Exxon Valdez Oil Spill Trustee Council
Gulf of Alaska Ecosystem Monitoring Project Final Report

ShoreZone Mapping of the Outer Kenai Coast, Alaska
Gulf of Alaska Ecosystem Monitoring Project 02613

John Harper

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May 2003

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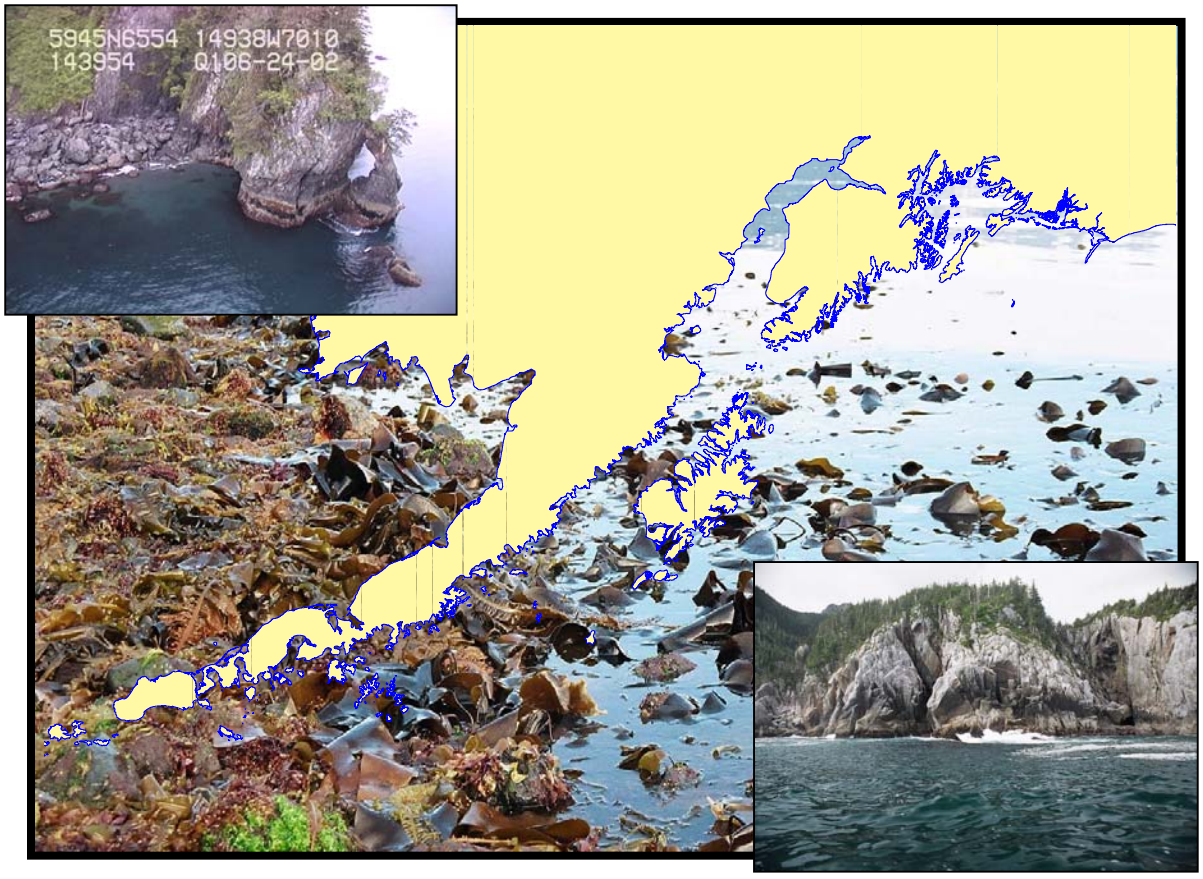
Shore-Zone Mapping of the Outer Kenai Coast, Alaska



for
The Exxon Valdez Oil Spill Trustee Council
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This project documented and mapped coastal habitat on the Outer Kenai Coast of Alaska and was funded by the Exxon Valdez Oil Spill Trustee Council (EVOS). This report is intended as a general overview of the project and as a description of deliverables.

The shoreline was flown and imaged during extremely low tides of June 2002. In addition to the georeferenced imagery, narration on the tapes provides a description of intertidal and subtidal biota, intertidal substrate and morphology and man-made features of interest. The 1,400, km of shoreline is documented on 17 miniDV (digital) videotapes. The video imagery and associated narration are the raw data for characterizing coastal habitat.

The digital imagery was sampled and is posted to the web to allow complete public access. In a unique interactive website, sections of the coast can be windowed, a flight starting point selected and the user can "fly" the shoreline using forward-reverse and speed buttons of the imagery player (http://imf.geocortex.net/mapping/cori/launch.html).

The Alaska ShoreZone Mapping Protocol (draft) was used to classify the shoreline in terms of biota, morphology and substrate. The mapping system has been applied to the entire BC and Washington shorelines, to Cook Inlet and an EVOS-funded project is currently underway to define an Alaskan standard. The system subdivides the shoreline into alongshore units and across-shore components and a variety of physical and biological data is recorded for each unit and component. This data can be displayed on maps through GIS. A total of 3,019 units and 9,993 across-shore components were defined for the 1,381 km of shoreline.

Maps of a few selected coastal habitat themes are included as part of this report. More precise habitat units can be delineated by using specific queries of the database (e.g., delineation of sandlance spawning habitat by searching for protected shorelines with sand berms or sand & pebble berms). The complete spatial data set, documented by the meta-data forms, and the ShoreZone database are included as part of this deliverable.

The data is potentially useful for a wide-variety of applications, including oil spill response, delineation of essential fish habitat, recreational planning and marine protected area planning.

Harper, J. 2003. Mapping Marine Habitats: Prince William Sound to McCarty Fjord. EVOSTC Restoration Project 02195 Final Report.

ACKNOWLEDGEMENTS

We gratefully acknowledge the funding support form the Exxon Valdez Oil Spill Trustee Council (EVOS) for this project. The Cook Inlet Citizens Advisory Council (CIRCAC) and the Kenai Peninsula Borough also provided support for a field survey, and although that field program is not discussed within this report, the information significantly improved our imagery interpretation. We also appreciate the support of the Kenai Fiords National Park and the Port Graham Corporation for providing access for fuel caches that were required during the survey. Joel Cusick of the National Park Service greatly assisted with advice on GIS data handling procedures and with provision of tide-controlled digital photography within Kenai Fiord National Park. Bill Hauser did a great job managing this contract on behalf of ADF&G.

The following individuals and organizations participated in the project.

Individual	**Organization**	**Notes**
John Harper	Coastal and Ocean Resources Inc	Principal Investigator
Neil Borecky, Rachel Speller, Sheri Ward	Coastal and Ocean Resources Inc	physical shore-zone mapping
Kitty Lloyd, Mary Morris, Nonnie Smith	Archipelago Marine Research Ltd.	biological shore-zone mapping
Chau Kum Liu	Archipelago Marine Research Ltd.	database design
Peter Amatto	Kenai Fiords National Park	provided unpublished reports on intertidal biota
Bill Hauser	Alaska Department of Fish and Game	contract management
Arnie Johnson	Evergreen Helicopters	pilot and helicopter charter
Susan Saupe	Cook Inlet Citizens Advisory Council (CIRCAC)	advice on biota distributions
Steven Myhill-Jones, Jackson Harper	Latitude Geographics Group Ltd.	imagery website design and support
Andy Wilder	*Weather Permitting* (water taxi)	fuel placement

1.1 Overall Description of the Project

This project was funded as part of the Gulf of Alaska Ecosystem Monitoring Program (GEM), a program to establish environmental monitoring sites within the Gulf of Alaska ecoregion. One component of the GEM program is the *Nearshore* and the ShoreZone Mapping Project (ShoreZone) was selected as part of the Nearshore GEM program. ShoreZone provides high resolution coastal habitat data that can be rapidly acquired, processed and distributed. By mapping coastal habitats over a wide region, the ShoreZone data provides a uniform spatial framework for selecting areas for more detailed mapping or monitoring.

ShoreZone has been widely used within the Pacific Northwest with the entire shoreline of British Columbia and Washington recently mapped (see Bookheim *et al* 2001, Howes 2001, Howes *et al* 1994, Morris *et al* 1995) as well as portions of Cook Inlet and the western Outer Kenai coast (funded by CIRCAC and the Kenai Peninsula Borough). Actual mapping procedures are described in these documents and an Alaska ShoreZone Mapping Protocol is currently in preparation.

Imagery was collected for this project between 24 and 28 June 2002, a period of very low tides, so that the entire intertidal zone could be imaged. The flightline data is summarized in a separate report to EVOS (CORI 2002). Figure 1 shows the extent of the shoreline that was mapped as part of this project.

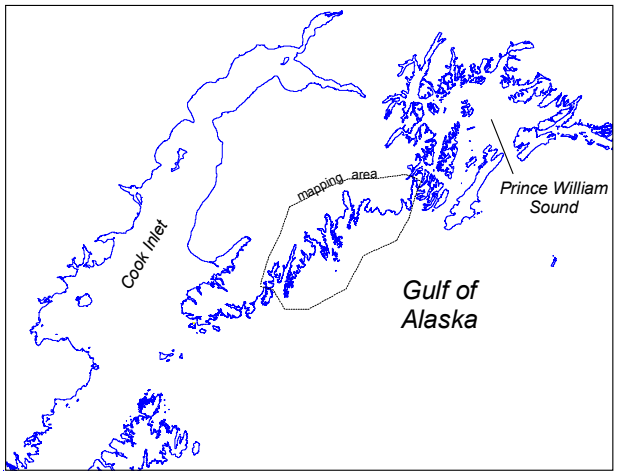

Figure 1. Mapping area for Outer Kenai Coast mapping project.

The general procedure is defined as a series of Steps:

1. collect imagery,
2. assemble electronic bases maps (shape files), video imagery and still photos.
3. subdivide shoreline into alongshore units based on morphology and exposure,
4. digitize electronic base maps into shore units (generally line segments but can be points or polygons).
5. classify physical attributes of alongshore units and across-shore components (Access97 database),
6. classify biological attributes of alongshore units and across-shore biobands (Access97 database)
7. QAQC data products

This procedure results in a segmented base map with linked database attributes so that a variety of themes can easily be displayed using GIS (e.g., ArcView).

1.2 Summary of Data Projects

Flightline Manual and Videotapes

Copies of the 16 videotapes collected as part of the survey have previously been provided to EVOS. A flightline manual showing the location of each tape and including a tape log has also been provided. Navigation data, consisting of 1-sec DGPS fix locations, tapes numbers and still photo locations, was provided on CD-ROM to EVOS.

Gulf of Alaska Coastal Imagery Site

The aerial video imagery was captured at 1-second intervals, georeferenced and posted to a publicly accessible website (http://imf.geocortex.net/mapping/demos/cori/launch.html). A portion of the Gulf of Alaska can be selected for more detailed viewing by zooming in so that individual 1-sec fix points can be viewed. The users then selects a starting point and starts the image player to literally *fly* the shoreline. The site runs under ArcIMS allowing interactive GIS manipulation by the user.

ShoreZone Mapping Data

The aerial imagery is interpreted and classified by geologists and biologists to produce electronic maps and databases of coastal habitat attributes. The points, lines and polygons on the maps are linked to the databases (Fig. 2) so that any of the attributes included in the databases can be displayed as a map. The actual attributes that are recorded are discussed in detail in the Data Dictionary (Appendix D). Data for the entire 1,400 km of shoreline is included in Appendix E as a CD-ROM.

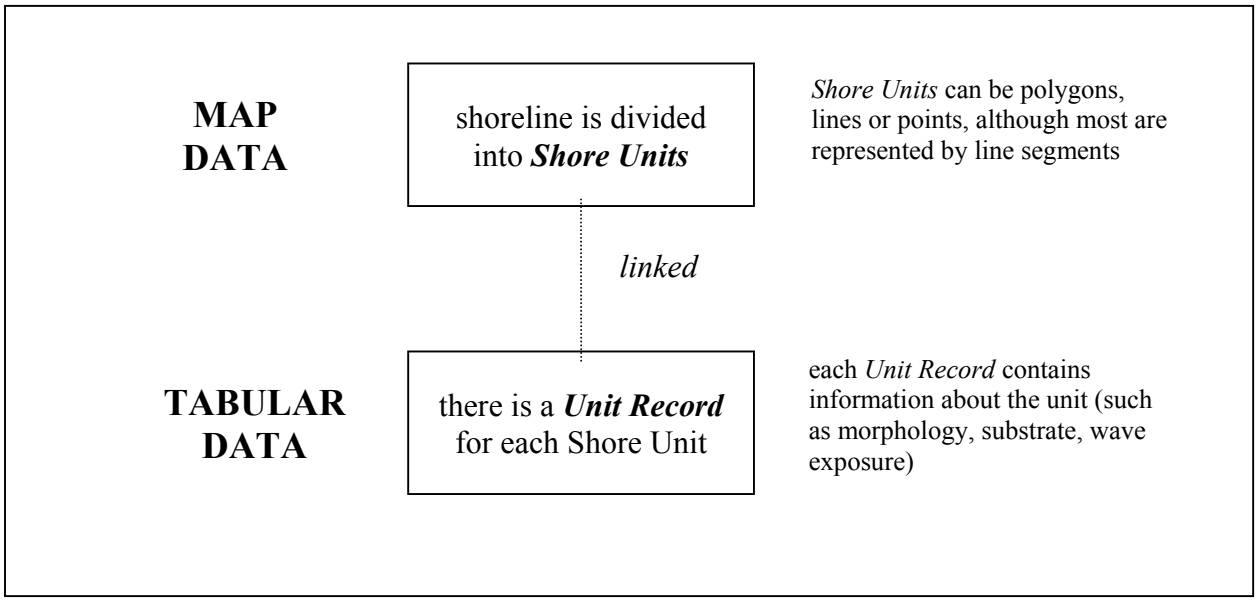

Figure 2. Schematic illustration of linkage between spatial and tabular data (database).

Selected thematic maps are included as part of this report. The selection provides a representative collection of themes but is by no means complete – there are literally hundreds of attributes or combinations of attributes that might be queried and displayed on maps. An example of using combinations of themes as a habitat management tool is included in the inset at right.

Using ShoreZone Data for Habitat Management

Sandlance are a small coastal fish that are present in the nearshore and are a major prey item for salmonids and for seabirds. Sandlance spawn in the upper intertidal zone of beaches and, as such, are sensitive to contaminant impacts as well as coastal development that can damage or remove spawning habitat. By querying the database for locations of *protected* or *semi-protected* wave exposure and for locations of *sand* or *sand/pebble berms*, potential sandlance spawn habitat can be identified. Maps show that the possible spawn sites are rare within the mapping region.

Maps are one of the primary products of this project. Maps include a collection of lines segments, points and polygons, each of which is linked to one or more database records describing attributes of that unit. Figure 3 shows a small map section of units (line segments).

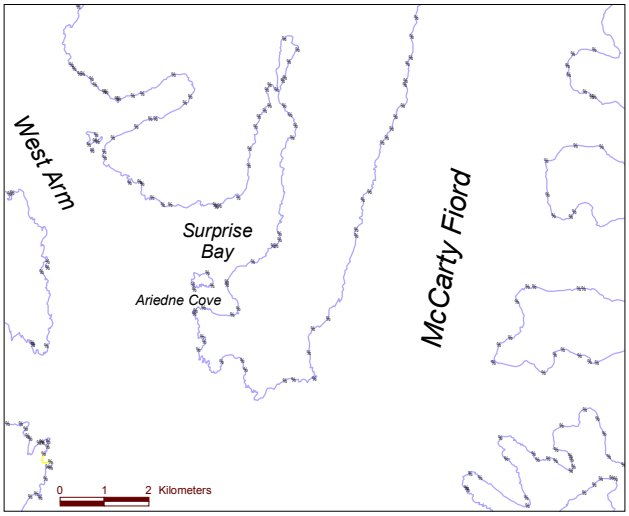

Figure 3. Section of shoreline showing line segments or units (defined by unit breaks) and point features (red dots). The are about 90 units shown in this example.

The original shoreline is taken from the USGS 1:63,000 electronic shoreline, which is generally a representation of the high-water line. In locations where there are significant errors from our interpretation of the high-water line, we have made corrections in the line work to reflect a more accurate shoreline. The corrections have generally been developed from digital aerial photos, which are registered to the line-work and then the questionable line work is replaced.

There are some areas of coastline where the line work is incorrect (e.g., Seward small boat Harbor) and for which new aerial photos were not easily obtainable. Problems with the shoreline have been noted in the database and will require future correction.

2.1 Meta Data

The vector dataset directly utilizes the Alaska Department of Natural Resources' 1:63,360 coastline circa. January 1998, including islands. This is also known as **coast63** shoreline. The Outer Kenai Shore Zone Map has clipped the coast63 shoreline to the area bounded by Kenai Fiords National Park's western boundary (Petroff Point), and in the east by Bainbridge Passage in Port Bainbridge (Pt. Waters). This vector dataset has been segmented in shore zone mapping process that utilizes oblique aerial video imagery to identify distinct shoreline units based upon geological and biological homogeneity. Segmentation has been achieved through the use of a split poly-line script written in Avenue for ArcView v. 3.2. Minor changes to the shoreline have been identified in the spatial database as "1" in the field **SHORE_MOD**, based upon DOQ and 1:12,000 scale air photo interpretation of the high-water shoreline. We expect to make more detailed changes to the shoreline in the near future.

Meta data forms are included in Appendix A.

2.2 Shape Files

The spatial data is provided as ESRI ArcView shape files. There are three sets of shape files included with the data products:

- **line segment files** – the USGS shoreline has been subdivided into a series of arcs or segments; each segment has a unique unit identifier to which data attributes are linked. Locations where the base shoreline has been modified are documented in the SHORE_MOD field of the coverage. Line segments are linked to the database via the PHY_IDENT field.

- **point variant files** – points where each point has a unique identifier that can be linked to data attributes. Points are linked to the database via the PHY_IDENT field.

- **point segment deliminators** – a point coverage that shows the beginning and end of each lines segment. These points have no associated attribute data – they are merely for deliminating the line segments.

2.3 Selected Thematic Maps

A collection of thematic maps is presented to illustrate generalized information for the region (Appendix B). More detailed maps can be plotted from the ArcView data and combinations of data can be plotted.

The following thematic plots are included in Appendix B (Windows metafiles that can be inserted into Word documents are included on the Data CD):

general substrate types
sediment types
Oil Residence Index
shoreline modifications
distributions of bio-bands
(Table 1; Appendix C)

Table 1 BioBand Distribution Maps

Zone	Code	Name
Supra-tidal	**VER**	'Verrucaria'
	PUC	salt-tolerant herbs and grasses
	GRA	grasses
upper Intertida	**BAR**	upper barnacle
	FUC	'Fucus'
mid Intertidal	**ULV**	'Ulva'
lower Intertidal	**HAL8**	'Halosaccion'
	BMU	blue mussel
	RED8	mixed filamentous & blade reds
	ALA	Alaria marginata morph
	SBR8	soft browns
	CHB8	chocolate browns
Sub-tidal	**ZOS**	'Zostera'
	NER	Nereocystis
	MAC	Macrocystis

Note: complete descriptions of *BioBands* are provided in Appendix C.

3.1 Database Organization

In addition to the spatial data, all of the coastal habitat data is characterized in the database, that can be linked to the spatial data. The database is developed in Access97 and includes five data tables (in other data management systems, these data tables would be considered stand-alone databases that can be linked using unique identifiers in each record). The relations between the various tables are schematically illustrated in Figure 4.

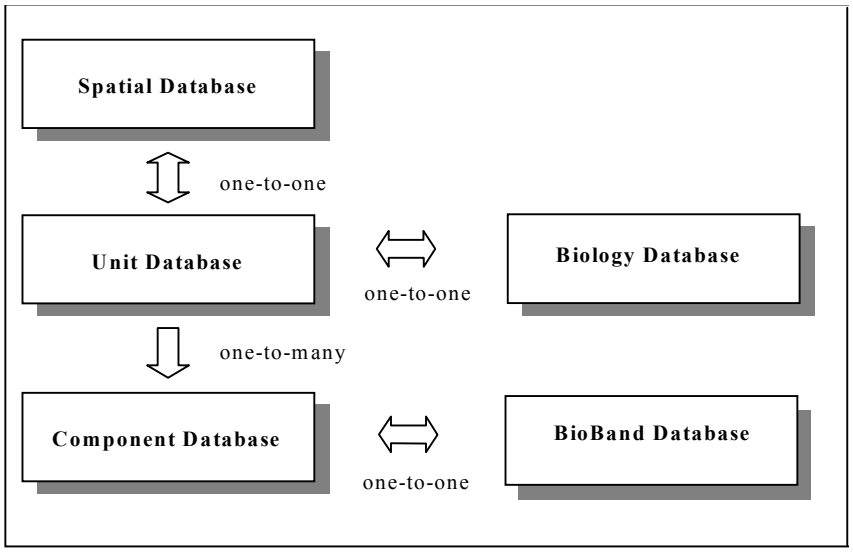

Figure 4. Schematic illustration of linkages or relationships between data tables.

3.2 Data Dictionary

The Data Dictionary (Appendix D) provides a field-by-field description of the data attributes. All the coding information that is used in the database is described in the Data Dictionary. Most users will require the Data Dictionary for conducting searches within the data.

4.1 Videotapes, Flightline Manual and Navigation Files

The following products were supplied to EVOS immediately following the aerial video imaging survey:

2 sets of VHS copies of the 17 aerial videotapes
1 set of 17 original miniDV digital videotapes (archived at CORI)
2 hard-copies of the flightline manual
1 electronic copy of the flightline manual (on CD)
1 electronic copy of the survey navigation data (1-sec fix marks during flight) in Access97 and Exce97 formats.

4.2 Gulf of Alaska Coastal Imagery Website

The Gulf of Alaska Coastal Imagery Website is accessible at:

http://imf.geocortex.net/mapping/demos/cori/launch

There are presently two sets of ~50,000 images on the site, all of which are georeferenced. One set of images is small for use in the video player and the other set is large for use in viewing individual frames of interest.

4.3 ArcView Map Files

The ArcView files that have been burned to the CD-ROM are listed in Table 2:

Table 2 Listing of ArcView Files Provided on Data CD

File Type	File Names
lines features	Reg3Ar12.dbf Reg3Ar12.sbn Reg3Ar12.sbx Reg3Ar12.shp Reg3Ar12.shx Reg3Ar12.txt
point features	Reg3Ar12points.dbf Reg3Ar12points.shp Reg3Ar12points.shx Reg3Ar12points.txt
points indicating the ends of linear units (e.g., line segments)	Unitbreaksreg3ar12.dbf Unitbreaksreg3ar12.sbn Unitbreaksreg3ar12sbx Unitbreaksreg3ar12shp Unitbreaksreg3ar12shx

4.4 Access97 Data Files

The latest version of the Access97 ShoreZone data file with the Outer Kenai Coast is:

Reg3Area1_2v2.mdb

The file contains data for mapping Region 3, Areas 1 & 2, which are part of a region-wide mapping project in the Gulf of Alaska. It is anticipated that the data files will eventually be combined with CIRCAC and Kenai Peninsula Borough datasets to provide regional coverage.

The information, and mapping standards conforms to the DRAFT version of the EVOS-funded Coastal Mapping Protocol for the Gulf of Alaska.

Bookheim, B, H. Berry and J.R. Harper 2001. An Inventory of Washington State's Marine Shorelines using the ShoreZone Mapping System. Proceedings of the 2001 Puget Sound Research Conference, Seattle, Washington. (poster).

Coastal and Ocean Resources Inc. (CORI) 2002. 2002 Aerial Video Imaging Survey, Outer Kenai, Alaska (24-28 June 2002). Contract Report by Coastal and Ocean Resources Inc. of Sidney, British Columbia to the Exxon Valdez Oil Spill Trustee Council, Anchorage, Alaska.

Howes, D. E., 2001. BC Biophysical shore-zone mapping system – a systematic approach to characterize coastal habitats in the Pacific Northwest. Proceedings of the 2001 Puget Sound Research Conference, Seattle, Washington: 11p.

Howes, D.E., J.R. Harper and E.H. Owens 1994. Physical shore-zone mapping system for British Columbia. Technical Report by Coastal & Ocean Resources Inc, Sidney, BC for the Coastal Task Force of the Resource Inventory Committee (RIC), RIC Secretariat. Victoria, B.C. 71p.

Morris, M., J.R. Harper, P.D. Reimer, H.R. Frith and D.E. Howes 1995. Coastal biotic mapping system using aerial video imagery. In: Proceedings of the Third Thematic Conference on Remote Sensing for Marine and Coastal Environments. Seattle, WA. p.200-210.

Peterson, J., J. Michel, S. Zengel, M. White, C. Lord and C. Plank. 2002. Environmental Sensitivity Index Guidelines, Version 3. NOAA Technical Memorandum NOS OR&R11, 192 pp.

Appendix A

Meta Data

Reg3ar12v1: Eastern Outer Kenai Shore Zone Map version 1, 1:63,360

Metadata also available as

Frequently-anticipated questions:

What does this data set describe?

Title:

Reg3ar12v1: Eastern Outer Kenai Shore Zone Map version 1, 1:63,360

Abstract:

This data consists of three main components: A line coverage, a point coverage and a master database. The line coverage is known as the Shore Unit. It segments the shoreline into distinct units that characterize shore morphology, shore-zone substrate, wave exposure and shore-zone biota. It is linked to the master database. The point coverage is a type of Shore Unit, but typically includes features that are too small to be captured in line unit. Examples of these point features are stream sources, boat ramps, jetties. The master database consists of geological and biological information both about the alongshore and cross-shore characteristics of each Shore Unit. The vector dataset utilizes the Alaska Department of Natural Resources' 1:63,360 coastline circa. January 1998, including islands. It has been clipped to the area bounded by Kenai Fiords National Park's western boundary and Pt. Waters/Bainbridge Passage in Port Bainbridge, just west of Prince William Sound. This vector dataset has been segmented in a shorezone mapping process that utilizes oblique aerial video imagery to identify distinct units. Segmentation has been achieved through the use of a split poly-line script written in Avenue for ArcView version 3.2 . Minor changes to the shoreline have been identified in the spatial database, based upon air photo interpretation of the high-water shoreline.

1. **How should this data set be cited?**

   Coastal and Ocean Resources Inc, Exxon Valdez Oil Spill Trustee Counci, 20030226, Reg3ar12v1: Eastern Outer Kenai Shore Zone Map version 1, 1:63,360.

2. **What geographic area does the data set cover?**

   West_Bounding_Coordinate: -150.7977

   East_Bounding_Coordinate: -148.2581

   North_Bounding_Coordinate: 60.2239

   South_Bounding_Coordinate: 59.4291

3. **What does it look like?**
4. **Does the data set describe conditions during a particular time period?**

   Calendar_Date: 2003

   Currentness_Reference: Publication Date

5. **What is the general form of this data set?**

   Geospatial_Data_Presentation_Form: Vector Digital Data

6. **How does the data set represent geographic features?**
   a. **How are geographic features stored in the data set?**
      This is a Vector data set. It contains the following vector data types (SDTS terminology):
      - Point (259)
      - GT-polygon composed of chains (2885)

   b. **What coordinate system is used to represent geographic features?**
      The map projection used is Albers Conical Equal Area.

Projection parameters:

Standard_Parallel: 55

Standard_Parallel: 65

Longitude_of_Central_Meridian: -154

Latitude_of_Projection_Origin: 50

False_Easting: 0.00000

False_Northing: 0.00000

Planar coordinates are encoded using coordinate pair
Abscissae (x-coordinates) are specified to the nearest 1.0
Ordinates (y-coordinates) are specified to the nearest 1.0
Planar coordinates are specified in METERS
The horizontal datum used is North American Datum of 1927.
The ellipsoid used is Clarke 1866.
The semi-major axis of the ellipsoid used is 6378206.4.
The flattening of the ellipsoid used is 1/294.98.

7. **How does the data set describe geographic features?**

`Reg3ar12v1.dbf`

Arview 3.2 database format attribute file (Source: From the map)

`Reg3ar12pointv1.dbf`

Arview 3.2 database format attribute file (Source: From the map)

`PHY_IDENT`

This field is the primary key for linking the physical shorezone data to the master attribute database for this shorezone project. (Source: from the map)

Value	Definition
form 00/00/0000/0	see above

`Shore_mod`

This field defines alterations to the coast63 map. A value of one indicates modification or addition of the line segment to the original coast63 high-water shoreline. (Source: from the map)

Value	Definition
0 or 1	Modified = 1 Original coast63 = 0

`Length`

Length of shore unit in meters. (Source: from the map)

Value	Definition
from the map	see above

Who produced the data set?

1. **Who are the originators of the data set?** (may include formal authors, digital compilers, and editors)
    - Coastal and Ocean Resources Inc.,
2. **Who also contributed to the data set?**

    EVOS Trustee Council, Coastal and Ocean Resources Inc; Sidney BC, Alaska Department of Natural Resource; Land Records Information Section, Alaska National Parks Service, US Geologic Survey US Forest Service; Chugach, US Forest Service; Tongass

3. **To whom should users address questions about the data?**

    John R. Harper
    Coastal and Ocean Resources Inc.
    214-9865 W. Saanich Rd.
    Sidney, British Columbia V8L 5Y8
    Canada

    250/655-4035 (voice)
    250/655-1290 (FAX)
    john@coastalandoceans.com

    Hours_of_Service: 900-1700 PST

Why was the data set created?

The shore-zone resource data is useful for identifying and mapping sensitive resource distributions such as eelgrass or marsh, for mapping the distribution of intertidal habitats, for identifying rare habitats or features and for providing information for sensitivity models such as an oil spill sensitivity model.

How was the data set created?

1. **From what previous works were the data drawn?**

    none (source 1 of 7)

    Alaska Department of Natural Re, Land Records Information Section, 1990, ITM hydrography: ITM hydrography data hydro, ADNR, LRIS, Anchorage, AK.

    Type_of_Source_Media: online

Source_Scale_Denominator: 63360

Source_Contribution:

Source used USGS 1:63,360 topographic maps ranging in date from 1950's to 1990's. These were photo revised by BLM. Only hydrography meeting the needs of the State Status Plats were automated. Arc features were coded with source and water type. US Forest Service, Tongass hydrography data was integrated into datbase to fit DNR's model.

none (source 2 of 7)

USGS, 1950-1990, ITM hydrography: DLG hydrography, USGS, Reston, Virginia.

Type_of_Source_Media: web

Source_Scale_Denominator: 63360

Source_Contribution:

Selected coastline information where needed and where available.

none (source 3 of 7)

USFS, Chugach, 1996, Chugach National Forest coastline: USFS, Anchorage, AK.

Type_of_Source_Media: magnetic tape

Source_Scale_Denominator: 63360

Source_Contribution:

Chugach National Forest has had significant changes in their shoreline, particularly near Columbia Glacier and Copper River Delta. They have generated a new coastline to reflect these changes. This information was selected and added as the best source for Prince William Sound.

none (source 4 of 7)

and, EVOS Habitat/Restoration ADNR, 1996, EVOS Research and Restoration CD-ROM: State Coastline coaststst, ADNR, Anchorage, AK.

Type_of_Source_Media: CD-ROM

Source_Scale_Denominator: 63360

Source_Contribution: Was used to fill in missing areas of data.

none (source 5 of 7)

and, EVOS Habitat/Restoration ADNR, 1996, EVOS Research and

Restoration CD-ROM: State Coastline coaststt, ADNR, Anchorage, AK.

Type_of_Source_Media: on line

Source_Contribution: most up to date sources of coastline

none (source 6 of 7)

and, EVOS Habitat/Restoration ADNR, 1996, EVOS Research and Restoration CD-ROM: State Coastline coaststt, ADNR, Anchorage, AK.

Type_of_Source_Media: CD-ROM

Source_Scale_Denominator: 63360

Source_Contribution: Was used to fill in missing areas of data.

none (source 7 of 7)

ADNR, EVOS and , 20030224, Outer Kenai Shore Zone Mapping: Alaska Shore Zone Mapping AKSHZN, EVOS, Anchorage, Alaska.

Online Links:

Other_Citation_Details:

Type_of_Source_Media: to be announced

Source_Scale_Denominator: 63360

Source_Contribution:

OuterKenai Shorezone Mapping clipped the AKDNR 1:63 360 shoreline maps in an area bounded by the western extremity of Kenai Fiords National Park and in the east, by Pt. Waters by Port Bainbridge passage. Minor shoreline fixes were performed using DOQ orthophotos in combination with oblique aerial video imagery.

2. **How were the data generated, processed, and modified?**

Date: 01-Jan-1998 (process 1 of 2)

From the DNR, LRIS hydrogrpahy, the arcs were selected where water-type = 'S' for shoreline or 'N' for null (closing mouth of streams). This information was used first as it had the most logical coding for arc attributes. The USGS information was downloaded from the web where holes existed. EVOS was used to fill in also. USFS, Chugach was used to completely replace the Prince William Sound area. The statewide 1:250000 alaska coastline was used to fill in where no other data was available. Attributes are structured the same as the ADNR, LRIS hydrography and were added. The attributes were not qc'ed and has errors.

Date: 24-Feb-2003 (process 2 of 2)

The vector dataset utilizes the Alaska Department of Natural Resources' 1:63,360 coastline circa. January 1998, including islands. It has been clipped to the area bounded by Kenai Fiords National Park's western boundary (Petroff Point) and in the east by Pt. Waters/Bainbridge Passage in Port Bainbridge, just west of Prince William Sound. This vector dataset has been segmented in a shorezone mapping process that utilizes oblique aerial video imagery to identify distinct shoreline units. Segmentation has been achieved through the use of a split-poly line tool constructed in ArcView's Avenue programming language. Minor changes to the shoreline have been identified in the spatial database, based upon air photo interpretation of the high-water shoreline in combination with oblique aerial video imagery.

Person who carried out this activity:

Neil Borecky
Coastal and Ocean Resources Inc
214-9856 W. Saanich Rd
Sidney, British Columbia V8L 5Y8
Canada

(250) 384 9963 (voice)
john@coastalandoceans.com

3. **What similar or related data should the user be aware of?**

How reliable are the data; what problems remain in the data set?

1. **How well have the observations been checked?**

   Since a mix of sources were used, this was not always calculated. Minor QC was done to check accuracy of original coast63 shoreline. Some shoreline inconsistencies were corrected using a mix of oblique aerial video, DOQ and 1:12,000 digital orthophotos. Will be corrected as problems arrise or more time is allowed. Attribute information was QA/QC'd by previous biological and geological mapper.

2. **How accurate are the geographic locations?**

   Information was cleanup on the screen. Polygons were closed, dangles deleted, and information edgematched.

3. **How accurate are the heights or depths?**

4. **Where are the gaps in the data? What is missing?**

   DNR, LRIS - reselected the hydrography features coded WATER_TYPE = 'S' or 'N' Did some clean up. EVOS - selected and added as need to fill in. USGS - downloaded ITM quads, where needed to fill in. Selected coastline arcs and closing arcs. USFS, Chugach - selected Prince William Sound coastline and filled in. USFS, Tongass - was included into

DNR, LRIS hydrography database.

There are attribute errors.

Coastal and Ocean Resources Inc. made minor shoreline corrections to shoreline as noted. Physical attributes carry the same caveats as the coast63 data.

5. **How consistent are the relationships among the observations, including topology?**

   chain-node topology present.

How can someone get a copy of the data set?

Are there legal restrictions on access or use of the data?

Access_Constraints:

To ensure distribution of the most current public information, please refer requests for data or products to the Exxon Valdez Oil Spill Trustee Council.

Use_Constraints:

It is not recommended the data be used at a scale larger than 1:63,360. Not to be used for navigation.

Any hardcopies or published datasets utilizing these data sets shall clearly indicate their source. If the user has modified the data in anyway they are obligated to describe the types of modifications they have performed.

1. **Who distributes the data set?** (Distributor 1 of 1)

   Hours_of_Service:

   Contact_Instructions:

2. **What's the catalog number I need to order this data set?**

3. **What legal disclaimers am I supposed to read?**

   The State of Alaska, EVOS, or associated contractors make no express or implied warranties (including warranties of merchantability and fitness) with respect to the character, function, or capabilities of the electronic services or products or their appropriateness for any users purposes. In no event will the State of Alaska, EVOS, or associated contractors be liable for any incidental, indirect, special, consequential or other damages suffered by the user or any other person or entity whether from the use of the electronic services or products, any failure thereof or otherwise, and in no event will the State of Alaska, EVOS or associated contractors' liability

to the requestor or anyone else exceed the fee paid for the electronic service or product.

4. **How can I download or order the data?**

   - **Availability in digital form:**

   Data format:
   Media you can order: CD-ROM (format CD)

   - **Cost to order the data:**

Who wrote the metadata?

Dates:

Last modified: 24-Feb-2003
Last Reviewed: 24-Feb-2003
To be reviewed: 24-Feb-2003

Metadata author:

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Hours_of_Service: 900-1700 PST

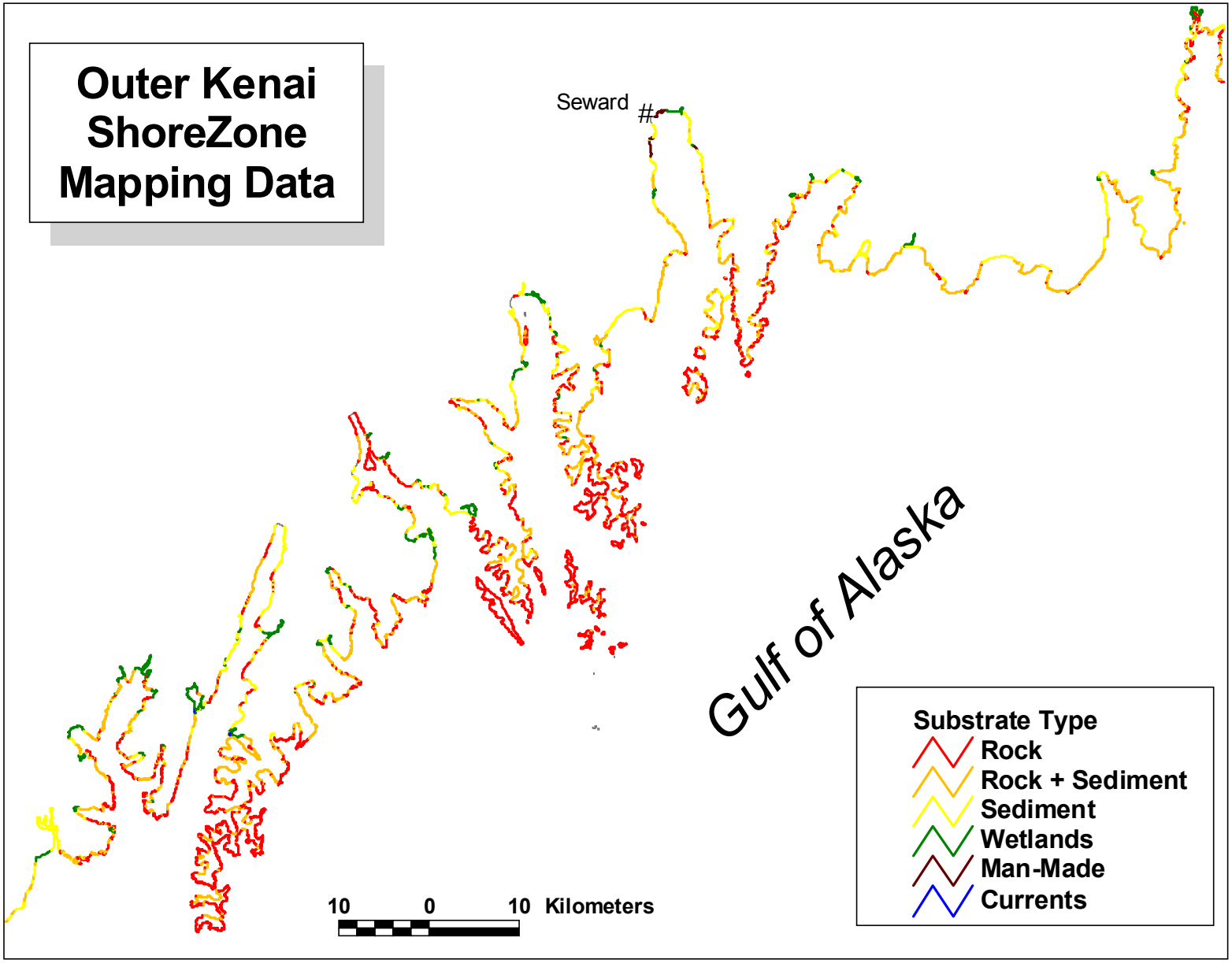
Metadata standard:

FGDC Content Standards for Digital Geospatial Metadata (FGDC-STD-001-1998)

Generated by mp version 2.7.34 on Thu Feb 27 11:51:28 2003

Appendix B

Selected Distribution Plots of Mapping Data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ShoreZone
Mapping Data
Seward
Gulf of Alaska
10 0 10 Kilometers
Substrate Type
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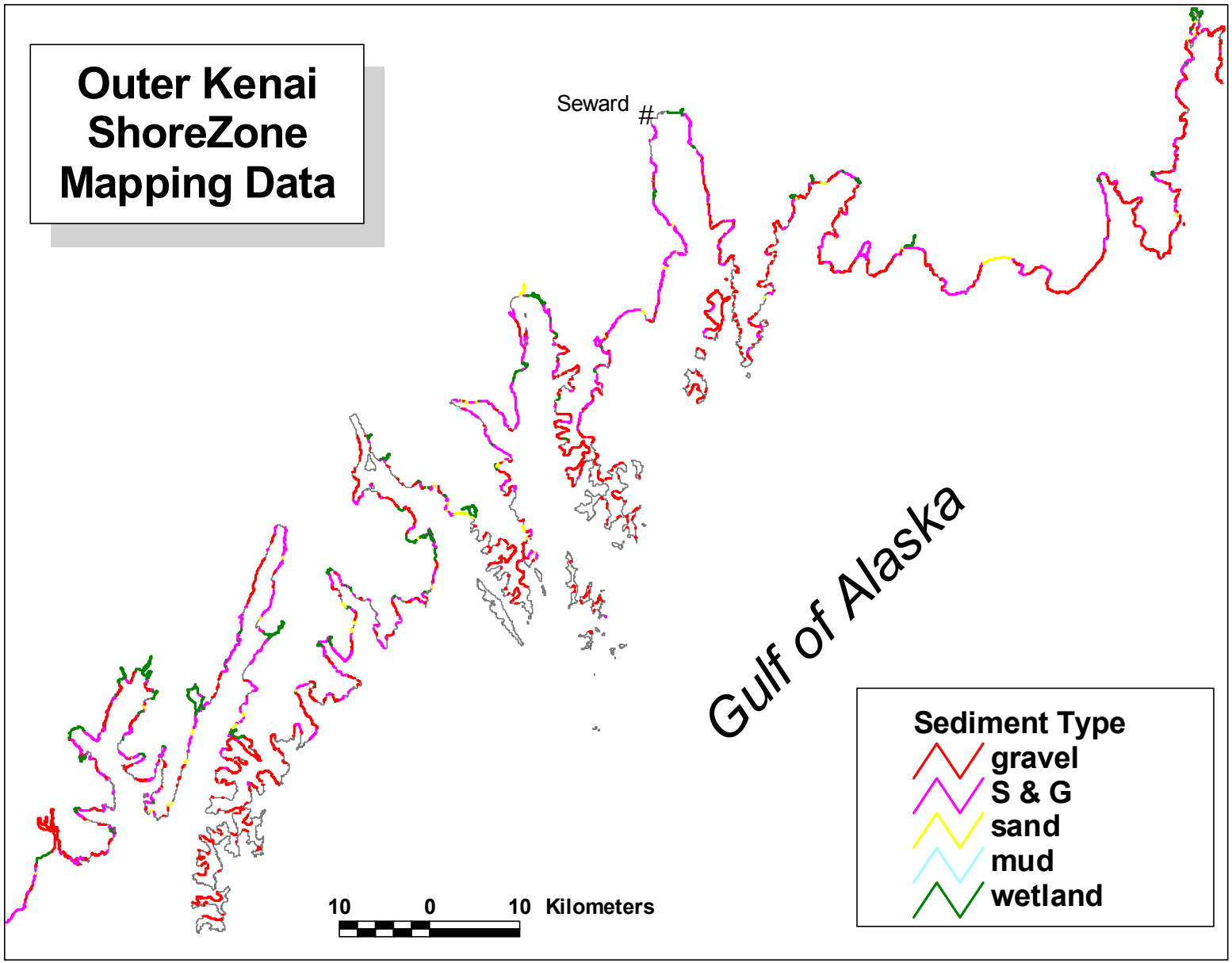
Rock + Sediment
Sediment
Wetlands
Man-Made
Currents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Seward
Gulf of Alaska
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S & G
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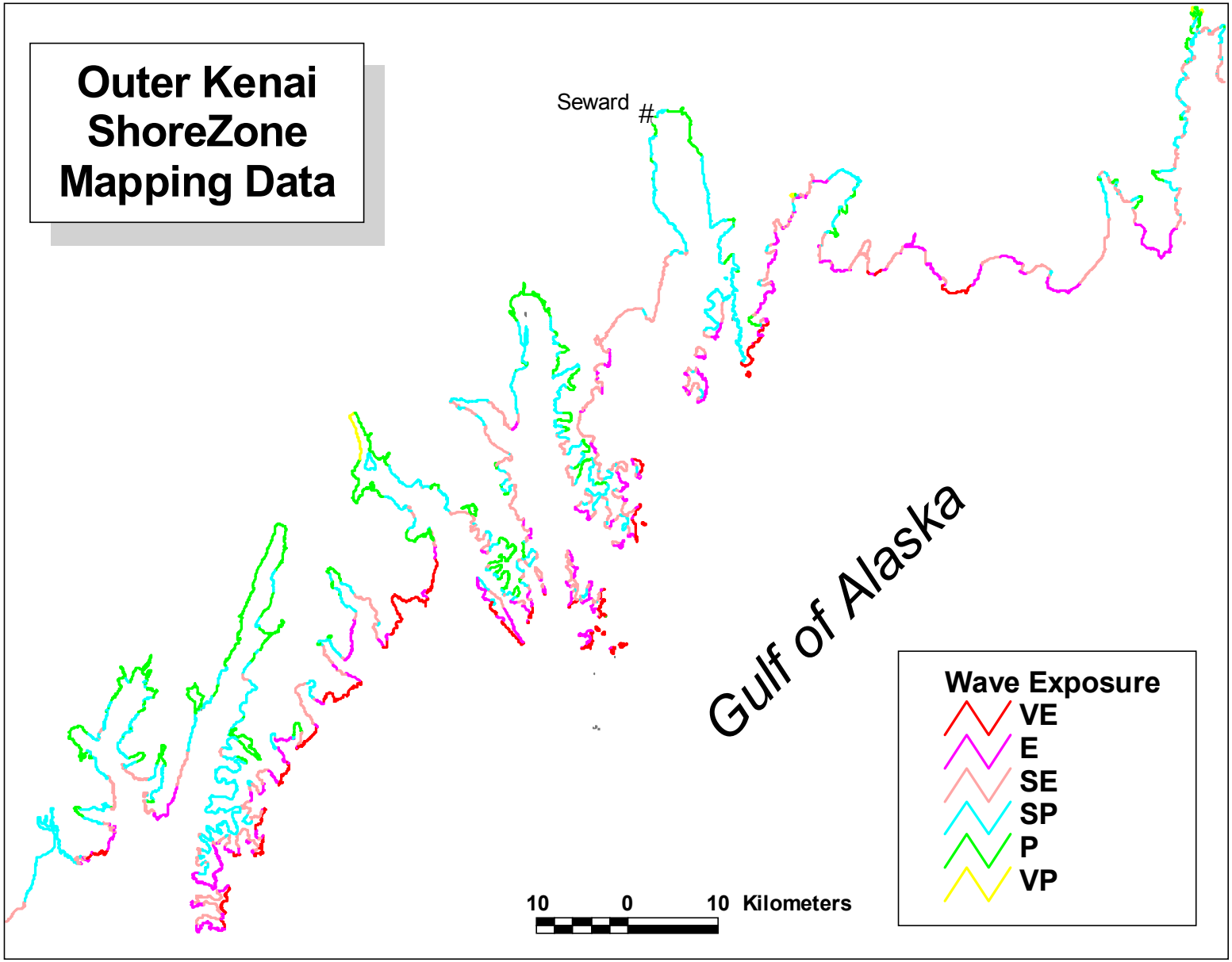
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Mapping Data
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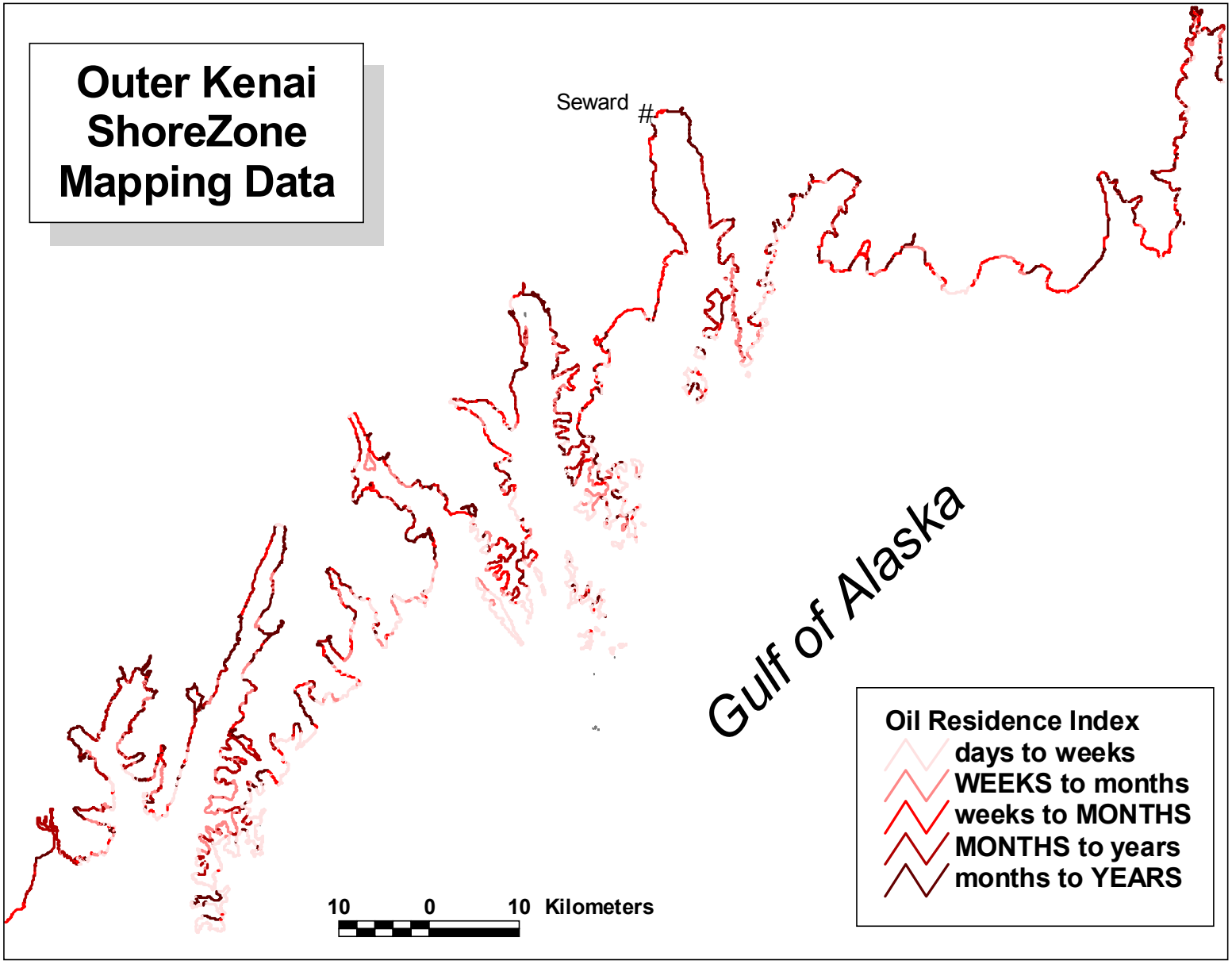
Gulf of Alaska
Wave Exposure
VE
E
SE
SP
P
VP
10 0 10 Kilometers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ShoreZone
Mapping Data
Seward
Gulf of Alaska
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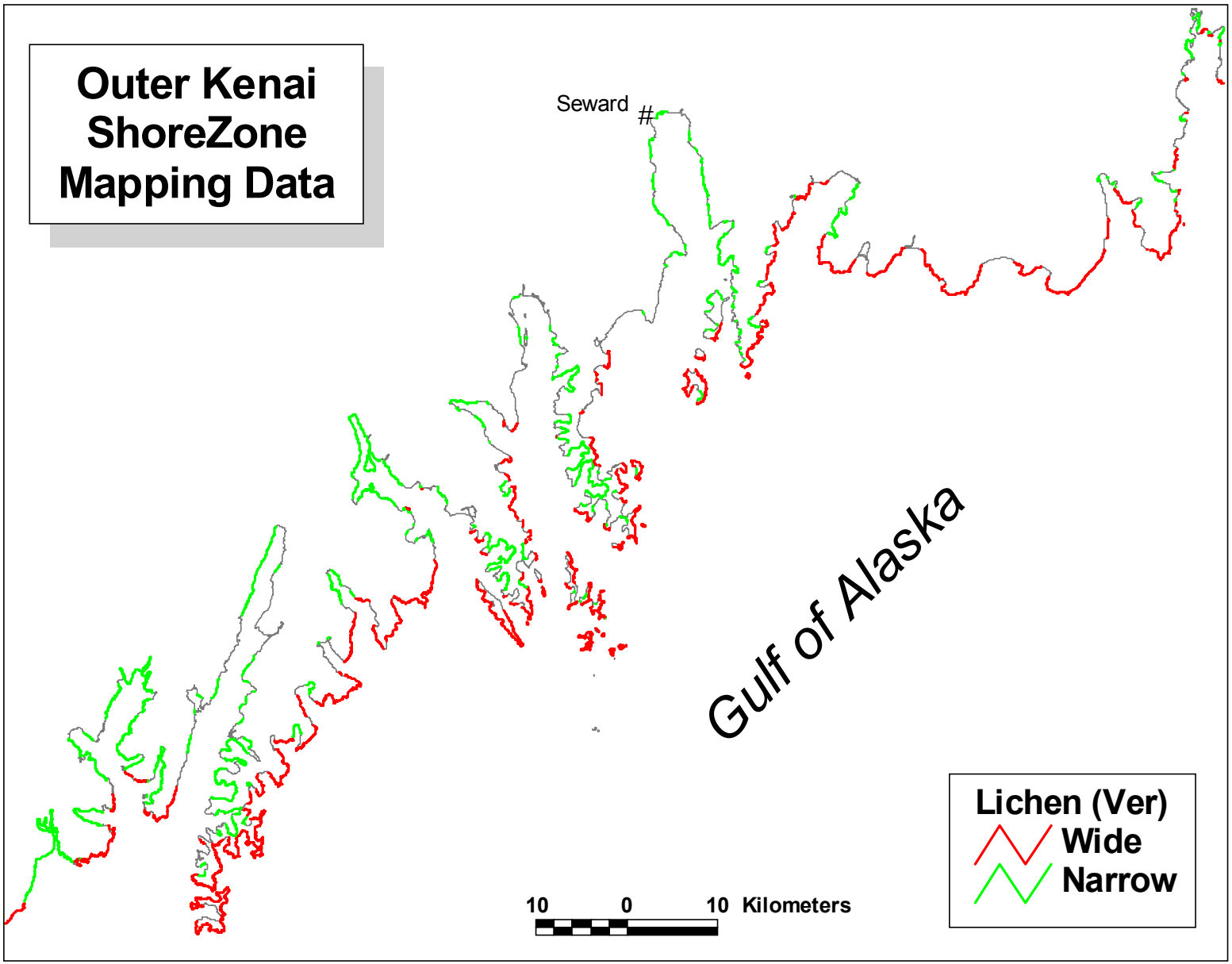
Oil Residence Index
days to weeks
WEEKS to months
weeks to MONTHS
MONTHS to years
months to YEARS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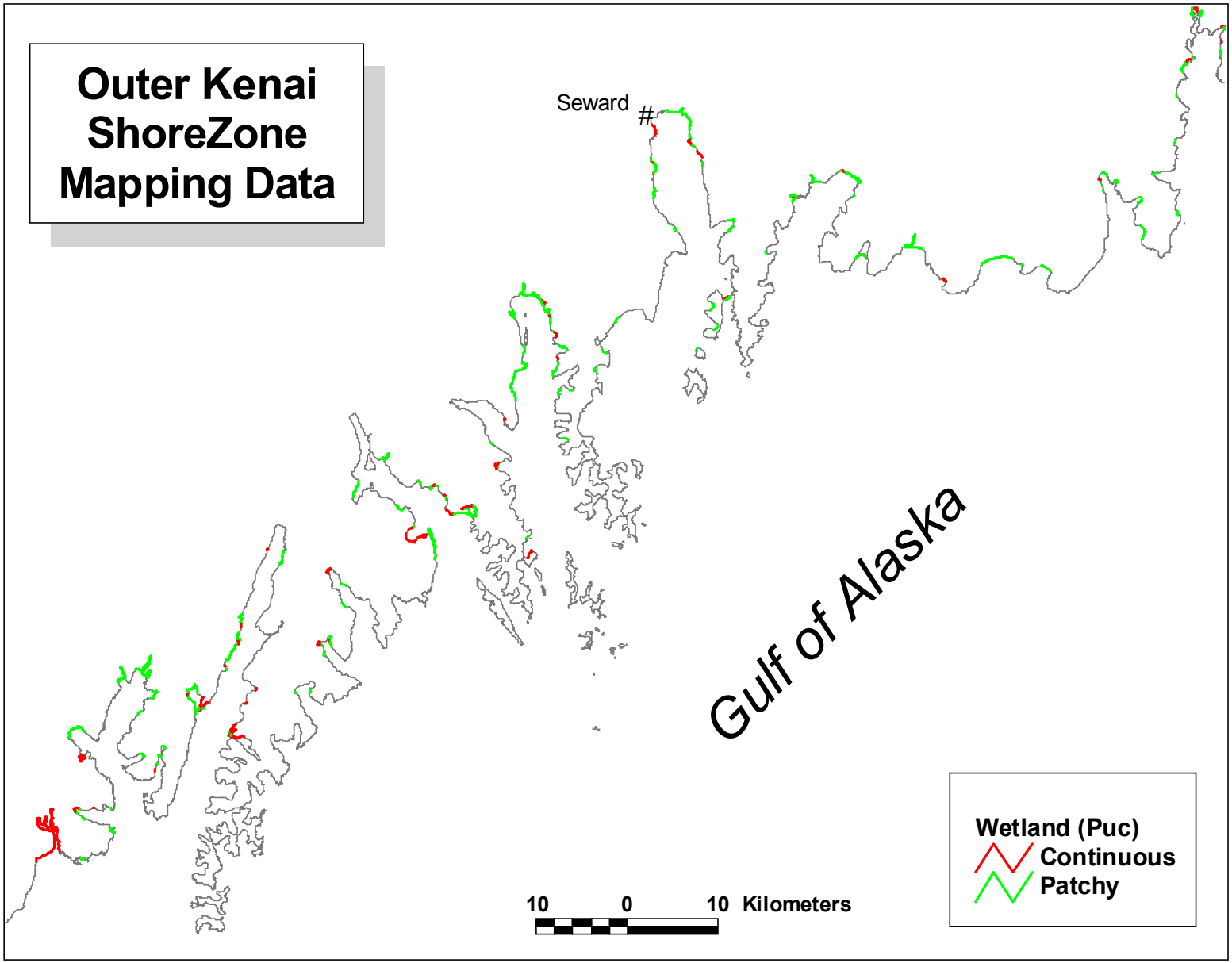
Narrow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ShoreZone
Mapping Data
Seward
Gulf of Alaska
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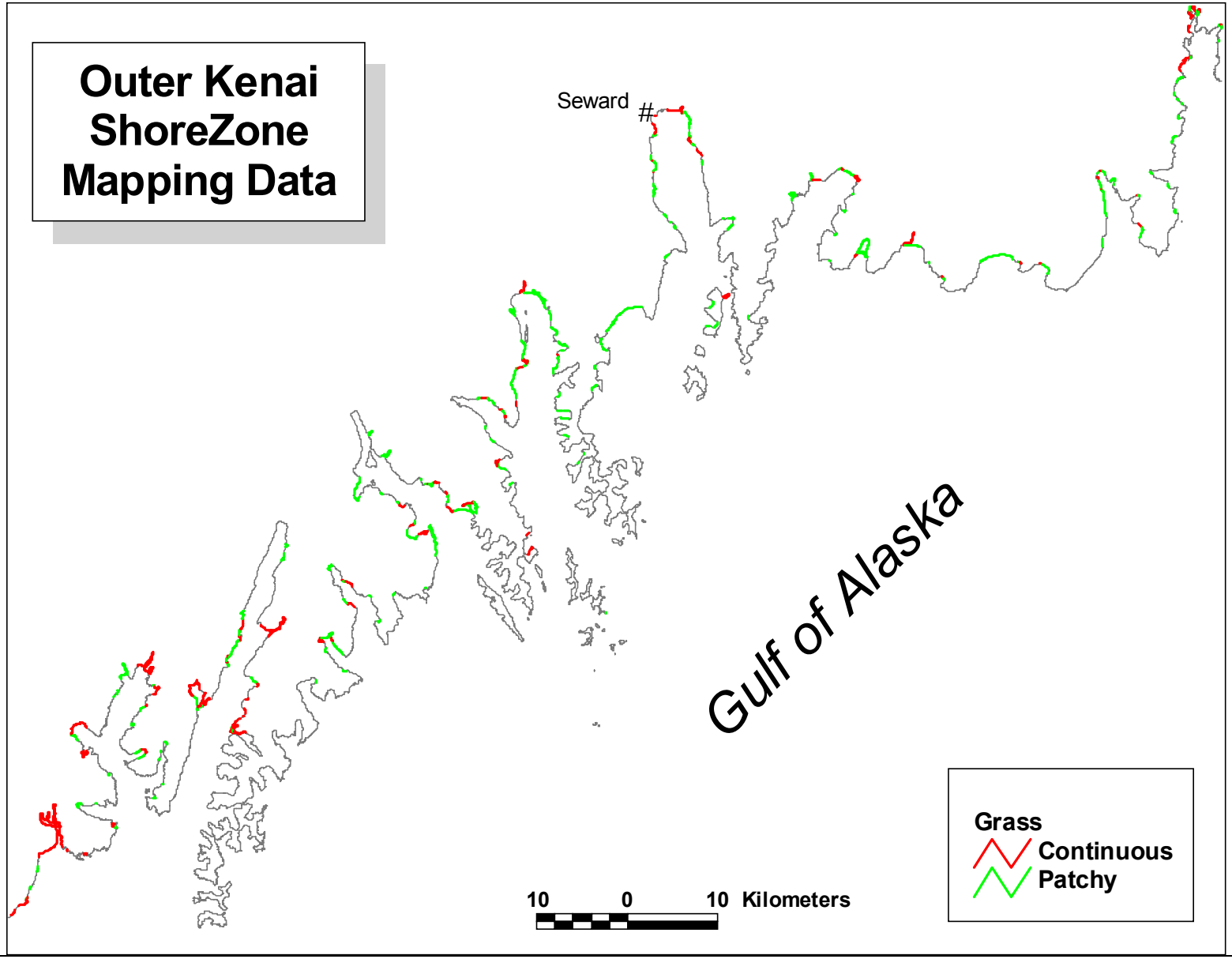
Continuous
Patchy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Gulf of Alaska
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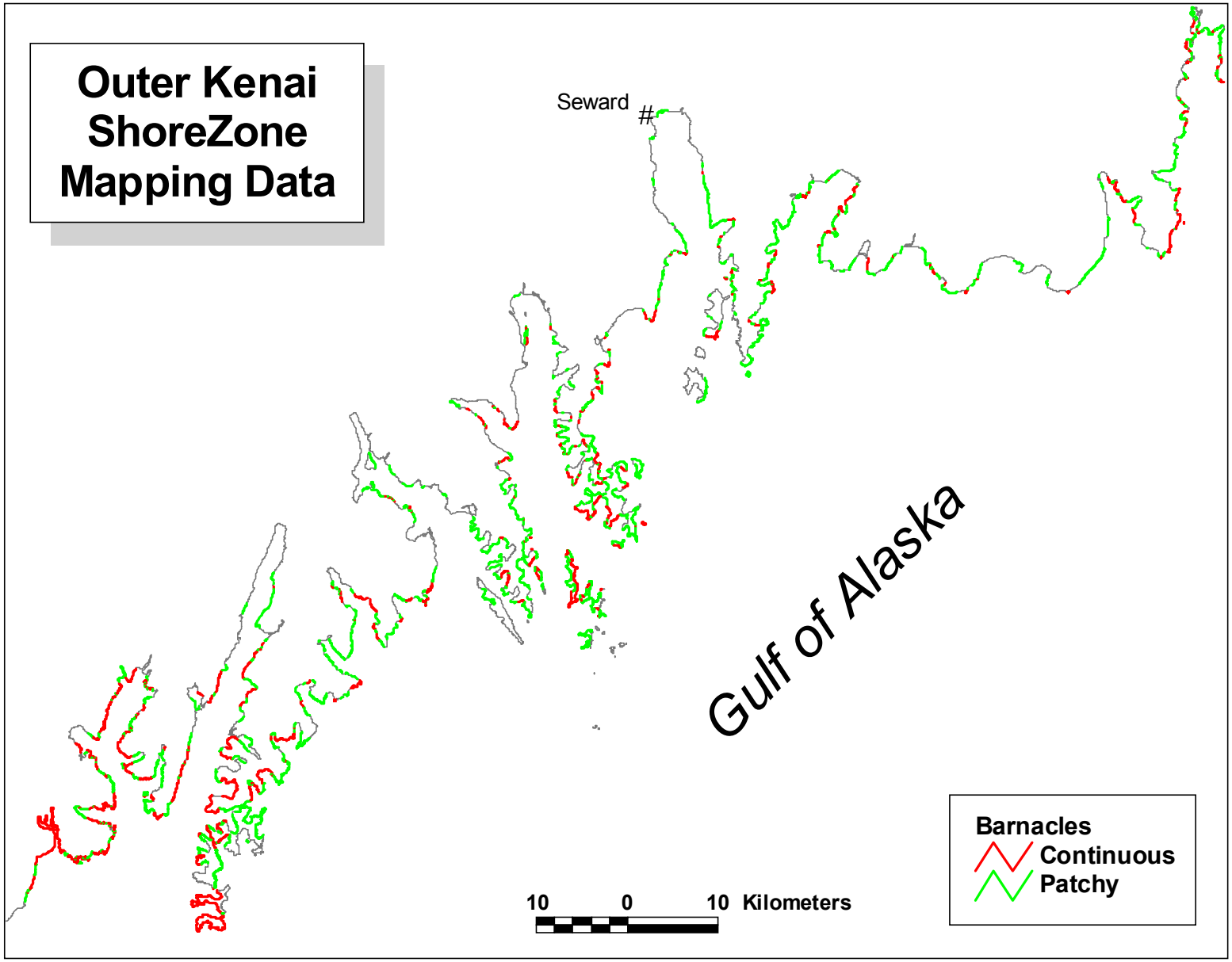
Continuous
Patchy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Mapping Data
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Gulf of Alaska
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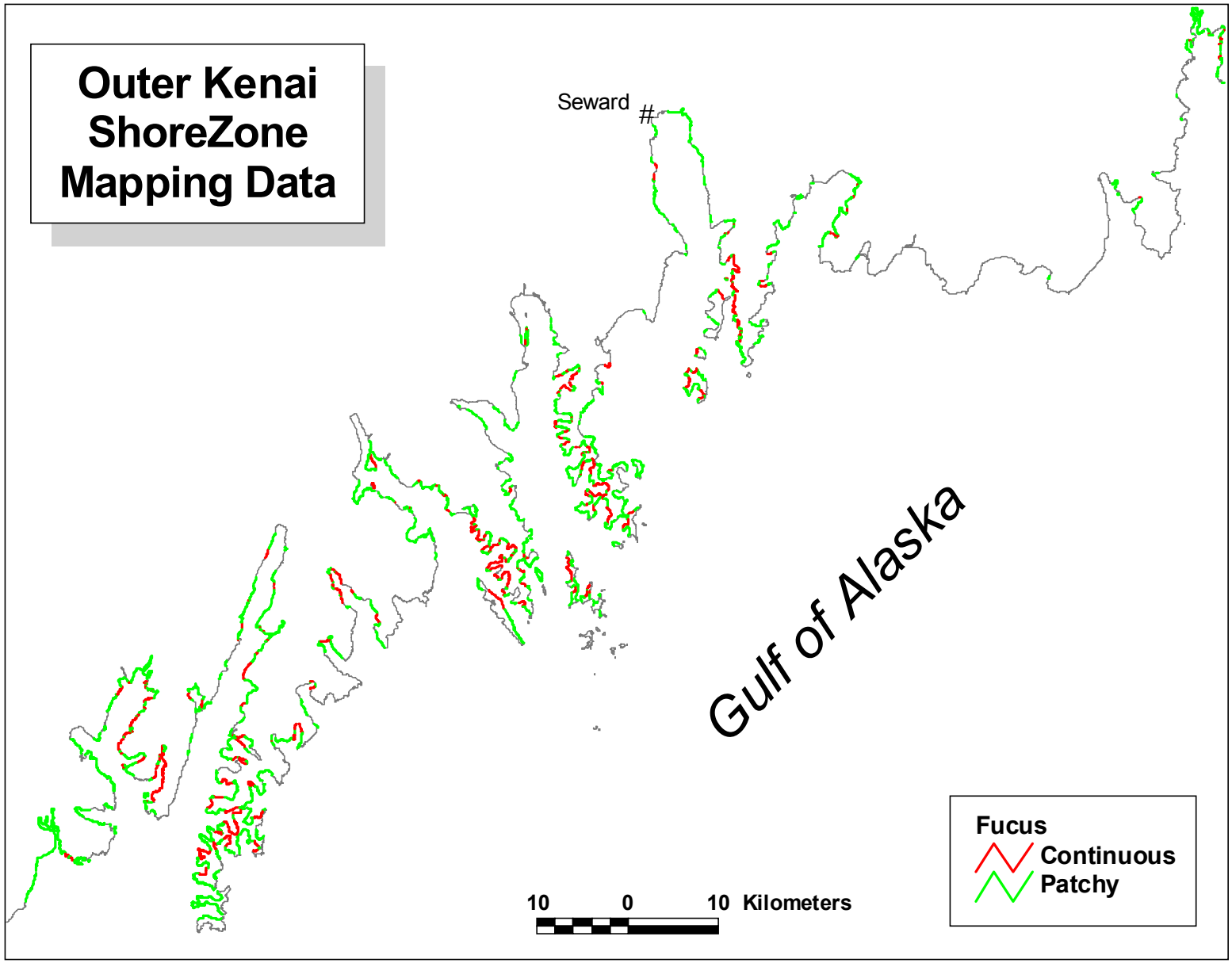
Barnacles
Continuous
Patchy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Mapping Data
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Gulf of Alaska
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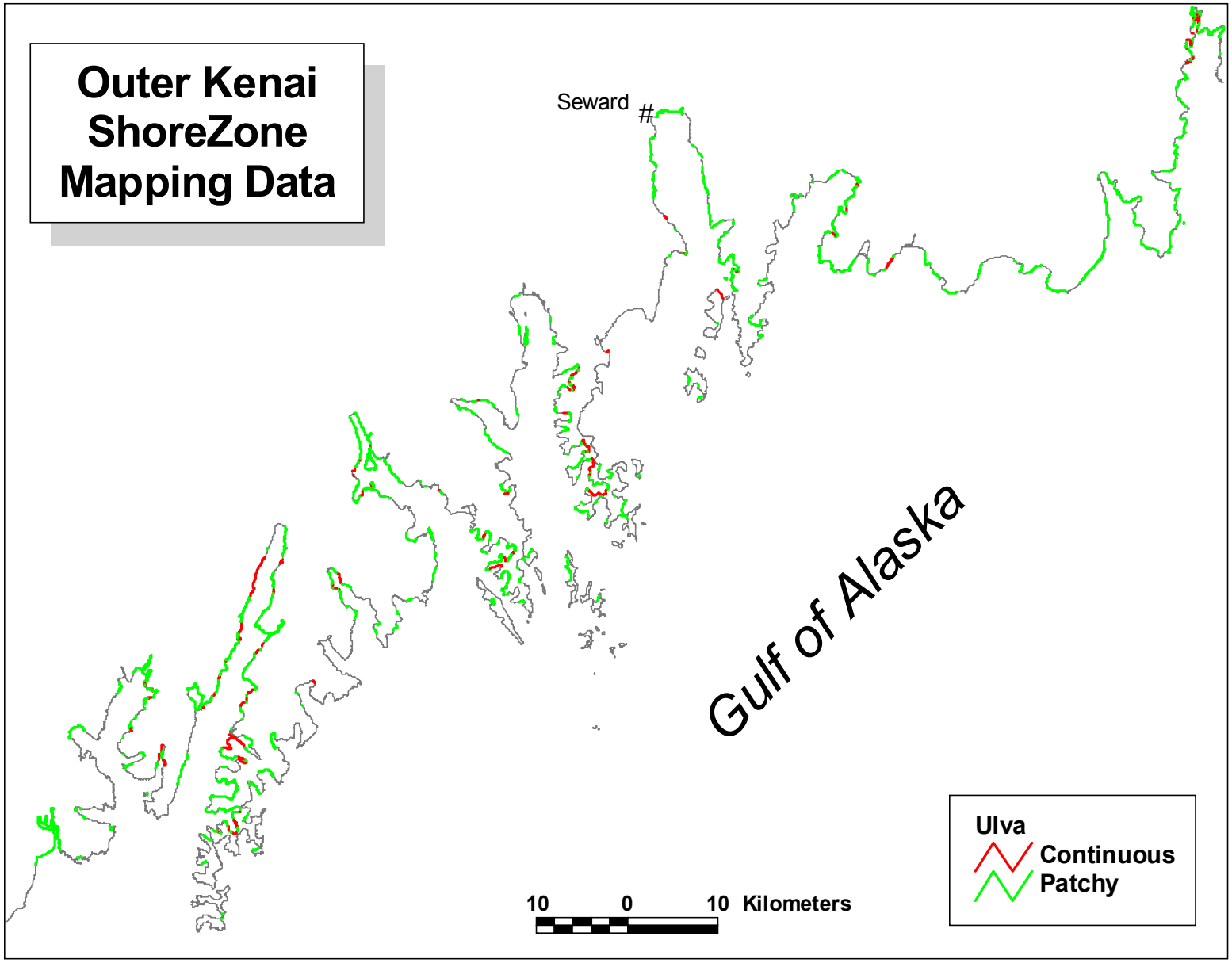
Continuous
Patchy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Mapping Data
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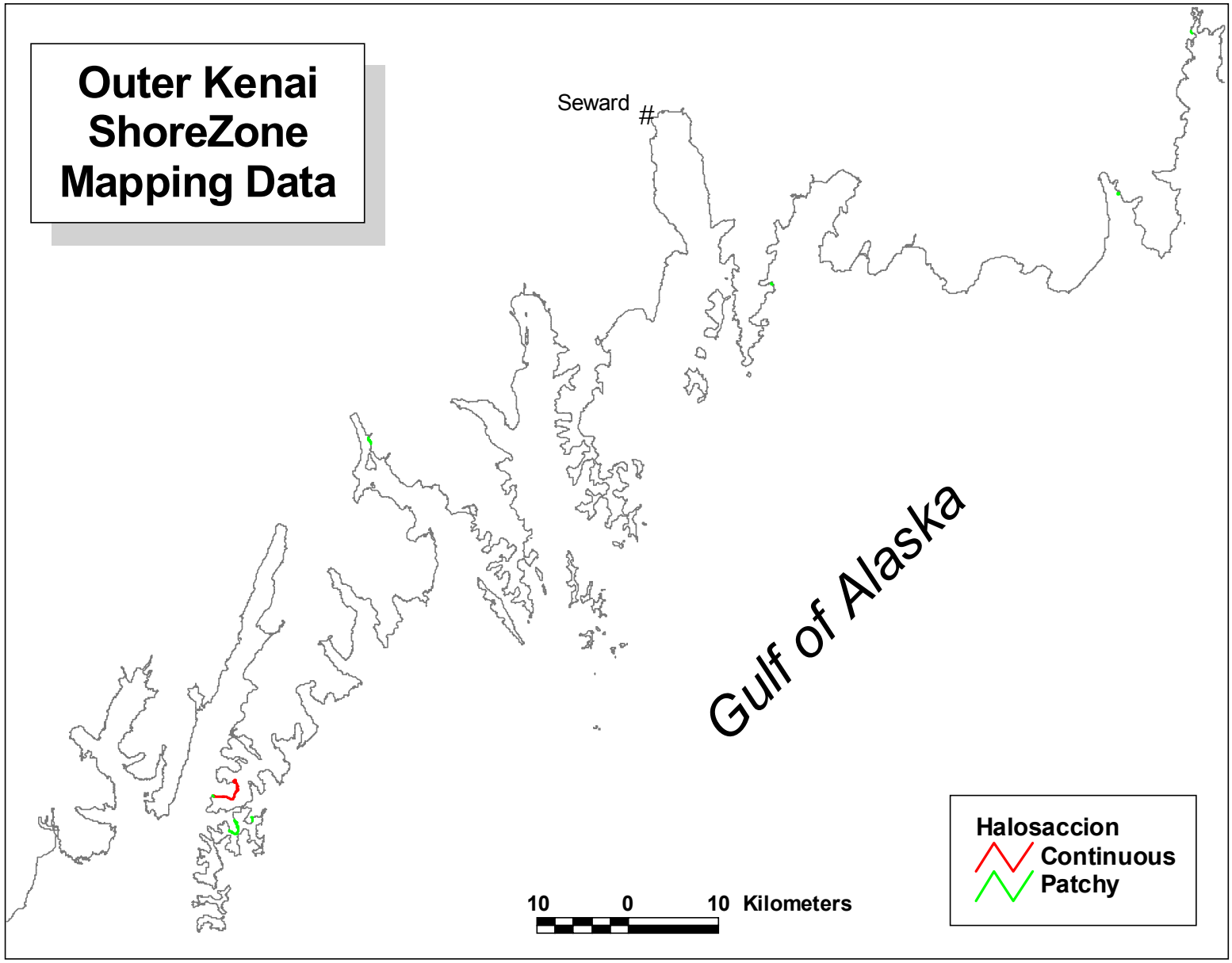
Ulva
Continuous
Patchy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ShoreZone
Mapping Data
Seward
Gulf of Alaska
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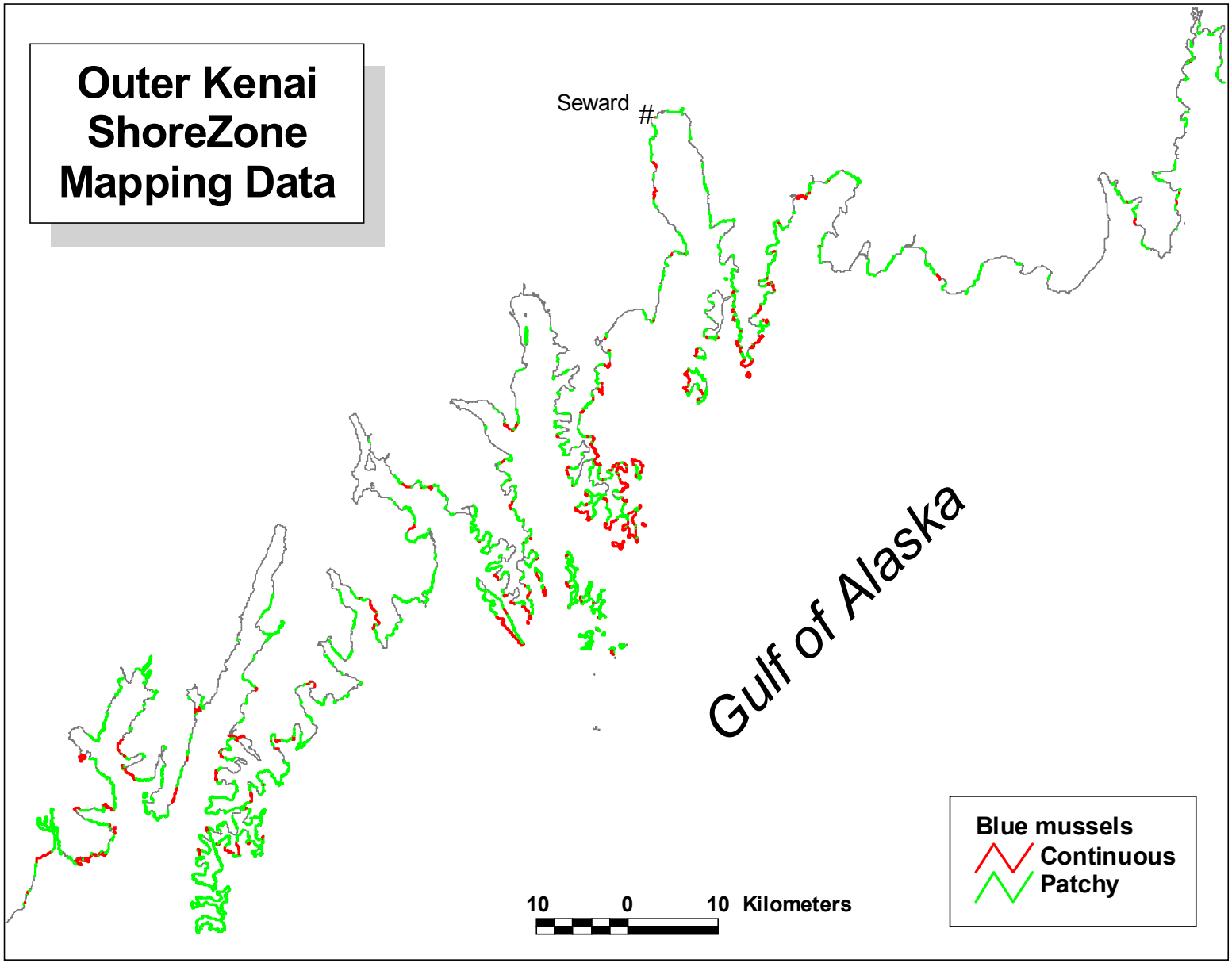
Halosaccion
Continuous
Patchy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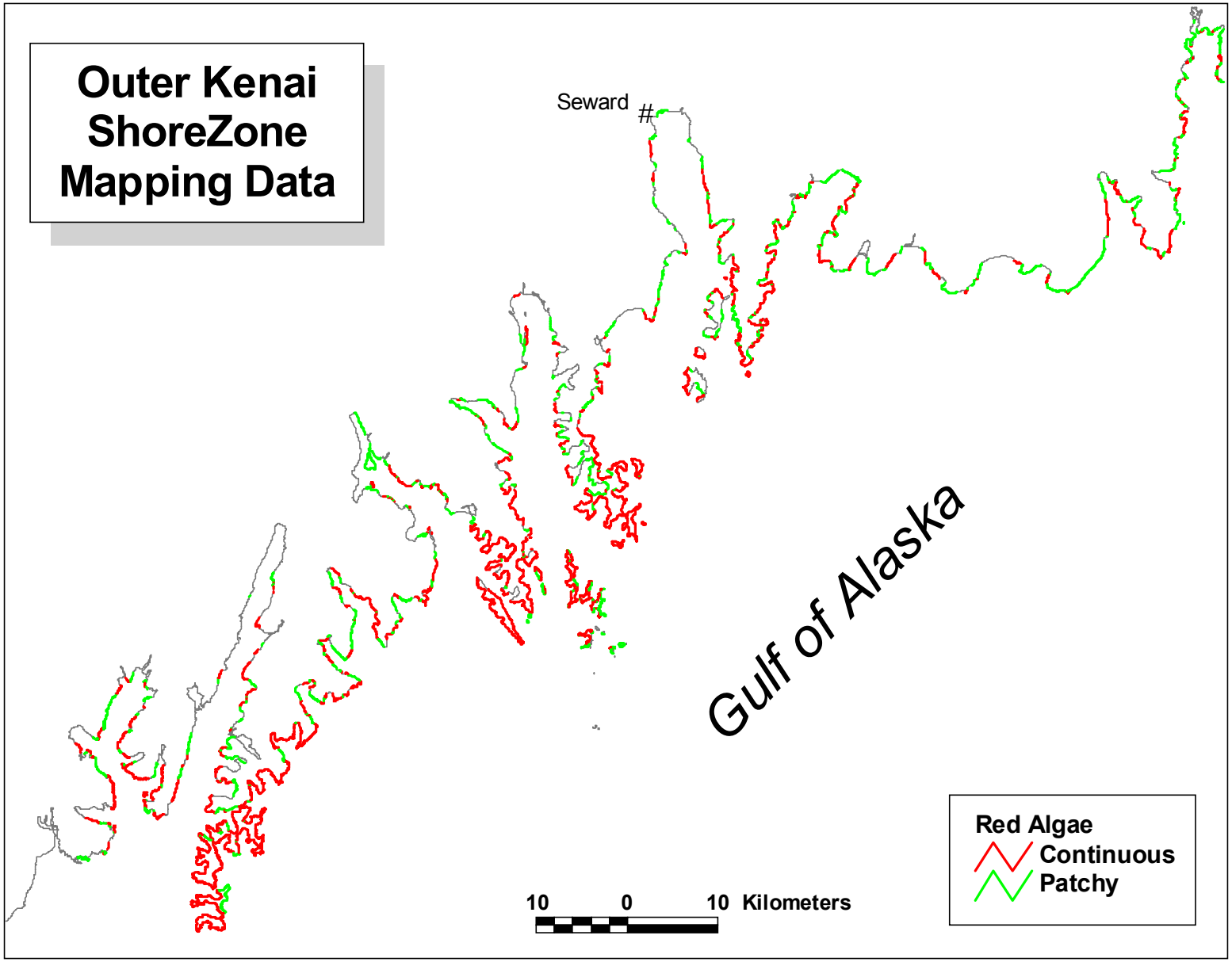
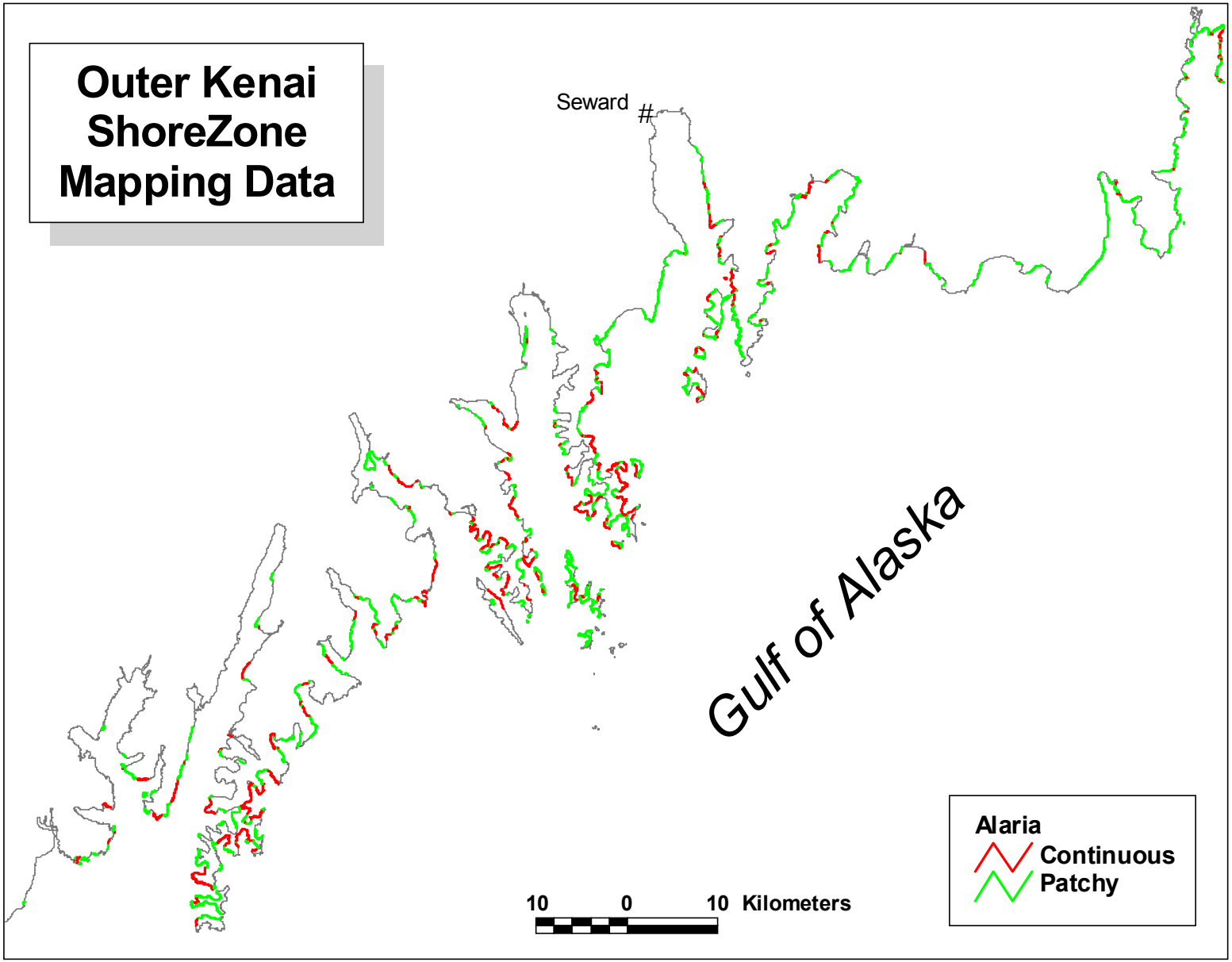
ShoreZone
Mapping Data
Seward
Gulf of Alaska
10 0 10 Kilometers
Blue mussels
Continuous
Patchy


Outer Kenai
ShoreZone
Mapping Data
Seward
Gulf of Alaska
10 0 10 Kilometers
Red Algae
Continuous
Patchy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ShoreZone
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Seward
Gulf of Alaska
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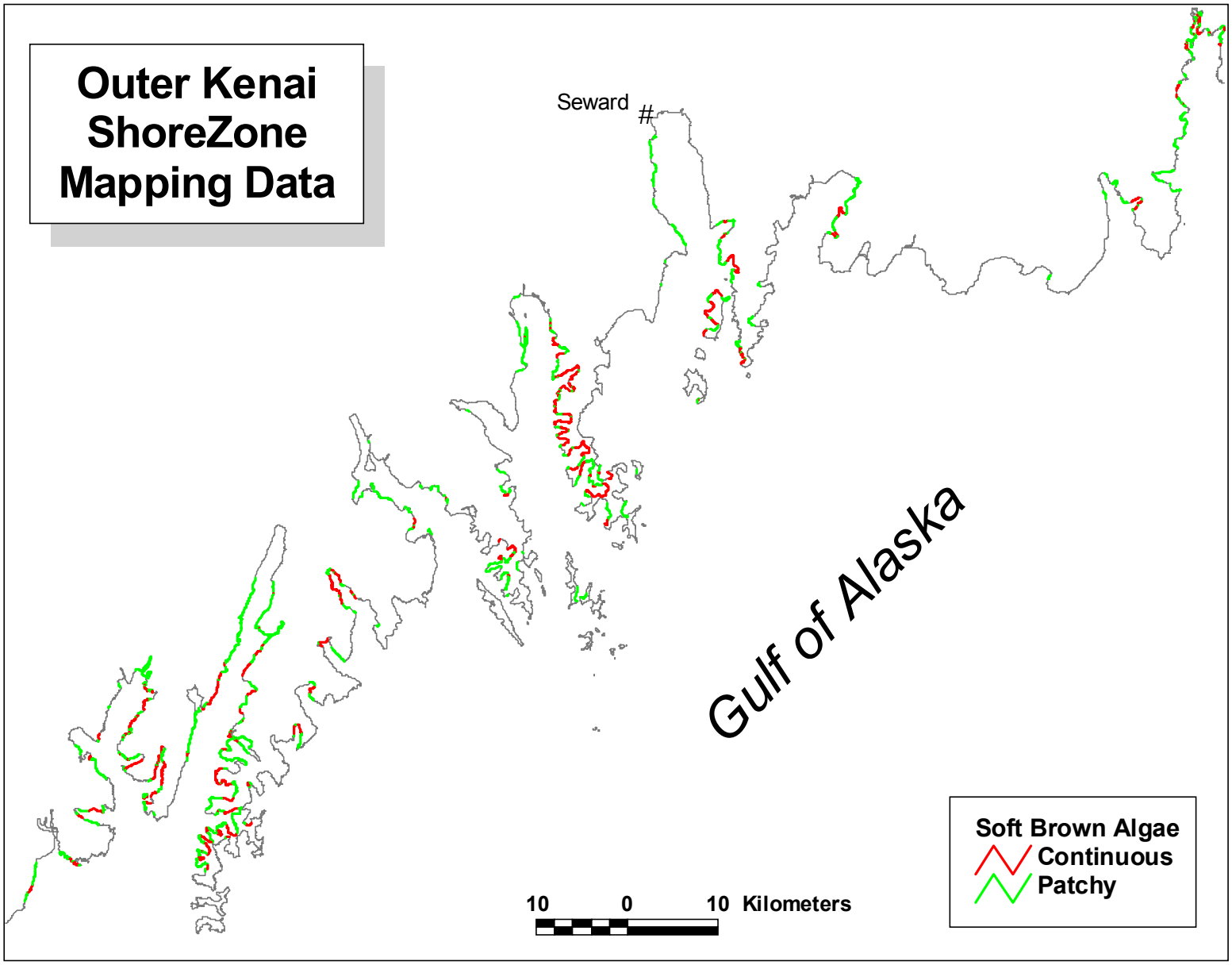
Alaria
Continuous
Patchy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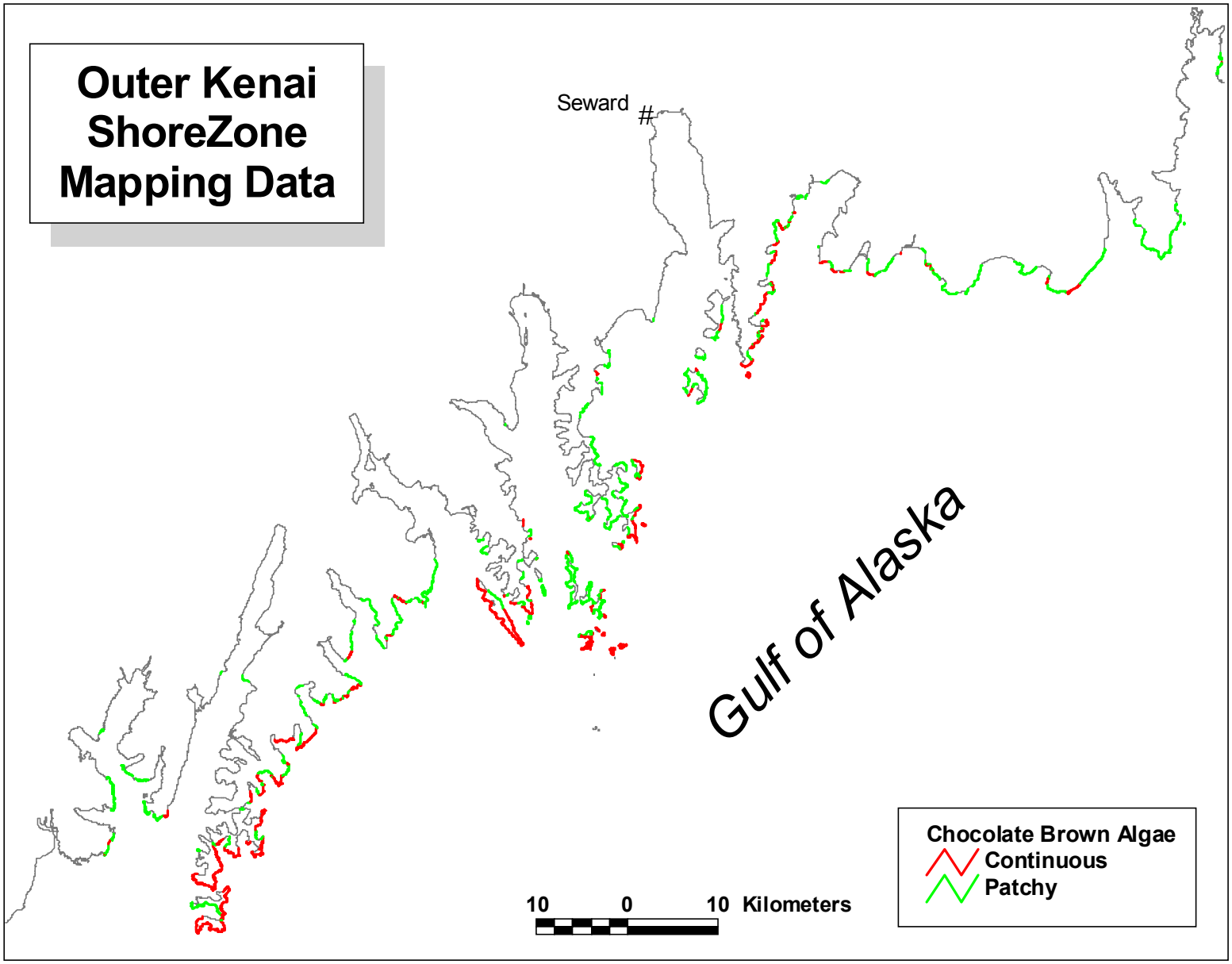
ShoreZone
Mapping Data
Seward
Gulf of Alaska
10 0 10 Kilometers
Soft Brown Algae
Continuous
Patchy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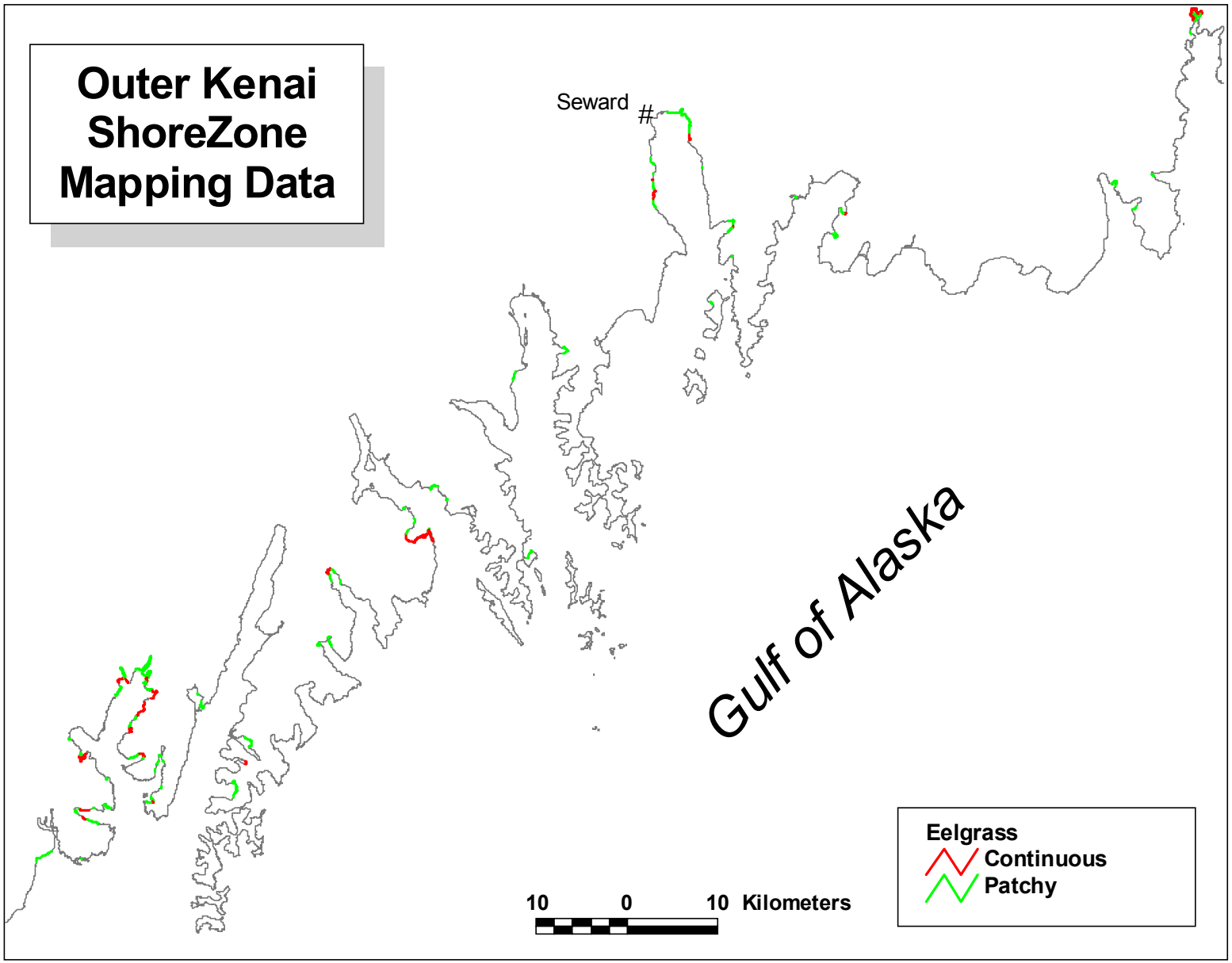
ShoreZone
Mapping Data
Seward
Gulf of Alaska
10 0 10 Kilometers
Chocolate Brown Algae
Continuous
Patchy


Outer Kenai ShoreZone Mapping Data
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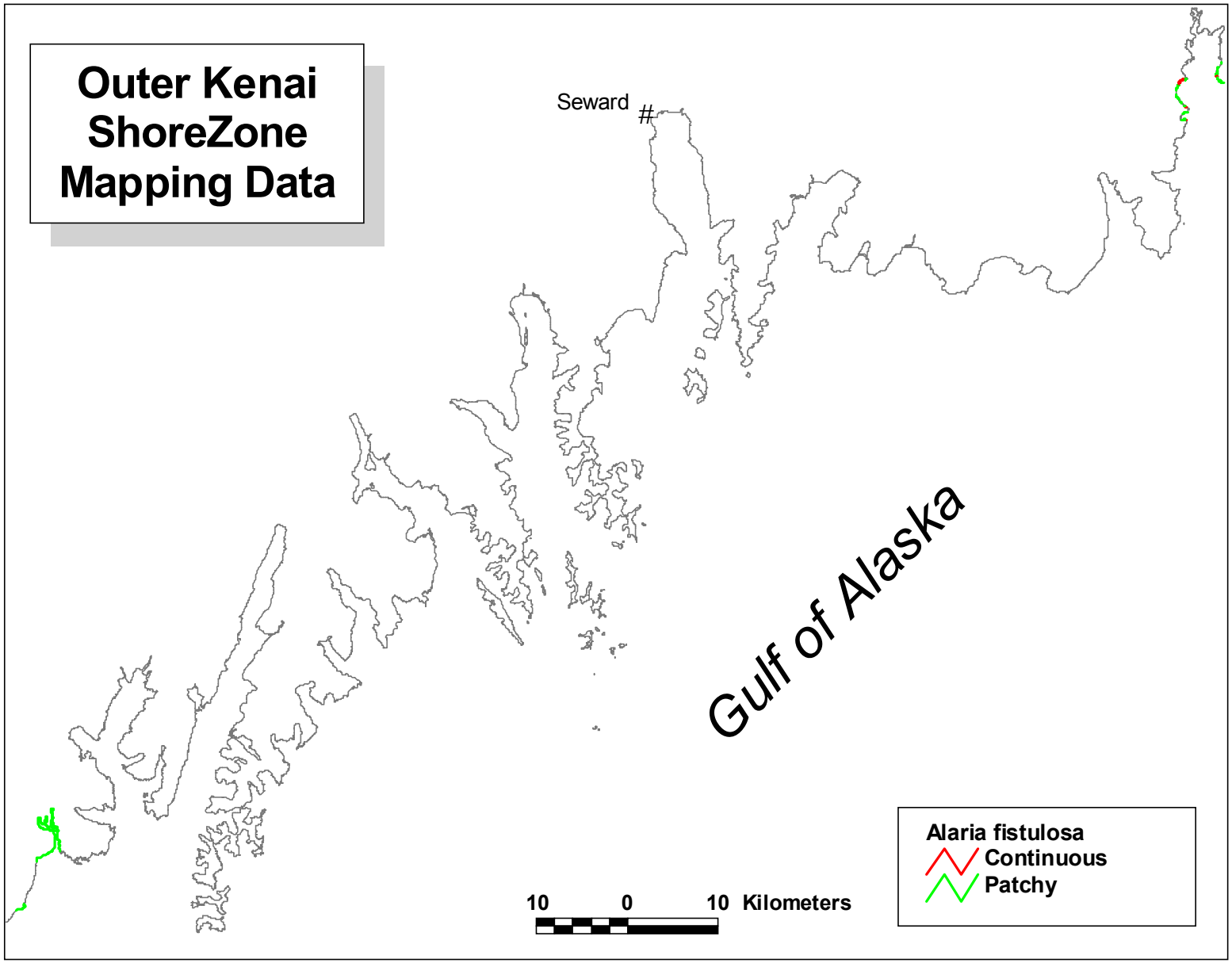
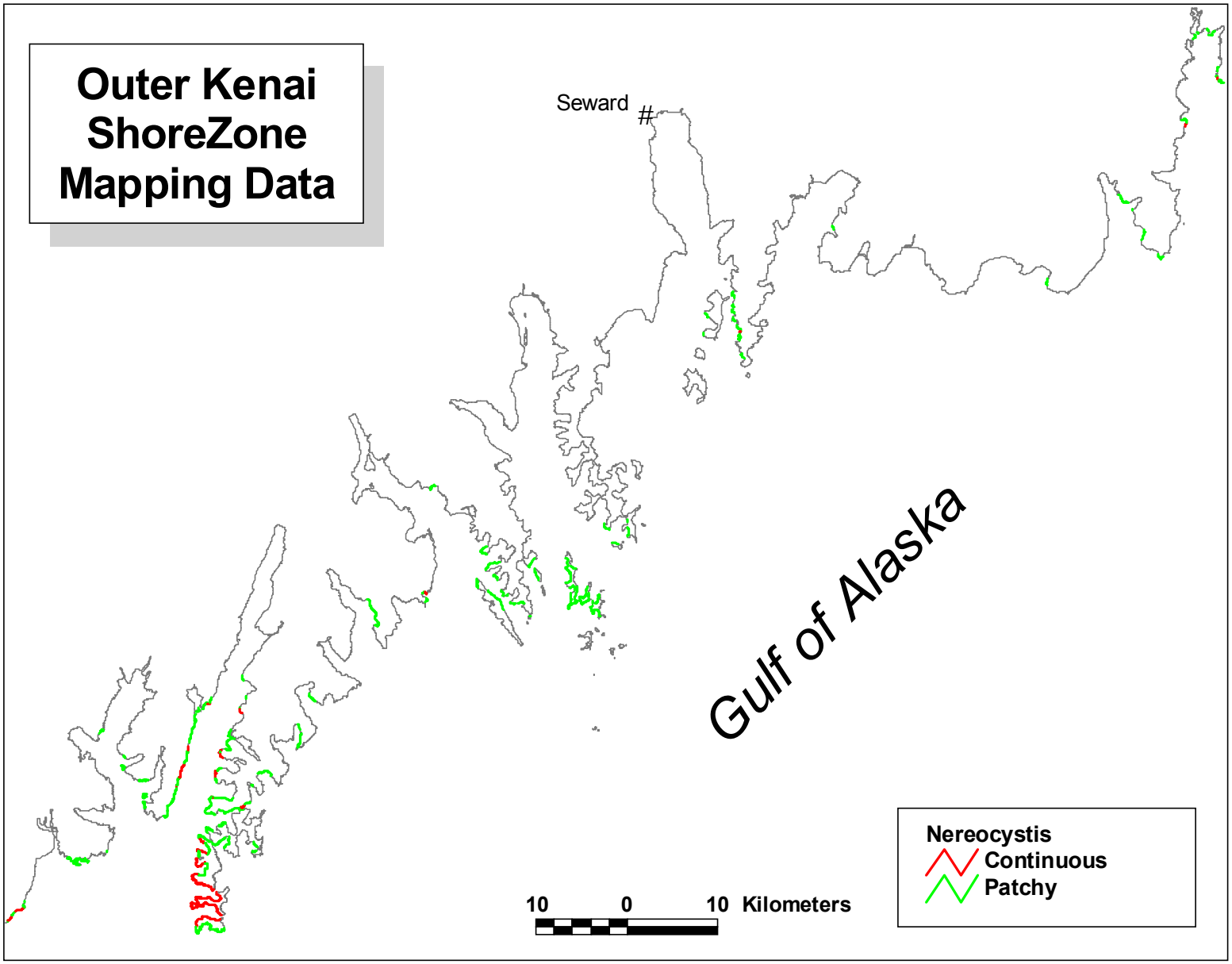
Gulf of Alaska
10 0 10 Kilometers
Eelgrass
Continuous
Patchy


Outer Kenai
ShoreZone
Mapping Data
Seward
Gulf of Alaska
10 0 10 Kilometers
Alaria fistulosa
Continuous
Patchy


Outer Kenai
ShoreZone
Mapping Data
Seward
Gulf of Alaska
10 0 10 Kilometers
Nereocystis
Continuous
Patchy

Appendix C

BioBands Descriptions and Notes

Attributes of the Bio-bands

The following bio-band table (Table C-1) is arranged from the supra-tidal, across the intertidal to the nearshore subtidal. By definition, bio-bands occur in certain across-shore elevations. The methodology and definitions used here are developed and applied in British Columbia in Searing and Frith (1995) and Harper *et al* (1996).

The across-shore intervals are called ***'zones'*** and are defined as:

- Zone A - Supratidal
- Zone B - Intertidal
- Zone C - Nearshore Subtidal

The occurrence of observed bio-bands (for all bands *except* the VER band) are coded as either:

- 'P' for patchy, and irregular through the unit or, as
- 'C' for continuous through the unit and an estimate of over 50% cover in the unit.

No entry in the band data field (i.e., the field is blank), indicates that the bio-band was not observed in that unit. The combination of bio-bands that are present and/or absent in the unit, together with the unit's substrate and wave exposure, are used to determine the overall summary *Bio-exposure* (the EXP_BIO category) and the *Habitat Observed* (the HAB_OBS) for the overall unit (see Table ???2). Substrate mobility in a shore unit is determined by the amount of bedrock and the size of coarse substrate, together with the wave exposure at the shoreline.

For the VER band (*Verrucaria* splash zone band in the supratidal), the observed banding is recorded by width as:

- N - narrow < 1m
- M - medium width 1 - 5 m
- W - wide, > 5m

Table C-1 Bio-Bands for theOuter Kenai Coast

Zone	Colour Band Name	Code Name	Colour	Description	Exposure Category
A	'Verrucaria'	**VER**	black or bare rock	splash zone: may be marked by black encrusting lichen & blue-green algae. Best observed on bedrock & sometimes visible on low energy boulder/cobble shorelines Extensive bare zones typically occur only in association with VER on high energy bedrock shorelines.	width can be an index of wave exposure
A	salt-tolerant herbs and grasses	**PUC**	light/bright green	*Puccinella, Plantago maritima, Triglochin, Carex,* other marsh grasses, and salt-tolerant herbaceous plants	SP, P, estuary
A	grasses	**GRA**	light green	*Elymus mollis,* dune grasses. May be the only band observed on high energy beaches.	any beaches
B upper	upper barnacle	**BAR**	grey-white	*B. glandula* and/or *S. balanoides* in upper intertidal, also can include bare rock. Common algae associated with BAR of upper intertidal are *Endocladia muricata, Gloipeltis furcata* and *Bangia sp.* Some *Porphyra* are associated with upper BAR in early spring. Observation of this band may be used to indicate a low cover of other bands.	E,SE,SP, P
B upper	'Fucus'	**FUC**	golden brown	dominated by *Fucus*, includes *B. glandula* and/or *S. balanoides*. Epiphytic *Ulva* are common on exposed areas and epiphytic *Pilayella* occur in protected areas.	SE, SP, P
B mid	'Ulva'	**ULV**	bright green	*Ulva/'Ulvaria'* blade greens and *Enteromorpha*-type filamentous greens. May appear as thick patches or as green haze of small plants. *Chladophora* and *Acrosiphonia* are common fine filamentous greens that can also appear as green band.	SP, P, estuary
B lower	'Halosaccion'	**HAL8**	golden yellow	Named for golden-yellow colour of *Halosaccion* which may not be present or dominate the band. Band may occur as an assemblage of bleached reds in the lower intertidal. Typical species are: *Palmaris spp., Odonthalia*, *Mazzaella* and other bleached blade and filamentous reds.	SP,P
B lower	blue mussel	**BMU**	dark blue-black	continuous bands of dense *Mytilus trossulus.* Often also associated with *Fucus, S. cariosus, Porphyra abbotae, Endocladia* or *Odnonthalia.* Occurs in high wave exposures and in areas of current or areas influenced by freshwater input, river deltas	E, SE, SP,P, currents, freshwater
B lower	mixed filamentous & blade reds	**RED8**	dark red-brown	Algal-rich band of lower intertidal, complex of filamentous and blade red algae, including *Neoptilota, Odonthalia, Neorhodomela, Palmaria* and others. Common invertebrates include *Pisaster, Nucella, Katharina.* Includes foliose coralline algae.	E, SE, SP, currents
B lower	Alaria marginata morph	**ALA**	dark brown	pure stand of large or small morph of *Alaria spp*. Usually also includes mixed REDs with foliose and encrusting corallines. *Pisaster* and Katharina commonly associated. *Alaria* can also be a component of CHB8.	SE, E
B lower	soft browns	**SBR8**	brown	large bladed *Laminaria spp.* - the unstalked blade browns, which are seen in the lower intertidal and nearshore subtidal. Includes *L.'saccharina'* morph: large blades, ruffled edges and *Cymathera*, *Cystoseira, Alaria* species.	SP, P

B lower	chocolate browns	**CHB8**	dark brown	shiny, leathery dark browns, including *Alaria marginata* morph*, L. setchelli, L. bongardiana* morph*, Lessoniopsis , L. yezoensis, Cymathera.* CHB often occurs with foliose and encrusting coralline algae and other lush REDs, such as *Odonthalia* and *Neoptilota*.	E, SE
C upper	'Zostera'	**ZOS**	dark green	eelgrass, (*Zostera marina*) fine sediment, may extend slightly upslope into intertidal. Often encrusted with epiphytic blade red.	P, SP, estuary
C upper	dragon kelp	**ALF**		giant *Alaria fistulosa* kelp band. Limited geographic distribution.	SE ?
C upper	Nereocystis	**NER**	dark brown, shiny	bull kelp beds, floating blades and fronds in nearshore	E, SE, SP, current
C upper	Macrocystis	**MAC**	brown	leafy, soft kelp beds, usually indicator of fully-marine waters	SE, SP, P

Appendix D

Data Dictionary

Appendix D Table of Contents

Appendix D List of Tables

Table D-1 Summary of Data Fields in the Unit Database

Field Names	Type	Description
UnitRecID	I	unique numerical number for each record
PHY_IDENT	T	unique alphanumeric identifier made up of the REGION, AREA, PHY_UNIT and SUBUNIT numbers
REGION	T	coastal region number
AREAS	T	coastal area number
PHY_UNIT	T	physical unit number
SUBUNIT	T	sub unit number
TYPE	T	indicator of polygon, line or point unit type
BC_CLASS	I	shoreline type, BC classification system
ESI_CLASS	T	shoreline type, ESI classification system
LENGTH_M	N	alongshore length of unit in meteres
AREA_M2	N	area of unit in square meters
GEO_MAPPER	T0	last name of geology mapper
GEO_EDITOR	T0	last name of individual responsible for reviewing and editing
GEO_MAP_DATE	D/T	date of geological mapping
GEO_SOURCE	T	data sources for geological interpretation
SCALE	T	scale of base maps used to delineate units
VIDEOTAPE	T	the videotape id number
SCRN_TIME	T	the screen time burned onto the video image
QUAD_MAP	T	identifier number of orthophoto map
MAP_NO	I	page number from the DeLorme Alaska Atlas
CHART	T	NOAA chart number
EXP_IDENT	T	cross-reference to EXPOSURE database
EXP_CALC	T	exposure calculated from fetch info
EXP_OBSER	T	exposure observed by geomorphologist
EXP_CLASS	T	“best” estimate of exposure from calculated-, observed- and bio-exposure
ORI	I	oil residence index
SED_SOURCE	T	source of sediment within the unit
SED_ABUND	T	qualitative index of sediment in the unit
SED_DIR	T	estimate of sediment transport direction based on indicators within the unit
CHNG_TYPE	T	accretional, stable, erosional status
CHNG_RATE	N	rate of change
SHORENAME	T	local geographic name
OTHER	T	comment
SHORE_PROB	T	indicator of significant base map problem
SM1_TYPE	T	type of primary shore modification (e.g., type of seawall)
SM%	I	estimate % occurrence of SM1 in unit
SM1_M	I	calculated length of SM1 in unit
SM2_TYPE	T	type of secondary shore modification (e.g., type of seawall)
SM2%	I	estimate % occurrence of SM2 in unit
SM2_M	I	calculated length of SM2 in unit
SM3_TYPE	T	type of tertiary shore modification (e.g., type of seawall)
SM3%	I	estimate % occurrence of SM3 in unit
SM3_M	I	calculated length of SM3 in unit
SMOD_TOT	I	total % occurrence of shore modification in the unit
RAMPS	I	number of boat ramps in the unit
PIERS_DOCKS	I	number of docks or pier within the unit
REC_SLIPS	I	number of “recreational slips within the unit
DEEPSEA_SLIP	I	number of ship or “deepsea” slips within the unit
ITZ	N	intertidal width; sum of the width for across-shore components

Data Dictionary for UNIT Databases

(Adapted from methods and codes outlined in Harper *et al* 1999)

Field Name	Type	Description
Unit_RecId	N	space for unique id for each record
PHY_IDENT	T	unique Physical Ident number for the unit, a combination of region, area, unit, and sub-unit. (RR/AA/UUUU/SS)
REGION	T	coastal region number; see Appendix E
AREAS	T	coastal area number; see Appendix E
PHY_UNIT	T	physical shore unit number; the unit is the primary alongshore subdivision during the mapping
SUBUNIT	T	sub-unit number: "0" for main Unit and "1, 2, 3...." for variants or point features; the sub-units may be added at a latter date to reflect additional mapping detail (e.g., degree of oiling)
TYPE	T	a description of Unit type: a polygon-type with (**A**)rea, a combination unit with (**B**)oth area and length, a (**L**)ine-type unit, or a (**P**)oint variant (see Table D-2)
BC_CLASS	N	a number indicating the BC 'coastal class' or 'shoreline type' (see Table D-3)
ESI_CLASS	T	a number code for the ESI coastal classification system (see Table D-4)
LENGTH_M	N	the unit or sub-unit along-shore length in M, to be calculated by the GIS software
AREA_M2	N	the polygon area in sq m to be calculated by GIS software
GEO_MAPPER	T	last name of mapper.
GEO_EDITOR	T	last name of editor or reviewer
GEO_MAP_DATE	D	date of original mapping
GEO_SOURCE	T	the data source for the interpretations: (V)ideotape, (P)hoto-aerial, (T)opo maps, (C)harts, (O)ther.

Field Name	Type	Description
SCALE	T	scale of the base map used to code and map original data
VIDEOTAPE	T	videotape identifier code(s)
SCRN_TIME	T	the "burned-in" tape time from the GPS that appears on the video image.
MAP_NO	T	the page number of the map in the DeLorme Alaska Atlas where the Unit is plotted
CHART	T	the NOAA chart number(s) for the Unit
EXP_IDENT	T	cross reference number to exposure database
EXP_CALC	T	The calculated exposure from fetch measurements (see D-5)
EXP_OBSER	T	an estimate of the wave exposure as observed by geomorphologist during mapping based on Table D-5.
EXP_CLASS	N	a numeric code for best exposure estimate where EXP_BIO better than EXP_OBS better than EXP_CALC and 1=VP, 2=P, 3=SP, 4=SE, 5=E, 6=VE (see Table D-5)
ORI	N	a code indicating the potential oil residence index, see Tables D-6 and D-7.
SED_SOURCE	T	a code indicating the estimated sediment source for the unit, (B)ackshore, (A)longshore, (F)luvial, (O)ffshore
SED_ABUND	T	code indicating the relative sediment abundance within the shore-unit, (A)bundant, (M)oderate, (S)carce
SED_DIR	T	one of the eight cardinal points of the compass indicating dominant sediment transport direction
CHNG_TYPE	T	a code indicating the stability of the shore unit, (A)ccretional, (E)rosional, (S)table

Data Dictionary for UNIT Databases (continued)

Field Name	Type	Description
CHNG_RATE	T	the rate of change of the shoreline within the unit in m/yr
SHORENAME	T	the name of a prominent geographic feature near the unit; used to facilitate searches
OTHER	T	a text field used for miscellaneous comments and notes during the mapping
SHORE_ PROB	T	comment on nature of the shore problem, usually the difference between electronic shoreline and observed shoreline
SM1_TYPE	T	the *primary* type of seawall occurring within the unit where:BR = boat ramp; CB = concrete bulkhead; LF = landfill; SP= sheet pile; RR = rip rap and WB = wooden bulkhead
SM1%	N	the estimated % occurrence of the *primary* seawall type in tenths (i.e., "2" = 20% occurrence within the unit)
SM1_M	N	the calculated length in meters of the *Primary* seawall type
SM2_TYPE	T	the *secondary* type of seawall occurring within the unit where: BR = boat ramp; CB = concrete bulkhead; LF = landfill; SP = sheet pile; RR = rip rap and WB = wooden bulkhead
SM2%	N	the estimated % occurrence of the *secondary* seawall type in tenths (i.e., "2" = 20% occurrence within the unit)
SM2_M	N	the calculated length in meters of the *Secondary* seawall type
SM3_TYPE	T	the *tertiary* type of seawall occurring within the unit where: BR = boat ramp; CB = concrete bulkhead; LF = landfill; RR = rip rap and WB = wooden bulkhead
SM3%	N	the estimated % occurrence of the *tertiary* seawall type in tenths (i.e., "2" = 20% occurrence within the unit)
SM3_M	N	the calculated length in meters of the *Tertiary* seawall type
SMOD_TOTAL	N	the total % occurrence of seawall in the unit, in tenths
RAMPS	N	the number of boat ramps that occur within the shore zone of the unit or subnunit. Ramps must impact some portion of the shore-zone and generally be constructed of concrete, wood or aggregate. Public boat ramps are shown as variants
PIERS/DOCKS	N	the number of piers or wharves that occur within the unit. Piers or docks must extend at least 10m into the shore zone. Category does not include anchored floats.
REC_SLIPS	N	the estimated number of recreational (or small) slips associated with the piers/docks of the unit based on small boat length (~<50')
DEEPSEA_SLIPS	N	the estimated number of slips for ocean-going vessels (~>100')
ITZ_WIDTH	N	the sum of the across-shore width of all the intertidal components (B-Zone) within the unit

Table D-2 Protocol for Unit Delineation

The primary goal of the mapping program is to catalog shore-zone features that may be of interest in resource management. As such the mapping should capture the key ecological features of the shore-zone. Units may be delineated as either *points*, *lines* or *polygons* within the spatial framework. This protocol provides criteria for assigning the most appropriate spatial characteristics to a unit.

1. the Alaska Shore-Zone mapping system is primarily a lineal system (length but not width) so that *a line segment representation is the preferred unit type*. These units are coded as **L** in the "Type" Field.

2. point and polygon features should be used in certain cases to *provide a clear characterization of the physical and biological characteristics of the unit as well as the processes that affect the unit*. These cases are outlined below.

3. ***points*** are used to identify features that are of interest to resource managers but are too small (in terms of alongshore length) to be represented by a line segment. The following features are represented by points: stream mouths, public boat ramps, and other small features within a unit with ecological or management significance such as wetlands. Stream mouths or marshes are normally identified from the aerial video imagery. These units are coded as **P** in the "Type" Field.

4. ***polygons*** are used when a feature has unique spatial characteristics that are not captured by a single line segment representation. Examples of possible polygons include: a wetland where the shape of the wetland does not allow a reasonable approximation of area by length and width estimates, an intertidal ebb-tidal delta where controlling processes (tidal currents) differ substantially from surrounding units or a very wide mudflat backed by a gravelly sand beach. The minimum area for a polygon is $1cm^2$ at a 1:12,000 mapping scale or $15{,}000\ ft^2$.

   Two types of polygons are represented:

   a. a polygon that incorporates features that span the entire "shore-zone" from supratidal to subtidal, and therefore have an associated alongshore length on the electronic shoreline. A large wetland area with associated fringing mudflat is an example of this type of polygon. In that the polygon has both an area and an alongshore length (where it intersects the electronic), the feature type is coded as **both** and both area and length measurements are added to the database. This type of unit is coded as **B** in the "Type" field.

   b. a polygon that describes only a portion of the shore-zone (equivalent to an across-shore component) and that does not intersect the MHWL shoreline. An ebb-tidal delta or a large, intertidal mudflat are examples of this type of polygon. This type of unit is coded as **A** in the "Type" field.

Table D-3 Rationale for BC Shore Types[1]

SUBSTRATE	SEDIMENT	WIDTH	SLOPE	Shore Type Code & Description
ROCK	n/a	WIDE (>30m)	STEEP(>20°)	n/a
			INCLINED(5-20°)	(1) Rock Ramp, wide
			FLAT(<5°)	(2) Rock Platform, wide
		NARROW (<30m)	STEEP(>20°)	(3) Rock Cliff
			INCLINED(5-20°)	(4) Rock Ramp, narrow
			FLAT(<5°)	(5) Rock Platform, narrow
ROCK + SEDIMENT	GRAVEL	WIDE (>30m)	STEEP(>20°)	n/a
			INCLINED(5-20°)	(6) Ramp w gravel beach, wide
			FLAT(<5°)	(7) Platform w gravel beach, wide
		NARROW (<30m)	STEEP(>20°)	(8) Cliff w gravel beach
			INCLINED(5-20°)	(9) Ramp w gravel beach
			FLAT(<5°)	(10) Platform with gravel beach
	SAND & GRAVEL	WIDE (>30m)	STEEP(>20°)	n/a
			INCLINED(5-20°)	(11) Ramp w gravel & sand beach, wide
			FLAT(<5°)	(12) Platform w G&S beach, wide
		NARROW (<30m)	STEEP(>20°)	(13) Cliff w gravel/sand beach
			INCLINED(5-20°)	(14) Ramp w gravel/sand beach
			FLAT(<5°)	(15) Platform with gravel/sand beach
	SAND	WIDE (>30m)	STEEP(>20°)	n/a
			INCLINED(5-20°)	(16) Ramp w sand beach, wide
			FLAT(<5°)	(17) Platform w sand beach, wide
		NARROW (<30m)	STEEP(>20°)	(18) Cliff w sand beach
			INCLINED(5-20°)	(19) Ramp w sand beach, narrow
			FLAT(<5°)	(20) Platform w sand beach, narrow
SEDIMENT	GRAVEL	WIDE (>30m)	FLAT(<5°)	(21) Gravel flat, wide
		NARROW (<30m)	STEEP(>20°)	n/a
			INCLINED(5-20°)	(22) Gravel beach, narrow
			FLAT(<5°)	(23) Gravel flat or fan
	SAND & GRAVEL	WIDE (>30m)	STEEP(>20°)	n/a
			INCLINED(5-20°)	n/a
			FLAT(<5°)	(24) Sand & gravel flat or fan
		NARROW (<30m)	STEEP(>20°)	n/a
			INCLINED(5-20°)	(25) Sand & gravel beach, narrow
			FLAT(<5°)	(26) Sand & gravel flat or fan
	SAND/MUD	WIDE (>30m)	STEEP(>20°)	n/a
			INCLINED(5-20°)	(27) Sand beach
			FLAT(<5°)	(28) Sand flat
				(29) Mudflat
		NARROW (<30m)	STEEP(>20°)	n/a
			INCLINED(5-20°)	(30) Sand beach
			n/a	
	ORGANICS/FINES	n/a	n/a	(31) Organics/Fines
ANTHRO-POGENIC	MAN-MADE	n/a	n/a	(32) Man-made, permeable
				(33) Man-made, impermeable
CURRENT-DOMINATED				(34) Channel
ICE				(35) Glacial ice shoreline

[1]Shore Type code is used to provide a generalized summation of the detailed physical data complied for each shore unit (from Howes *et al*. 1994).

Table D-4 ESI Shore Type Classification (after Peterson *et al* 2002)

ESI No.	Description
1A	Exposed rocky shores; Exposed rocky banks
1B	1B Exposed, solid man-made structures
1C	Exposed rocky cliffs with boulder talus base
2A	Exposed wave-cut platforms in bedrock, mud, or clay
2B	Exposed scarps and steep slopes in clay
3A	Fine- to medium-grained sand beaches
3B	Scarps and steep slopes in sand
3C	Tundra cliffs
4	Coarse-grained sand beaches
5	Mixed sand and gravel beaches
6A	Gravel beaches; Gravel Beaches (granules and pebbles
6B	Riprap; Gravel Beaches (cobbles and boulders)*
6C	Riprap
7	Exposed tidal flats
8A	Sheltered scarps in bedrock, mud, or clay; Sheltered rocky shores (impermeable)
8B	Sheltered, solid man-made structures; Sheltered rocky shores (permeable)
8C	Sheltered riprap
8D	Sheltered rocky rubble shores
8E	Peat shorelines
9A	Sheltered tidal flats
9B	Vegetated low banks
9C	Hypersaline tidal flats
10A	Salt- and brackish-water marshes
10B	Freshwater marshes
10C	Swamps

Table D-5 Exposure Matrix Used for Estimating Calculated Exposure (EXP_CALC)

Maximum Fetch (km)	Modified Effective Fetch (km)				
	<1	**1 - 10**	**10 - 50**	**50 - 500**	**>500**
<1	very protected	n/a	n/a	n/a	n/a
<10	protected	protected	n/a	n/a	n/a
10 – 50	n/a	semi-protected	semi-protected	n/a	n/a
50 – 500	n/a	semi-exposed	semi-exposed	semi-exposed	n/a
>500	n/a	n/a	semi-exposed	exposed	exposed

[1] exposure definitions are the same categories listed in EXP_BIO - Table D-15.

Codes for exposures:	very protected	**VP**
	protected	**P**
	semi-protected	**SP**
	semi-exposed	**SE**
	exposed	**E**
	very exposed	**VE**

Table D-6 Oil Residence Index

Persistence	Oil Residence Index	Estimated Persistence
short	1	days to weeks
	2	**weeks** to months
↓	3	weeks to **months**
	4	**months** to years
long	5	months to **years**

Table D-7 Look-Up Table of Calculated ORI Classes Defined by Shore Type and Exposure

Shore Type	Calculated Exposure					
CLASS	VE	E	SE	SP	P	VP
1	1	1	1	2	3	3
2	1	1	1	2	3	3
3	1	1	1	2	3	3
4	1	1	1	2	3	3
5	1	1	1	2	3	3
6	2	3	5	4	4	4
7	2	3	5	4	4	4
8	2	3	5	4	4	4
9	2	3	5	4	4	4
10	2	3	5	4	4	4
11	1	2	3	4	5	5
12	1	2	3	4	5	5
13	1	2	3	4	5	5
14	1	2	3	4	5	5
15	1	2	3	4	5	5
16	1	2	3	3	4	4
17	1	2	3	3	4	4
18	1	2	3	3	4	4
19	1	2	3	3	4	4
20	1	2	3	3	4	4
21	2	3	5	4	4	4
22	2	3	5	4	4	4
23	2	3	5	4	4	4
24	1	2	3	4	5	5
25	1	2	3	4	5	5
26	1	2	3	4	5	5
27	2	2	3	3	4	4
28	2	2	3	3	4	4
29	999	999	999	3	3	3
30	2	2	3	3	4	4
31	5	5	5	5	5	5
32	2	2	3	3	5	5
33	1	1	1	2	2	2
34	999	999	999	4	4	4

Table D-8 Summary of Data Fields in the BioUnit Database

Field Names	Type	Description
UnitRecID	I	unique numerical number for each record
PHY_IDENT	T	unique alphanumeric identifier made up of the REGION, AREA, PHY_UNIT and SUBUNIT numbers
EXP_BIO	T	exposure estimated from biota indicator species
HAB_OBS	I	observed habitat
HAB_CALC	I	predicted habitat based on BC_CLASS and EXP_CALC
BIO_SLIDE	T	roll number and frame number of 35 mm slide
BIO_SOURCE	T	data sources for biological interpretation
BIO_SITE	T	number of ground station
RIPARIAN%	I	% occurrence of coastal riparian (terrestrial vegetation overhang within the unit)
RIPARIAN_M	I	length of coastal riparian in meters
COMMENTS	T	comment field
BIO_MAPPER	T	last name of biology mapper
BIO_MAP_DATE	D/T	date of biological mapping
QAQC	Y/N	yes/no if unit reviewed in QAQC
QAQC_NAME	T	last name of QAQC reviewer
QAQC_CHANGE	T	QAQC change type code
%MOBILE	I	estimate of the % of unit with mobile substrate
HAB_OBS_OVERRIDE	Y/N	yes/no if HAB_OBS is over-ride of HAB_CALC lookup

Data Dictionary for BioUnit Databases

BioUnit Database

Field Name	Type	Description
UnitRecID	N	unique id for each record
PHY_IDENT	T	unique Physical Ident number for the unit, a combination of region, area, unit, and sub-unit. (RR/AA/UUUU/SS)
EXP_OBSER	T	an estimate of the wave exposure as observed by geomorphologist during mapping based on Tabl e D-5.
HAB_OBS	N	the observed biotic assemblage from the imagery and classified according to Table D-17
HAB_CALC	N	the predicted intertidal biotic assemblage from the mapped BC_Class and the EXP_CALC (Table D-17)
BIO_SLIDE	T	oblique aerial slide-format image ident, film roll/ frame number
BIO_SOURCE	T	the source that was used to interpret shore-zone biota, (V)ideotape, (S)lide, (I)nferred
BIO_SITE	T	
BIO_SLIDE	T	oblique aerial slide-format image ident, film roll/ frame number

Field Name	Type	Description
BIO_SOURCE	T	the source that was used to interpret shore-zone biota, (V)ideotape, (S)lide, (I)nferred
BIO_SITE	T	the Station number of an ground surveys that were conducted in the unit
BIO_MAPPER	T	the last name of the biologist that provided the biological interpretation of the imagery.
BIO_EDITOR	T	last name of biologist that is responsible for reviewing and editing data
BIO_MAP_DATE	D	the date of the bio mapping
QAQC_NAME	T	last name of QAQC reviewer
QAQC_CHANGE	T	code (Table D-9) to indicate degree of discrepancy between original mapper and reviewer
%MOBILE	I	an estimate by the biological mapper of the percentage of the unit length that has mobile substrate (i.e., precludes development of epiflora or epifauna

Table D-9. Definitions of the Biology QA/QC Checks

Code for Change Type	Definitions & Discussion	Significance of change?
1	**Change band distribution code** – from patchy to continuous or vice versa. A revision of this type is defined as the least significant and is considered as an example of variation of interpretation between observers.	least significant
2	**Add a bio-band** – Adding a band was the most common revision made in QA/QC review and the frequency of this change decreased as junior mappers' experience with video interpretation increased. These changes are defined as an 'error of omission', not an error in interpretation	
3	**Delete a bio-band** – Deleting a band that had been mapped was considered an error in interpretation. Usually these changes were associated with an 'add band' change and were subject of discussion for assisting in clarifying bio-band descriptions.	
4	**Change the HAB_OBS classification** – a discrepancy between the HAB_OBS and the HAB_CALC, which is computed as a function of the exposure (from biota) and the shore-type (BC_CLASS) *may* indicate that an error was made in the HAB_OBS classification. Only those QAQC'd units where a *change* was made in the HAB_OBS are flagged.	
5	**Change the EXP_BIO** – The correct interpretation of the Exposure category was considered the most significant QA/QC change type.	most significant

Table D-10 Summary of Data Fields in the Component Database (XSHR)

Field Names	**Type**	**Description**
UnitRecID	N	unique record number that relates across-shore records to a unit record
XshrRecID	N	unique record number for each across-shore record
PHY_IDENT	T20	unique alphanumeric identifier made up of the REGION, AREA, PHY_UNIT and SUBUNIT numbers
CROSS_LINK	T20	unique alphanumeric identifier of component made up of: REGION, AREA, PHYS_UNIT, SUBUNIT, ZONE and COMPONENT
ZONE	T1	portion of shore-zone: supratidal, intertidal, subtidal
COMPONENT	Is	number of component
Form1	T20	descriptor of primary morphology of component
MatPrefix1	T1	descriptor holding "v" = veneer surface layer
Mat1	T20	descriptor of sediment of Form1
Form2	T20	descriptor of primary morphology of component
MatPrefix2	T1	descriptor holding "v" = veneer surface layer
Mat2	T20	descriptor of sediment of Form2
Form3	T20	descriptor of primary morphology of component
MatPrefix3	T1	descriptor holding "v" = veneer surface layer
Mat3	T20	descriptor of sediment of Form3
Form4	T20	descriptor of primary morphology of component
MatPrefix4	T1	descriptor holding "v" = veneer surface layer
Mat4	T20	descriptor of sediment of Form4
WIDTH	Is	average width of the primary component in metres
SLOPE	Is	estimated slope of primary component
PROCESS	T4	dominant coastal process modifying the primary component
COMPONENT_ORI	I	an estimate by the GeoMapper of the ORI of the primary component (see Table D7)

Data Dictionary for Across-Shore Component Databases (XSHR)

(Adapted from methods and codes outlined in Howes *et al* 1994)

Field Name	Type	Description
UnitRecId	N	the record number of the Unit to which the component is related
XshrRecID	N	a unique record number for each X-SHR record
PHYS_IDENT	T	unique id combining the region-area-unit-subunit fields (see UNIT Table data dictionary, above).
CROSS_LINK	T	a unique alphanumeric id combining the region-area- unit-subunit-zone-component fields
ZONE	T	a text code indicating the across-shore position of the component: (A) supratidal, (B) intertidal or (C) subtidal zone
COMPONENT	N	further subdivision of Zones, numbered from highest elevation in across-shore profile within Zone to lowest.
Form1	T	describes primary physical Form within each across-shore component (see Table D-10 for codes)
MatPrefix1	T	veneer indicator field; blank = no veneer; "v" = veneer
Mat1	T	describes substrate associated with primary form (see Table D-11 for codes)
FormMat1Txt	T	translation of Form and Material codes into a sentence descriptor
Form2	T	describes seconrdary physical Form within each across-shore component (see Table D-10 for codes)
MatPrefix2	T	veneer indicator field; blank = no veneer; "v" = veneer
Mat2	T	describes substrate associated with secondary form (see Table D-11 for codes)
FormMat2Txt	T	translation of Form and Material codes into a sentence descriptor
Form3	T	describes tertiary physical Form within each across-shore component (see Table D-10 for codes)
MatPrefix3	T	veneer indicator field; blank = no veneer; "v" = veneer
Mat3	T	describes substrate associated with tertiary form (see Table D-11 for codes)
FormMat3Txt	T	translation of Form and Material codes into a sentence descriptor
Form4	T	describes forth most common physical Form within each across-shore component (see Table D-10 for codes)
MatPrefix4	T	veneer indicator field; blank = no veneer; "v" = veneer
Mat4	T	describes substrate associated with forth-order form (see Table D-11 for codes)
FormMat4Txt	T	translation of Form and Material codes into a sentence descriptor
SUB_WIDTH	N	the mean across-shore width of the component in meters.
SUB_SLOPE	N	the estimated across-shore slope of the component in degrees; not coded in Carr Inlet
PROCESS	T	the dominant coastal process affecting the morphology of the component (F)luvial, (M)asswasting, (W)aves, (C)currents, (O)ther, (E)olean
COMPONENT_ ORI	N	a numeric index between 1 and 5 that indiecates the potential oil residency based on Table D-12

Table D-11 'Form' Code Dictionary. (after Howes *et al* 1994).

A = Anthropogenic
- a dolphin
- b breakwater
- c log dump
- d derelict shipwreck
- f float
- h shell midden
- i cable/ pipeline
- j jetty
- k dyke
- m marina
- n ferry terminal
- o log booms
- p port facility
- q aquaculture
- r boat ramp
- s seawall
- t landfill, tailings
- w wharf
- x outfall or intake
- y intake

B = Beach
- b berm
- c washover channel
- f face
- i inclined (no berm)
- m multiple bars&troughs
- n relic ridges, raised
- p plain
- r ridge (single intertidal bar)
- s storm ridge
- t low tide terrace
- w washover fan
- v veneer (modifier)

C = Cliff
- a eroding
- p passive
- c cave
- f fan,apron
- g surge channel
- t terraced
- r ramp

slope
- i inclined (20to35°)
- s steep (>35°)

Cliff cont.

height
- l low (<5m)
- m moderate (5-10m)
- h high (>10m)

D = Delta
- b bars
- f fan
- l levee
- m multiple channels
- p plain (no delta, <5°)
- s single channel

E = Dune
- b blowouts
- i irregular
- n relic
- o ponds
- r ridge/swale
- p parabolic
- v veneer
- w vegetated

F = Reef
- f horizontal
- i irregular
- r ramp
- s smooth

I = Ice
- g glacier

L = Lagoon
- o open
- c closed

M = Marsh
- f drowned forest
- h high
- l mid to low (discontinuous)
- c tidal creek
- e levee
- o pond
- s brackish - supratidal

O = Offshore Island
- b barrier
- c chain of islets
- t table shaped
- p pillar/stack
- w whaleback

elevation
- l low (<5m)
- m moderate (5-10m)
- h high (>10m)

P = Platform
- f horizontal
- g surge channel
- h high tide platform
- i irregular
- l low tide platform
- r ramp
- t terraced
- s smooth
- p tidepool

R = River Channel
- a perennial
- t intermittent
- m multiple channels
- s single channel

T = Tidal Flat
- b bar,ridge
- c tidal channel
- e ebb tidal delta
- f flood tidal delta
- l levee
- s multiple tidal channels
- t flats
- p tidepool

Component Database

[The form code describes the physical 'form' of a component, using a primary form descriptor, with or without a secondary form modifier (e.g. Ap, Bxfbu). Use of one primary form description indicates that it comprises up to 75% of component. If two descriptors shown (separated by a semi-colon) then the second form is >10% of the component

Table D-12 'Material' Code Dictionary. (after Howes *et al* 1994).

A = Anthropogenic

a	metal (structural)
c	concrete (loose blocks)
d	debris (man-made)
f	fill, undifferentiated mixed
o	concrete (solid cement blocks)
r	rubble, riprap
t	logs (cut trees)
w	wood (structural)

B = Biogenic

c	coarse shell
f	fine shell hash
g	grass on dunes
l	trees, fallen not cut, dead
o	organic litter
p	peat
t	trees (alive)

C = Clastic

a	blocks (angular,>25cm)
b	boulders (round, subround,>25cm)
c	cobbles
d	diamicton (poorly sorted sediment containing a range of particles in a mud matrix)
f	fines or mud (mix of silt, clay)
g	gravel (mix pebble, cobble, boulder >2mm)
k	clay
p	pebbles
r	rubble (boulders>1m)
s	sand
$	silt
x	angular fragments (mix block & rubble)

v **sediment veneer**

R = Bedrock

rock type:

i	igneous
m	metamorphic
s	sedimentary
v	volcanic

rock structure:

1	bedding
2	jointing
3	massive

U = Undefined

DESCRIPTION OF SUBSTRATE
Simplified from Wentworth scale

GRAVELS

boulder	> 25cm
cobble	6 to 25 cm
pebble	0.5 to 6 cm
granule	0.2 to 0.5 cm

SAND
from very coarse to very fine:
all between .5mm to 2 mm

FINES (MUD)
from silt to clay:
smaller than .5mm

Component Database

[The 'material' descriptor consists of one primary term code and associated modifiers (e.g. Cskb, Ad). Up to three descriptors may be written in order of importance to describe each layer. If only one descriptor is used, indicated material comprises 75% of the volume of the layer (e.g.Cs), if more than one descriptor, they are ranked in order of volume. A surface layer can be described by prefix 'v' for veneer (e.g. vCsk).

Where more than one 'form' is coded for a component, the 'material' code is matched to the correct 'form' by retaining the order used in the 'form' coding. (e.g. form = Bi;Ph, material = At/Cps;Rs indicates log material over pebble & sand beach berm, with platform of sedimentary rock.).

Table D-13 Component ORI Matrix

Component Substrate	VE	E	SE	SP	P	VP
rock	1	1	1	2	3	3
man-made, impermeable	1	1	1	2	2	2
boulder	2	3	5	4	4	4
cobble	2	3	5	4	4	4
pebble	2	3	5	4	4	4
sand	2	2	3	3	4	4
mud	999	999	999	3	3	3
organics/vegetation	999	999	999	5	5	5
man-made, permeable	2	2	3	3	5	5

Table D-14 Summary of Data Fields in the BioBand Database

Field Names	Type	Description
UnitRecID	N	unique record number that relates across-shore records to a unit record
XshrRecID	N	unique record number for each across-shore record
PHY_IDENT	T20	unique alphanumeric identifier made up of the REGION, AREA, PHY_UNIT and SUBUNIT numbers
CROSS_LINK	T20	unique alphanumeric identifier of component made up of: REGION, AREA, PHYS_UNIT, SUBUNIT, ZONE and COMPONENT
VER	T1	occurrence of *Verrucaria* bio-band
PUC	T1	occurrence of *Puccinella* and othersalt-tolerant herbaceous plants
GRA	T1	occurrence of dune grasses.
BAR	T1	occurrence of barnacle bio-band
FUC	T1	occurrence of *Fucus* bio-band
ULV	T1	occurrence of *Ulva* bio-band
HAL8	T1	occurrence of *Halosaccion* bioband
BMU	T1	occurrence of blue mussel bio-band
RED8	T1	occurrence of red algae bio-band
ALA	T1	occurrence of *Alaria* bio-band
SBR8	T1	occurrence of soft brown algae band
CHB8	T1	occurrence of the chocolate brown bio-band
NEO	T1	occurrence of the *Neoptilota* bioband
ZOS	T1	occurrence of the *Zostera* bio-band
ALF	T1	occurrence of the giant *Alaria fistulosa* kelp band
NER	T1	occurrence of the *Nereocystis* bio-band
MAC	T1	occurrence of the *Macrocystus* bio-band
COMMENTS	T50	misc. comments by the bio-mapper

Data Dictionary for BIO Databases

[Methodology described in Searing & Frith (1995)]

Field Name	Type	Description
UnitRecId	N	the record number of the Unit to which the component is related
XshrRecID	N	a unique record number for each X-SHR record
PHYS_IDENT	T	unique id combining the region-area-unit-subunit fields (see UNIT Table data dictionary, above).
CROSS_LINK	T	a unique alphanumeric id combining the region-area- unit-subunit-zone-component fields

Note: all Bio-bands are coded **P**atchy or **C**ontinuous (>50% cover) except the VER band, coded by width **N**arrow (<1m), **M**edium (1-5m) or **W**ide.(>5m) see Table D-14 for details.

Field Name	Type	Description
VER	T	bio-band for 'VERrucaria' in supratidal splash zone
PUC	T	bio-band for PUCcinellia and other salt tolerant grasses
GRA	T	bio-band code for dune GRAsses of supra-tidal
BAR	T	bio-band for continuous *Balanus glandula* BARnacle in upper intertidal
FUC	T	bio-band for FUCus-barnacle of upper intertidal
ULV	T	bio-band for mixed ULVa-type green algae band, mid intertidal
HAL8	T	Named for golden-yellow colour of *Halosaccion* which may not be present or dominate the band.
BMU	T	bio-band for blue mussels (*Mytilus trossulus)* of mid-intertidal, protected areas
RED8	T	bio-band for mixed RED algae of lower intertidal
ALA	T	pure stand of large or small morph of *Alaria spp*. Usually also includes mixed REDs with foliose and encrusting corallines.
SBR8	T	large bladed *Laminaria spp.* - the unstalked blade browns, which are seen in the lower intertidal and nearshore subtidal
CHB8	T	shiny, leathery dark browns, including *Alaria marginata* morph*, L. setchelli, L. bongardiana* morph*, Lessoniopsis , L. yezoensis, Cymathera*
SUR	T	bio-band for green SURfgrass of lower intertidal
NEO	T	Neoptilota
ZOS	T	bio-band for *ZOStera* (eelgrass) of sheltered areas, lower intertidal and subtidal
ALF	T	giant *Alaria fistulosa* kelp band.
NER	T	bio-band for nearshore subtidal *NEReocystis* bull kelp
MAC	T	bio-band for nearshore subtidal *MACrocystis* kelp
COMMENT	T	a field for miscellaneous comments

Table D-15 BioBand Descriptions for the Outer Kenai Coast

Zone	Colour Band Name	Code Name	Colour	Description	Exposure Category
A	'Verrucaria'	**VER**	black or bare rock	splash zone: may be marked by black encrusting lichen & blue-green algae. Best observed on bedrock & sometimes visible on low energy boulder/cobble shorelines Extensive bare zones typically occur only in association with VER on high energy bedrock shorelines.	width can be an index of wave exposure
A	salt-tolerant herbs and grasses	**PUC**	light/bright green	*Puccinella, Plantago maritima, Triglochin, Carex,* other marsh grasses, and salt-tolerant herbaceous plants	SP, P, estuary
A	grasses	**GRA**	light green	*Elymus mollis,* dune grasses. May be the only band observed on high energy beaches.	any beaches
B Upper	upper barnacle	**BAR**	grey-white	*B. glandula* and/or *S. balanoides* in upper intertidal, also can include bare rock. Common algae associated with BAR of upper intertidal are *Endocladia muricata, Gloipeltis furcata* and *Bangia sp.* Some *Porphyra* are associated with upper BAR in early spring. Observation of this band may be used to indicate a low cover of other bands.	E,SE,SP, P
B Upper	'Fucus'	**FUC**	golden brown	dominated by *Fucus*, includes *B. glandula* and/or *S. balanoides*. Epiphytic *Ulva* are common on exposed areas and epiphytic *Pilayella* occur in protected areas.	SE, SP, P
B Mid	'Ulva'	**ULV**	bright green	*Ulva/'Ulvaria'* blade greens and *Enteromorpha*-type filamentous greens. May appear as thick patches or as green haze of small plants. *Chladophora* and *Acrosiphonia* are common fine filamentous greens that can also appear as green band.	SP, P, estuary
B Lower	'Halosaccion'	**HAL8**	golden yellow	Named for golden-yellow colour of *Halosaccion* which may not be present or dominate the band. Band may occur as an assemblage of bleached reds in the lower intertidal. Typical species are: *Palmaris spp., Odonthalia*, *Mazzaella* and other bleached blade and filamentous reds.	SP,P

BioBand Database

B Lower	blue mussel	**BMU**	dark blue-black	continuous bands of dense *Mytilus trossulus.* Often also associated with *Fucus, S. cariosus, Porphyra abbotae, Endocladia* or *Odnonthalia.* Occurs in high wave exposures and in areas of current or areas influenced by freshwater input, river deltas	E, SE, SP,P, currents, freshwater
B Lower	mixed filamentous & blade reds	**RED8**	dark red-brown	Algal-rich band of lower intertidal, complex of filamentous and blade red algae, including *Neoptilota, Odonthalia, Neorhodomela, Palmaria* and others. Common invertebrates include *Pisaster, Nucella, Katharina.* Includes foliose coralline algae.	E, SE, SP, currents
B Lower	Alaria marginata morph	**ALA**	dark brown	pure stand of large or small morph of *Alaria spp*. Usually also includes mixed REDs with foliose and encrusting corallines. *Pisaster* and Katharina commonly associated. *Alaria* can also be a component of CHB8.	SE, E
B Lower	soft browns	**SBR8**	brown	large bladed *Laminaria spp.* - the unstalked blade browns, which are seen in the lower intertidal and nearshore subtidal. Includes *L.'saccharina'* morph: large blades, ruffled edges and *Cymathera*, *Cystoseira, Alaria* species.	SP, P
B Lower	chocolate browns	**CHB8**	dark brown	shiny, leathery dark browns, including *Alaria marginata* morph, *L. setchelli, L. bongardiana* morph, *Lessoniopsis , L. yezoensis, Cymathera.* CHB often occurs with foliose and encrusting coralline algae and other lush REDs, such as *Odonthalia* and *Neoptilota*.	E, SE
B Lower	'Neoptilota'	**NEO**	bright red	Neoptilota **(not sure if this will form identifiable bio-band for AVI)**	SE
C Upper	'Zostera'	**ZOS**	dark green	eelgrass, (*Zostera marina*) fine sediment, may extend slightly upslope into intertidal. Often encrusted with epiphytic blade red.	P, SP, estuary
C Upper	dragon kelp	**ALF**		giant *Alaria fistulosa* kelp band. Limited geographic distribution.	SE ?
C Upper	Nereocystis	**NER**	dark brown, shiny	bull kelp beds, floating blades and fronds in nearshore	E, SE, SP, current
C Upper	Macrocystis	**MAC**	brown shiny	leafy, soft kelp beds, usually an indicator of fully-marine waters	SE, SP, P

[1] Codes for exposures: **E** = exposed; **SE** = semi-exposed; **SP** = semi-protected; **P** = protected; **VP** = very protected

[2] not a 'true' band but is an indicator species in the subtidal.

BioBand Database

Table D-16 (Part 1 of 2) Habitat Classification that Relates Biotic Assemblages to Wave Exposure and Shore Types

MAJOR SUBSTRATE	BEDROCK/BOULDER	BEDROCK/BOULDER	BEDROCK/BOULDER	BEDROCK/BOULDER	BEDROCK/BOULDER
COASTAL CLASS	1-20	1-20	1-20	1-23, 32, 33	1-23, 33
EXPOSURE (EXP_BIO)	VE	E	SE	SP	P, VP
HABITAT OBSERVED (HAB_OBS)	1	2	3	4	5
Upper	*Verrucaria*	*Verrucaria*	*Verrucaria*	*Verrucaria*	*Verrucaria*
		Balanus glandula	*Balanus glandula*	*Balanus glandula*	*Balanus glandula*
			Fucus distichus	*Fucus distichus*	*Fucus distichus*
Middle		*Semibalanus carriosus*	*Semibalanus carriosus*	*Semibalanus carriosus*	
		Mytilus trossulus	*Mytilus trossulus*	*Mytilus trossulus*	*Mytilus trossulus*
				Ulva/ Ulvaria spp.	*Ulva/ Ulvaria spp.*
mid/low			diverse mixed red algae, including *Odonthalia*	diverse mixed red algae including *Odonthalia*	
				Palmeria spp	
			Neoptilota		
		Alaria 'nana' morph			
Lower	*Lessoniopsis littoralis*	*Lessoniopsis littoralis*			
		Laminaria setchellii	*Laminaria setchellii*		
			Laminaria yezoensis		
				Cystoseira	
			Cymathera	*Cymathera*	
	foliose coralline reds	foliose coralline reds			
			Laminaria bongardiana morph		
				Pleurophycus	
			Alaria 'marginata' morph	*Alaria 'marginata'* morph	
				Laminaria saccharina morph	*Laminaria saccharina* morph
Subtidal		*Nereocystis luetkeana*	*Nereocystis luetkeana*	*Nereocystis luetkeana*	
			Alaria fistulosa		
				Zostera marina	*Zostera marina*

Table D-16 (Part 2 of 2) Habitat Classification that Relates Biotic Assemblages to Wave Exposure and Shore Types

MAJOR SUBSTRATE	SAND & GRAVEL	SAND & GRAVEL	SAND/MUD	SEDIMENT	BEDROCK OR SEDIMENT
COASTAL CLASS	**24 to 30, 32** **no PUC band**	**24 to 30, 32** **no PUC band**	**24 to 30, 31** **has PUC band** **ESTUARY**	**24 - 30**	**usually bedrock types**
EXPOSURE (EXP_BIO)	**SP**	**P, VP**	**SP, P, VP**	**SP, SE, E**	**VP, P, SP**
HABITAT OBSERVED (HAB_OBS)	**6**	**7**	**8**	**9**	**10**
Upper	*Verrucaria*	*Verrucaria*	*Triglochin, Plantago maritima, Carex*	*Elymus mollis*	tidal current dominated; may be a Protected wave exposure but shows an assemblage of indicator species from higher wave exposures.
			Puccinellia		
	Balanus glandula	*Balanus glandula*	*Balanus glandula*		
	Fucus distichus	*Fucus distichus*	*Fucus distichus*		
Middle	*Semibalanus carriosus*			no visible macrobiota due to sediment mobility or scour	
	Mytilus trossulus	*Mytilus trossulus*	*Mytilus trossulus*		
	Ulva/ Ulvaria spp.	*Ulva/ Ulvaria spp.*	*Ulva/ Ulvaria spp.*		
mid/low					
Lower	*Laminaria saccharina* morph	*Laminaria saccharina* morph			
	Alaria 'marginata' morph				Alaria 'marginata' *morph*
Subtidal	*Nereocystis luetkeana*				*Nereocystis luetkeana*
	Zostera marina	*Zostera marina*	*Zostera marina*		

Appendix E

CD Pocket

Directories:

ArcView	ArcView Shape Files
Access97	ShoreZone Data Files
MetaData	Meta Data Files
Word97	flightline Manual, Data Report (this report)