioritize areas in the territorial sea that are important for ecological resources (based on current best available science)

### ***How ODFW approached building NEDA***

The inspiration for developing the NEDA was TSP Part 5; however, it was built to be a general resource, useful for ODFW and the public for any management need. Because the TSP Part 5 timeline (2010-2012) did not allow for original data collection, NEDA is currently restricted to existing data, provided by ODFW and other data sources. In identifying existing information relevant for this planning exercise we looked for three defining dataset characteristics:

- Provides coastwide data (preferably as a continuous map surface)
- Data are available (no new data collection; data are already in a spatial format or can be readily converted to a spatial format)
- Data have differing values across the territorial sea (i.e. the data can not have equal value across the planning area, which is not useful for the planning process)

As part of identifying existing information, we have identified data gaps but we have not conducted an in-depth gaps analysis. We also documented data that we considered for inclusion in NEDA but did not use, along with the reasons for not including the data at this time. The

“data gaps” and “data not used” lists are available on the STAC section of the oregonocean.info website.

We organized marine resource data into categories as follows:

- Habitat/Oceanographic (“Ecosystem”)
- Fish & Invertebrates (rock habitat was also used as a proxy for rock-associated species)
- Seabirds
- Marine Mammals

Marine resource data are presented in two forms on Oregon Marine Map:

- Basic data (primarily data mapped directly from original sampling, which may have been summarized, but not expanded through modeling)
- Modeled data (original data modeled to develop a continuous map surface over an area defined by the original studies) – includes some datasets within Fish, Seabirds, and Marine Mammals

Both forms of the data were then analyzed using Marxan, a software program that has been used worldwide to identify conservation areas based on integration (or summarization) and optimization of many input datasets. Marxan provides a spatial solution where a threshold resource value is returned for each target identified – the result is a footprint on a map within which threshold levels (or higher) are present for all targets identified. A “target” is a dataset for a resource (e.g. rock reef habitat), which may or may not be post-hoc [geographically] stratified, depending on whether it was determined to be ecologically meaningful to do so. For example, because of the geology of the seafloor in Oregon, subtidal rocky habitat is much more abundant south of Coos Bay than north, so several variables (e.g., rocky substrate, kelp, seabird nesting colonies) were stratified accordingly so that Marxan did not satisfy its “goal” (see explanation below) by selecting only targets south of Coos Bay. Because our primary area of interest for this CMSP process was within the Territorial Sea, many targets were stratified as either within or outside of the Territorial Sea. We set all target thresholds (i.e. “goal levels”) equally, so that each resource target had equal weight relative to all others (60% goal level for all targets). Lastly, we chose to have Marxan run 100 times, with each “run” consisting of 10,000,000 iterations, to produce a “sum run” solution, which approximates an average Marxan output for a given set of targets (and goal levels). Initially, we ran Marxan for each of the 4 categories separately (Habitat, Fish & Inverts, Seabirds, Marine Mammals). Although these separate runs were informative because they were more user-friendly to evaluate, ultimately, ODFW used results from an all-target Marxan sum run, which included targets from all 4 categories analyzed together. For more information, see the summary report “[STAC MARXAN Analysis Methods.pdf](#)”.

### ***Ecosystem-specific methods***

There are three analytical approaches used in developing ecosystem data layers and analyses that require additional explanation:

1. Categorizing data (e.g., re-classifying substrate types into collapsed categories, and binning continuous data for dissolved oxygen, chlorophyll a, upwelling)
2. Stratification of data for Marxan analysis

3. Proxy (kelp bed extent used as proxy for rock habitat)

## **1. Categorizing habitat data**

During the Science Workshop in Corvallis in September 2011, it became clear that the habitat and oceanographic data sets were fundamentally different from the other NEDA data in that they were value neutral in terms of resource protection. Instead of wanting to capture one end of a continuous scale for resource protection (e.g. high end of fish abundance scale), for habitat features we wanted to capture the variation within that feature across the Territorial Sea. All of these datasets were therefore used as categorical data and each category was used as an individual target in the Marxan analysis.

Oregon Marine Map layers of interest:

### **Physical > Terrestrial**

#### **1. Shoreline**

- **Rocky Shoreline** (ODFW, 2005)
- **Sandy Shoreline** (ODFW, 2005)

### **Physical > Ocean**

#### **2. Oceanographic Information**

- **Dissolved Oxygen** (map shows continuous data; data were binned for Marxan analysis)
- **Chlorophyll a** (map shows binned data)
- **Upwelling persistence** (map shows binned data)

#### **3. Seafloor Habitat Classification (ATSML, 2011)**

- **Gravel, Cobble, Shell, or Mixed**
- **Mud**
- **Rock**
- **Sand**

## **2. Stratification**

Because Marxan is designed to return an optimal spatial solution that captures a given goal level (e.g., 60% in our case) of pre-defined targets, it is important to carefully articulate each target. For NEDA, stratification was used to develop targets within data layers so that additional resource components were accounted for. Stratification of datasets into multiple targets prior to Marxan analysis guarantees that Marxan will select values from within each of the strata in the resource map. For some resources, we want to protect representative segments of the full spectrum of the resource found in Oregon, rather than simply a percentage of the resource. For example, while Marxan could have satisfied its Estuary Salmonid Index goals by choosing the Columbia River area only, we stratified estuaries into 5 strata ranging in size from the Columbia River to small streams, which ensured that these small streams were also eligible for selection. During the Science Workshop in September 2011, we received strong guidance to have Marxan return a variety of habitat types in its solution. Stratification helps ensure this.

Stratification applied in Marxan that is relevant to the Habitat/Ecosystem layers:

- Substrate type
  - By depth (0-30 m, 30-60 m, 60-200 m, 200-700 m, >700 m)
  - North coast vs. South coast (divided at Coos Bay) – rocky substrate only
- Rocky Shoreline
  - North coast vs. South coast (divided at Coos Bay)
- Chlorophyll a concentration
  - Territorial Sea vs. Exclusive Economic Zone (east-west stratification)
- Upwelling Persistence
  - Territorial Sea vs. Exclusive Economic Zone (east-west stratification)
- Dissolved Oxygen
  - Territorial Sea vs. Exclusive Economic Zone (east-west stratification)

### **3. Proxy**

Although it had a very small impact on the footprint of rocky reef habitat, we used a composite map of the total extent of kelp bed canopies obtained via remote sensing to effectively “add in” shallow rock habitat to the Seafloor Habitat dataset (traditional seafloor mapping techniques generally have not been used off Oregon in < 10-15 m water depth).