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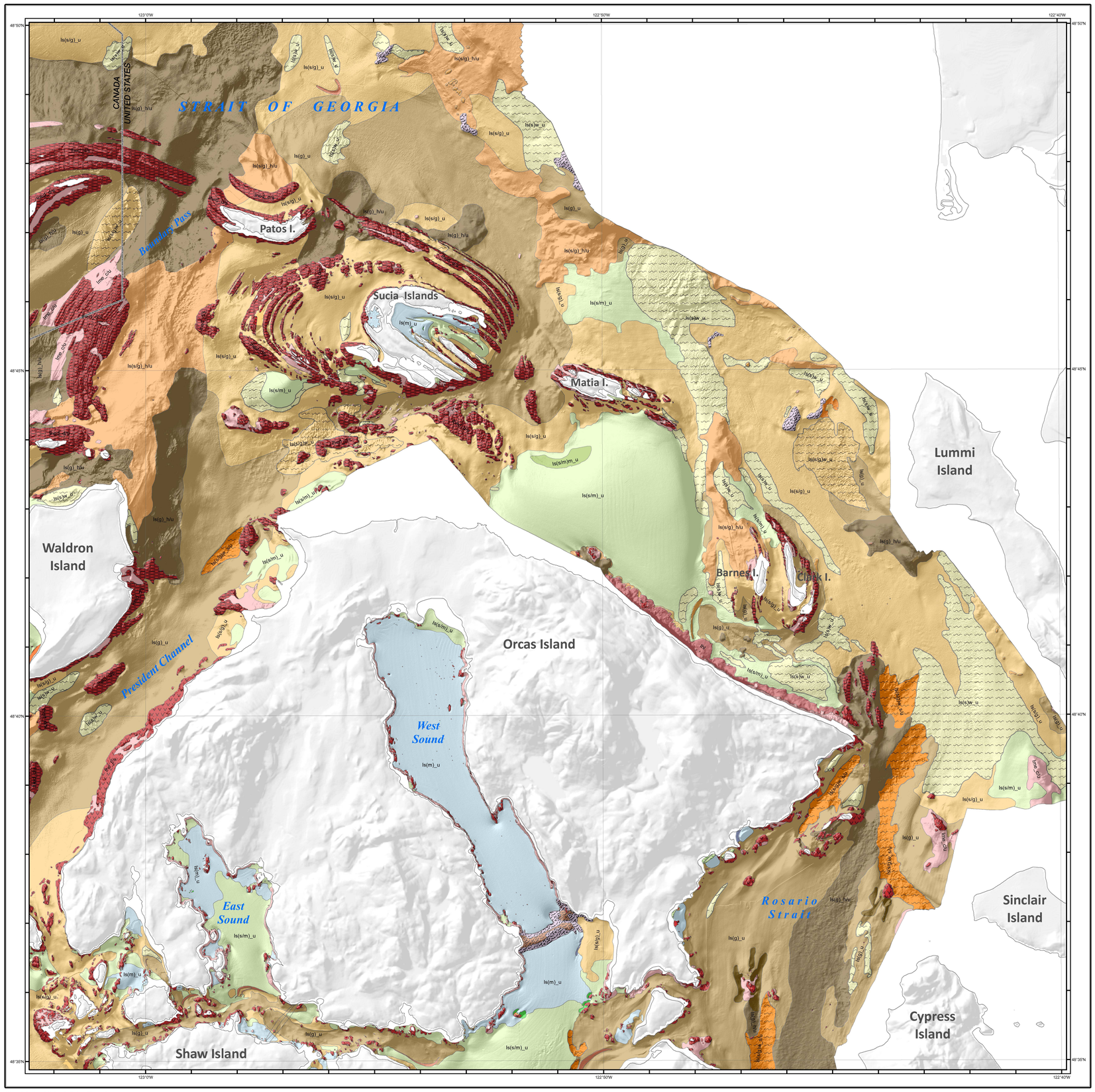


OPEN FILE 6625

POTENTIAL MARINE BENTHIC HABITATS AND SHADED SEAFLOOR RELIEF

SOUTHERN GULF ISLANDS AND SAN JUAN ARCHIPELAGO

CANADA AND U.S.A.

Sheet 3: Orcas Island

Scale 1:50 000/Échelle 1/50 000

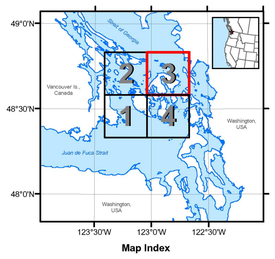
kilometres 1 0 1 2 3 4 kilomètres

Universal Transverse Mercator Projection, Zone 10
North American Datum 1983

This map is not to be used for navigational purposes

Projection transverse universelle de Mercator, Zone 10
Système de référence géodésique nord-américain, 1983

Cette carte ne doit pas être utilisée aux fins de navigation



Map Index

DESCRIPTIVE NOTES

The San Juan Archipelago-Southern Gulf Islands seafloor-mapping effort is an ongoing mapping program focused on the characterization of marine benthic habitats and the mapping of geology within the Salish Sea. The Salish Sea has suffered a severe decline in several species of bottom fish over the past several decades perhaps due to environmental degradation and overfishing (Puget Sound Ambient Monitoring Program, 2002; Fisheries and Oceans Canada, Rockfish Conservations Areas, 2006). The primary objective of this mapping program is to characterize potential[1] marine benthic habitats and geology. The final product includes interpretive maps that can be used to identify rockfish (*Sebastes* sp.) habitats, which then can be used by both Canada and the US to manage, conserve and sustain economically significant fisheries (considered outcomes) in the transboundary region. A mechanism that has been developed to address fisheries conservation and sustainability is the establishment of Marine Protected Areas (MPAs) and voluntary or mandatory no-take zones whose evaluation as a benthic habitat can be done using potential habitat maps. Therefore, a secondary objective of this mapping effort is to provide data where assessment, and if necessary modification, of established MPAs, and the establishment of new MPAs, can be made. Additional mapping objectives that evolved from this project include the identification of specific deep-water foraging habitats such as dynamic bedforms that harbor sand lance (*Ammodytes hexapterus*) and potential siliceous sponge reefs (*hexactinellid*), although these are not specifically identified in the maps as characterization of these specific habitat types is continuing.

The San Juan Archipelago-Georgia Basin region is an active tectonic province whose physiography and geomorphology reflect both Mesozoic to Cenozoic convergent (subduction/accretion) plate tectonic processes and Pleistocene glaciation (glacial scouring/deposition) (Barrie & Conway, 2002; England & Bustin, 1998). These processes have juxtaposed and deformed Jurassic-Cretaceous metamorphic rocks with Tertiary-Quaternary sedimentary rocks producing a complex of fjords, grooved and polished bedrock outcrops, and erratic boulders and moraines. Banks of till and glacial advance outwash deposits also contribute to the variety of sedimentary deposits and relief within the region. Tidal currents have reworked much of the preexisting glaciomarine sediments into dynamic bedforms consisting of sand and gravel waves, dune fields, and other modern day sedimentary deposits, such as sandy and muddy banks (Barrie & al., 2005).

This tectonic province can be divided into two distinct zones based on bedrock types: a northern sedimentary bedrock zone (Mustard & Rouse, 1994) and a southern metamorphic rock zone (Yorath, 2005) separated by the Haro fault (see map sheets 2 and 3). Both zones contain large underwater bedrock exposures showing clearly the differential erosion characteristic of sedimentary rocks, which form ledges and overhangs. In contrast, the metamorphic bedrock is highly fractured and faulted, forming cracks, crevices, and blocky boulder aprons. The intensity and variety of geological processes have resulted in the large variety of potential marine benthic habitat types mapped in the region.

The habitat classification scheme follows an existing habitat classification code, which was established to distinguish habitat types for species of interest and to facilitate ease of use and queries in GIS and other database programs. The code used in this map is modified from the scheme developed by Greene et al. (1999, 2007) for deep-water habitat characterisation.

The interpretation of the high-resolution multibeam seafloor imagery into habitat type delineation was based on knowledge of the geology of the seafloor and seafloor processes in the study area (Thompson, 1981, Mosher et al., 2000; Hewitt & Mosher, 2001; Barrie et al., 2005; 2009). Geological processes, structure and morphology depicted in the imagery were used to distinguish distinct potential habitat types. Mapping of the habitats was done at 1:20 000 scale using editing tools in ESRI ArcGIS software. Resolution of seafloor features varied from 2 to 5 m/pixel, depending on the type of multibeam echosounder (MBES) systems that were used in the various surveys (Greene & Barrie (Eds.), 2011a; 2011b). However, for most of the area, seafloor features such as bedrock types (e.g., sedimentary, metamorphic, volcanic, and granitic rocks), structures (e.g., faults, folds, scours, and landslides), and bedforms of unconsolidated sediments were easily distinguished. To differentiate pinnacle and/or boulder (lh(b)/p) habitats from simple bedrock habitat, a specific rule was assigned where any known bedrock polygons with a surface area smaller than 500 m2 became identified with "lh(b)/p".

The Transboundary region covered by this map series has been divided into four quadrants and this sheet (Sheet 3 of 4, Orcas Island area) covers most of the area around Orcas Island including West and East sounds, Patos, Sucia, Matia, Barnes and Clark islands. Habitat types here are predominantly comprised of hard differentially eroded sedimentary bedrock on the smaller islands and northern Orcas while most of Orcas is comprised of metamorphic and plutonic basement rocks. Dynamic bedforms are located in northern Rosario Strait and southern most Strait of Georgia. A large lobe of sediment, probable Fraser River sediment, is located offshore northeastern Orcas, while an apron of rubble, probable landslide deposits, are located along the steep front of southwestern Orcas. Strong currents through Rosario Strait and President Channel sweep the bedrock clean and produce sediment waves and dune fields.

This potential benthic habitat open file is the third product presented as part of an open file map series. Seafloor topographic multibeam sonar data is presented as the first open file of the series (Greene & Barrie (Eds.), 2011a) and co-registered along with multibeam sonar bathymetric data, backscatter strength data is presented as the second open file of the series (Greene & Barrie (Eds.), 2011b).

[1]'Potential' is used here to indicate that the habitat mapped on the basis of morphology and substrate type may not have a known species or assemblage of organisms that are identified to use the habitat.

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KEY TO HABITAT TYPES

Not all units may appear on this map sheet.

Unconsolidated substrate (mud)

ls(m)_u	*Unconsolidated sediments*
ls(m)t_u	*Unconsolidated sediment terrace*
ls(m)_h/u	*Hummocky unconsolidated sediments*
ls(m)m_u	*Mound*
ls(m)h_e/u	*Pockmark*
ls(m)h_s/u	*Scour depression*
ls(m)_h/a-dd/u	*Hummocky dredge or anchor disturbances*
ls(m)g_a-dg/u	*Dredge channel*
ls(m)t_h/a/u	*Sawdust terrace*

Unconsolidated substrate (sand / mud)

ls(s/m)_u	*Unconsolidated sediments*
ls(s/m)_h/u	*Hummocky unconsolidated sediments*
ls(s/m)v/t_u	*Vegetated unconsolidated sediment terrace*
ls(s/m)m_u	*Linear ridge*
ls(s/m)i/m_u	*Ice-formed mound*
ls(s/m)h_u	*Depression*
ls(s/m)h_s/u	*Scour depression*
ls(s/m)g_s/u	*Scour gully*
ls(s/m)g/w_s/u	*Scour gully with sediment bedforms*
ls(s/m)s_s/u	*Current-scoured scarp*
ls(s/m)s_u	*Scarp*
ls(s/m)_h/a-dd/u	*Hummocky dredge or anchor disturbances*

Unconsolidated substrate (sand / gravel)

ls(s/g)_u	*Unconsolidated sediments*
ls(s/g)_h/u	*Hummocky unconsolidated sediments*
ls(s/g)w_u	*Sediment bedforms*
ls(s/g)w_s/u	*Current-scoured sediment bedforms*
ls(s/g)m_u	*Mound or linear ridge*
ls(s/g)i/m_u	*Ice-formed mound, esker or moraine*
ls(s/g)i/m_h/u	*Hummocky ice-formed mound*
ls(s/g)h_u	*Depression*
ls(s/g)i/h_s/u	*Dropstone depression*
ls(s/g)h_s/u	*Scour depression*
ls(s/g)g_s/u	*Scour gully*
ls(s/g)l_h/u	*Hummocky landslide deposit*
ls(s/g)s_s/u	*Current-scoured scarp*
ls(s/g)_a-dm/u	*Dredge disposal*
ls(s/g)_h/a-dd/u	*Hummocky dredge or anchor disturbances*
ls(s/g)g_a-dg/u	*Dredge channel*
ls(s/_h/a-f/u	*Ferry-wash scour*

Unconsolidated substrate (sand)

ls(s)_u	*Unconsolidated sediments*
ls(s)t_u	*Unconsolidated sediment terrace*
ls(s)w_u	*Sediment bedforms*
ls(s)m_u	*Mound or Linear ridge*
ls(s)m_s/u	*Scour ridge*
ls(s)h_s/u	*Scour depression*

Unconsolidated substrate (gravel)

ls(g)_u	*Unconsolidated sediments*
ls(g)_h/u	*Hummocky unconsolidated sediments*
ls(g)m_u	*Mound or linear ridge*
ls(g)i_m/u	*Ice-formed mound or moraine*
ls(g)h_s/u	*Scour depression*
ls(g)s_s/u	*Current-scoured scarp*

Unconsolidated substrate (boulders)

ls(b)i/m_u	*Moraine*

Sediment covered bedrock

lme_c/u	*Sediment covered bedrock*

Hard substrate

lhl	*Rock fall*
lh(b)/p	*Pinnacle or boulder*
lhe_f/s	*Fractured bedrock*
lhe_g/s	*Granitic bedrock*
lhed_d/s	*Sedimentary bedrock*
lh_a-w	*Anthropogenic structure - Shipwreck*
lh_a-p	*Anthropogenic structure - Supports*
lh_a-s	*Anthropogenic structure - Pipeline*
lh_a-g	*Anthropogenic structure - Former vessel loading facility, jetty or riprap*

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SHEET 3 OF 4
FEUILLET 3 DE 4

Sheet 3 of 4, Orcas Island
Endris, C.; Picard, K.

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