Review of the geospatial Benthic Habitat, Marine Life and Habitat Data layer, which support Marine Spatial Planning in Washington. The review was based on exploration of version 3.6 of the data downloaded from the Washington Marine Spatial Planning web site (http://www.msp.wa.gov/explore/data-catalog/) using ESRI ArcGIS ver. 10.2, the summary document containing excerpts from Pacific Northwest Marine Ecoregional Assessment (Schaaf, et.al., 2013), and the Pacific Northwest Coast Ecoregion Assessment – Appendix 4E (Schaaf, et.al. 2006).

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For this review, the spatial extent and original input data sources used in construction of the final dataset were not assessed. The review focuses on the modeling and representation of the outcome and how the results may be used. The review findings are below.

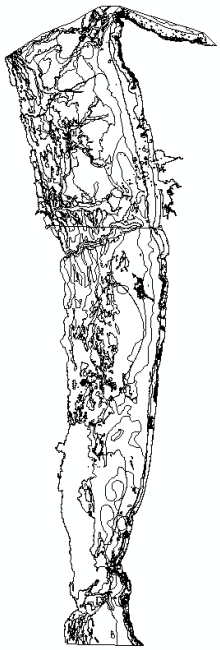

Figure 1. ATSML_V3_6_WA_OR, vector object

The ATSML_V3_6_WA_OR (fig.1) is a fully documented vector shapefile providing polygonal spatial objects with attributes describing substrate types interpreted from a variety of seafloor surveying methods (multibeam sonar, sidescan sonar, sediment grab, cores, seismic reflection and both still and video imaging). The entry and attribute code descriptions in this version of the dataset strive to maintain consistency with earlier versions while incorporating more recent observational data and providing a common classification system with data from Washington, Oregon, and California.

As described, this dataset represents classified benthic habitat. The dataset extends from the southern border of Oregon to the northern border of Washington and extends from the coast (excluding estuaries) to the toe of the continental shelf. These data were collected using lead line soundings, single beam sonar, multibeam sonar, and sidescan sonar. (credit: Oregon State University, Active Tectonics & Seafloor Mapping Lab (AT&SML), the Oregon Department of Fish and Wildlife, NOAA Biogeography Branch, and The Nature Conservancy)

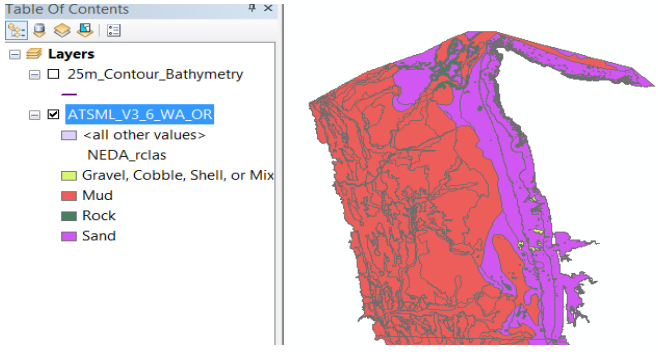

Figure 2. NEDA_rclas symbology

While the attribute NEDA_rclas (fig. 2) is a useful generalization and helpful for cartography simplification, the substrate code descriptions found in the metadata for the primary "groups" of attribute fields ("Phys_Hab", "Geo_Hab",

"SGH_Lith") provide richer designations of the most common or abundant substrate type and geomorphologic context (i.e. "basin, soft sediments (mud), on the flat, valley floor". The lithologic characterization of the most abundant (SGH_lith1) and secondary abundance (SGH_lith2) type compliments the more general classification field (NEDA_rclas) field nicely.

The documentation provided for review regarding the modeling process used in the construction of this dataset highlights three key considerations: (1) the use of depth classes, (2) the minimum mapping unit thresholds used when preforming the overlay and combinatorial analysis, and (3) the use of a Topographic Position index (TPI). The depth classes (0-40m, 40-200m, 200-700m, 700-3500m) have been used before and were applied here to the NOS bathymetry 30m grid dataset. The occurrences of unique area of less the 1ha were omitted from input data layers and any potential benthic habitat class object resulting from the combination of input layers less the 10 ha were also omitted. The TPI algorithm classifies each grid "cell" into a position type relative to its neighbors (i.e. flat, slope, ridge, etc.). This "landform" position along with depth and substrate type is then combined. Four eight (48) unique combination of four types of submarine landforms, 4 depth classes, and 3 substrate types form the basis for the final classifications.

It would be useful if the depth binning could be linked to processes or species of interest. Where depth due to light limitation or mixing potential for example are of interest there could be finer vertical resolution resulting in a pattern of different spatial objects. Likewise, the minimum mapping unit issues should either be linked to the scale or extent of processes of concern or stated as a limitation in the application of this dataset. The use of the TPI algorithm bringing relative landform position into the final classification does enrich the interpretation of the data. However, the definition of the relationship between fine scale and broad scale position (focal kernels of varying size) is not explained.

The use of this data in the Marine Spatial Planning context may be centered on the utility to inform stakeholders of the composition and configuration of seafloor benthic habitat. The web map application at https://fortress.wa.gov/dnr/mspmaps/index.html, provided as a data access portal from the menu for "Marine Life and Habitat can be used to launch a graphic user interface to mapping the benthic habitats (fig. 3).

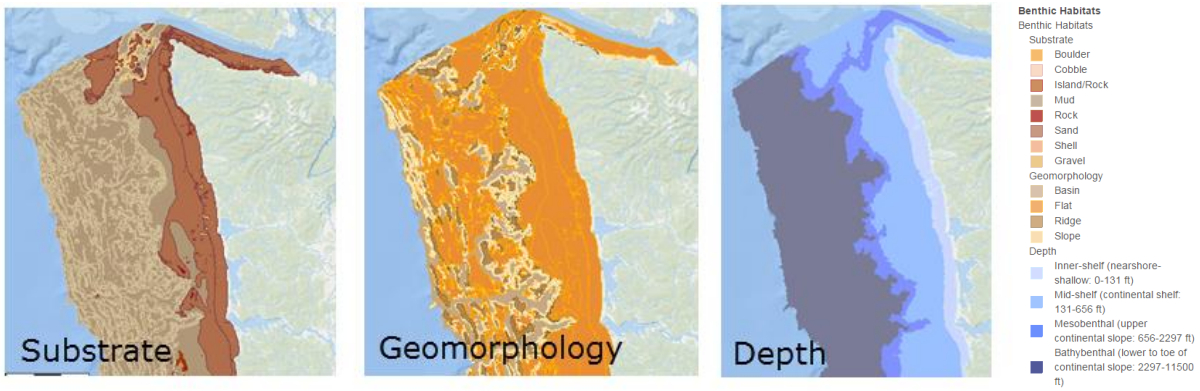

Figure 3. Web Mapping Application

In this context, the online mapping tools over simplifies the information content of the downloadable data. Yet the variables that are combine to construct the physical concept of "marine benthic habitat" (depth, substrate type, and structure) are well presented. The online tool does not facilitate basic spatial overlay, proximity, or attribute queries, the cartographic choice to include the polygon boundaries of all spatial objects does successfully suggest the complexity of the underlying data.

In creating this dataset the authors faces the primary challenge of reducing the complexity of the input data in order to providing useful information in the final product, while maintaining the detail of both composition and configuration of the underlying spatial pattern of that data. The theme of this dataset is "benthic habitat"; a general term intended for use in a public planning process. However for many end users, the meaning of the word "habitat" and the potential use of this data may be linked to needs of a selected species or organism life stage. Without specifying a species requirements or identifying some form of critical limits, the appropriateness of the level of data representation allowed by this dataset cannot be fully assessed.

In summary, this dataset and the associated metadata fully describe the polygon attributes and codes used to represent the benthic "type" and "relative position" of general homogenous regions of the seafloor. The online mapping of this same theme is more general in its description, but does allows for the display of other associated themes to aid in interpretation. The modeling procedure does use some binning and threshold constrains which are not fully described but do seem reasonable given the spatial extent and intended use of the data. The process and results to create consistent codes for habitat from the various sources of input data is understandable. The inclusion of a "position index" in the code description enriches the interpretation of the final data. The usefulness of this generalized representation of the complexity of in a planning process remains to be determined.

Schaaf, Vander, D., K. Popper, D. Kelly and J. Smith. **2013**. "Pacific Northwest Marine Ecoregional Assessment", The Nature Conservancy, Portland, Oregon.

Schaaf, Vander, D., G. Wilhere, Z. Ferdaña, K. Popper, M. Schindel, P. Skidmore, D. Rolph, P. Iachetti, G. Kittel, R. Crawford, D. Pickering, and J. Christy. **2006**. "Pacific Northwest Coast Ecoregion Assessment". Prepared by The Nature Conservancy, the Nature Conservancy of Canada, and the Washington Department of Fish and Wildlife. The Nature Conservancy, Portland, Oregon