STAC Briefing Report – BIRD MAMMAL 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".

Bird and Mammal specific methods

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

1. Categorizing and binning
2. Creation of a gray migration pathway data layer
3. Stratification of bird and mammal data for Marxan

1. Categorizing and binning

Seabird nesting colony information collected by USFWS was summarized to classify the colonies into three relative importance categories. The original dataset consists of locations for each of 324 colonies, and the maximum species-specific counts for all known existing and historical seabird nesting colonies on the Oregon Coast (1979-2009). The maximum count was used instead of the average or most recent count because several seabird populations have declined significantly in recent years (for a variety of reasons, including predation by native and non-native animals such as bald eagles and rats), and it is presumed that these species may return to historical population levels if favorable conditions return. The relative ecological importance of each colony was assigned based on the following criteria, which were developed by USFWS biologists and other seabird experts:

- Importance level 1: Offshore colonies/complexes with ≥ 5,000 breeding birds, *OR* offshore or mainland colonies with Tufted Puffins, *OR* offshore colonies with Leach's Storm Petrels or Fork-tailed Storm Petrels
- Importance level 2: All rocks, reefs, and islands of Oregon Islands and Three Arch Rocks NWRs with breeding seabirds that were not included in Importance level 1, *OR* mainland seabird breeding sites with ≥ 1,000 breeding birds
- Importance level 3: All other colonies

The number of breeding birds used in the determination was based on the maximum observed count from 1979-2009.

Pinniped haulouts were binned into size classes and each species size class was used as a separate Marxan target. Species size classes are as follows:

- Harbor Seal haulout used by
  - < 10 animals
  - 10-100 animals
  - 100 - 500 animals
  - > 500 animals
- California Sea Lion haulout used by
  - < 10 animals
  - 10-100 animals
  - 100 - 500 animals
  - > 500 animals
- Steller Sealion haulout used by
  - 10-100 animals
  - 100 - 500 animals
  - > 500 animals
- Northern Elephant Seal haulout used by
  - 10 – 100 animals

2. Gray Whale Migration Pathway

There was no comprehensive data source defining the migration pathway for gray whales, so this dataset was developed for this CMSP process. At the Science Workshop held on marine mammals (October 2011), participants advised us to represent the corridor based on the depth distribution of gray whales recorded in the Ortega-Ortiz and Mate (2008) gray whale migration study. The results from this study were expanded to the entire Oregon coast based on their consistency with similar studies conducted elsewhere on the West Coast of North America. The 10th and 90th percentiles of depth values for each phase of the gray whale migration were used to demarcate the inshore and offshore boundaries of the migratory pathway, based on advice from the study authors. Phases of gray whale migration and 10th-90th percentile depth ranges were classified as "Southbound" (34 – 65 m), "Northbound phase A" (31 – 62 m), and "Northbound phase B (mothers and calves, 15 – 59 m). The migratory pathway shown on Marine Map is a composite of the three migratory phases (15 – 65 m). While this layer shows the primary migratory pathway, it should be recognized that gray whales often occur in both shallower and deeper waters.

Ortega-Ortiz, J. and B. Mate. 2008. Distribution and movement patterns of gray whales off central Oregon: shore-based observations from Yaquina Head during the 2007/2008 migration. Newport, OR: Oregon State University Marine Mammal Institute. Report produced for Oregon Wave Energy Trust. 34pp.

3. 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 bird and mammal distribution:

- Seabird Nesting Colonies (stratified for each Importance Level – 1-3)
    - North coast vs. South coast (divided at Coos Bay)
- Seabird Density Information from Crescent Coastal Research surveys
    - Data extent is within the Territorial Sea only
    - North coast vs. South coast (divided at Coos Bay)
    - Metrics: Seabird Density, Seabird Diversity Index
    - Species: Brandt's Cormorant, Loons and Grebes, Common Murre, Marbled Murrelet

- Seabird Density and community index information from Point Reyes Bird Observatory modeling
    - Data extent is outside the Territorial Sea only
    - No additional stratification applied
    - Metrics: Seabird foraging area abundance, Seabird foraging area importance, Seabird foraging area persistence,
    - Species: Black-footed Albatross, Brandt's Cormorant, Common Murre, Sooty Shearwater
- Cetacean density information from NOAA modeling
    - Territorial Sea vs. Exclusive Economic Zone (east-west stratification)
    - Species: Berardius whales (Berardius bairdii), Blue Whale, Dall's Porpoise, Fin Whale, Humpback Whale, Northern Right Whale Dolphin, Pacific White-sided Dolphin, Risso's Dolphin, Sperm Whale
- Marine mammal relative abundance information from Crescent Coastal Research surveys
    - Data extent is within Territorial Sea only
    - Species: Gray Whale (Pacific Coast feeding group, a.k.a. “summer residents”), Harbor Porpoise