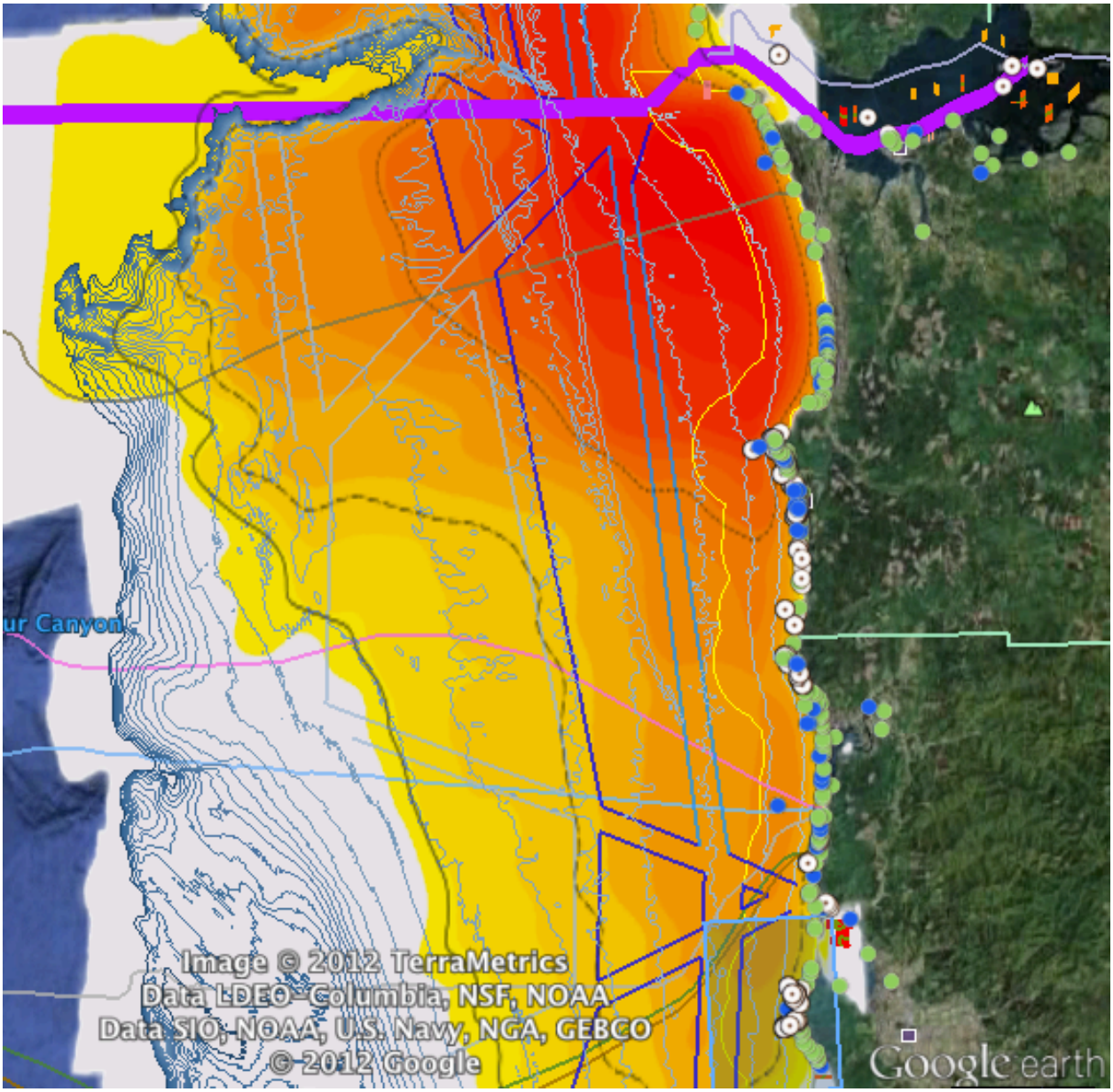
Mapping: Getting to know the dynamic coast (DRAFT – Not Reviewed)

"The sea, so smooth and flat on its surface is corrugated underneath with vast canyons and mountain chains, ragged seams where the tectonic plates that ride over the surface of the planet come together and pull apart, leaving great rifts open to the volcanic cauldrons seething in earth's heart."
Eccentric Islands: Travels Real and Imaginary (Minneapolis: Milkweed Editions, 2000). Copyright © 2000 by Bill Holm.



Oregon MarineMap: Astoria fishing grounds, 3-mile Oregon Territorial Sea boundary, proposed Garibaldi/Tillamook ocean energy site, recreational boating, commercial shipping lane, tow lanes, underwater telecommunication cables, recreational boating, wildlife viewing, seabird nesting colonies and pinniped haulouts. *www.oregon.marinemap.org*

Vast regions of the oceans, some within our territorial waters, remain unknown to us. Escalating wave heights pound our shores, and tectonic subduction strains threaten havoc. Climate change, sea level rise and ocean acidification add to the burden of uncertainty facing coastal communities. Human pressures are also growing. As we broaden our consumption of the ocean's resources, we are faced with the overlapping and sometimes conflicting geographies of the many established and emerging uses for the Oregon ocean.[1]

University researchers, government agencies and other interested parties are mapping the Oregon coast and the ocean off its shores. Projects range from mapping the distribution and migratory patterns of marine life, to complex modeling of the sand depth on the beaches adjacent to projected wave energy farms, to allow for future monitoring of the impacts of wave flow diversion. Maps created also assist in identifying and preparing for coastal hazards.

Ocean and Coastal Mapping Websites:

- The Northwest Association of Networked Ocean Observing Systems (**NANOOS**) is the Pacific Northwest Regional member of the national Integrated Ocean Observing System (IOOS). NANOOS maintains in-water data collection devices and provides observational and model data, plus forecasts; it provides funding for mapping of ocean floor bathymetry, sea life distribution and tracking, marine spatial planning, climate change resilience and shoreland erosion. The goal is to give an integrated picture of what is going on in our oceans and estuaries, with emphasis on maritime operations, ecosystem impacts, regional fisheries, and coastal hazards, including tsunami evacuation maps. Their website accesses mapping, information and resources. http://www.nanoos.org/home.php
- The Pacific Coast Ocean Observing System (PaCOOS) Marine Habitat Viewer is an interactive web mapping application for the display and investigation of marine geological, oceanographic, and fisheries datasets within the California Current Large Marine Ecosystem. The Active Tectonics and Seafloor Mapping Lab collects seabed data off Oregon and California, and develops maps used to model essential fish habitat of the West Coast groundfish. http://pacoos.coas.oregonstate.edu/MarineHabitatViewer/viewer.aspx
- The Oregon Department of Geology and Mineral Industries (DOGAMI) has developed many interactive web-based maps, including tsunami evacuation maps for the coastal zone (http://www.oregongeology.org/sub/pub&data/interactivemaps.htm) and an interactive natural hazards map based on lidar[2] data for Coos County for landslide, flood zones, river channel migration, earthquakes and tsunami inundation http://www.oregongeology.org/sub/earthquakes/earthquakehome.htm DOGAMI publishes tsunami inundation maps and evacuation maps for Oregon coastal communities. http://www.oregongeology.org/sub/pub%26data/pub%26data.htm
- The Center for Coastal Margin Observation & Prediction (CMOP) is a National Science Foundation Science and Technology Center. CMOP studies the sustainability and management of the Columbia River coastal margin under changing climate and land/water uses. Using stationary and mobile observational systems, the Saturn programs collect long-term physical and biochemical ocean data. From these, CMOP

produces the Virtual Columbia River, a 4D (space-time) dynamic visualization of the water levels, salinity, temperature, and velocities of the Columbia River estuary and plume. http://www.stccmop.org/datamart/virtualcolumbiariver/forecasts

- Oregon Coastal Atlas is a web-based educational tool and web portal providing access to coastal topics for planners, researchers and the public. The project offers background information for different coastal systems, access to interactive mapping, online geospatial analysis tools, and direct download of various planning and natural resource data sets. www.coastalatlas.net/
- Oceana produces maps and reports in support of the development of marine reserves and protected areas. http://na.oceana.org/en/news-media/publications/reports/protecting-the-oregon-coast-identifying-and-protecting-important-ecological-areas
- The Oregon MarineMap has been created to assist in the development of the territorial sea planning process for the coast (see below). http://oregon.marinemap.org.

Oregon Coastal and Marine Spatial Planning:
"Building an offshore road map for the waters off the Oregon Coast, who gets to use them and how."[3]

The Oregon MarineMap lights up like an interlocking puzzle where the Oregon coast meets the Pacific Ocean.[4] This Google Earth/NOAA bathymetric[5] interface displays the most integrated information available for the overlapping and, at times, competing interests of the many stakeholders plying the Oregon Territorial Sea.

The web-based map was launched by the Department of Land Conservation and Development in February 2010, to aid communication and coordination for the following Oregon Coastal Management Program initiatives: 1) marine reserves process, 2) activities of the nearshore research taskforce, 3) territorial sea planning process, and 4) ongoing seafloor mapping process.[6] In July, 2010, President Obama issued an Executive Order, establishing a National Ocean Policy (NOP). The NOP recognizes the importance of exploring the development of renewable energy and the role of regional coastal and marine spatial plans to maximize the ability of marine resources to support a wide variety of human uses.[7,8,9]

A salient characteristic of ocean energy development is that these facilities will "physically occupy, for decades at a time, defined pieces of ocean real estate."[10] Therefore, the first step in considering potential sites for ocean energy facilities has been to map the resources and uses that must be protected according to Statewide Planning Goal 19: Ocean Resources, and the Territorial Sea Plan.[11]

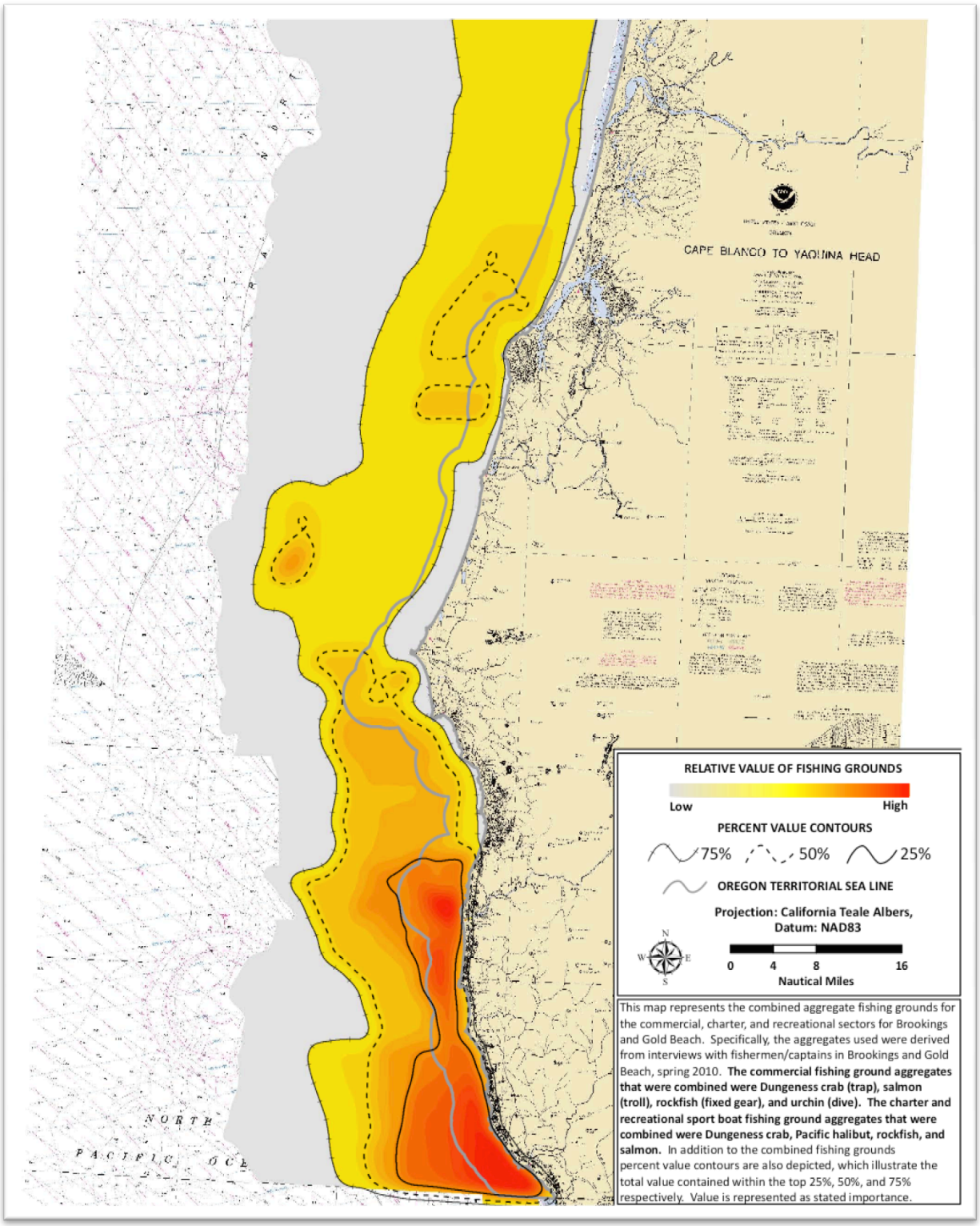
Identification of critically important and fiercely prized fishing grounds has been key to the project. The result of confidential interviews with commercial, charter and recreational fishermen, the aggregated data are displayed as "heat" maps, showing regions of the coastal waters with high value for fishing.[12,13] An example of this data mapping is displayed below, and is included in the data layers of the Oregon MarineMap.

Brookings/Gold Beach Combined Value Fishing Grounds: All Sectors (commercial, charter, recreational sport boat)

Oregon Territorial Sea Plan Amendment Process: Marine Fisheries Uses and Values Project

Appendix A-3

(Northern portion of the map is clipped/removed, compared with original.)



RELATIVE VALUE OF FISHING GROUNDS:
Brookings/Gold Beach Combined Value Fishing Grounds: All Sectors (commercial, charter, recreational sport boat), November 15, 2012, Oregon Territorial Sea Plan Amendment Process: Marine Fisheries Uses and Values Project.[12]

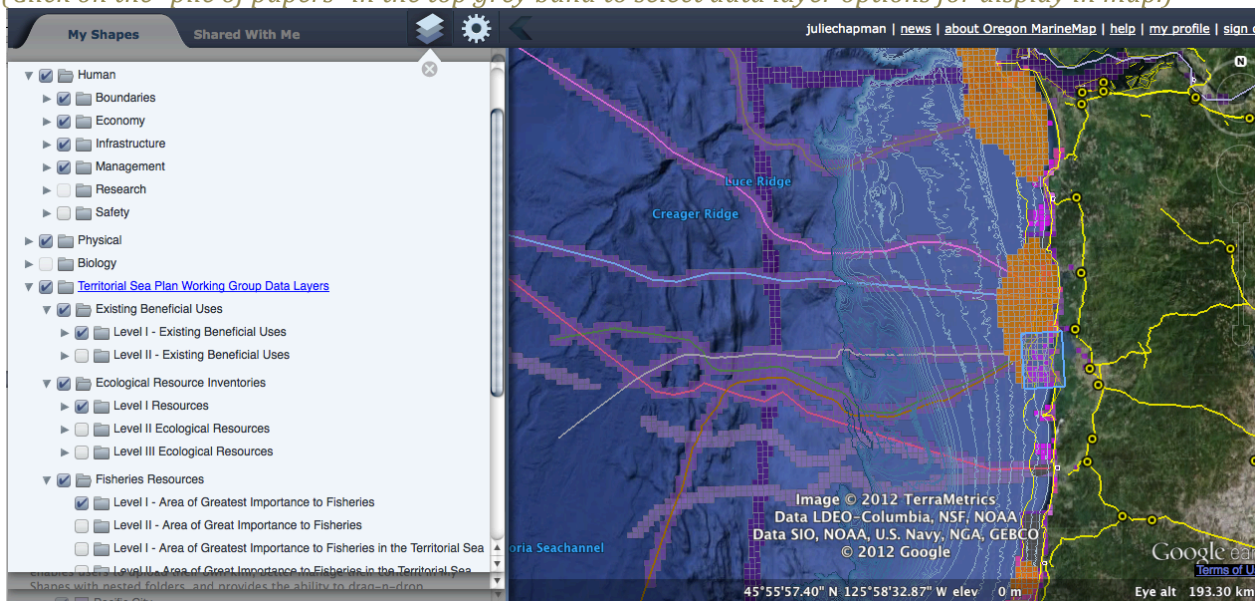
Using MarineMap:
MarineMap allows layers of environmental, commercial infrastructure, recreational uses, fisheries, marine life, research data and ecological analysis tools to be drawn and analyzed in an interactive, web-based format.

In the example below, the viewer simultaneously activates layers of:

- proposed renewable energy sites
- undersea telecommunication cables
- commercial shipping lanes
- electrical transmission lines and substations, and
- draft maps of Level 1 (highly valued) resources and existing beneficial uses of the Territorial Sea.

These and other data layers can be displayed in map form for the purpose of planning discussions.

(Click on the "pile of papers" in the top grey band to select data layer options for display in map.)



View of the North Oregon Coast. http://oregon.marinemap.org/

Additional assistance in using the map, including tutorials, is available from the "help" tab, in the top right of the screen.

The maps created will be used in the analysis of the spatial extent of existing uses that provide the economic and socio-cultural benefits around which renewable ocean energy projects must be sited. They will serve as a foundation for a marine version of land use planning. Potential locations for wave energy facilities will be adopted as an amendment to the Territorial Sea Plan.[13]

(For more information, refer to the LWVOR study: Coastal and Nearshore Oregon: Using and Protecting Our Natural Resources, 2012, http://voteoregon.org/issues/study-reports/recent-study-reports/*)*

References and Definitions:

1. The White House Council on Environmental Quality, Final Recommendations Of The Interagency Ocean Policy Task Force, July 19, 2010. www.whitehouse.gov/administration/eop/ceq/initiatives/oceans/ accessed 8/21/12.
2. Lidar – light detection and ranging (lidar) data are collected from a light aircraft carrying a highly accurate laser scanner. The scanner builds up a model of the surface of the earth, and the vegetation and structures on it.
3. David Morgan, 9/28/2010, http://newslincolncity.com/
4. http://oregon.marinemap.org
5. Bathymetric *(map)* - a relief map representing the topography of a seafloor, river or lake bed.
6. http://www.oregonocean.info.
7. STATE JURISDICTION AND FEDERAL WATERS, STATE COASTAL MANAGEMENT PROGRAMS, OCEAN MANAGEMENT AND COASTAL AND MARINE SPATIAL PLANNING, Office of Ocean and Coastal Resource Management (OCRM) National Oceanic and Atmospheric Administration (NOAA) April 18, 2011. seagrant.gso.uri.edu/coast/cmsp_material/state_fed-waters.pdf, accessed 8/22/12.
8. Land Conservation and Development Commission, Richard Whitman, Director, Agenda Item 11, September 1-2, 2010, LCDC Meeting. www.oregon.gov, accessed 6/20/11.
9. The White House Council on Environmental Quality, Final Recommendations Of The Interagency Ocean Policy Task Force, July 19, 2010, www.whitehouse.gov/administration/eop/ceq/initiatives/oceans, accessed 7/9/11.
10. Frequently Asked Questions About Ocean Planning in Oregon (Updated June 1, 2011), Onno Husing, Director, OCZMA (November 2009), http://www.oczma.org/detail.php?item=131, accessed 8/21/12.
11. A Citizen's Guide to the Territorial Sea Plan Amendment Process, Oregon Dept. of Land Conservation and Development, 2/2/12. http://cms.oregon.gov/LCD/Pages/TerrSeaPlanAdComm.aspx#Citizens_Guide_to_the_TSP, accessed 8/22/12.
12. Final Report Wave Energy Outreach Activities on the Oregon Coast, Prepared for: Economic Development Administration (EDA) U.S. Department of Commerce Award No. 07-69-06031, Prepared by: Oregon Coastal Zone Management Association (OCZMA) Author: Onno Husing, Director, September 2010, http://www.oczma.org/detail.php?item=153, accessed 8/17/12.
13. Ecotrust, Marine Fisheries Uses and Values Project, in support of the Oregon Territorial Sea Plan Revision, www.ecotrust.org accessed 5/11/11.

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