OregonWaveEnergy TRUST

Apr | 10

Cumulative Impacts of Wave Energy In Oregon

Data Atlas

Prepared by
Parametrix
In partnership with Aquatera Ltd.
On behalf of Oregon Wave Energy Trust

This work was funded by the Oregon Wave Energy Trust (OWET). OWET was funded in part with Oregon State Lottery Funds administered by the Oregon Business Development Department. It is one of six Oregon Innovation Council initiatives supporting job creation and long-term economic growth.

Oregon Wave Energy Trust (OWET) is a nonprofit public-private partnership funded by the Oregon Innovation Council. Its mission is to support the responsible development of wave energy in Oregon. OWET emphasizes an inclusive, collaborative model to ensure that Oregon maintains its competitive advantage and maximizes the economic development and environmental potential of this emerging industry. Our work includes stakeholder outreach and education, policy development, environmental assessment, applied research and market development.

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About Oregon Wave Energy Trust

The Oregon Wave Energy Trust – (OWET) - with members from fishing and environmental groups, industry and government - is a nonprofit public-private partnership funded by the Oregon Innovation Council in 2007. Its mission is to serve as a connector for all stakeholders involved in wave energy project development - from research and development to early stage community engagement and final deployment and energy generation - positioning Oregon as the North America leader in this nascent industry and delivering its full economic and environmental potential for the state. OWET's goal is to have ocean wave energy producing 2 megawatts of power - enough to power about 800 homes - by 2010 and 500 megawatts of power by 2025.

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Preface

The Cumulative Effects Framework project conducted a survey of available datasets for evaluation and incorporation as the framework was developed. The data collected were catalogued and reviewed by the project team to determine applicability in the modelling effort. This data review was conducted in parallel with the development of the wave energy cumulative effects model development. The data and atlas products provided here accompany the report, *Cumulative Impacts of Wave Energy in Oregon: Existing environmental character, trends and pressures*.

The following sections are structured similar to the other Cumulative Effects Analysis Framework categories. Technical suitability is not included because it is a product of many of the datasets presented here, and not a primary source. The sections are briefly discussed before the presentation of the maps. Included in this report are data inputs organized around the following topics:

1. Physical
2. Ecological
3. Conservation
4. Social
5. Economic

Model development assisted in identifying data gaps and opportunities as the data sources were reviewed. The following sections document the data sources that were included in the first version of the cumulative effects framework. The sections match the analysis categories in the model.

The data survey included outreach to existing data providers and distributors as well as contact with specific resource managers or data managers. Data was collected included datasets from:

- Mineral Management Service Marine Cadastre
- National Oceanographic and Atmospheric Administration
- Northwest Association of Networked Ocean Observing Systems (NANOOS)
- Oregon Department of Land Conservation and Development
- Oregon Department of Fish and Wildlife
- Oregon State University
- Pacific Coast Ocean Observing System (PaCOOS)
- Pacific Marine Fishery Management Council

Additional datasets were also collected from individual agencies or industries such as sea cable data, utility infrastructure data, and marine shipping data. Social and economic data was also

reviewed from more specific studies on coastal communities. These studies are referenced in subsequent sections.

Data Requirements

The OWET Cumulative Effects Framework is a spatially explicit model to understand the various benefits and impacts of wave energy development on the Oregon coast. The model development is structured to provide a one nautical mile resolution analysis of the territorial sea and outer continental shelf. As the project searched for and evaluated data several key criteria were included:

- Data inputs must have a geographic or spatial component;
- The spatial units must be of resolution and scale to match the project's analysis;
- The data must be documented, public, and trusted.
- Only secondary analysis is possible. Primary sources must be available and ready for use in the framework.

These requirements resulted in some datasets requiring additional modelling or interpolation for inclusion in the extent used for this study. In some cases the modelling was possible with techniques that are accepted, in other cases the modelling was not performed because accepted methodologies were not available.

Data presented in this report are the inputs for the model. The model utilizes raster datasets for analysis. These inputs often required data processing and conversion for inclusion in the model.

1 Physical Datasets

The physical datasets include bathymetry, geology, oceanographic and topographic data in the study area. These datasets capture the abiotic components of the environment, and the physical processes at work in the ocean. Some of these datasets inform the suitability analysis for siting and operation of wave energy projects. Analysis with physical datasets provides the basis for understanding the environmental interaction with wave energy devices and support activities.

1.1.1 Data Gaps

Physical data sets are primarily coarse scale remote sensing products or point data from limited observations. The latter presents challenges for generating an appropriate study area dataset for inclusion in the model. Air and water quality data is only available in limited observation points. The same is true for many of the other physical attributes of the surface of the sea and the sea floor. Several ongoing research efforts will help better understand these physical processes with spatially explicit data.

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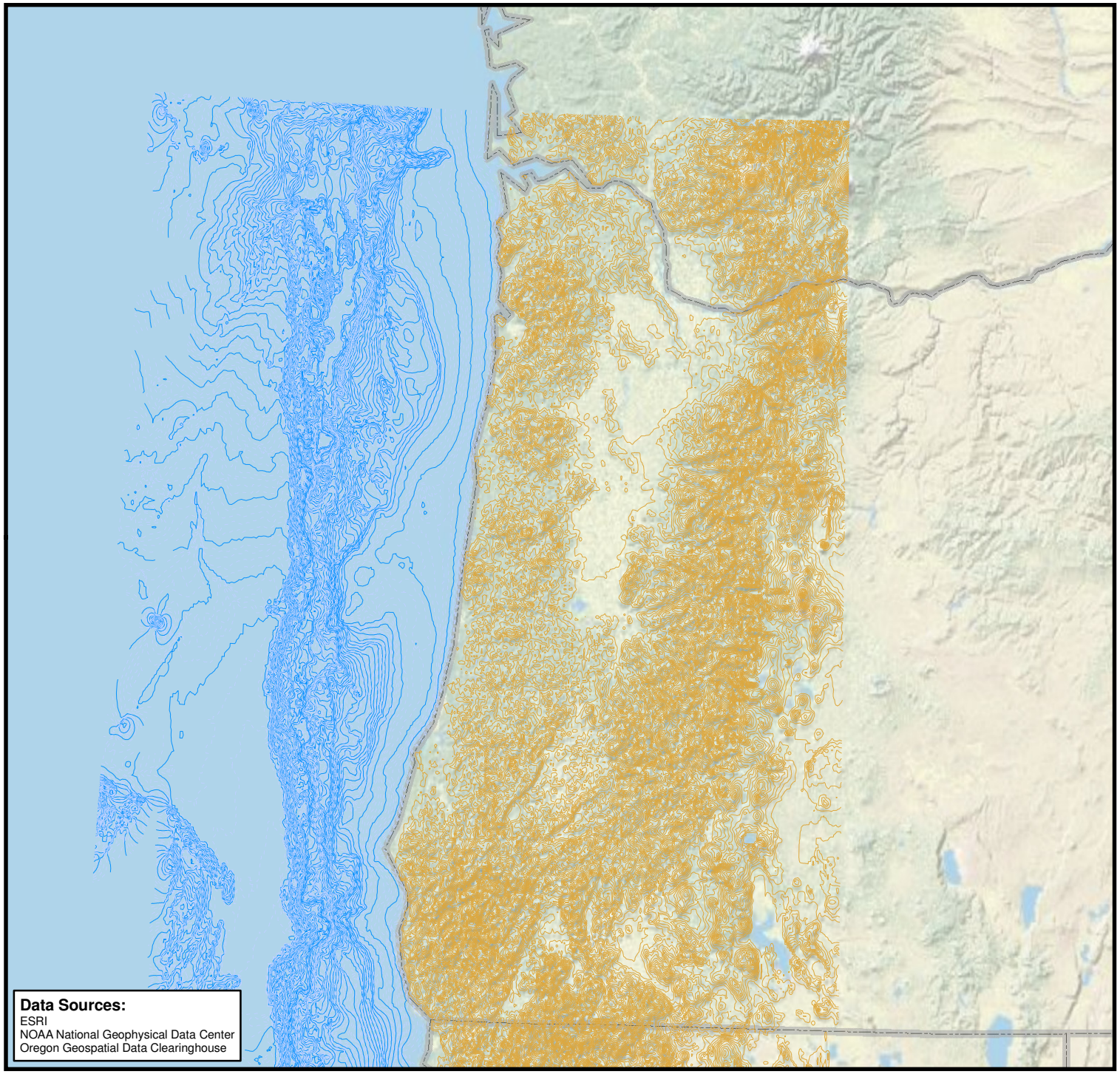

Fig. 1-1

Bathymetry

Bathymetry
- 10 meter interval
- 50 meter interval

Elevation
- 100 meter interval

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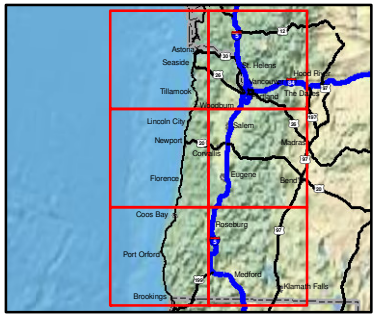
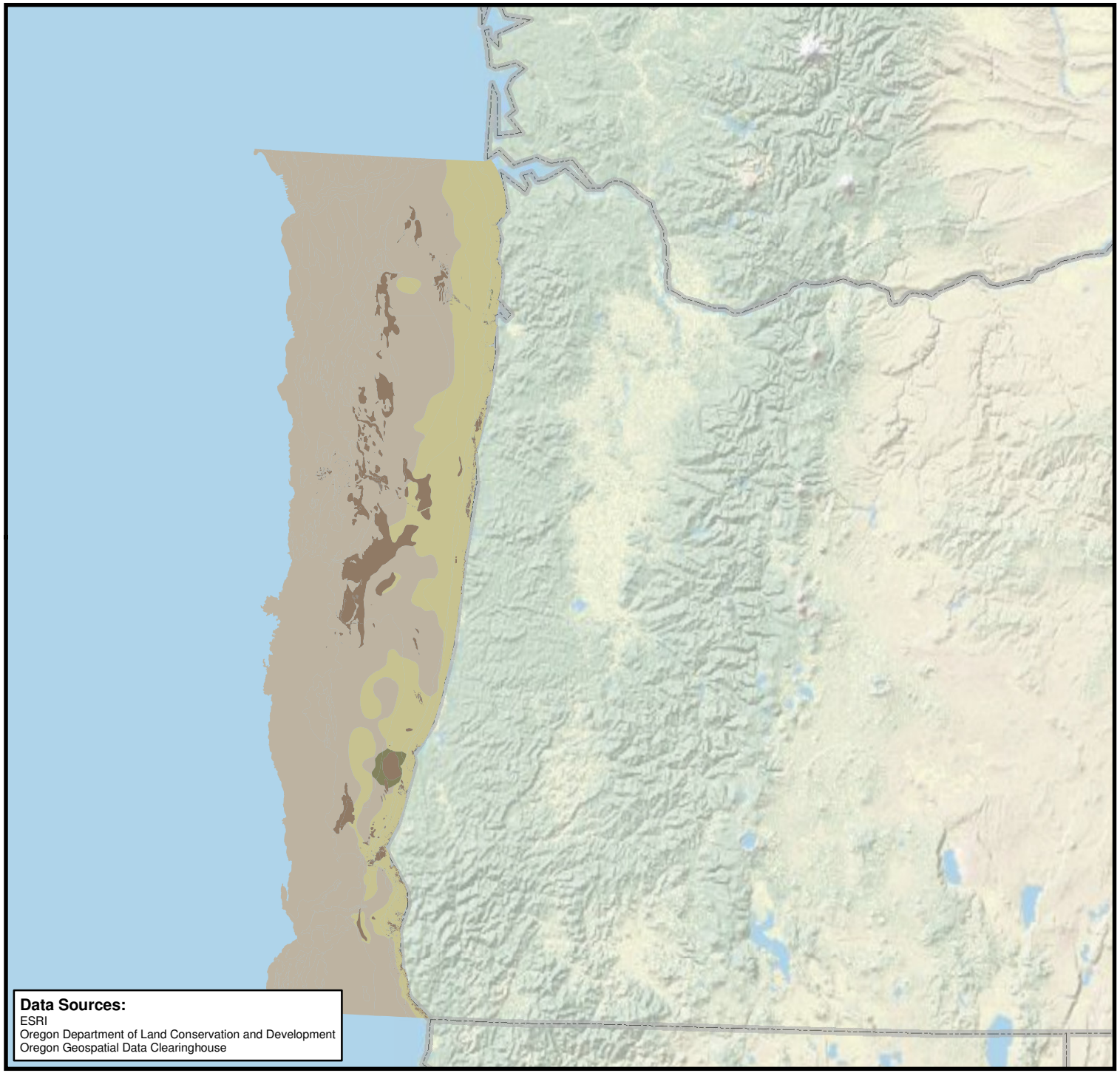
Powertech EMEC

0 25 50 75

Nautical Miles





Data Sources:
ESRI
Oregon Department of Land Conservation and Development
Oregon Geospatial Data Clearinghouse

Fig. 1-2

Seabed Type

Sediment type
- Shell
- Sand
- Gravel
- Cobble
- Mud
- Boulder
- Rock

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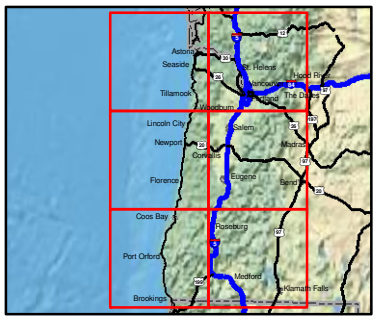
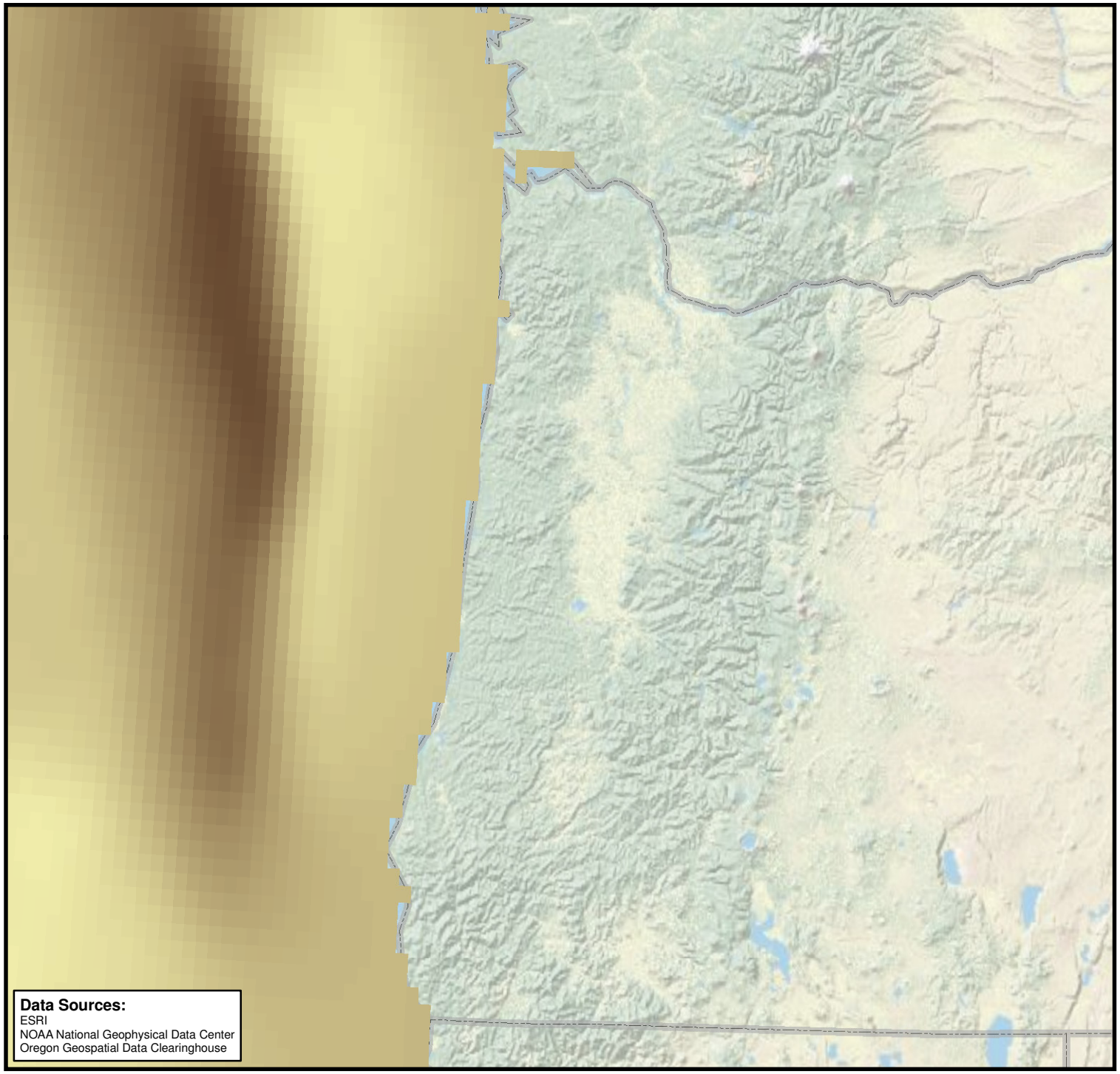
Powertech EMEC

0 25 50 75
Nautical Miles





Data Sources:
ESRI
NOAA National Geophysical Data Center
Oregon Geospatial Data Clearinghouse

Fig. 1-3

Sediment Depth

Depth (meters)

High : 2032

Low : 11

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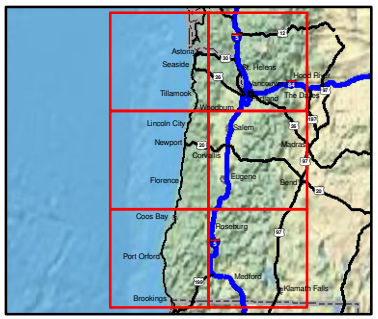
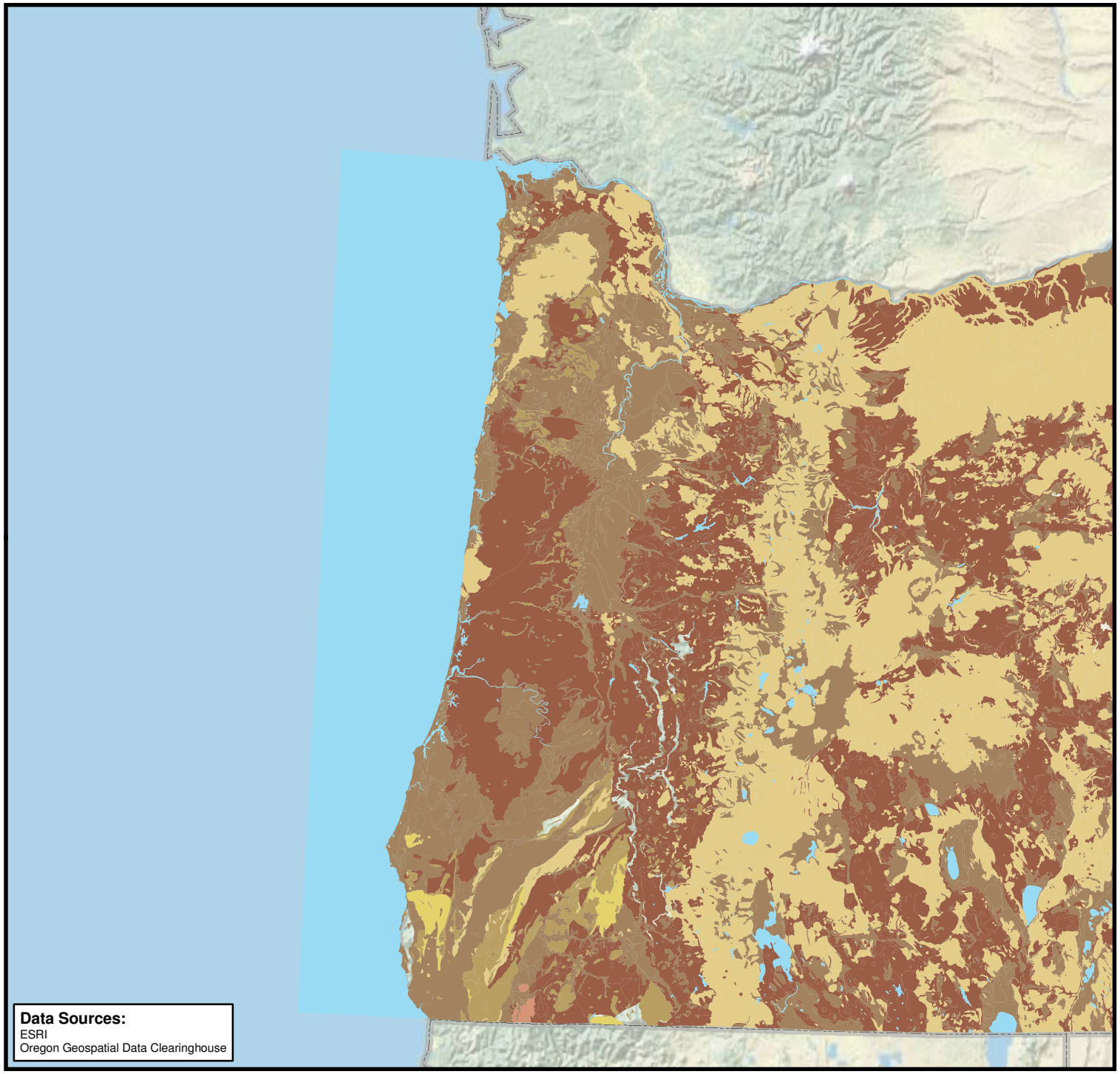
Powertech EMEC

0 25 50 75

Nautical Miles





Data Sources:
ESRI
Oregon Geospatial Data Clearinghouse

Fig. 1-4

Geology

Onshore geology
- Intrusive rock
- Metamorphic rock
- Mixed
- Sedimentary rock
- Sedimentary and volcanic rock
- Volcanic rock
- Water
- No data

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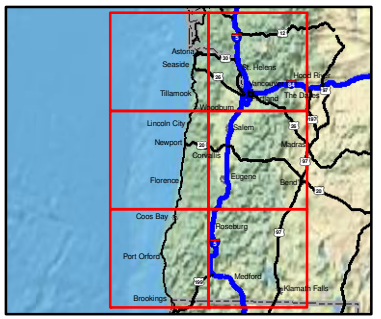
Powertech EMEC

0 25 50 75
Nautical Miles



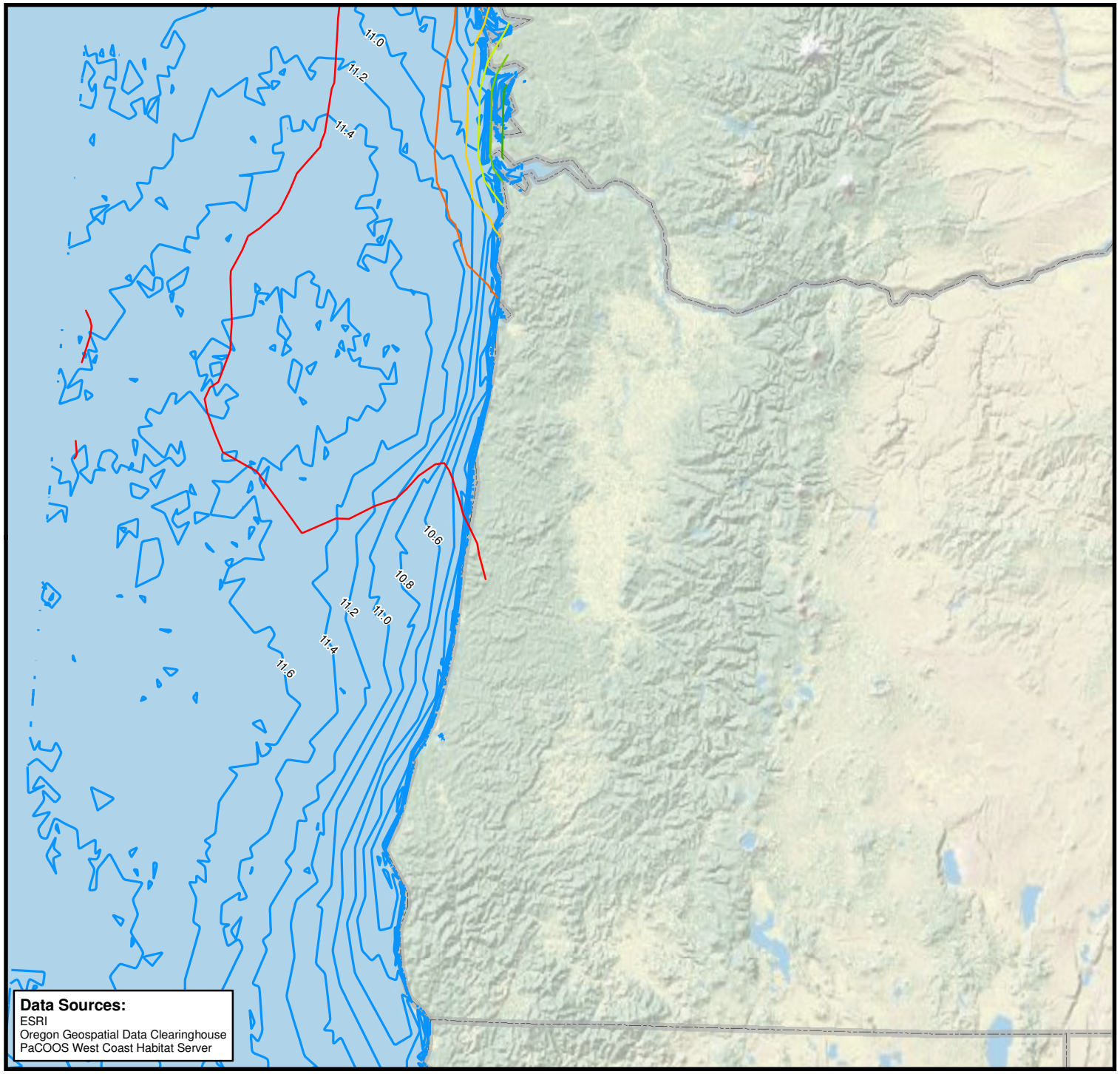


Fig. 1-5

Salinity and Surface Temperature

Surface temperature
(avg º C 1997-2003)

Salinity (avg 1997-2003)
- 22
- 24
- 26
- 28
- 30
- 32

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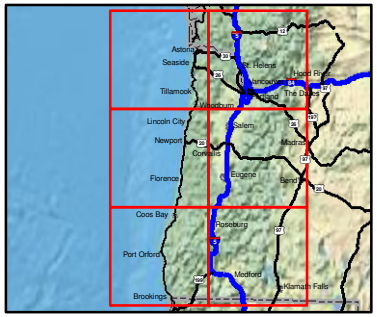
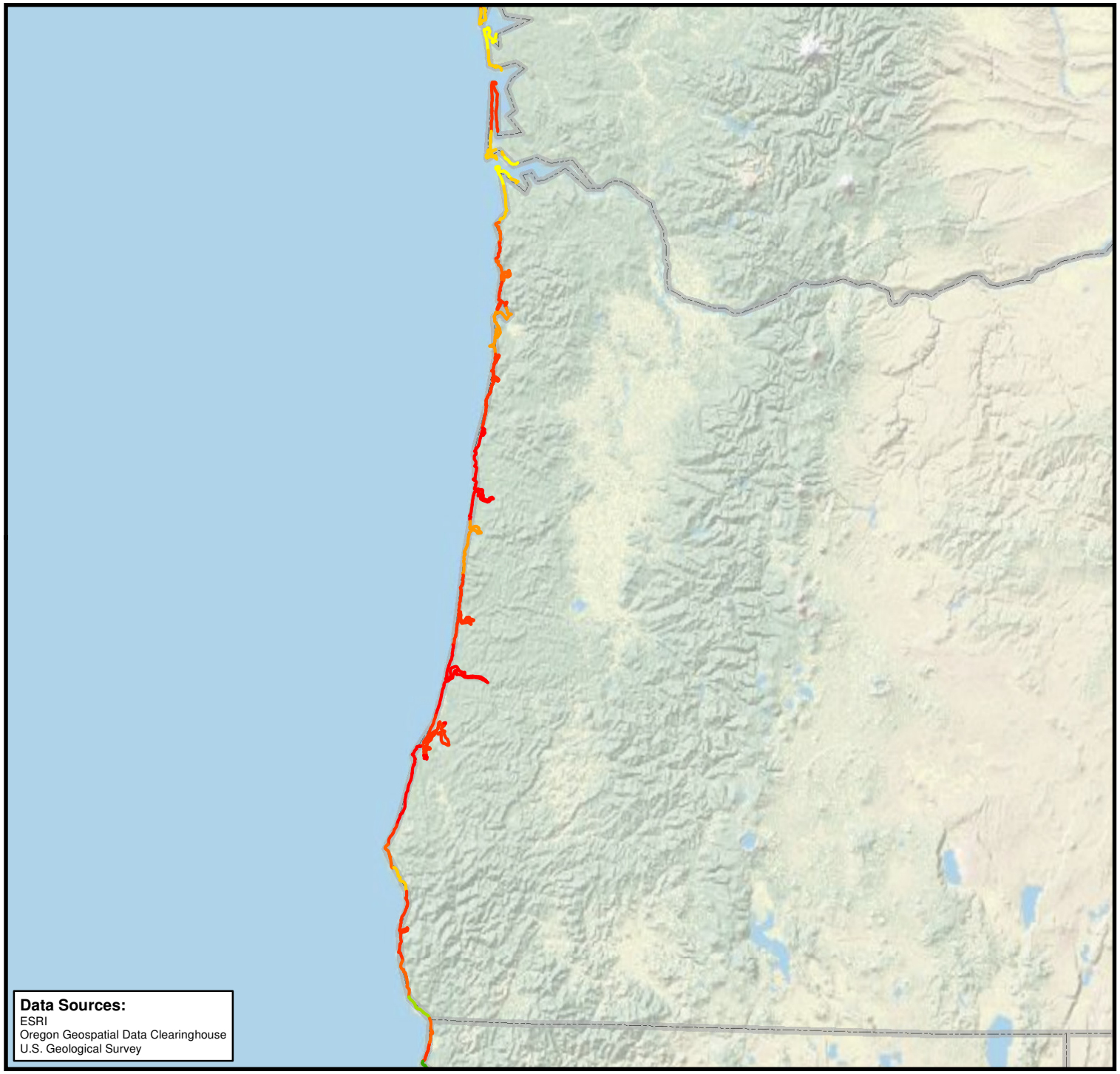
0 25 50 75
Nautical Miles





Data Sources:
ESRI
Oregon Geospatial Data Clearinghouse
U.S. Geological Survey

Fig. 1-6
Coastal Wave Height

Mean wave height (m)
- 1.8
- 1.9
- 2.0
- 2.1
- 2.2
- 2.3
- 2.4
- 2.5
- 2.6
- 2.7
- 2.8

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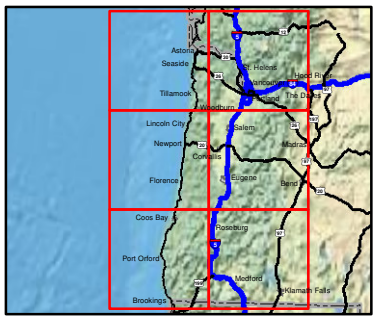
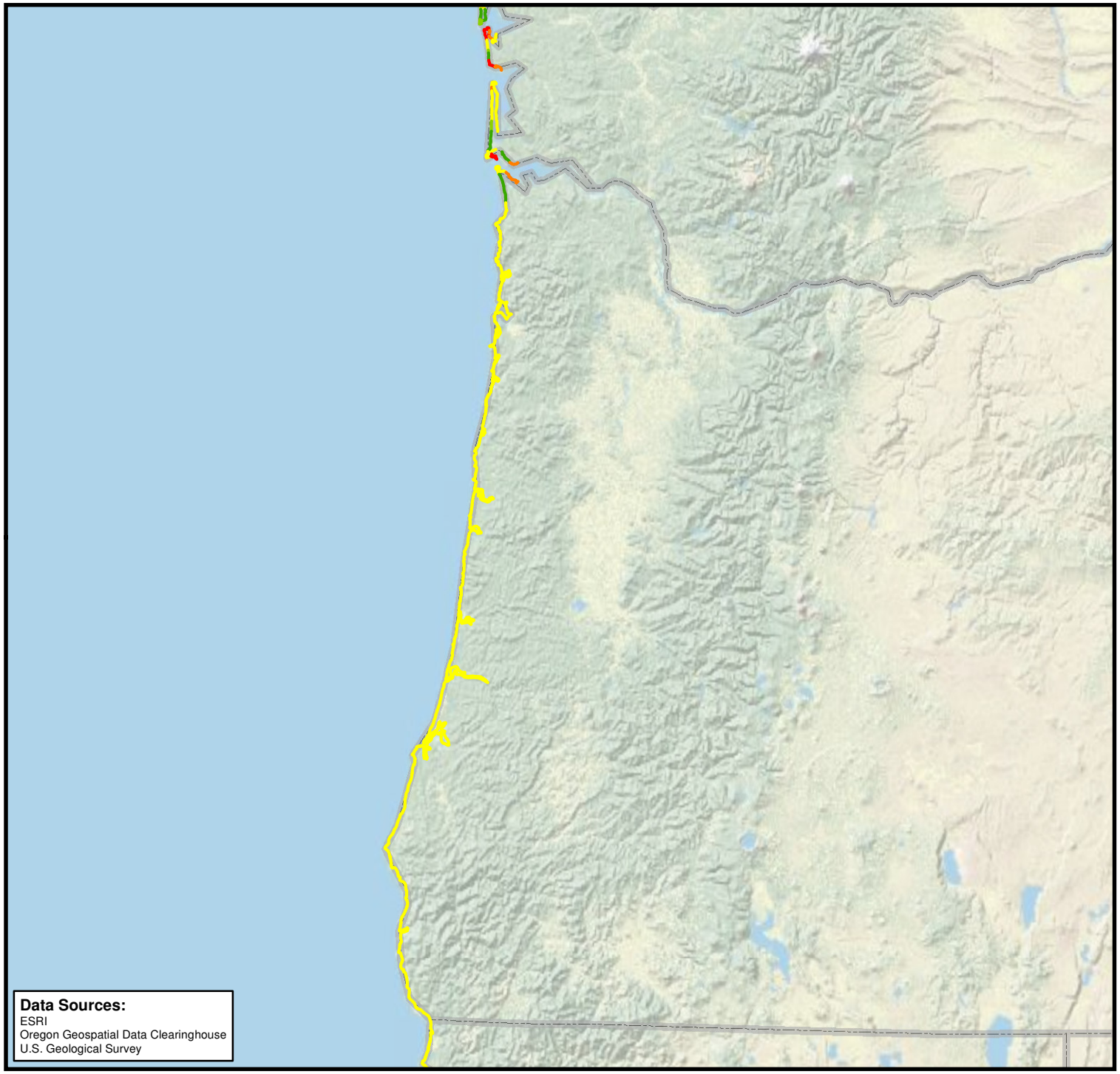
0 25 50 75
Nautical Miles





Data Sources:
ESRI
Oregon Geospatial Data Clearinghouse
U.S. Geological Survey

Fig. 1-7
Risk of Coastal Erosion

Erosion risk
- Very Low
- Low
- Moderate
- High
- Very High

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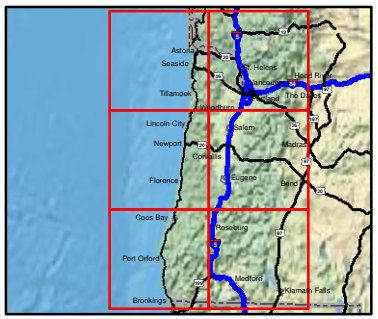
Powertech EMEC

0 25 50 75
Nautical Miles



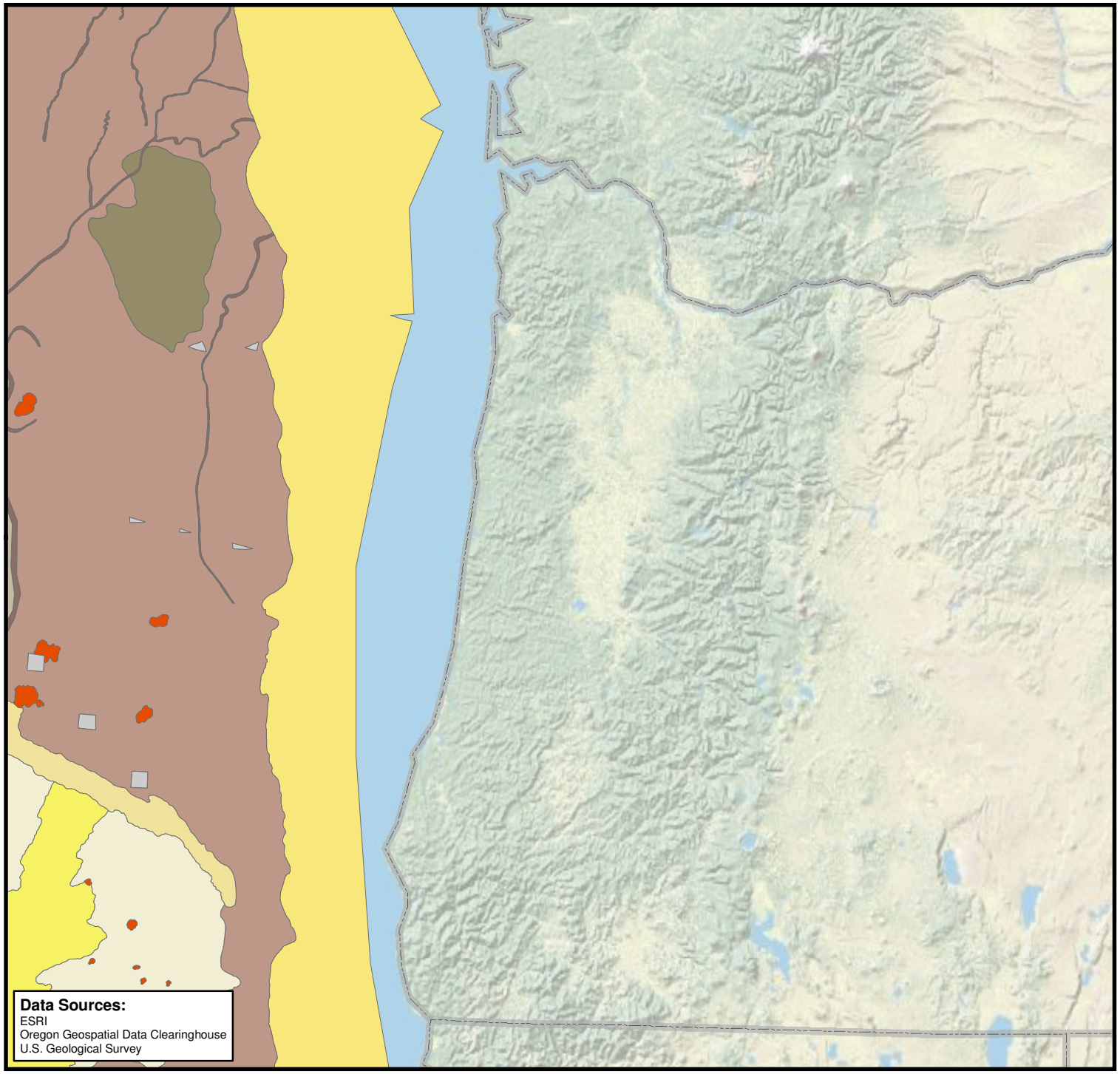


Fig. 1-8

Seabed Morphology

Seabed Morphology

- Basement fracture zone
- Basement ridge with sparse sediment cover
- Basement ridge with thick sediment cover
- Continental margin
- Sediment, basin facies
- Sediment, channeled
- Sediment, fan facies
- Sediment-fan facies with large bedforms
- Individual volcano with crater
- No data

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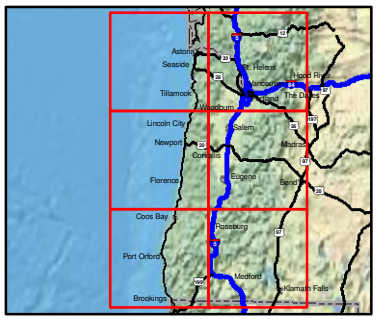
Powertech EMEC

0 25 50 75

Nautical Miles



2 Ecological Datasets

Ecological data included in the model focused on providing information on the presence and use of various species or species groups within the study area. These data inputs identify areas of interaction between ecological resources, species and wave energy development. Included in the ecological datasets are both species specific data as well as measures plankton biomass. Species specific data is point based data for observed use. Plankton biomass is the one dataset that covers the entire study area and is measured with concentrations of chlorophyll a.

2.1.1 Data gaps

Similarly to physical data sets, much of the data is limited to specific areas of concern, or sampled data sites. These formats do not provide coverage for the entire study area, but identify priority areas of concern. Ongoing research is providing the tools for future modelling to provide more inputs into the modelling effort.

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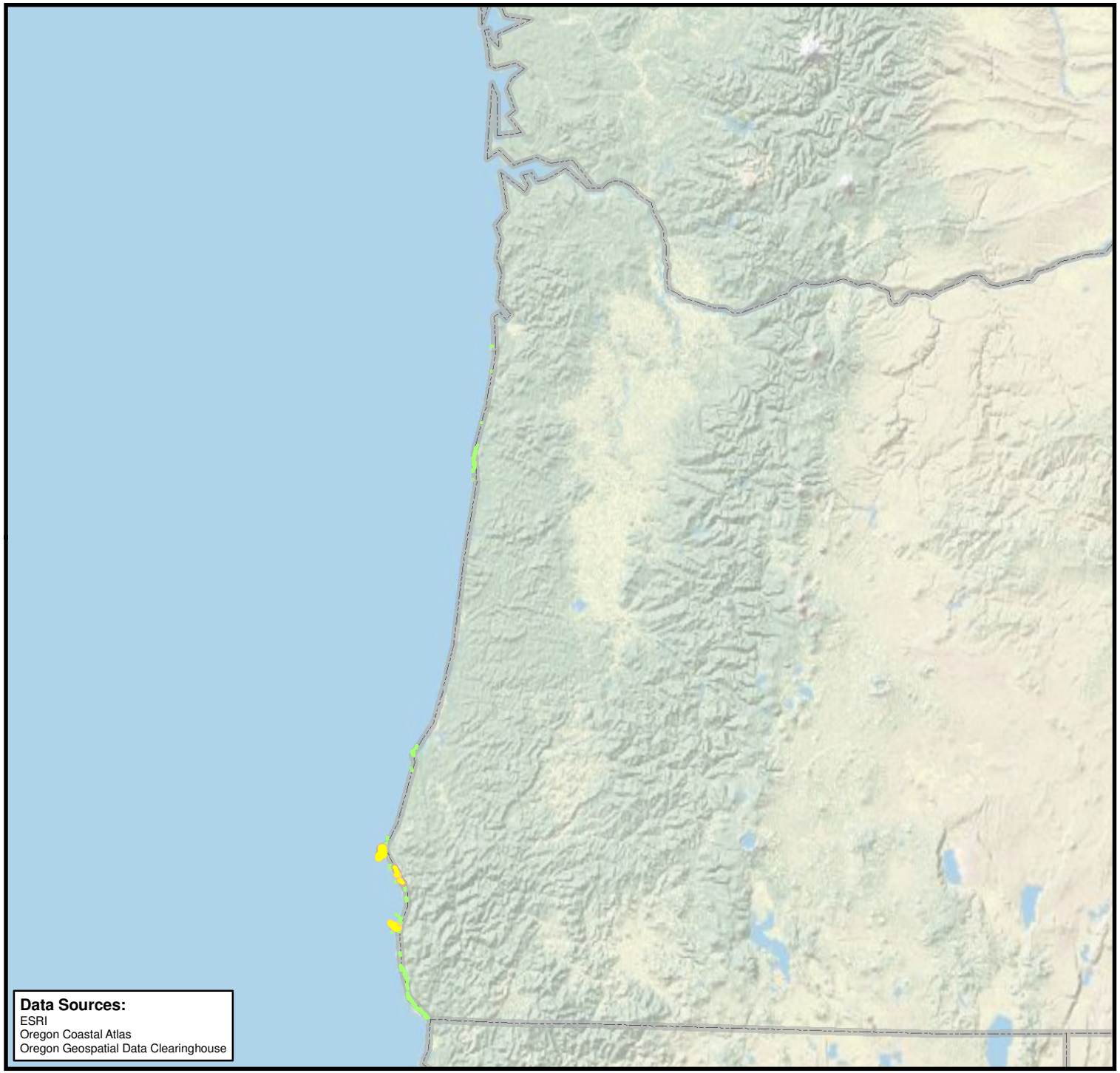
Fig. 2-1

Surveyed Kelp Beds



Kelp surveys
- Oregon coastwide (1990)
- Southern Oregon coast (1999)
- Southern Oregon coast (1999)
- Southern Oregon coast (1999)
- Southern Oregon coast (1999)

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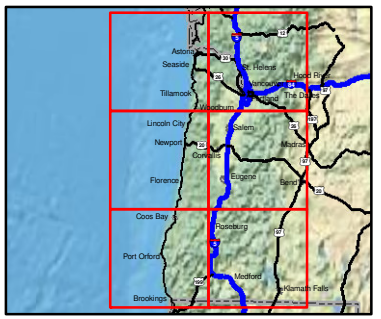
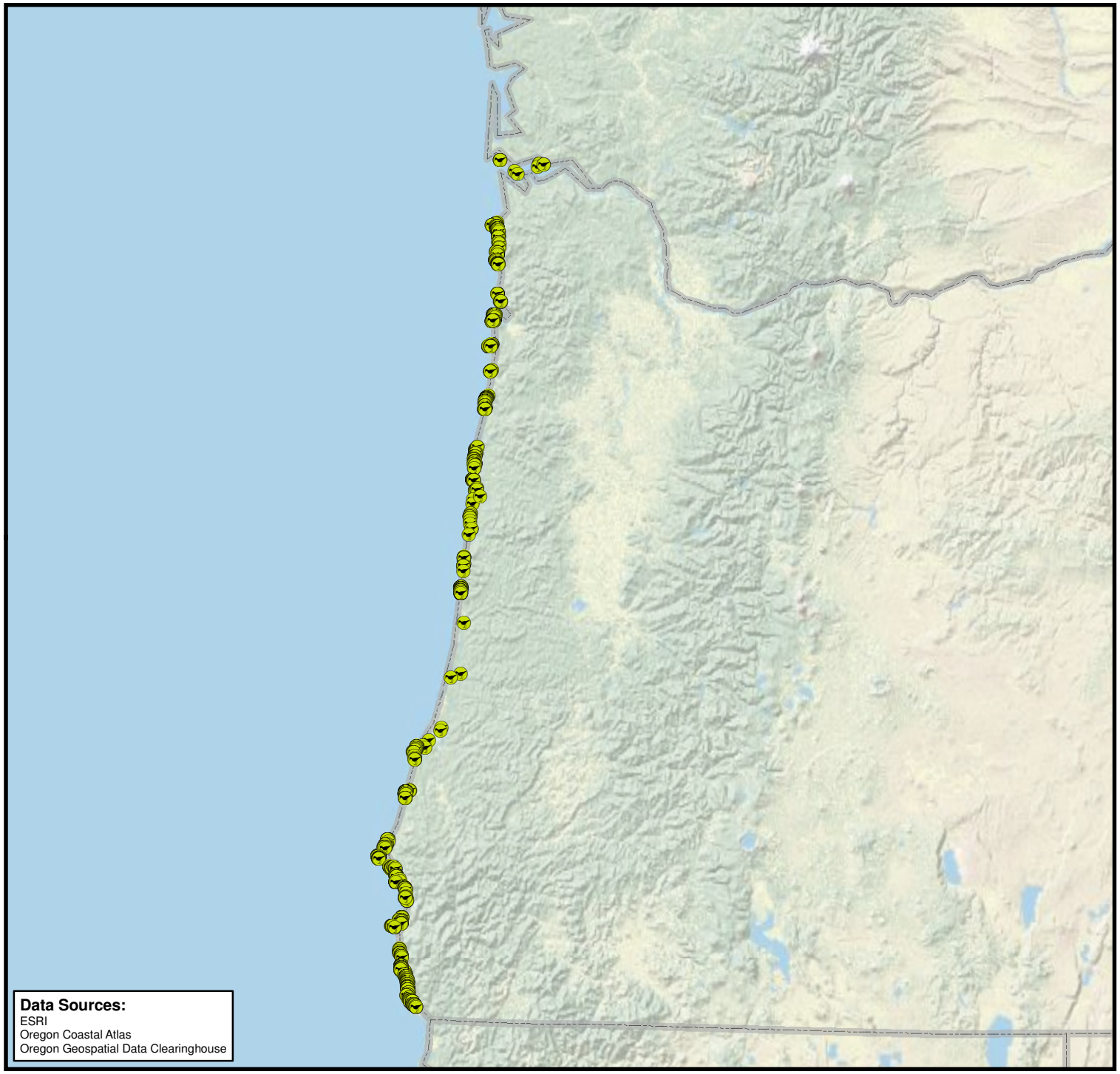
0 25 50 75

Nautical Miles

Data Sources:
ESRI
Oregon Coastal Atlas
Oregon Geospatial Data Clearinghouse





Data Sources:
ESRI
Oregon Coastal Atlas
Oregon Geospatial Data Clearinghouse

Fig. 2-2

Seabird Colonies

Colony locations

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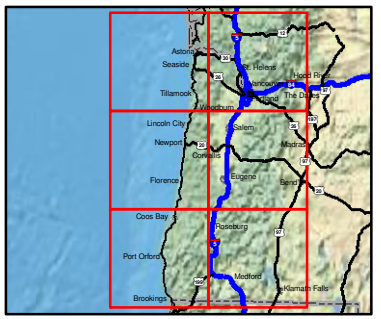
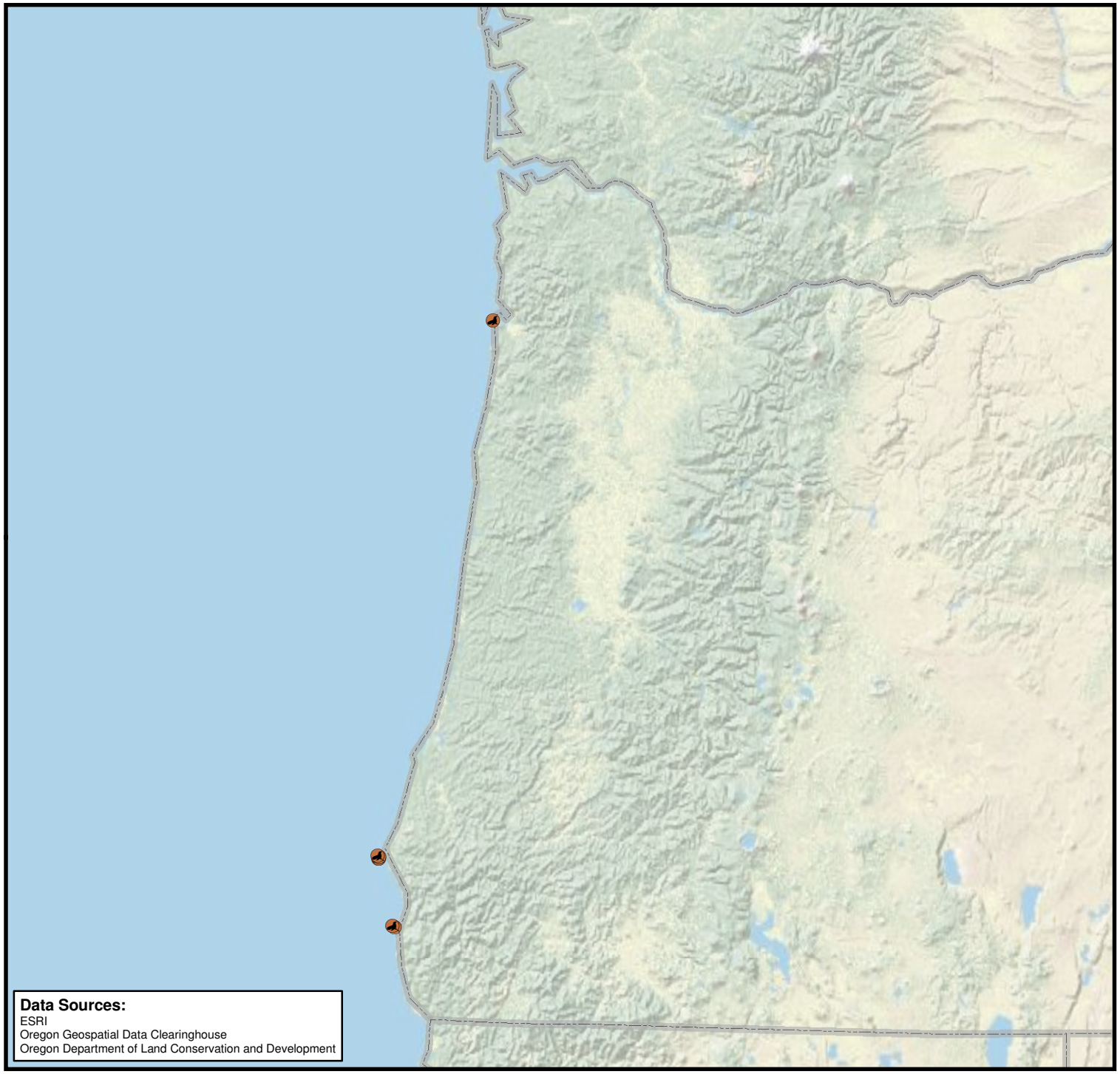
Powertech EMEC

0 25 50 75
Nautical Miles





Data Sources:
ESRI
Oregon Geospatial Data Clearinghouse
Oregon Department of Land Conservation and Development

Fig. 2-3

Sea Mammal Rookeries

Steller Sea Lion

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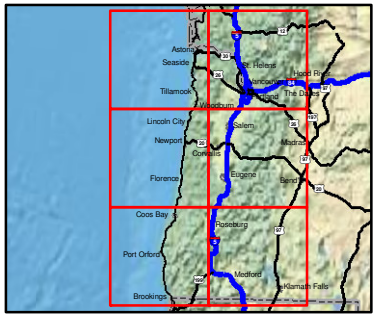
Powertech EMEC

0 25 50 75
Nautical Miles



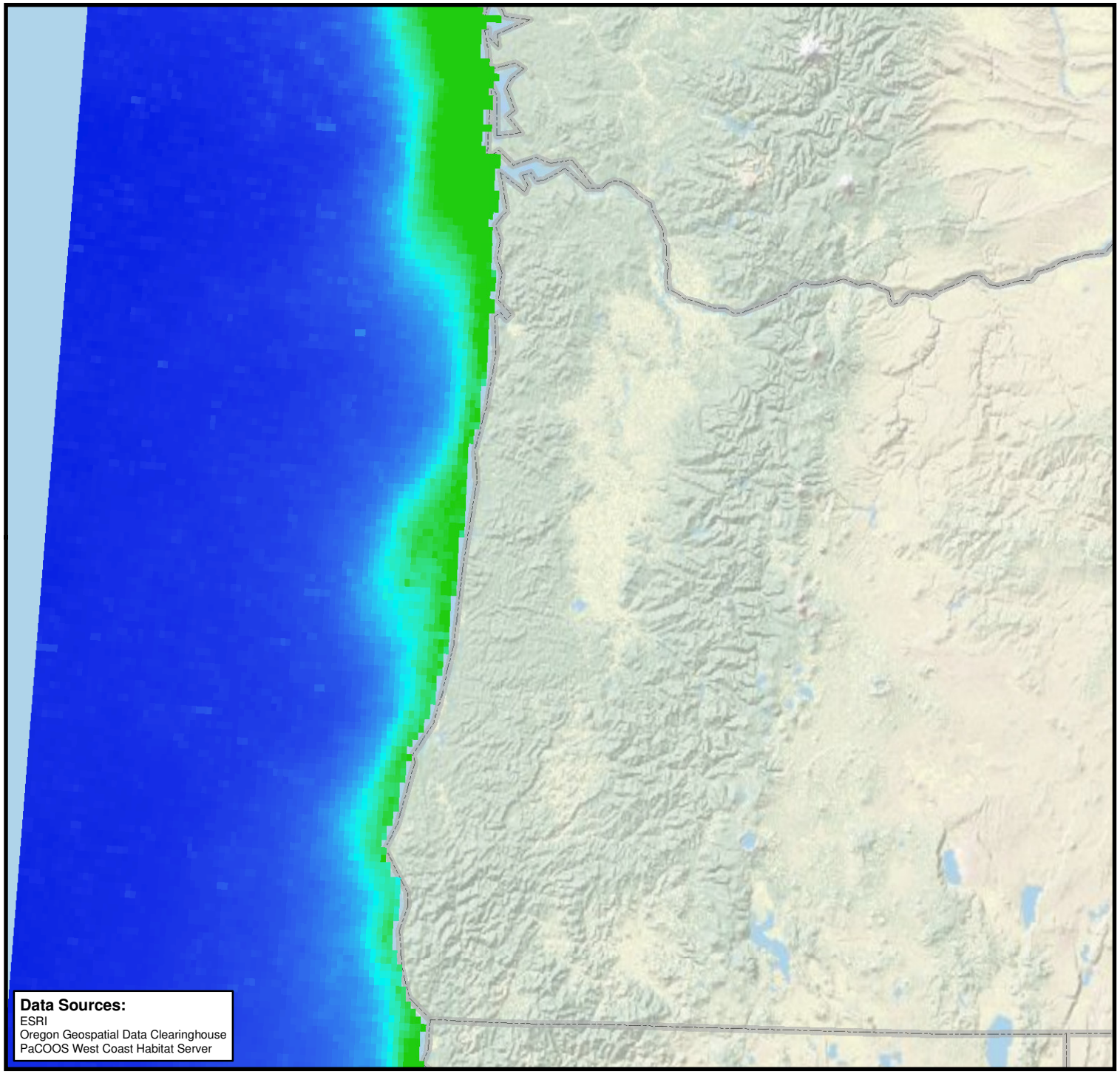


Fig. 2-4

Plankton/Productivity

Chlorophyll a

Value

High : 10.7737

Low : 0.311502

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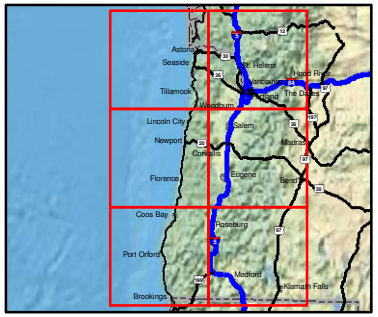
Powertech EMEC

0 25 50 75

Nautical Miles



3 Conservation Datasets

Conservation data includes natural and anthropogenic features that are managed through law, regulation or public ownership. These areas include areas protected for species conservation or management, as well as state parklands and shipwrecks. Habitat management areas under the Endangered Species Act (ESA) and the Fishery Conservation and Management Act (Magnuson-Stevens Act) are also included in these datasets. These are included because they indicate both areas sensitive to development as well as regulatory issues that will need to be considered in project evaluation.

3.1.1 Data gaps

Some regulatory designations cover the entire study area, not providing and prioritization for conservation actions under the Fishery Conservation and Management Act (Magnuson-Stevens Act). Some historic data is intentionally obscured to prevent illegal damage or theft to historic resources, this adds some uncertainty to the model. Limited terrestrial habitat data was included, only Marbled Murrelet and wetland data was included.

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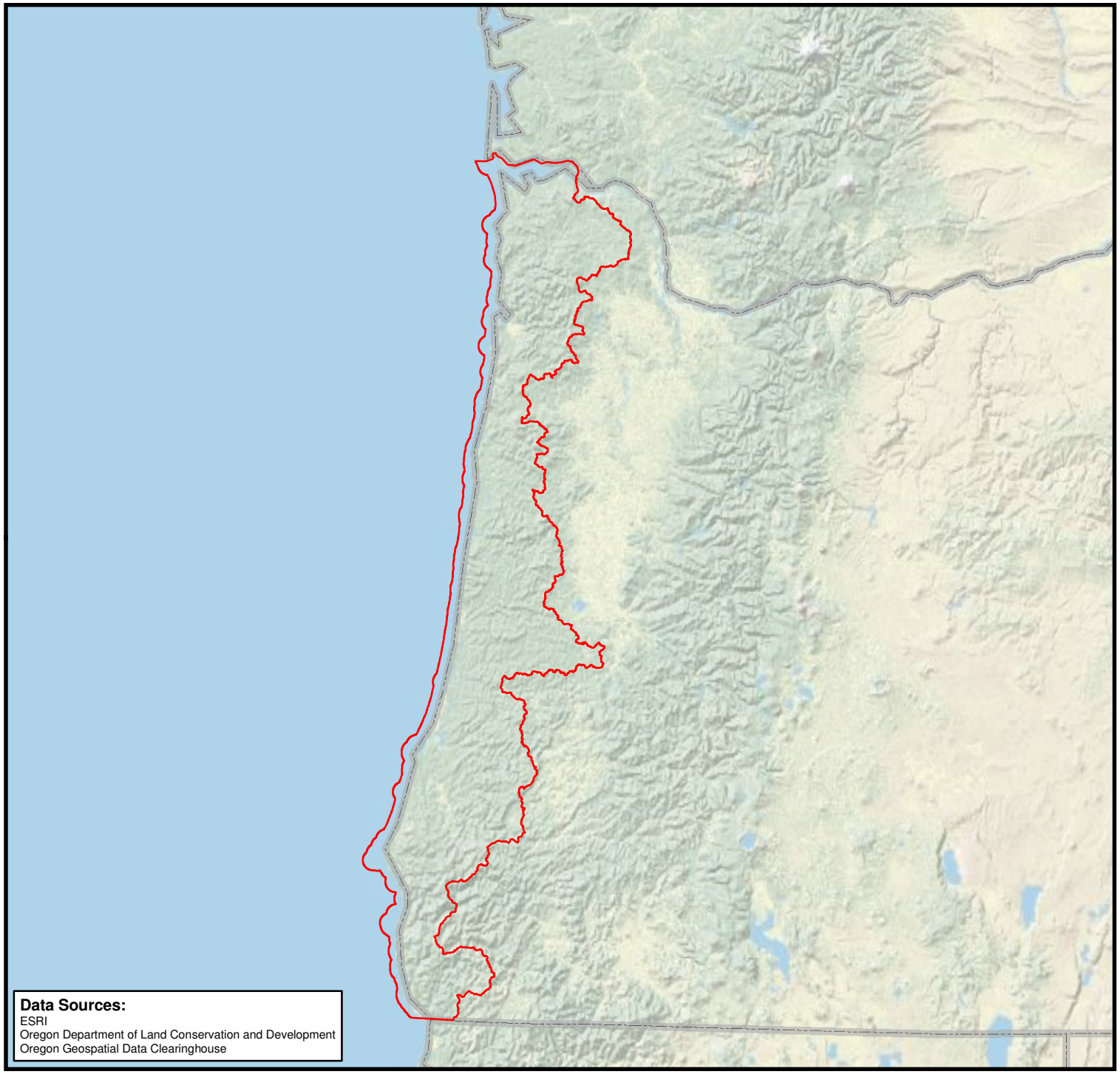

Data Sources:
ESRI
Oregon Department of Land Conservation and Development
Oregon Geospatial Data Clearinghouse

Fig. 3-1

Oregon Coastal Management Zone

Program boundary

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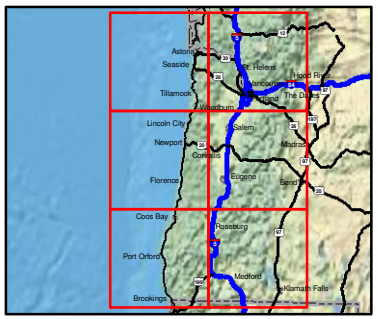
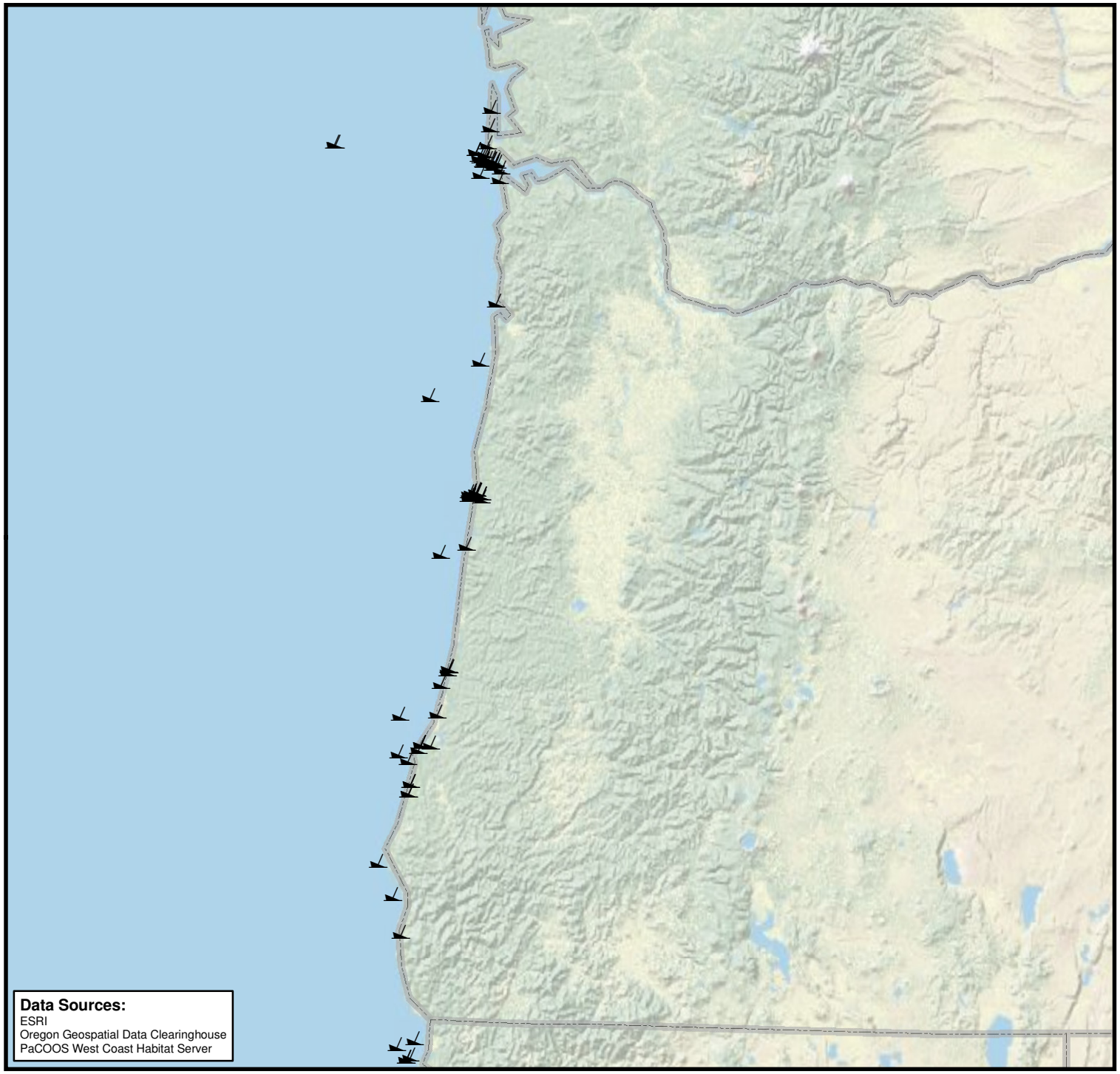
0 25 50 75
Nautical Miles





Data Sources:
ESRI
Oregon Geospatial Data Clearinghouse
PaCOOS West Coast Habitat Server

Fig. 3-2

Historic Wrecks

Submerged wrecks

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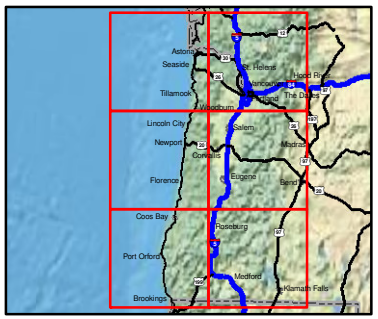
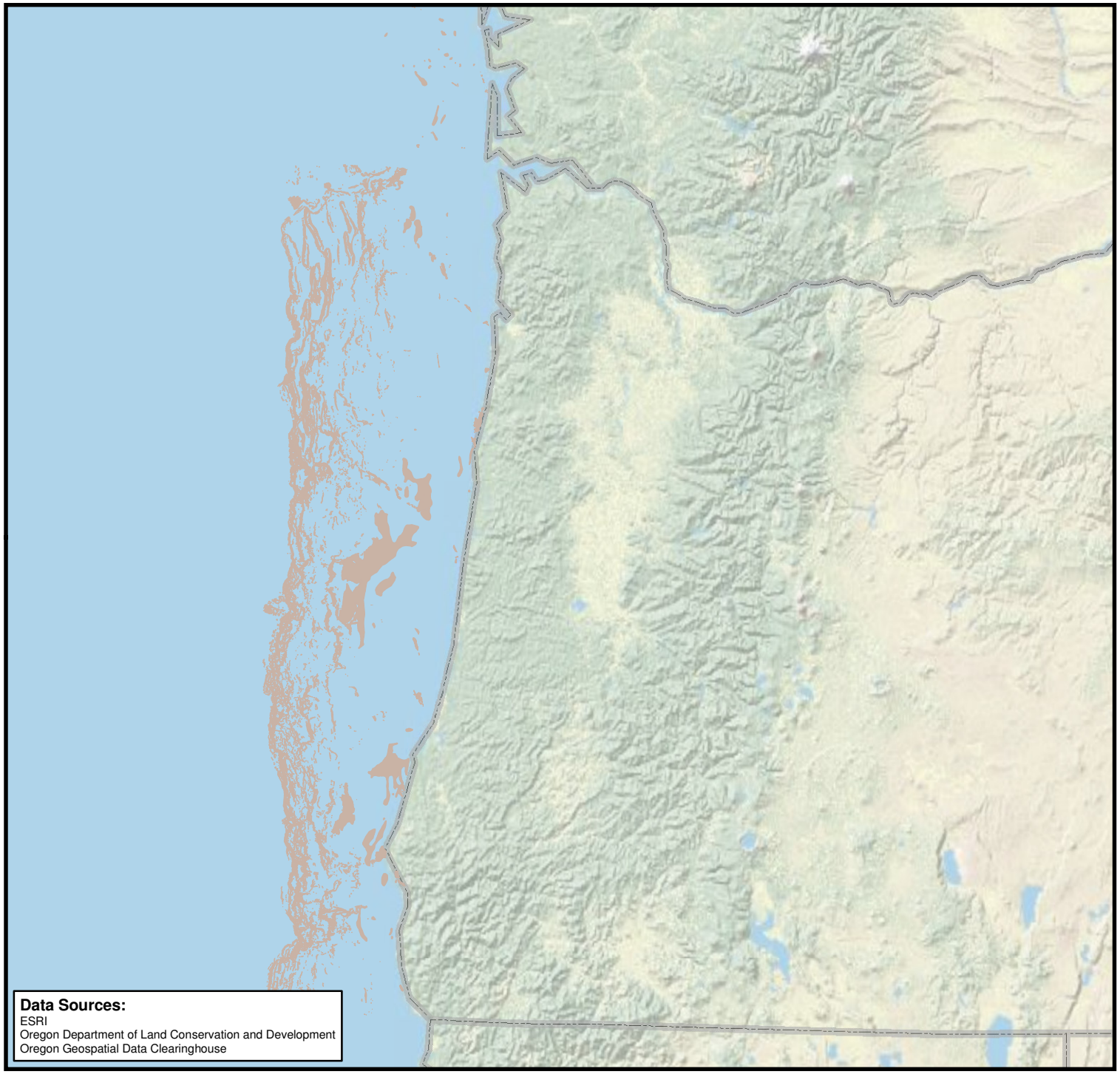
aquatera.co.uk Parametrix
Powertech EMEC

0 25 50 75
Nautical Miles





Data Sources:
ESRI
Oregon Department of Land Conservation and Development
Oregon Geospatial Data Clearinghouse

Fig. 3-3

Groundfish EFH Habitat Areas of Particular Concern

Rocky Reefs

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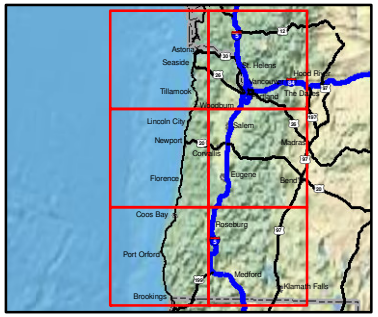
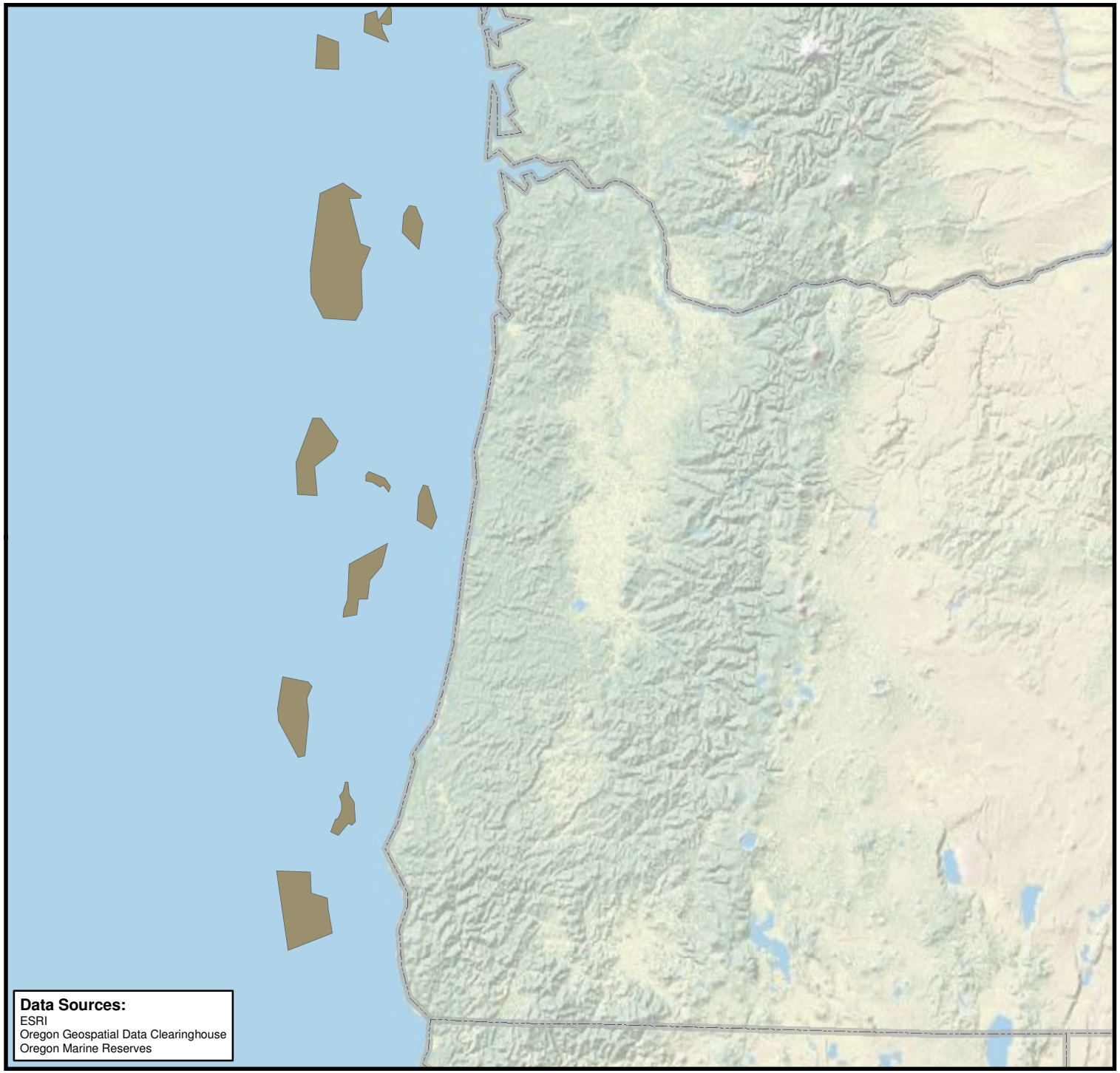
Powertech EMEC

0 25 50 75
Nautical Miles





Data Sources:
ESRI
Oregon Geospatial Data Clearinghouse
Oregon Marine Reserves

Fig. 3-4

Groundfish EFH
Gear Restrictions

Gear type prohibited
Bottom trawl gear

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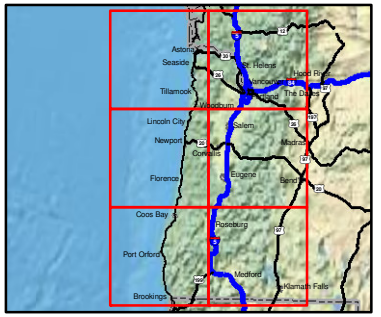
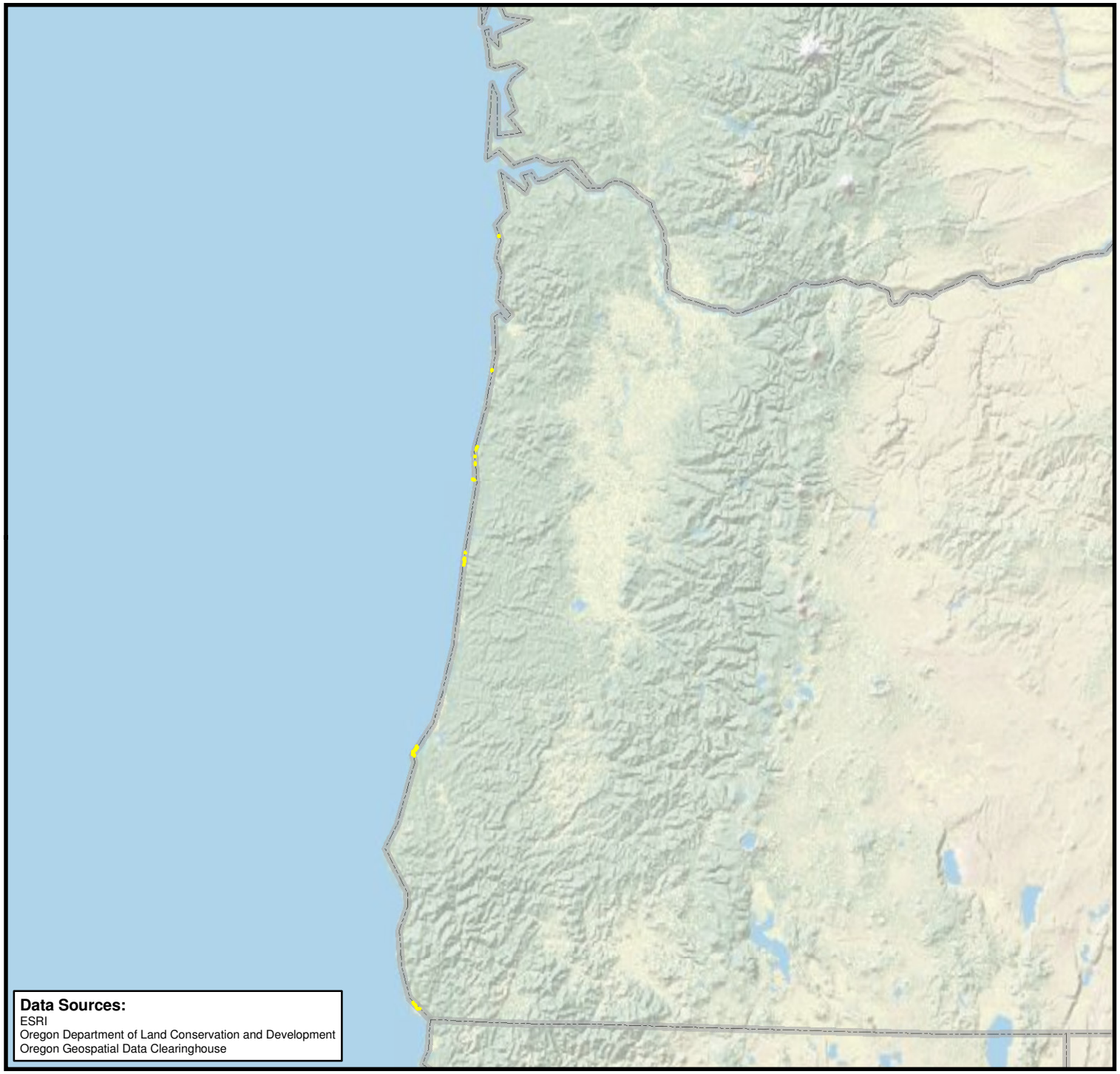
Powertech EMEC

0 25 50 75
Nautical Miles





Data Sources:
ESRI
Oregon Department of Land Conservation and Development
Oregon Geospatial Data Clearinghouse

Fig. 3-5

State Marine Managed Areas

State Marine Managed Areas

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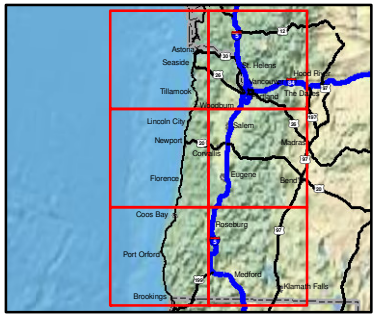
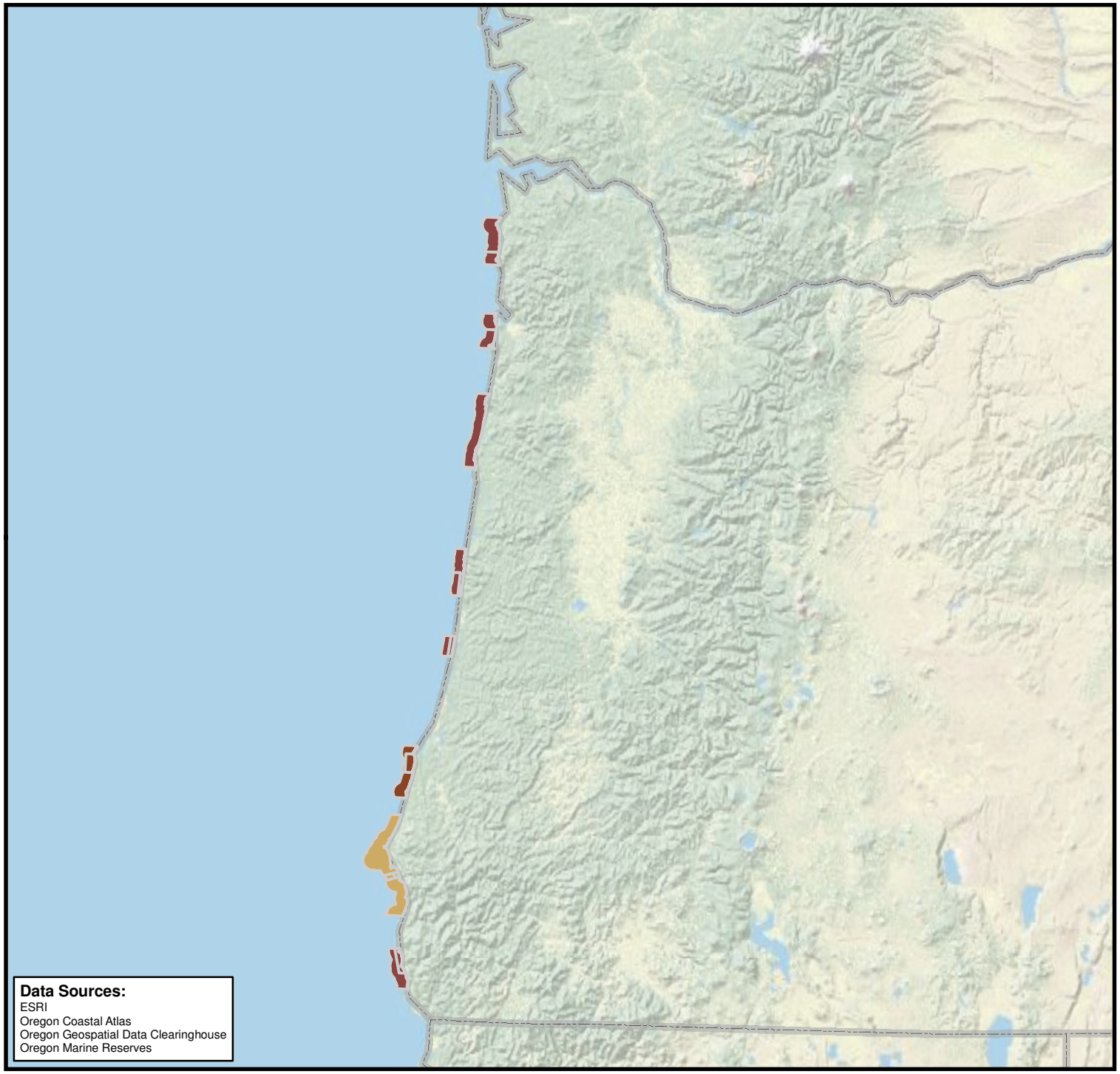
Powertech EMEC

0 25 50 75

Nautical Miles





Data Sources:
ESRI
Oregon Coastal Atlas
Oregon Geospatial Data Clearinghouse
Oregon Marine Reserves

Fig. 3-6
Marine Reserves

Pilot

Candidate

OregonWaveEnergy TRUST
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Powertech EMEC

0 25 50 75
Nautical Miles

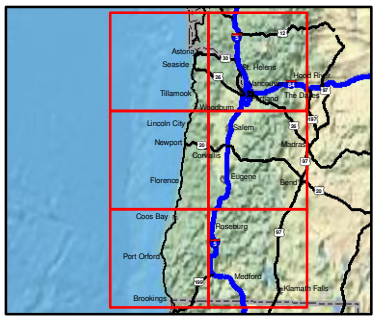
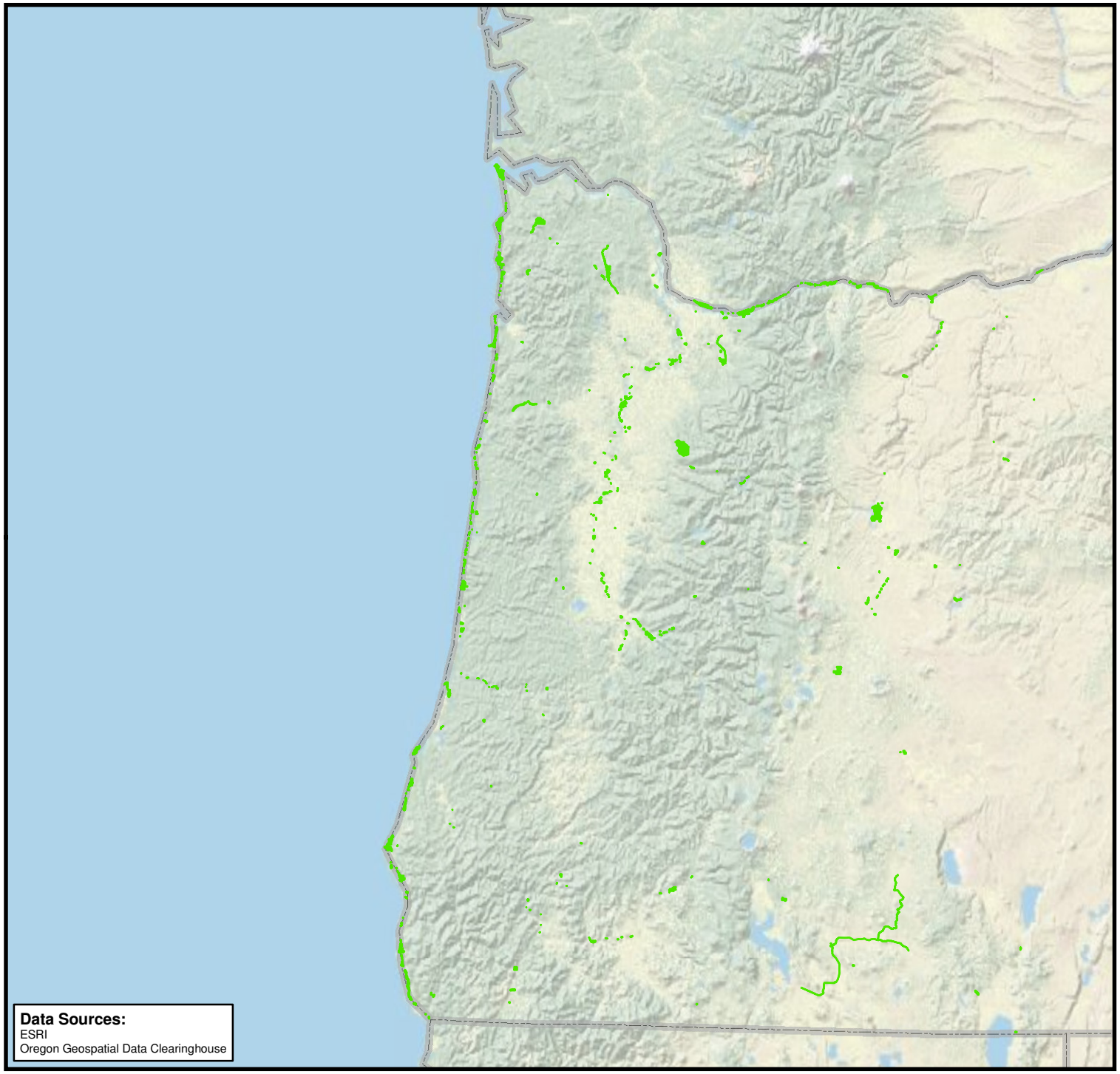


Fig. 3-7

State Parks



Oregon State Parks

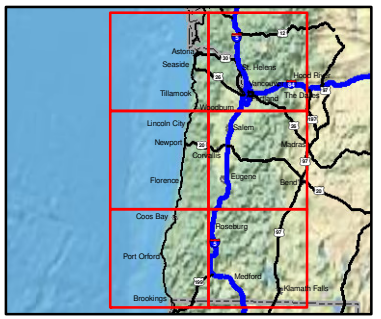
OregonWaveEnergy TRUST

aquatera.co.uk Parametrix

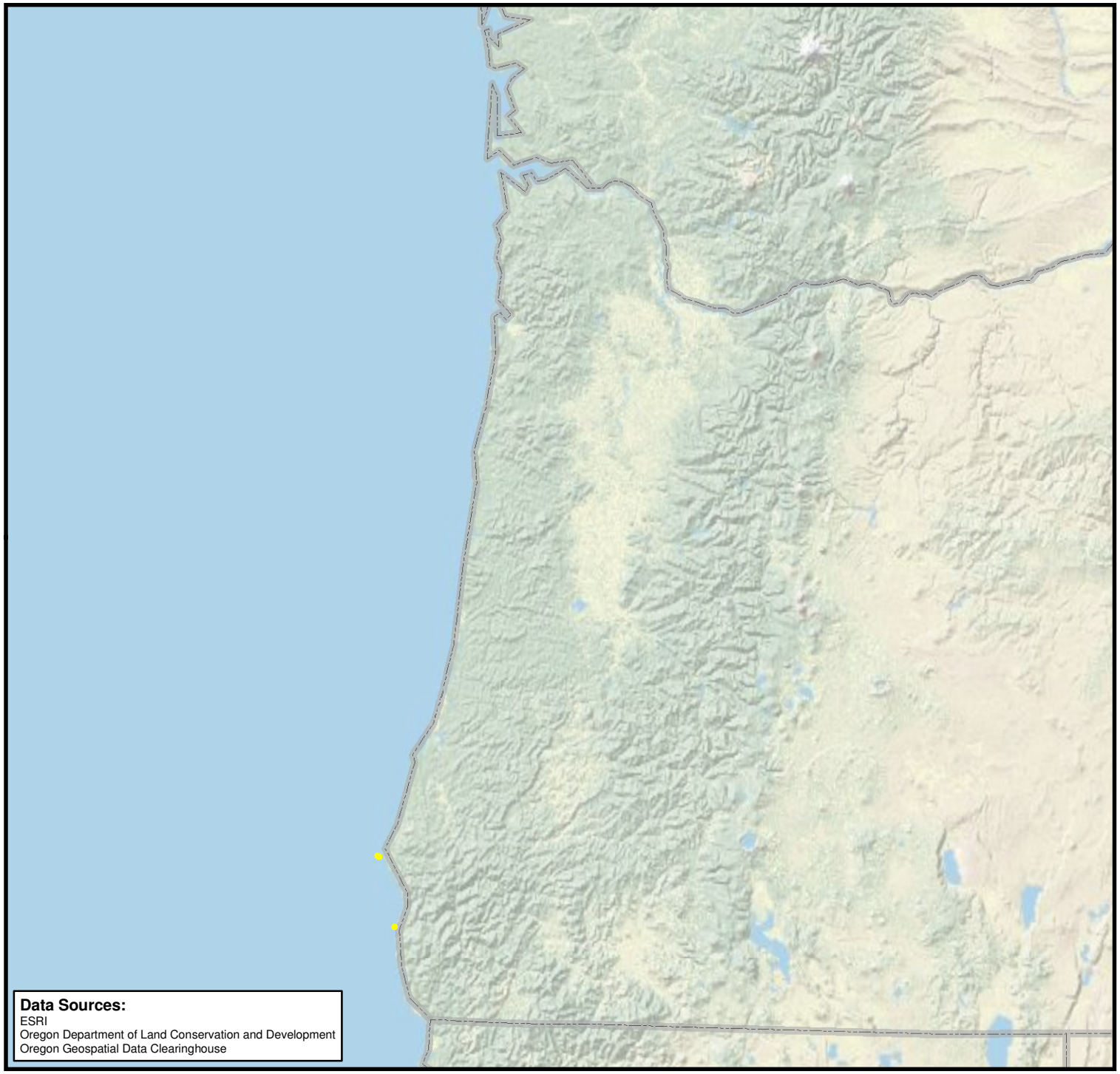
Powertech EMEC

0 25 50 75

Nautical Miles



Data Sources:
ESRI
Oregon Geospatial Data Clearinghouse



Data Sources:
ESRI
Oregon Department of Land Conservation and Development
Oregon Geospatial Data Clearinghouse

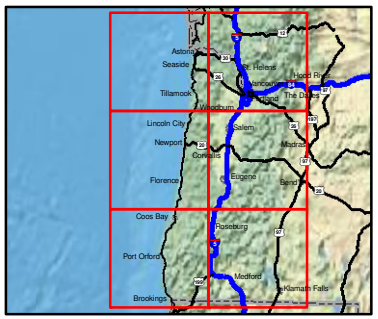
Fig. 3-8

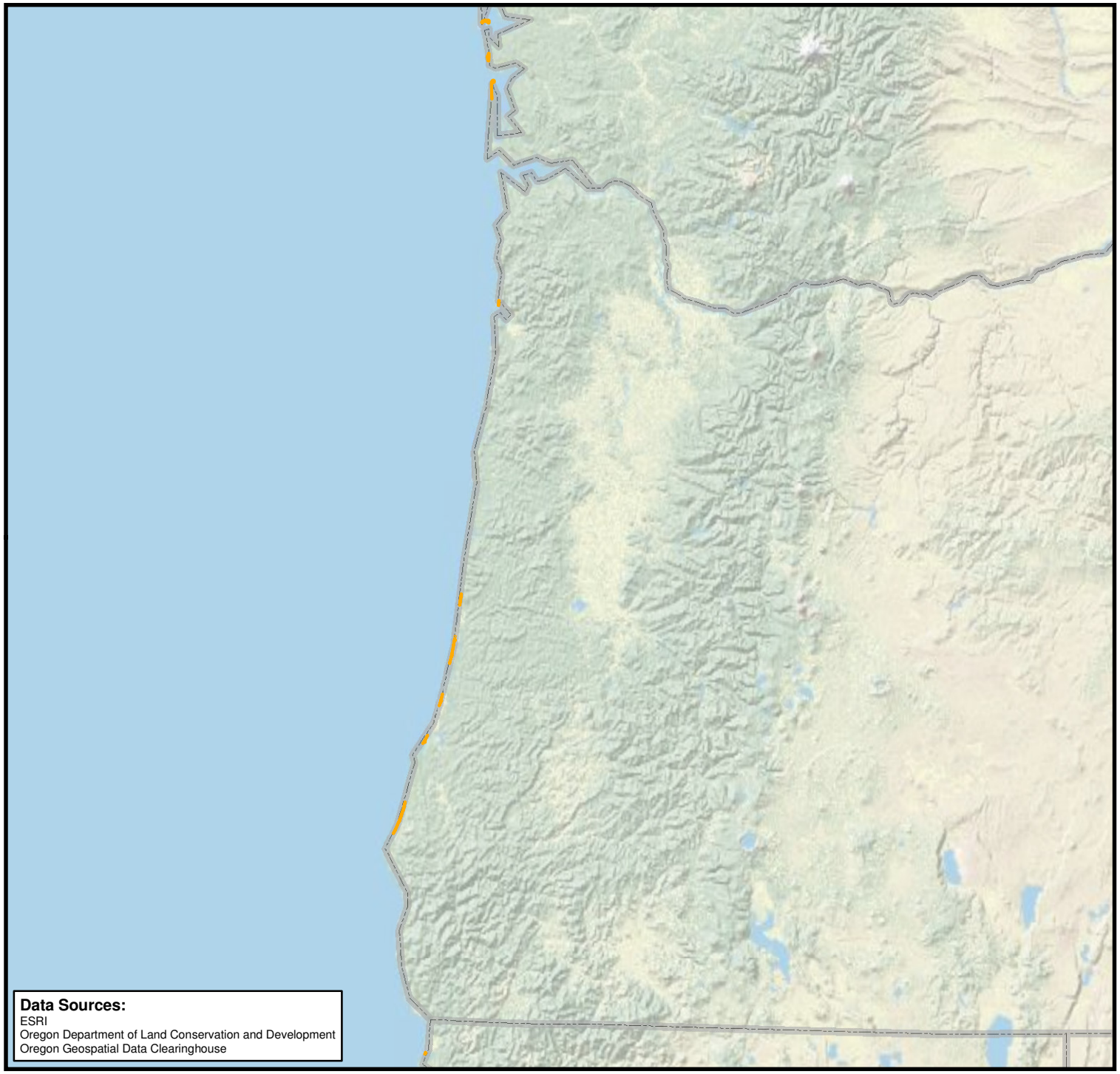
Steller Sea Lion Critical Habitat

Designated critical habitat

OregonWaveEnergy TRUST
aquatera.co.uk Parametrix
Powertech EMEC

0 25 50 75
Nautical Miles





Data Sources:
ESRI
Oregon Department of Land Conservation and Development
Oregon Geospatial Data Clearinghouse

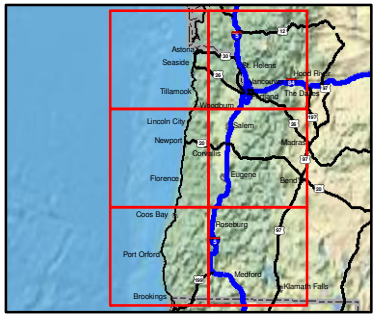
Fig. 3-9

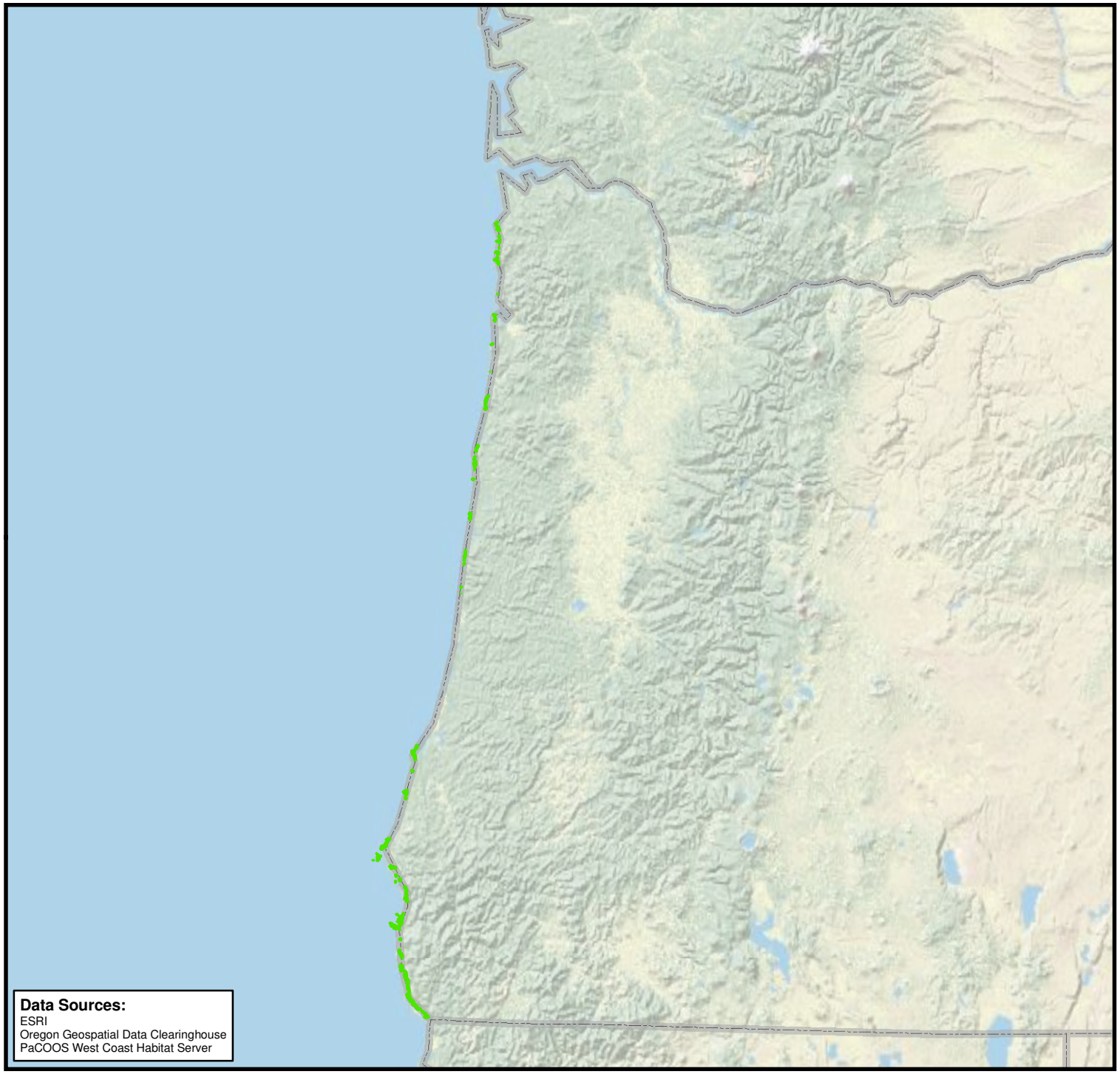
Snowy Plover Critical Habitat

Designated critical habitat

OregonWaveEnergy TRUST
aquatera.co.uk Parametrix
Powertech EMEC

0 25 50 75
Nautical Miles





Data Sources:
ESRI
Oregon Geospatial Data Clearinghouse
PaCOOS West Coast Habitat Server

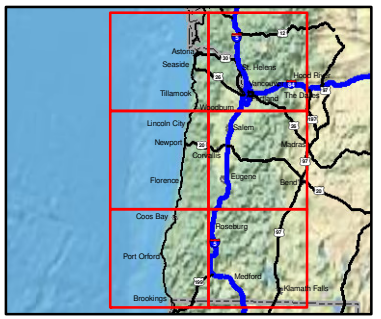
Fig. 3-10

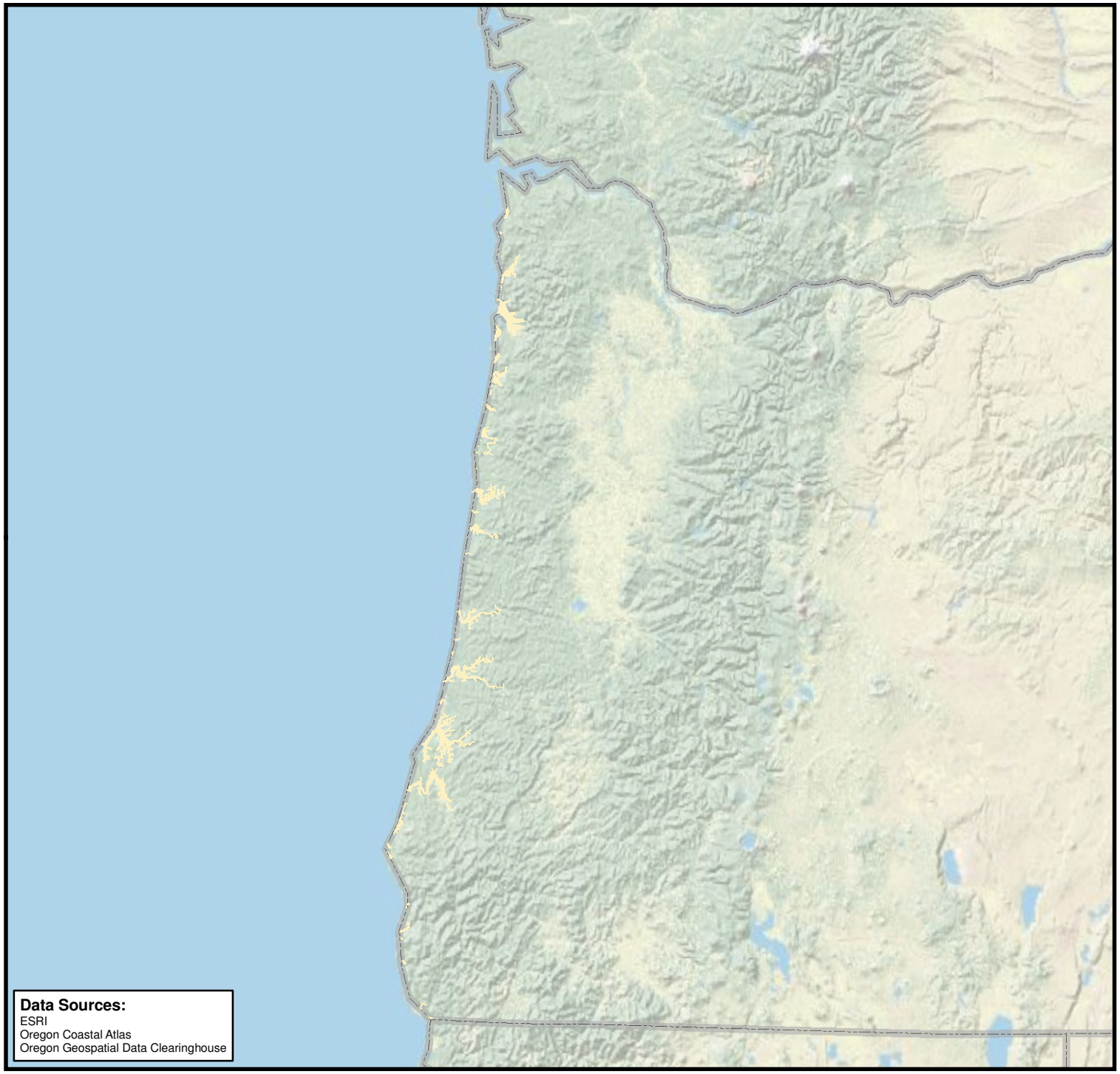
Oregon Islands National Wildlife Refuge

Oregon Islands National Wildlife Refuge

OregonWaveEnergy TRUST
aquatera.co.uk Parametrix
Powertech EMEC

0 25 50 75
Nautical Miles





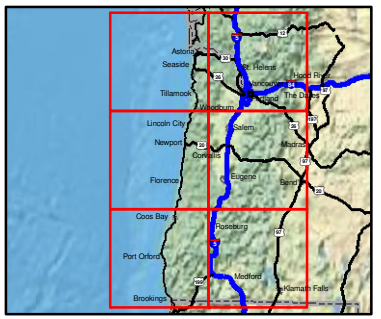
Data Sources:
ESRI
Oregon Coastal Atlas
Oregon Geospatial Data Clearinghouse

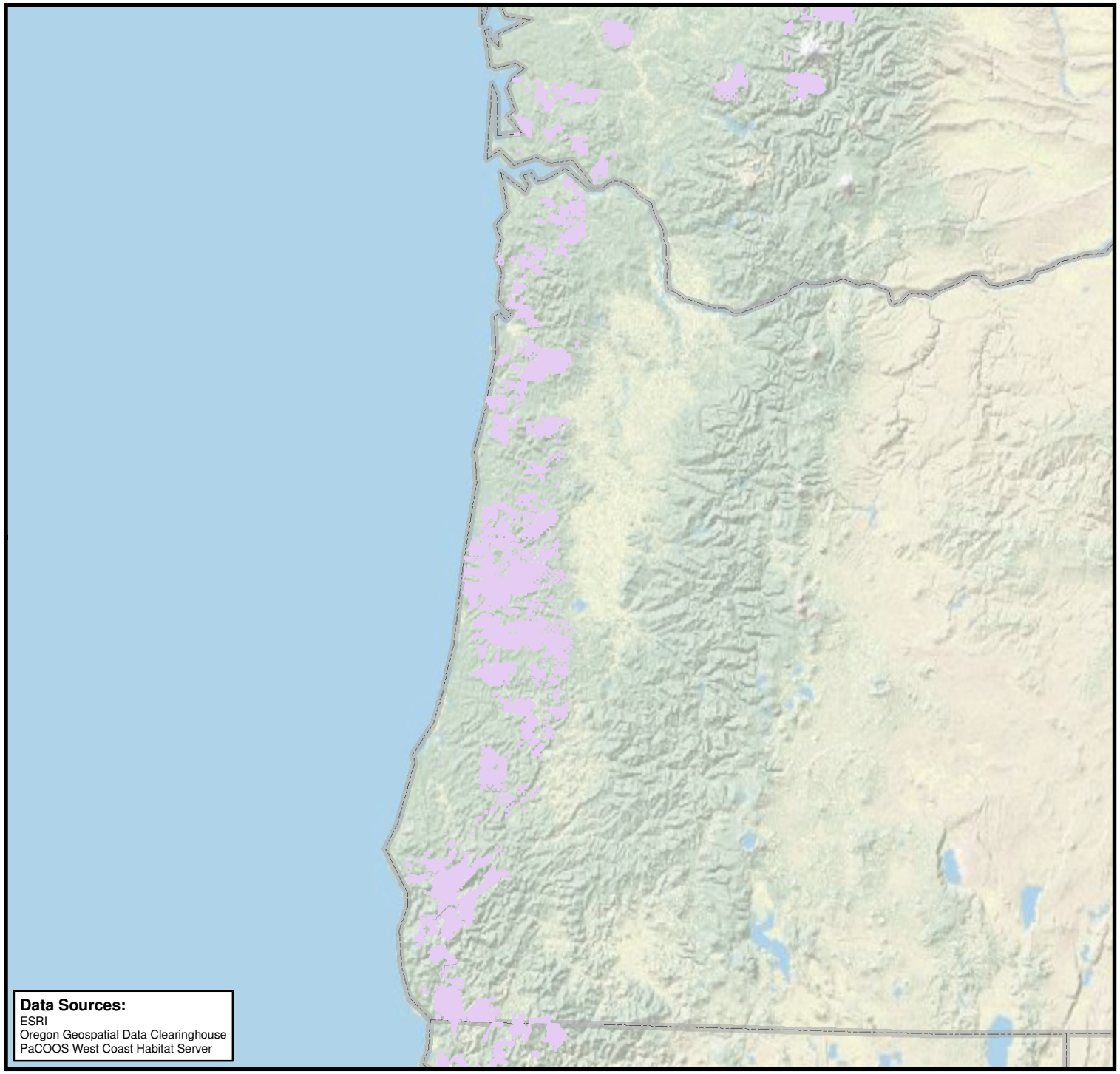
Fig. 3-11
Tidal Wetlands

Tidal wetlands

OregonWaveEnergy TRUST
aquatera.co.uk Parametrix
Powertech EMEC

0 25 50 75
Nautical Miles





Data Sources:
ESRI
Oregon Geospatial Data Clearinghouse
PaCOOS West Coast Habitat Server

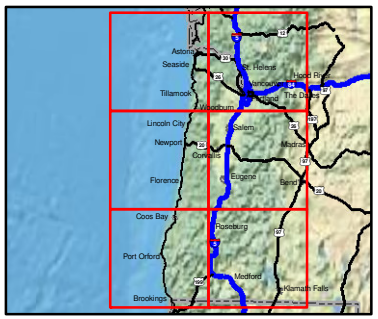
Fig. 3-12

Marbled Murrelet Critical Habitat

Designated critical habitat

OregonWaveEnergy TRUST
aquatera.co.uk Parametrix
Powertech EMEC

0 25 50 75
Nautical Miles



4 Social Datasets

The social component of the model includes the social capacity for the development of the wave energy industry and the potential impacts of other societal uses. The capacity measures include an analysis of the workforce and industrial capabilities of communities to support the industry's development.

An additional component to the social and economic that differs from the marine reserve context is the role this new industry will play on shore. The energy sites will involve hiring workers to construct and operate the sites and the new energy may provide a long term and low cost alternative to other power sources. Energy development will also require substantial investments in shore-side and harbor facilities near the development of wave energy sites.

Other societal uses considered include cultural and historic resources, scenic and visual resources and recreational resources.

4.1.1 Data gaps

Economic and social data for the Oregon coast have been developed over the past several decades. Most of these data sources are for the entire coast, by region such as north, central and south, or by county. To date, no spatial unit of analysis has been used that can at a finer scale.

Some of the dataset designs introduce challenges for our analysis. The state's Employment Department keeps two detailed data series on employment numbers that can support an analysis of economic impacts. The first is a monthly survey of firms and their activities. The second is analysis of unemployment insurance tax receipts.

Census data also tracks similar information, though at the time of this study the data is ten years old. Due to the lower population density, interim data estimation tools from the Census are less accurate.

Both the state and Census data sources face unique challenges in marine economic analysis. The state's survey data on firm activity is not statistically valid for the coast only, and it is designed to capture firm based employers which will underestimating fishing economic activity. The state unemployment tax receipt dataset do not include those who make a living from fishing as participation in unemployment insurance is optional for this industry. The Census data aggregates fishing employment with timber and mining, which for the coast can may cause overestimation.

Other input-output model efforts have resulted in coast-wide or county level analyses. Most of these have been performed for forestry based economic analysis, though Oregon Coastal Zone Management Association work has studied fisheries as well as the terrestrial economies.

For the Cumulative Effects Framework we are using these data sources to inform trends analysis and to derive community based data for analysis. Census data is being included to capture community and basic economic characteristics by Census Designated Places (CDP). The data inputs reviewed and included are following:

4.1.2 Data Products Reviewed:

Oregon Coastal Zone Management Association (OCZMA).

2006 A Demographic and Economic Description of the Oregon Coast: 2006 Update. Prepared by Shannon Davis and Hans Radtke.

Oregon Labor Market Information System (OLMIS), State of Oregon

nd Unemployment Tax Receipt Data

nd Monthly Firm Employment Survey

Oregon State University

nd Oregon Explorer: Rural Communities Explorer Data Portal

US Census

2000 Decennial Census, SF3 and SF4

2008 2006-2008 ACS Data Release for State of Oregon

Other models surveyed but not included are the economic modelling studies from the BLM Western Oregon Plan Revision process and economic modelling on forestry management issues on the South Coast. These studies provide insights, but are not able to be adapted into a spatial modelling effort for marine uses.

4.1.3 Census Tables

2000 Census data was linked to Census-Designated Places (CDP) within the Coastal Zone Management Act area. These data provide a basis for the model to assess social attributes for communities in the study area. These data are joined in the model to the polygons for each CDP, but for ease of presentation the data is provided here in tabular form.

Fig. 4-1

Communities

City limits

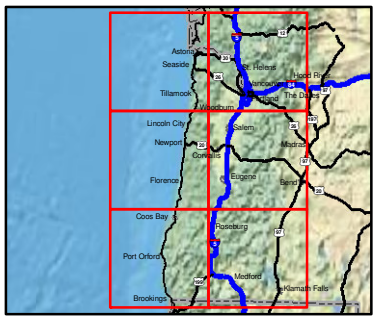
OregonWaveEnergy TRUST

aquatera.co.uk Parametrix

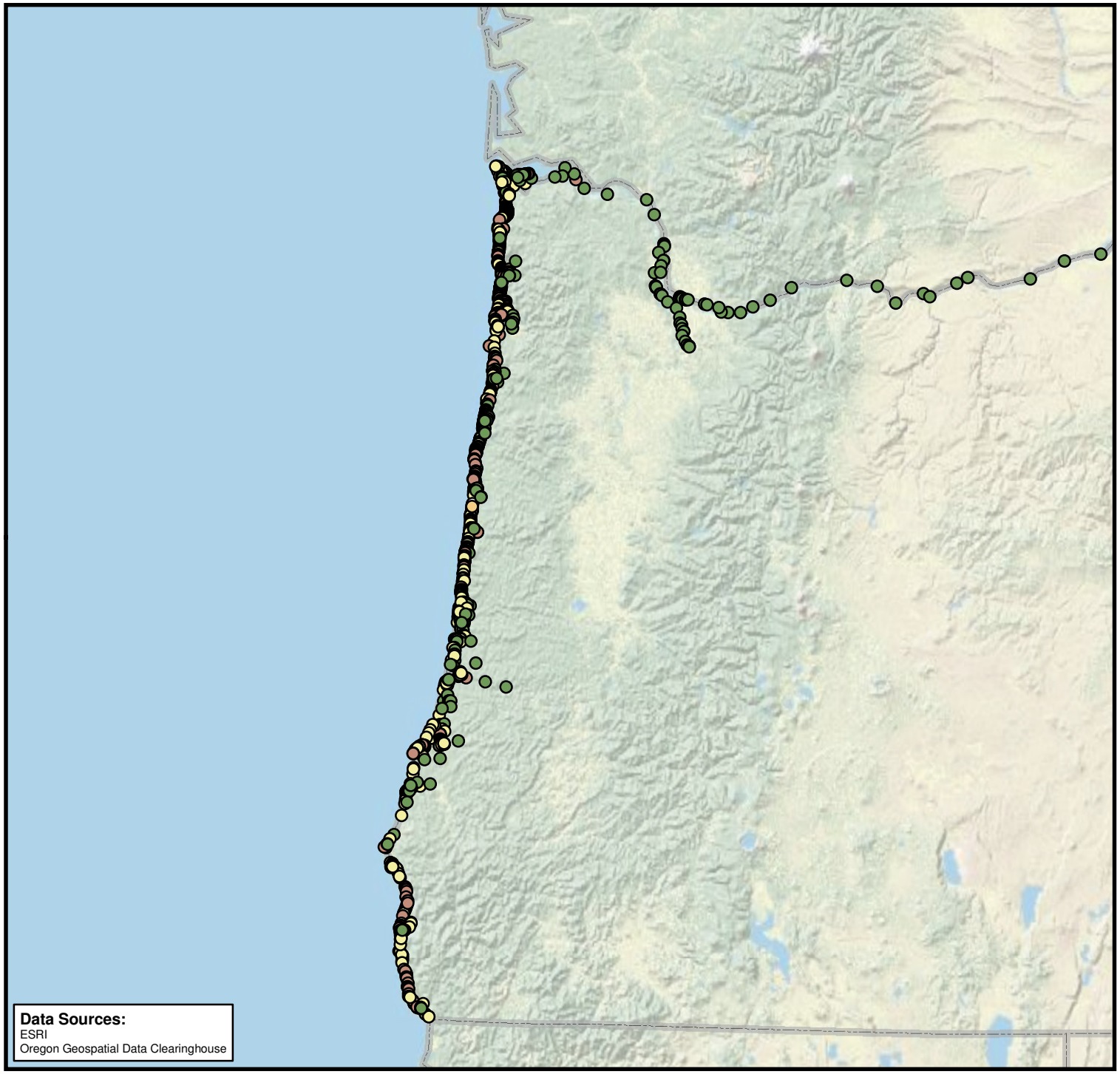
Powertech EMEC

0 25 50 75

Nautical Miles



Data Sources:
ESRI
Oregon Geospatial Data Clearinghouse



Data Sources:
ESRI
Oregon Geospatial Data Clearinghouse

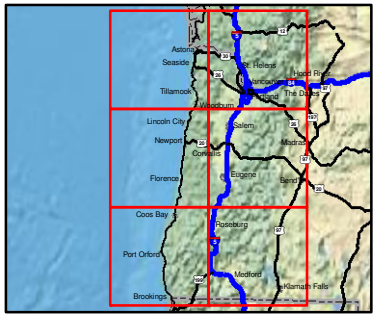
Fig. 4-2

Beach Access Points

Tyoe of access
- Boat
- Pedestrian
- Vehicle
- Visual
- No developed access

OregonWaveEnergy TRUST
aquatera.co.uk Parametrix
Powertech EMEC

0 25 50 75
Nautical Miles



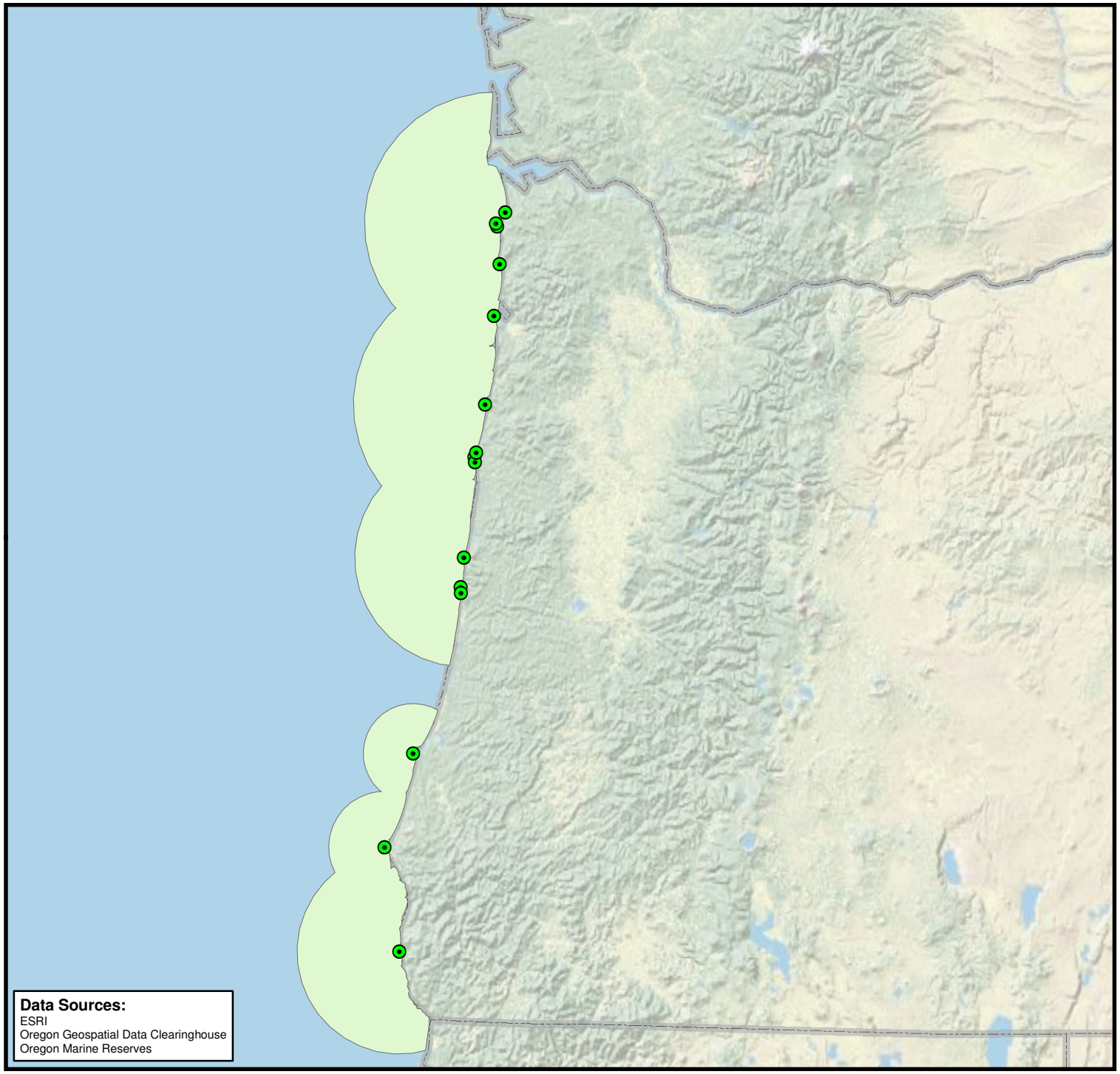


Fig. 4-3

Coastal Viewsheds

Viewpoints

Viewshed from viewpoints

OregonWaveEnergy TRUST

aquatera.co.uk Parametrix

Powertech EMEC

0 25 50 75

Nautical Miles

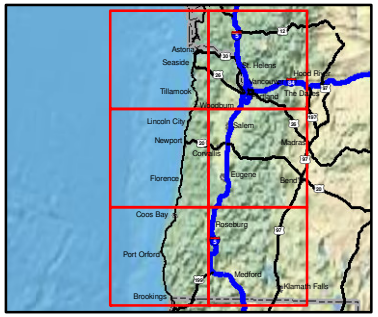


Table 4-1 2000 Census Data for Coastal Communities

					Workforce Type by Percentage			
Community	Population	Per capita Income	Unemployment	Poverty	Construction	Manufacturing	Professional Services	Management
Astoria	9,807	$18,759	35.8%	15.9%	6.3%	7.8%	3.1%	0.0%
Bandon	2,880	$20,051	53.1%	16.0%	4.4%	8.9%	3.1%	0.0%
Barview	1,855	$13,022	50.8%	23.1%	5.9%	10.2%	0.0%	0.0%
Bay City	1,128	$18,731	39.4%	12.4%	9.3%	24.4%	2.2%	0.0%
Beaver	165	$17,284	38.3%	7.9%	0.0%	8.5%	0.0%	0.0%
Brookings	5,363	$17,010	43.8%	11.5%	7.1%	9.8%	2.6%	0.0%
Bunker Hill	1,571	$10,570	40.0%	25.6%	14.8%	8.3%	1.6%	0.0%
Cannon Beach	1,600	$24,465	33.9%	12.0%	7.6%	2.5%	5.0%	0.0%
Cape Meares	49	$26,635	57.1%	30.6%	0.0%	0.0%	0.0%	0.0%
Cloverdale	241	$17,325	24.4%	6.6%	11.6%	13.6%	4.5%	0.0%
Coos Bay	15,443	$18,158	42.1%	16.5%	6.0%	5.7%	2.4%	0.1%
Coquille	4,345	$14,619	46.8%	10.6%	3.3%	12.3%	4.1%	0.0%
Depoe Bay	1,188	$24,994	46.9%	8.0%	9.5%	4.8%	4.1%	0.0%
Dunes City	1,282	$27,048	56.1%	10.6%	11.2%	3.8%	3.8%	0.0%
Florence	7,318	$18,008	61.0%	14.4%	9.6%	4.9%	2.0%	0.0%
Garibaldi	904	$18,075	47.2%	11.6%	8.9%	12.5%	2.2%	0.0%
Gearhart	948	$25,224	33.3%	6.4%	12.2%	3.9%	3.9%	0.0%
Gold Beach	1,864	$16,717	41.3%	12.4%	7.6%	5.9%	5.2%	0.0%
Harbor	2,688	$16,318	58.9%	14.8%	8.6%	7.2%	0.0%	0.0%
Hebo	275	$16,053	38.2%	4.4%	9.6%	4.4%	0.0%	0.0%
Lakeside	1,391	$16,702	60.6%	15.2%	7.3%	11.4%	4.1%	0.0%
Lincoln Beach	2,123	$21,810	50.1%	6.9%	5.5%	3.3%	5.1%	0.0%
Lincoln City	7,307	$15,597	41.1%	16.1%	7.6%	3.4%	2.4%	0.0%
Manzanita	501	$26,428	47.5%	7.2%	17.6%	3.0%	5.6%	0.0%
Myrtle Point	2,510	$13,695	51.1%	19.8%	8.0%	13.3%	3.3%	0.0%
Nehalem	261	$15,408	32.8%	7.7%	25.8%	4.7%	2.3%	0.0%
Neskowin	211	$26,576	48.8%	8.1%	0.0%	0.0%	7.6%	0.0%
Netarts	705	$18,888	45.2%	17.3%	2.6%	24.7%	10.3%	0.0%

Table 4-1 2000 Census Data for Coastal Communities (continued)

					Workforce Type by Percentage			
Community	Population	Per capita Income	Unemployment	Poverty	Construction	Manufacturing	Professional Services	Management
Newport	9,493	$20,580	37.3%	14.4%	4.9%	5.9%	4.2%	0.0%
North Bend	9,571	$16,703	41.1%	14.8%	5.7%	6.7%	3.8%	0.0%
Oceanside	351	$32,158	46.1%	6.8%	8.9%	6.5%	8.3%	0.0%
Pacific City	949	$25,819	45.3%	7.9%	8.8%	14.3%	4.3%	0.0%
Port Orford	1,153	$16,442	55.5%	17.8%	5.5%	6.3%	5.8%	0.0%
Powers	737	$12,544	59.2%	23.5%	7.2%	12.2%	1.4%	0.0%
Reedsport	4,270	$16,093	53.7%	16.0%	11.2%	4.9%	5.2%	0.0%
Rockaway Beach	1,280	$17,766	47.5%	10.8%	7.9%	13.4%	0.8%	0.0%
Rose Lodge	1,613	$18,297	38.0%	13.5%	15.1%	5.6%	2.6%	0.0%
Seaside	5,822	$17,893	38.3%	15.6%	8.6%	5.7%	3.7%	0.0%
Siletz	1,174	$14,690	41.0%	15.4%	6.0%	10.8%	1.6%	0.0%
Tillamook	4,374	$15,160	33.0%	15.4%	5.4%	15.3%	4.0%	0.0%
Toledo	3,438	$14,710	35.9%	19.3%	6.5%	13.5%	2.1%	0.0%
Vernonia	2,254	$16,647	39.2%	9.7%	8.9%	26.2%	2.1%	0.0%
Waldport	2,054	$15,939	44.8%	17.3%	4.7%	5.6%	1.1%	0.0%
Waldport	2,054	$15,939	44.8%	17.3%	4.7%	5.6%	1.1%	0.0%
Warrenton	4,082	$16,874	35.6%	14.2%	12.2%	9.2%	3.7%	0.0%
Wheeler	425	$16,535	52.2%	16.2%	8.6%	6.8%	8.6%	0.0%
Winchester Bay	530	$17,307	57.0%	21.3%	20.6%	9.9%	0.0%	0.0%
Yachats	644	$24,143	52.5%	14.1%	8.1%	5.2%	4.0%	0.0%

5 Economic Datasets

The basic issue in the study of social and economic cumulative effects from wave energy development is the identifying and quantifying the impacts and benefits from dedicating certain areas of the ocean to power production. These impacts and benefits will affect a range of ocean users including consumptive users (e.g. fishing industry) and non-consumptive users (e.g. recreationalists). The social and economic component of this framework must be analyzed in spatial units that can join the other aspects of the cumulative effects analysis. This requires some assumptions to be made in order to allow coarse spatial data such as city or county level to be applied to the adjacent ocean. These assumptions are necessary to create a link between actions on the ocean and the impacts and benefits that will serve communities and users on shore.

Efforts to study the social and economic impacts of ocean policy have centered on the development of marine reserves and fisheries management. Marine reserves share some traits with wave energy developments site from a social and economic perspective. Consumptive ocean users may be excluded from energy sites, though this is not always the case. These sites may also provide unknown benefits if the exclusion of harvest allows improvement in fish stocks that are compatible with the wave technology selected. The energy sites differ from marine reserves for non-consumptive uses.

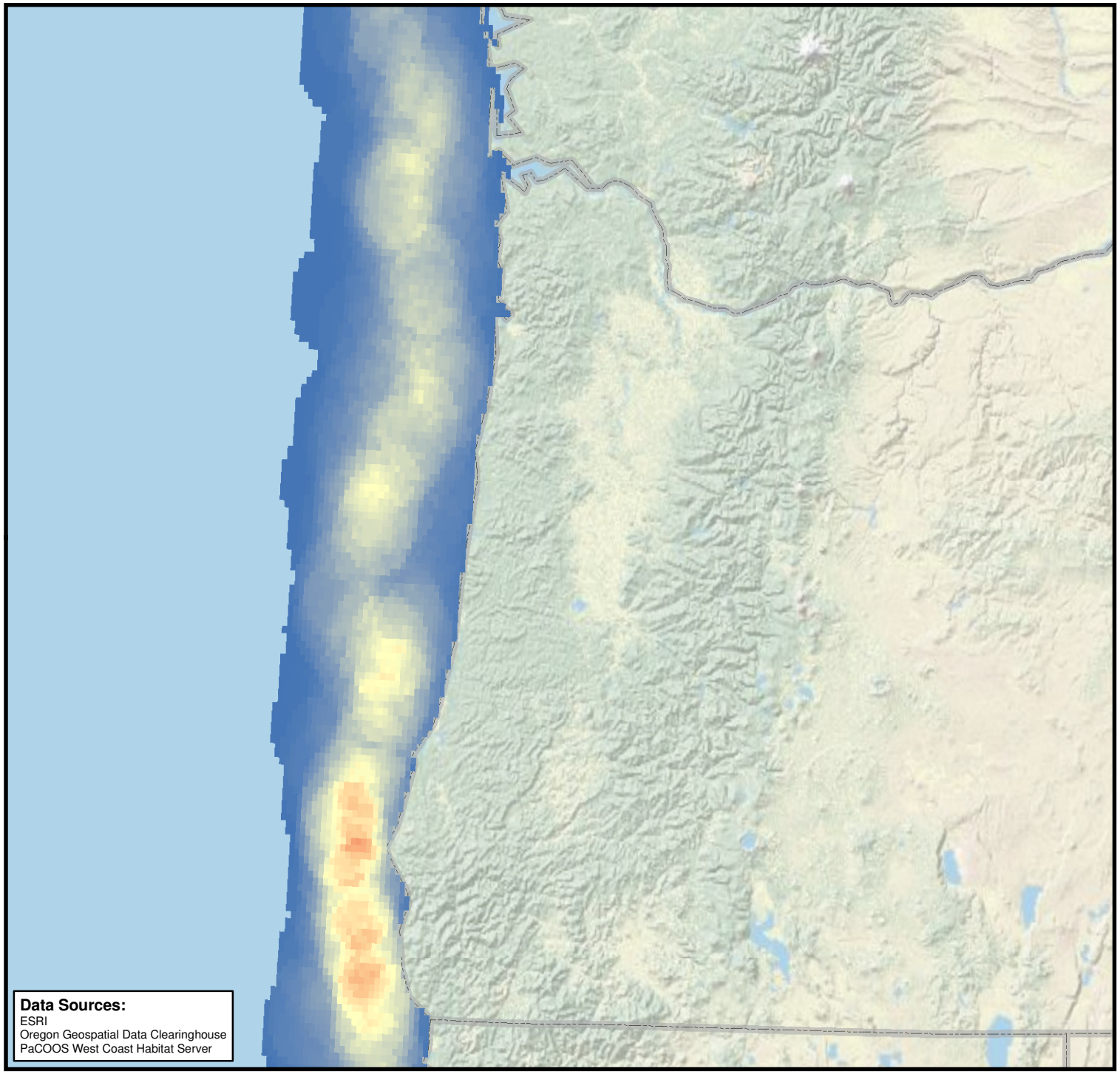
5.1.1 Data Gaps

Shipping routes and intensity is a dataset that could be collected with the use of an AIS recording system. The recording would capture the signals broadcast from transiting vessels and provide a complete set of routing data that documents preferred areas of the ocean for transit by vessel type.

Fishing data from the Ecotrust study will provide spatially explicit and weighted data to understand the higher and lower value areas on the ocean for fishing activity. This data will ideally also provide an economic weighting to understand the relative importance to various fisheries and ports.

5.1.2 Census Tables

2000 Census data was linked to Census-Designated Places (CDP) within the Coastal Zone Management Act area. These data provide a basis for the model to assess economic attributes for communities in the study area. These data are joined in the model to the polygons for each CDP, but for ease of presentation the data is provided here in tabular form.



Data Sources:
ESRI
Oregon Geospatial Data Clearinghouse
PaCOOS West Coast Habitat Server

Fig. 5-1

Groundfish Harvest

2003 - 2006 Harvest
kg/km²

High : 33,692,836

Low : 0

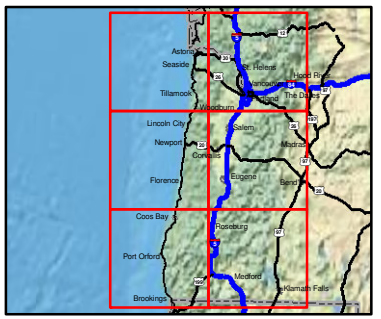
OregonWaveEnergy TRUST

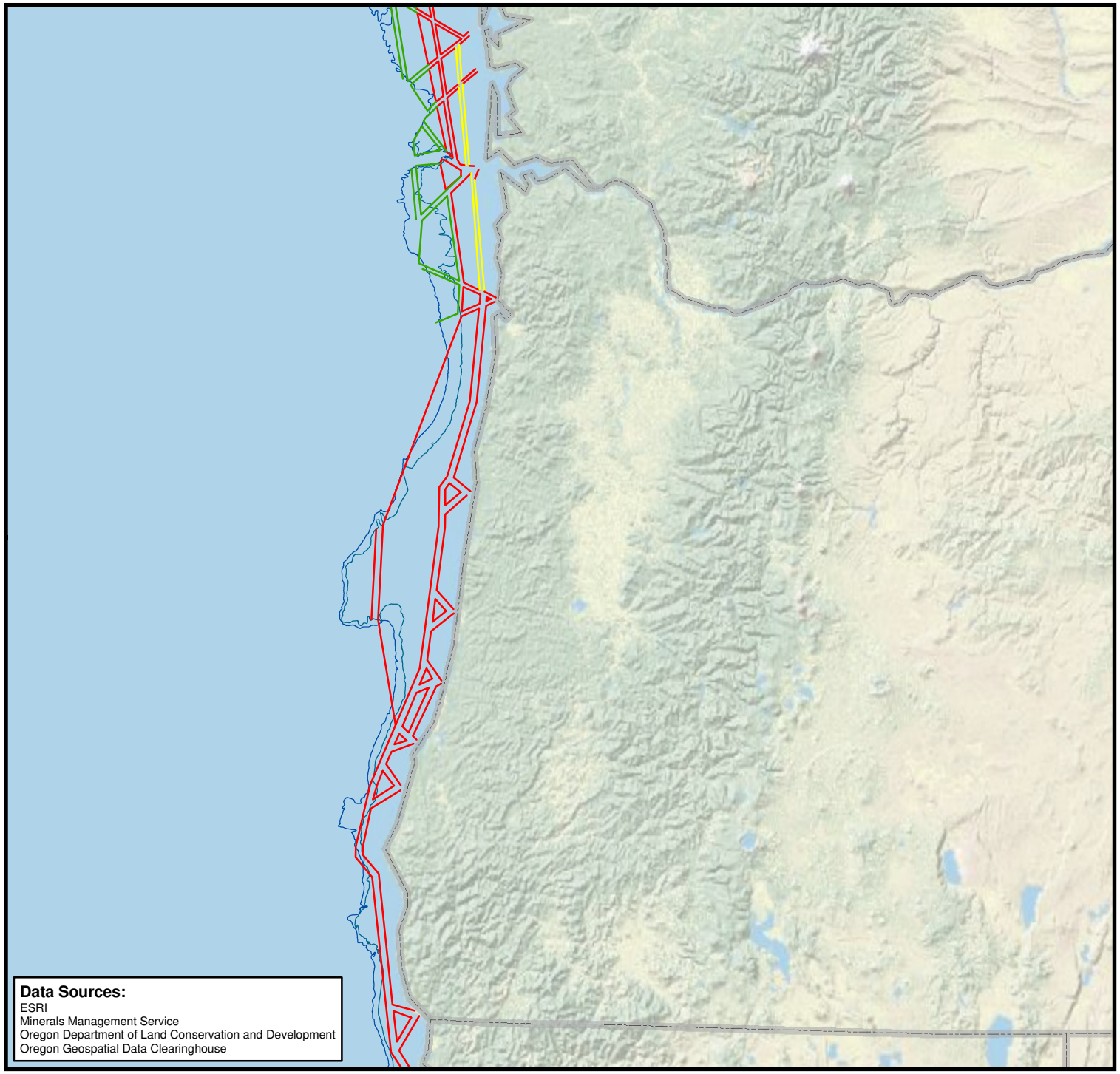
aquatera.co.uk Parametrix

Powertech EMEC

0 25 50 75

Nautical Miles





Data Sources:
ESRI
Minerals Management Service
Oregon Department of Land Conservation and Development
Oregon Geospatial Data Clearinghouse

Fig. 5-2

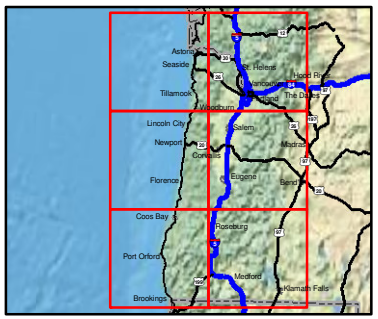
Towlanes

Towlane rule
- Advisory only
- Summer only
- Year-Round

Depth
- 100 fathom contour
- 75 fathom contour

OregonWaveEnergy TRUST
aquatera.co.uk Parametrix
Powertech EMEC

0 25 50 75
Nautical Miles



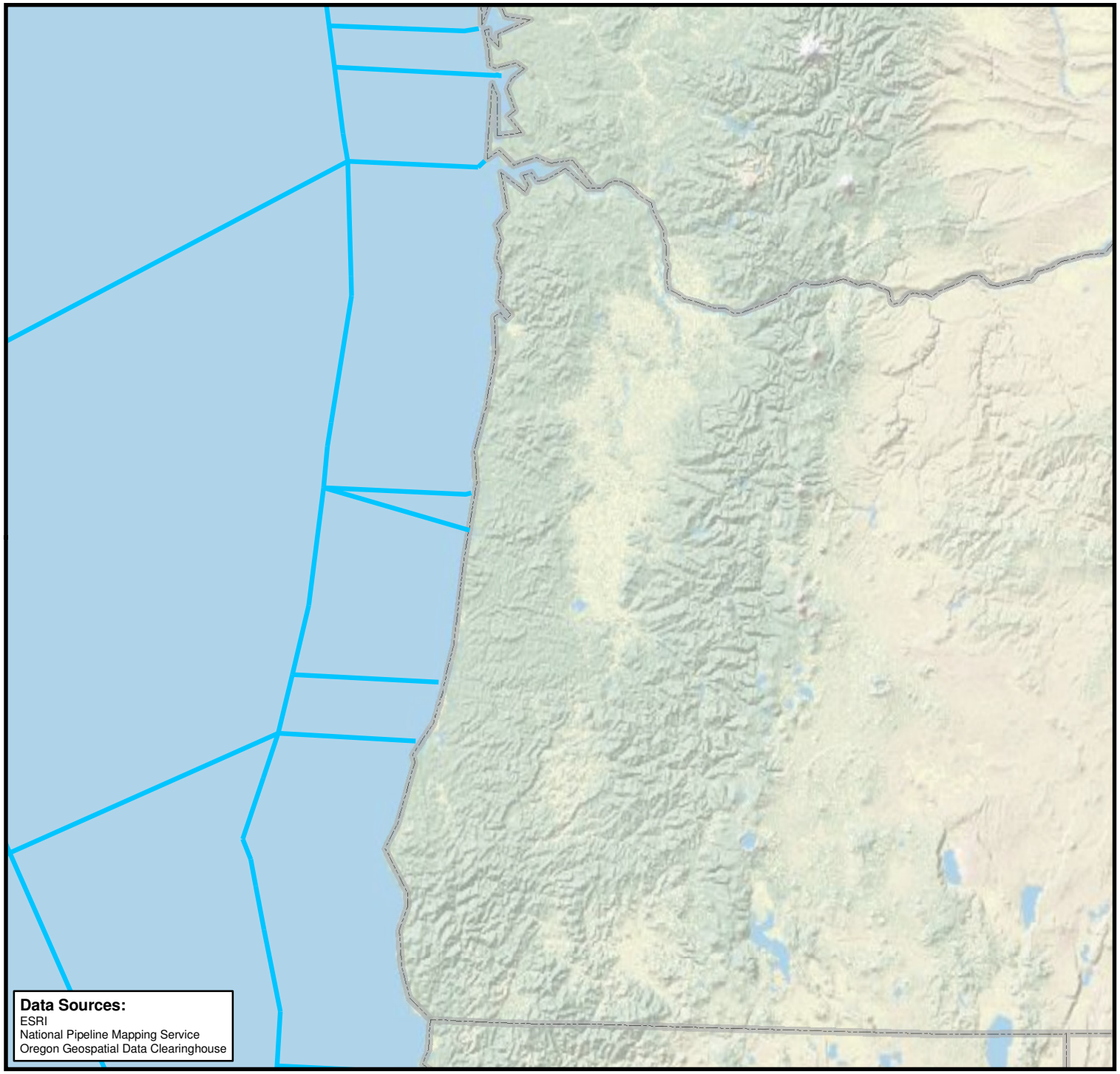


Fig. 5-3

Clear Navigable Waterways

Ocean routes

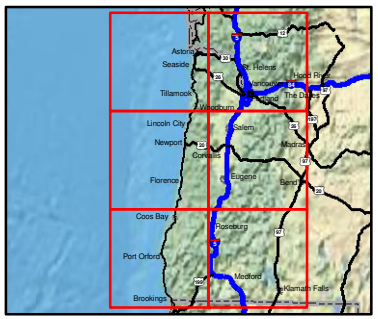
OregonWaveEnergy TRUST

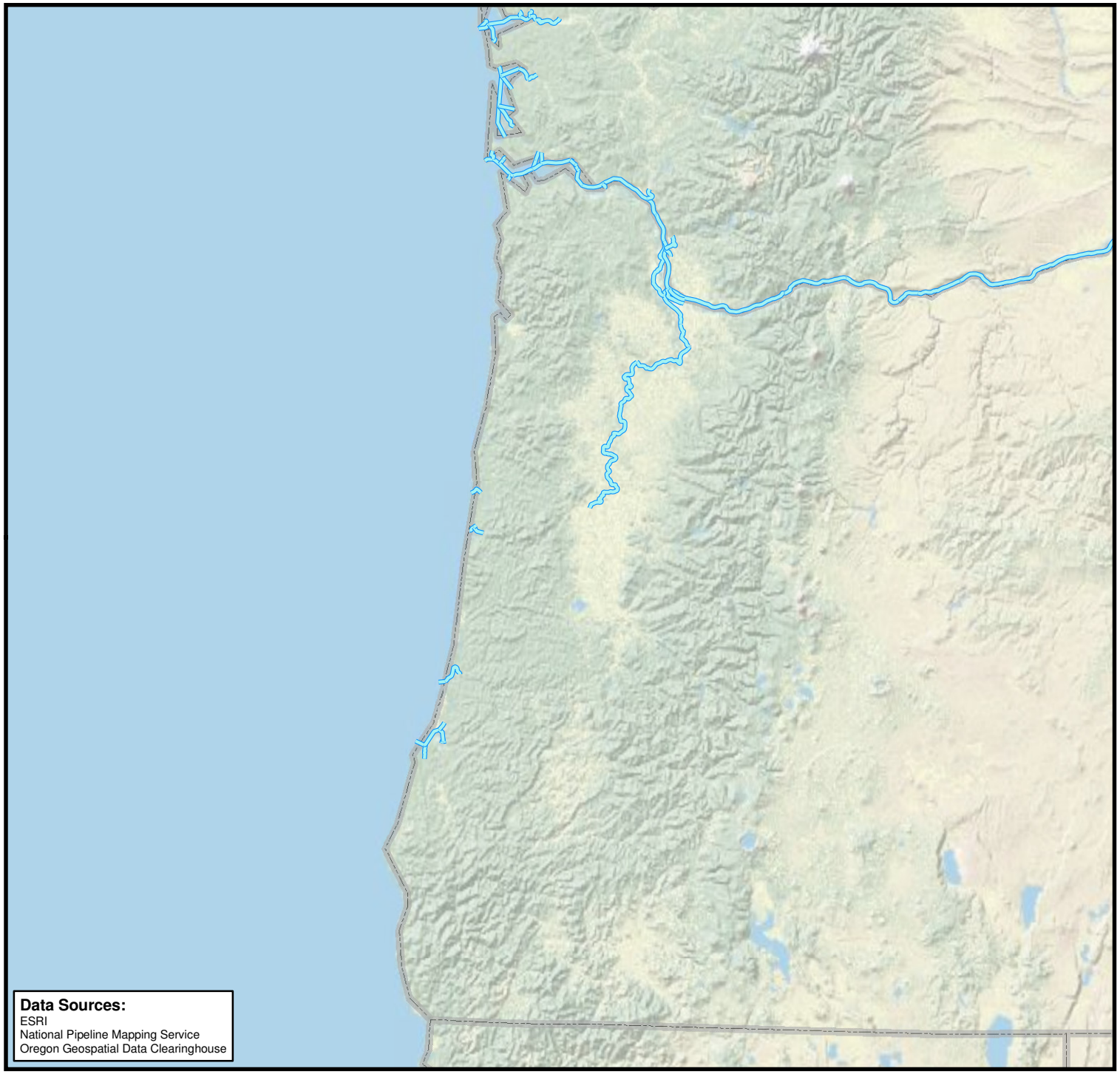
aquatera.co.uk Parametrix

Powertech EMEC

0 25 50 75

Nautical Miles





Data Sources:
ESRI
National Pipeline Mapping Service
Oregon Geospatial Data Clearinghouse

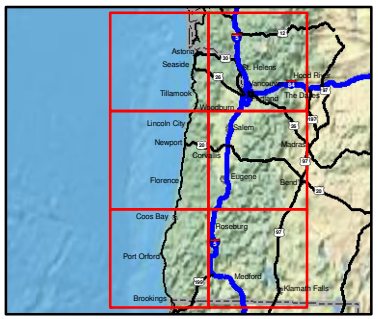
Fig. 5-4

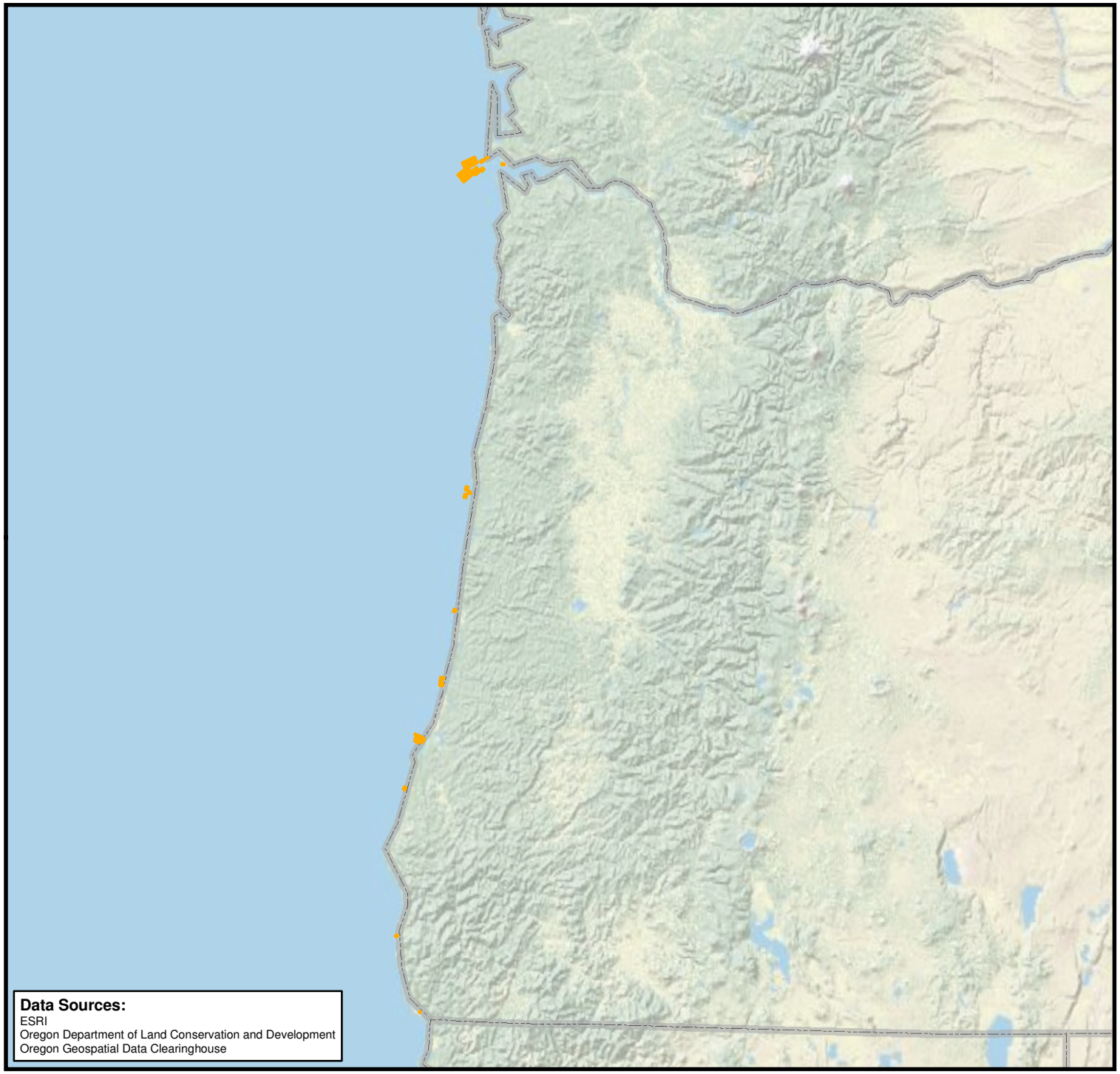
Inshore Navigation

Inshore routes

OregonWaveEnergy TRUST
aquatera.co.uk Parametrix
Powertech EMEC

0 25 50 75
Nautical Miles





Data Sources:
ESRI
Oregon Department of Land Conservation and Development
Oregon Geospatial Data Clearinghouse

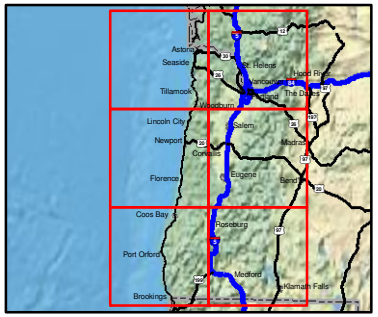
Fig. 5-5

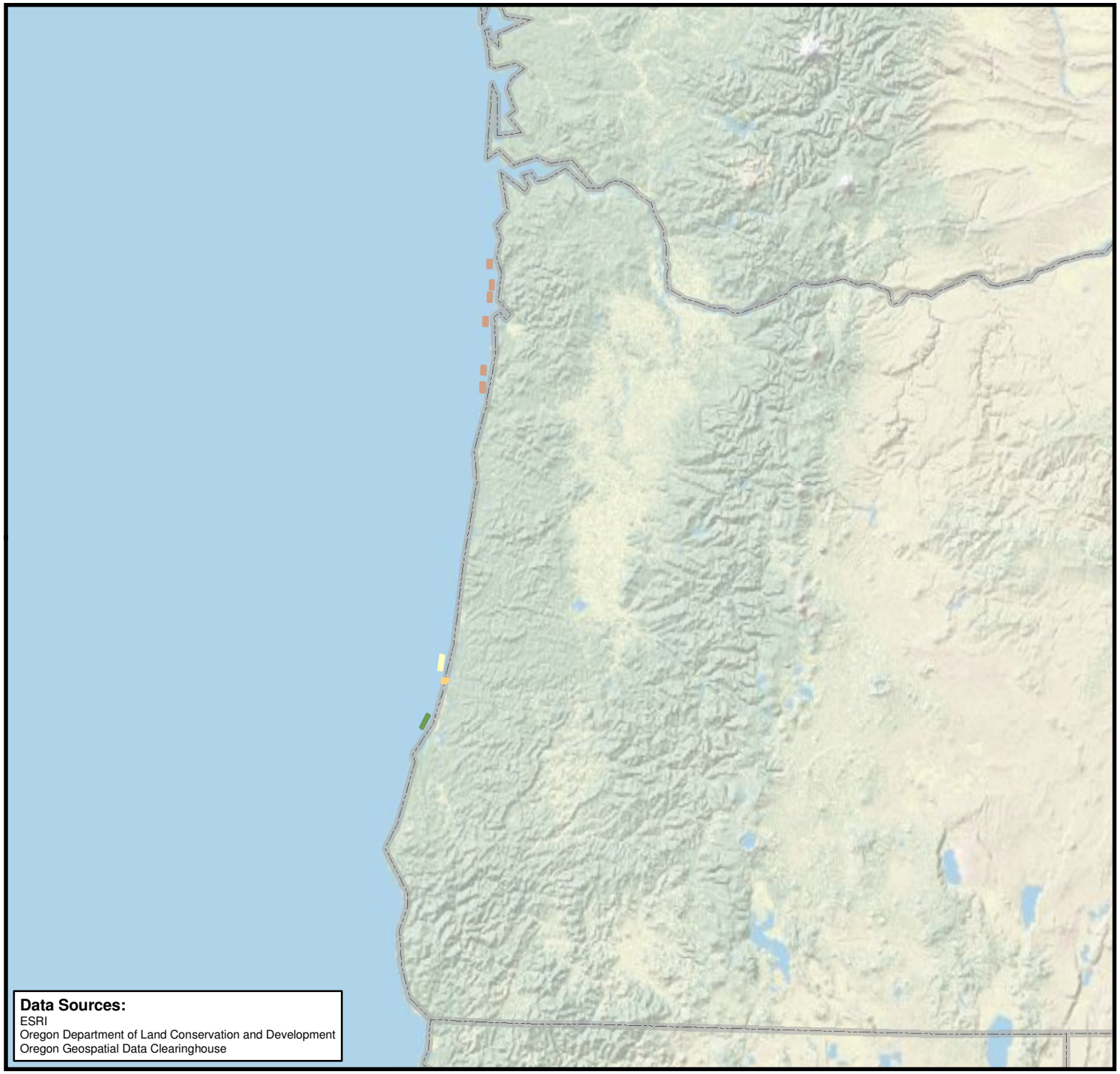
Dredge Disposal Areas

Dredge material disposal sites

OregonWaveEnergy TRUST
aquatera.co.uk Parametrix
Powertech EMEC

0 25 50 75
Nautical Miles





Data Sources:
ESRI
Oregon Department of Land Conservation and Development
Oregon Geospatial Data Clearinghouse

Fig. 5-6

Pending Wave Energy Permit Areas

Projects
- Coos Bay OPT Wave Park
- Douglas County Wave Tidal Energy Power Project
- Oregon Coastal Wave Energy Project
- Reedsport OPT Wave Park

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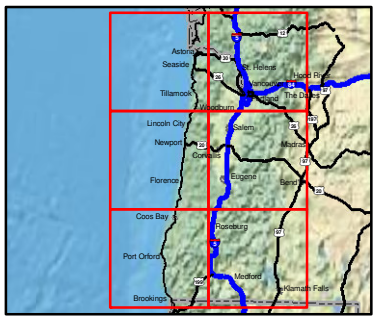
aquatera.co.uk Parametrix
Powertech EMEC

0 25 50 75
Nautical Miles



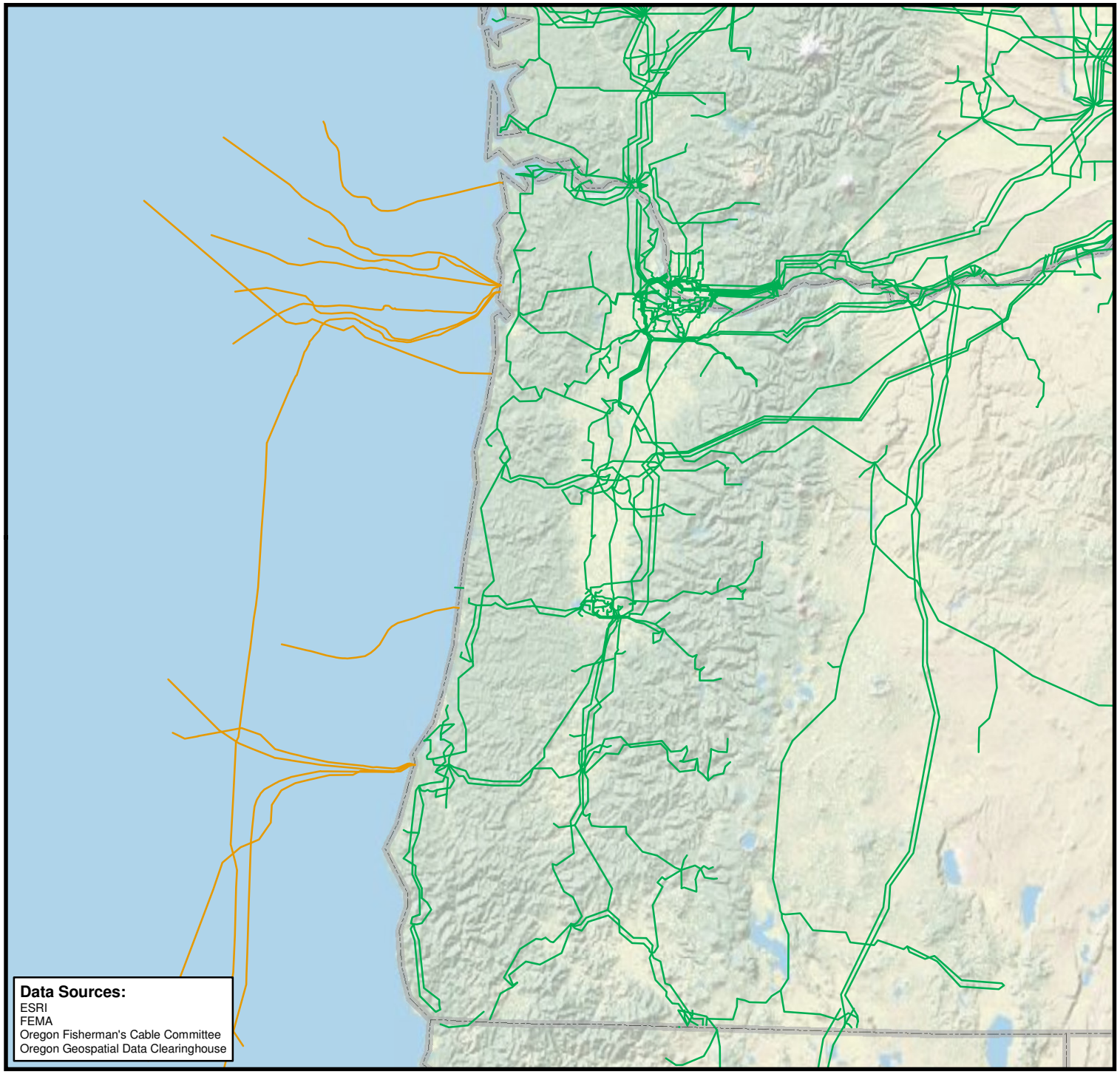


Fig. 5-7

Subsea Telecom Cables and Onshore Grid

Electric grid

Underwater fiber optic cables

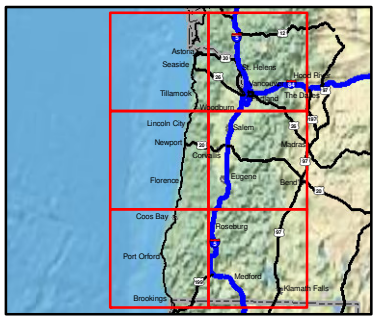
OregonWaveEnergy TRUST

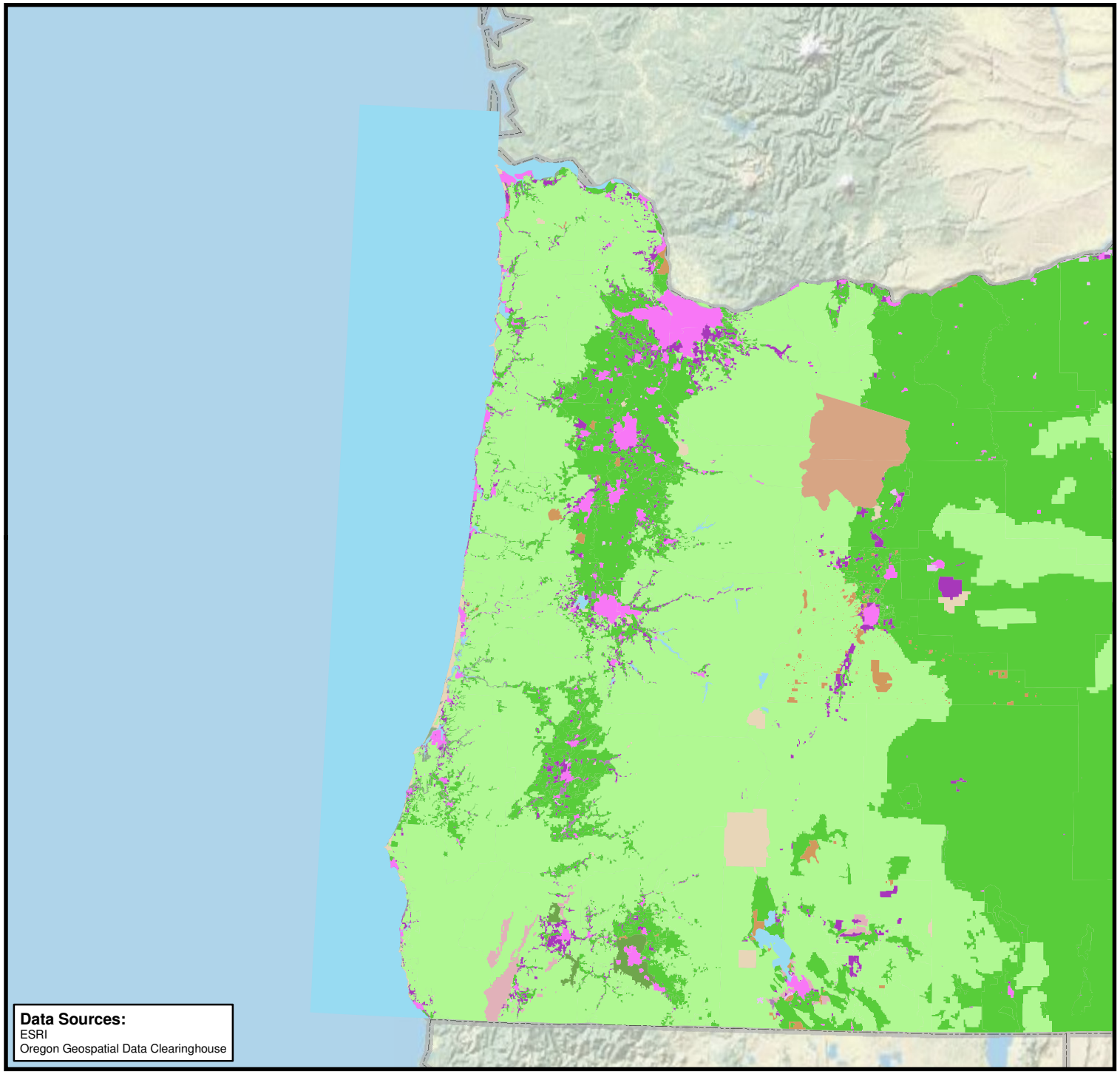
aquatera.co.uk Parametrix

Powertech EMEC

0 25 50 75

Nautical Miles





Data Sources:
ESRI
Oregon Geospatial Data Clearinghouse

Fig. 5-8

Land Use Zoning

Land use
- Agriculture
- Coastal
- Forestry
- Indian Reservation
- Mixed ag and rural residential
- Natural resource
- Non resource
- Park and Recreation
- Public facility
- Rural commercial
- Rural industrial
- Rural residential
- Rural service center
- Urban
- Water

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Powertech EMEC

0 25 50 75
Nautical Miles

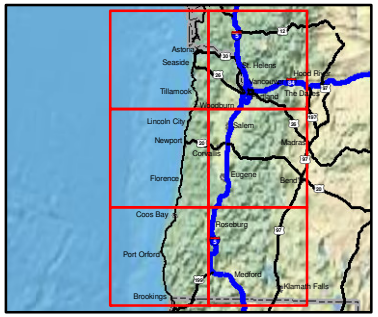

Table 5-1 Tourism and Related Workforce by Community

Community	Percent in Tourism and Related Workforce
Astoria	1.4%
Bandon	4.2%
Barview	4.8%
Bay City	0.8%
Beaver	0.0%
Brookings	1.8%
Bunker Hill	1.4%
Cannon Beach	3.4%
Cape Meares	0.0%
Cloverdale	0.0%
Coos Bay	2.7%
Coquille	3.6%
Depoe Bay	5.8%
Dunes City	2.5%
Florence	3.3%
Garibaldi	0.0%
Gearhart	3.9%
Gold Beach	1.3%
Harbor	3.0%
Hebo	0.0%
Lakeside	3.4%
Lincoln Beach	1.5%
Lincoln City	12.7%
Manzanita	3.0%
Myrtle Point	2.3%
Nehalem	0.0%
Neskowin	0.0%
Netarts	0.0%
Newport	2.9%
North Bend	1.7%
Oceanside	5.3%
Pacific City	3.0%
Port Orford	3.5%
Powers	0.9%
Reedsport	3.2%
Rockaway Beach	2.1%
Rose Lodge	8.0%
Seaside	2.7%

Table 5-1 Tourism and Related Workforce by Community (continued)

Community	Percent in Tourism and Related Workforce
Siletz	7.8%
Tillamook	1.2%
Toledo	2.8%
Vernonia	0.8%
Waldport	3.4%
Waldport	3.4%
Warrenton	0.6%
Wheeler	7.4%
Winchester Bay	0.0%
Yachats	3.6%