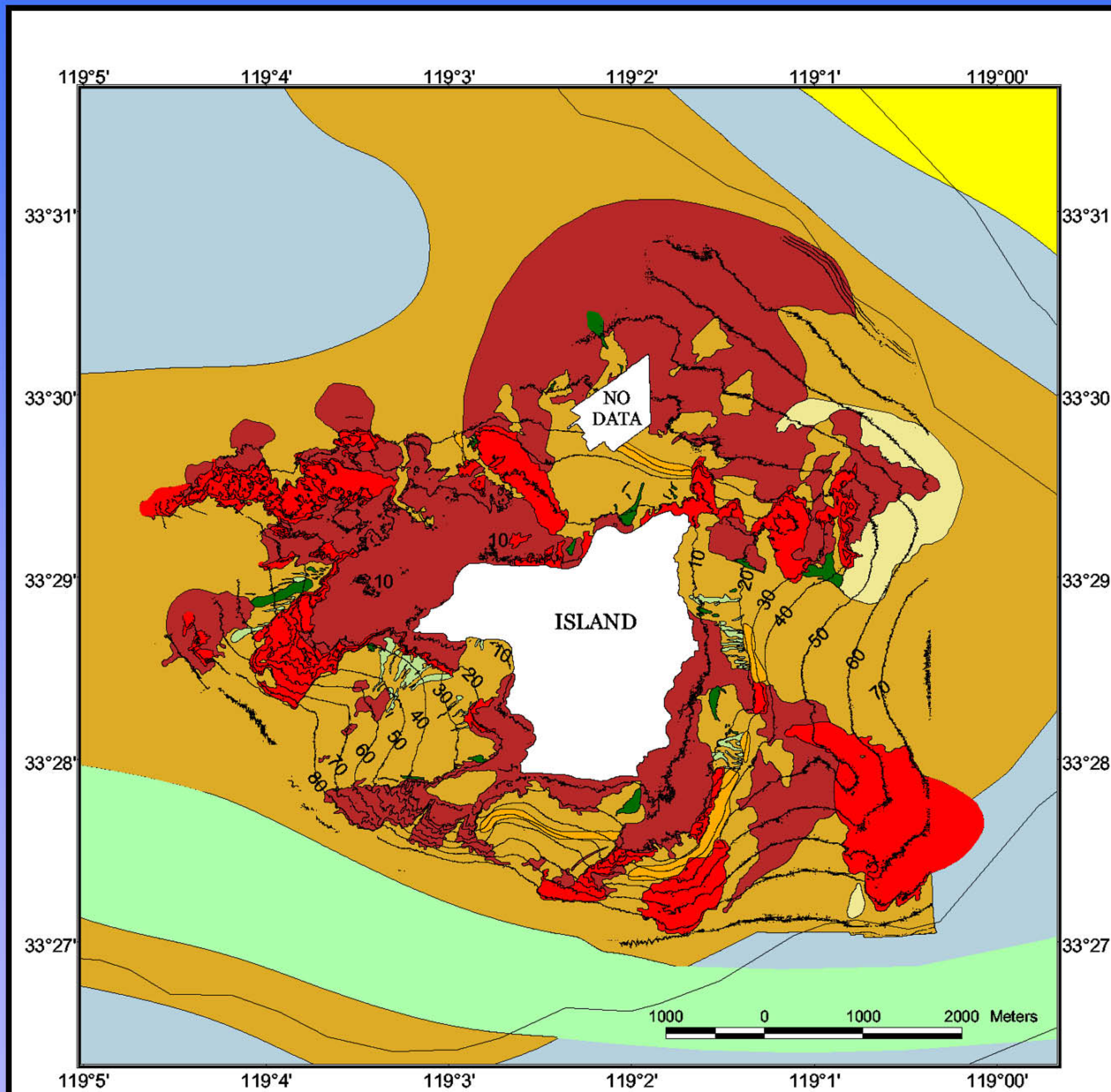
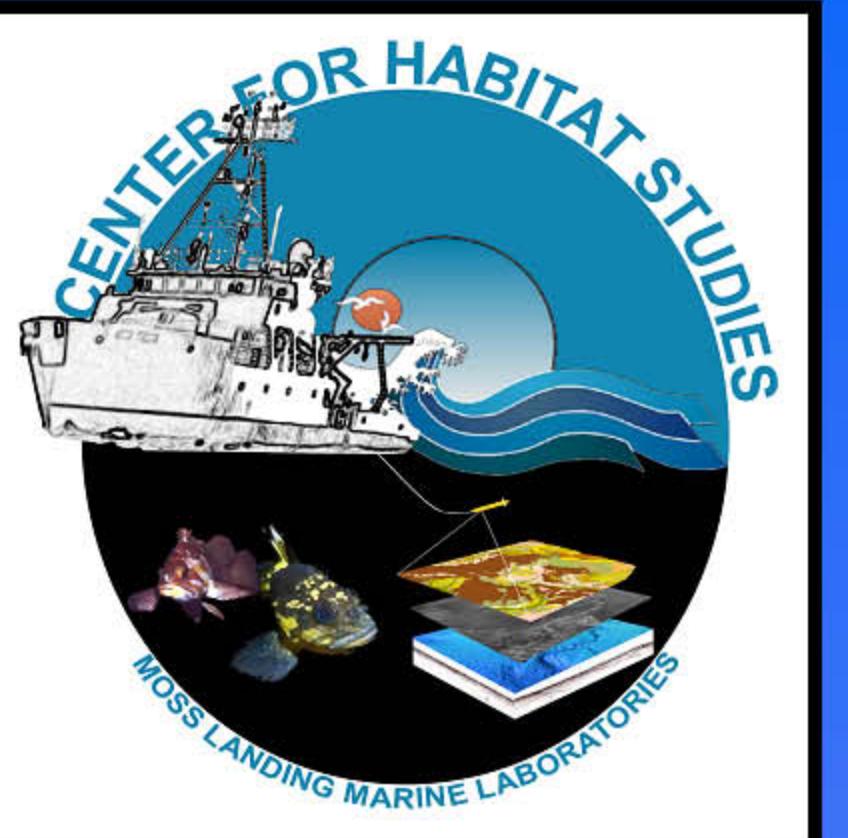




Habitat Mapping of the Cowcod Conservation Areas, Southern California Borderland, USA

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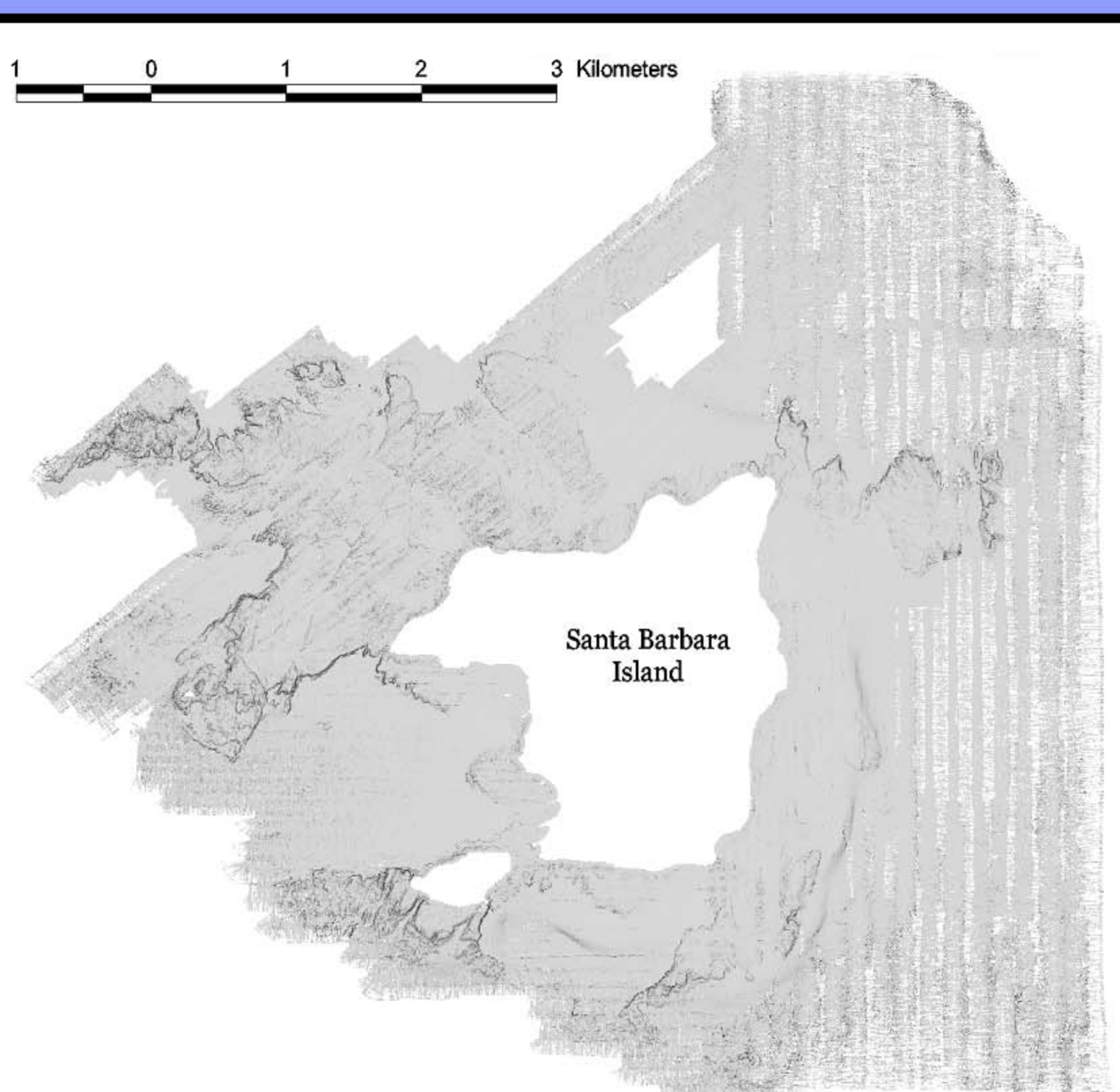


Santa Barbara Island

Santa Barbara Island was formed by volcanic activity and uplifted to its current position. During different periods of the uplifting process, wave erosion formed marine terraces and the island was submerged during the Pliocene and Pleistocene eras. As a result of its geologic history, the shallow shelf areas around Santa Barbara Island are comprised of hard volcanic rock outcrops and fairly well developed marine terraces, as depicted above.

Abstract

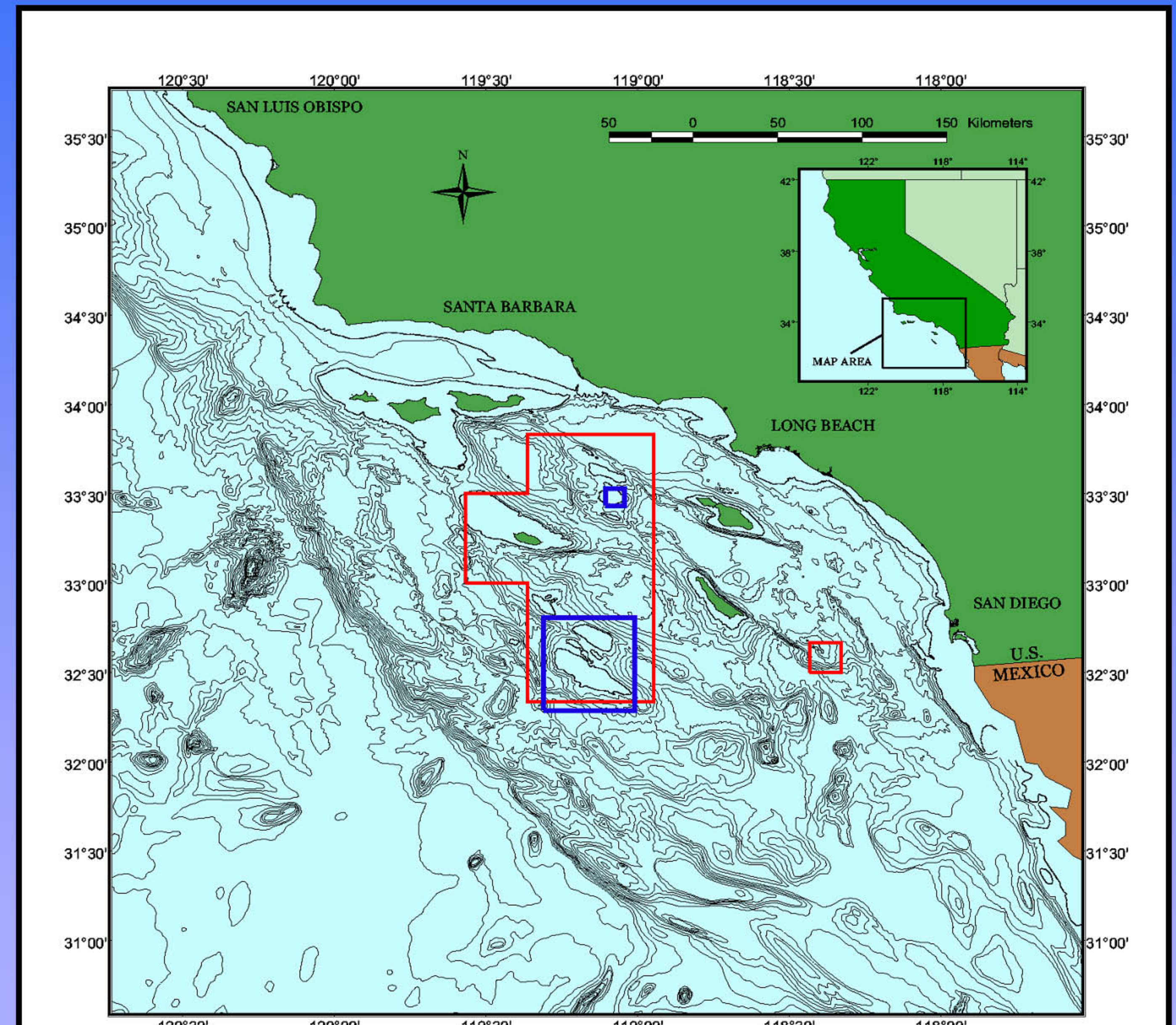
The recent collapse of both recreational and commercial fisheries for cowcod prompted the Pacific Fisheries Management Council, together with the National Marine Fisheries Service and the state of California, to establish two Cowcod Conservation Areas (CCAs) in the Southern California Bight. These two areas, encompassing approximately 4,200 nm² and 100 nm², include key cowcod habitat along the Santa Rosa-Cortes and northern San Clemente Ridges and also the San Nicholas and Santa Barbara Islands. This area lies in a diverse and complex geologic setting comprised of basins filled with sediment and ridges generally covered with unconsolidated sediment. In order to distinguish habitat types for further assessment of cowcod abundance in these areas, we have compiled a seafloor data set comprised of marine geologic maps, seafloor sampling information, and a Reson 8101 100 kHz multibeam bathymetric survey in the shallow shelf areas of Santa Barbara Island for interpretation into habitat maps. The geologic maps were primarily constructed from interpreted seismic reflection profiles and modified to show true or assumed seafloor, or near seafloor, substrate types. This work illustrates the usefulness of marine geologic maps in "first-cut" habitat type delineation, especially in delineating hard from soft substrate types. Habitat types ranging from hard differentially eroded bedrock exposures to soft unconsolidated sediments were identified. Complex detailed habitats were identified around Santa Barbara Island and on the Tanner-Cortes Bank. On Tanner-Cortes Bank irregular, highly rugose volcanic rock crops out in the shallow-water crests and is surrounded by well-developed erosional and depositional marine terraces and flow surfaces. The shallow shelf areas around Santa Barbara Island are comprised of hard volcanic rock outcrops and fairly well developed marine terraces. These habitat maps will be used to prioritize future high-resolution mapping efforts and to locate submersible dive sites for cowcod assessment surveys.



A Reson 8101 100 kHz multibeam bathymetric survey which also provided backscatter data was used in making interpretations, of habitat types around Santa Barbara Island. Geologic maps were used to supplement these data.

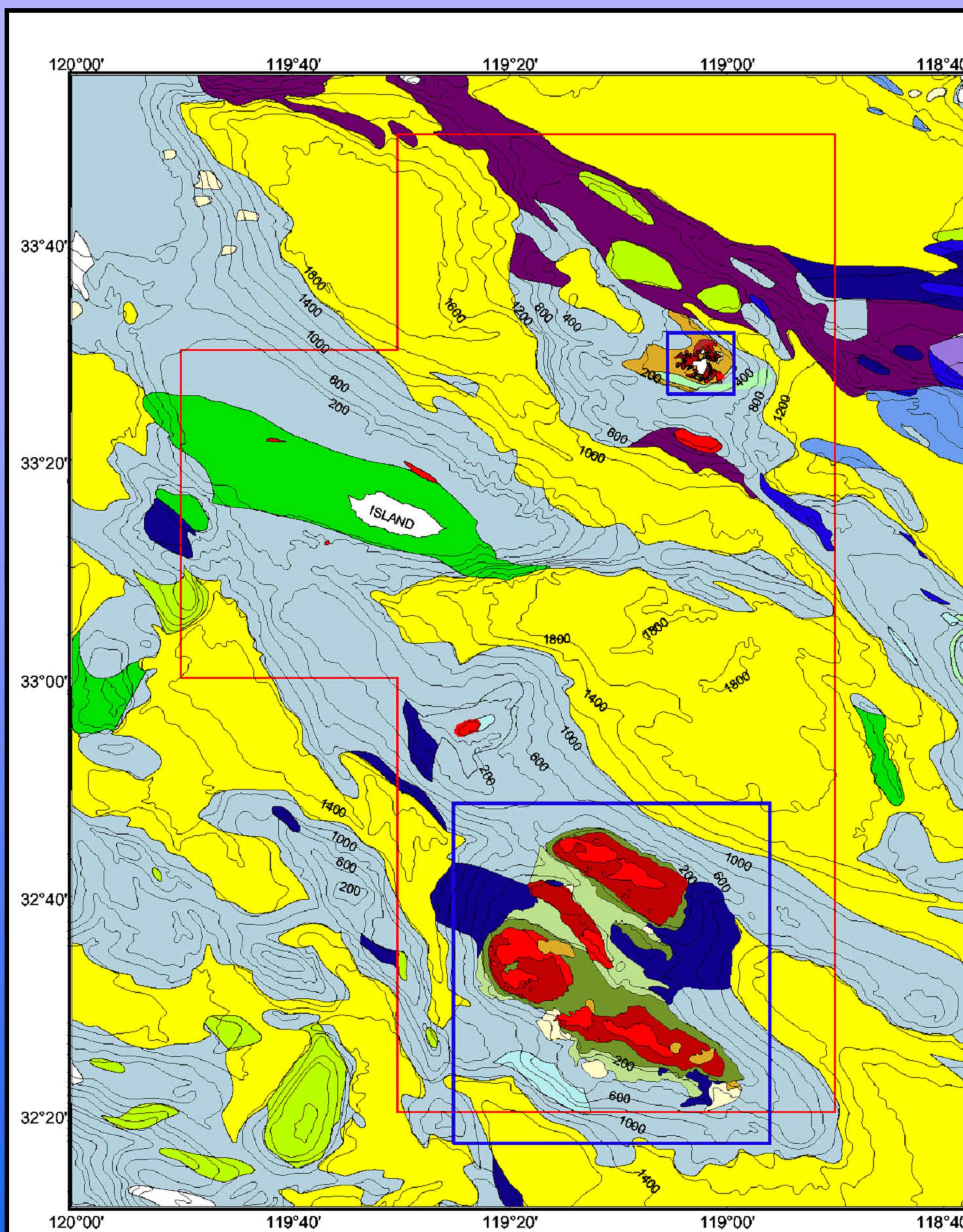
Habitat type Description

Habitat type	Description
Bs_u	Soft unconsolidated sediment on basin floor
Fsl_h	Hummocky landslide deposit of unconsolidated sediment on ridge flank
Rs(s)_u	Soft (sand?) unconsolidated sediment on ridge crest
Rsl/b_u	Soft unconsolidated sediment on depositional terrace, beach ridge, or island crest
Rsw_u	Soft unconsolidated sediment waves on ridge crest
Fm(b?)_u/h	Mixed hard boulders locally covered with unconsolidated sediment, hummocky surface, on ridge flank
Fm_b/u	Mixed consolidated bimodal sedimentary bedrock locally exposed and covered by unconsolidated sediment on ridge flank
Fm_v	Mixed hard volcanic rock covered by soft unconsolidated sediment on ridge or island flank
Fmd_u/d	Mixed unconsolidated sediment overlying deformed, differentially eroded bedrock locally exposed on ridge flank and basin slope
Fme_u/d	Mixed unconsolidated sediment overlying differentially eroded bedrock on ridge flank
Fme_u/h	Mixed consolidated sedimentary bedrock locally covered by soft unconsolidated sediment with hummocky surface on ridge flanks
Fmt_c/d	Hard wave cut terrace or consolidated differentially eroded sedimentary bedrock, locally covered with unconsolidated sediment on island flank
Rm(g/p?)_b/u	Mixed unconsolidated sediment (gravel/pebble) stringers and deposits on island shelf
Rme_b/u	Mixed hard bimodal (conglomerate) bedrock locally covered by unconsolidated sediment on ridge
Rm_v	Mixed hard volcanic rock locally covered with soft unconsolidated sediment on ridge
Rm(b)_t_d	Mixed unconsolidated and consolidated sediment depositional terrace on outer edge of ridge crest
Rm_b/u	Mixed ponded unconsolidated bimodal (sand and gravel?) in swales on ridge and in stringers on island flank
Rmt_c/d	Mixed hard wave eroded bedrock terrace locally differentially eroded and covered with sediment on ridge
Rh(b)_v	Hard volcanic rock outcrops, pinnacles, and boulders exposed on ridge crest and locally covered with soft unconsolidated sediment with hummocky surface on ridge flank
Rht_v	Hard wave eroded volcanic rock terrace or flow surface locally covered with unconsolidated sediment on ridge crest



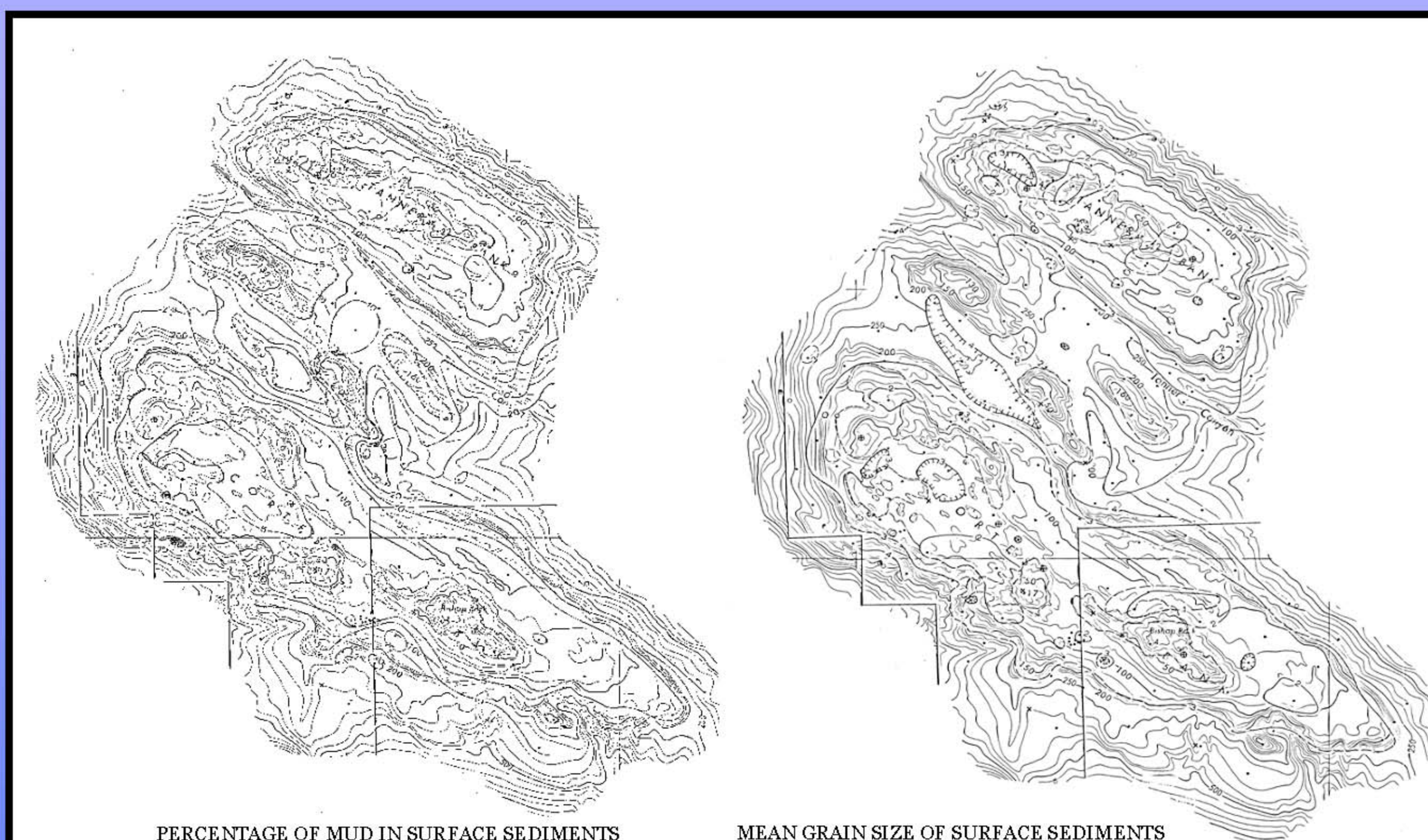
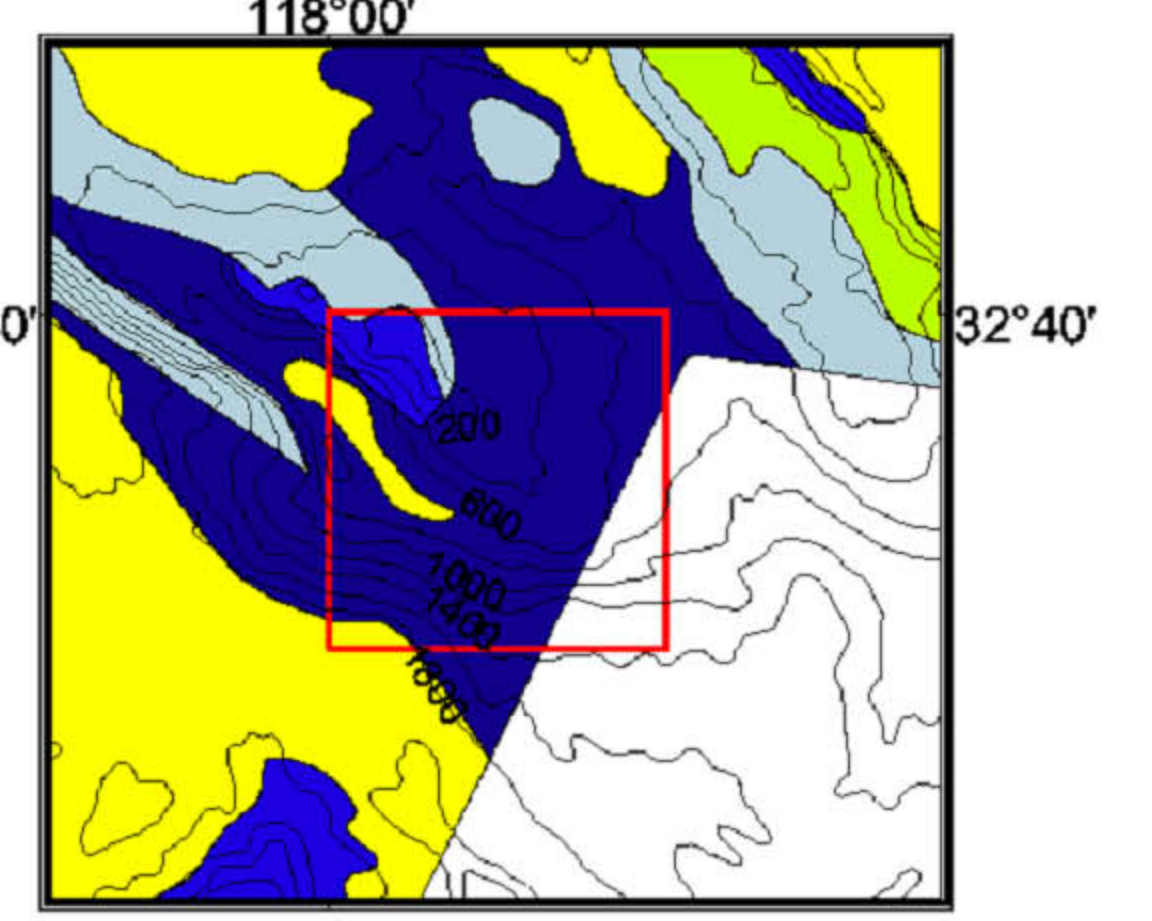
Reference Map

The Southern California Bight is a topographically and geologically complex region consisting of a series of basins and islands/ridges. The basins are a sequence of sedimentary sinks that lie at varying distances from the sediment sources and have a large variety of basin-floor morphologies and depths, slope gradients, sill depths, and sediment accumulation rates.

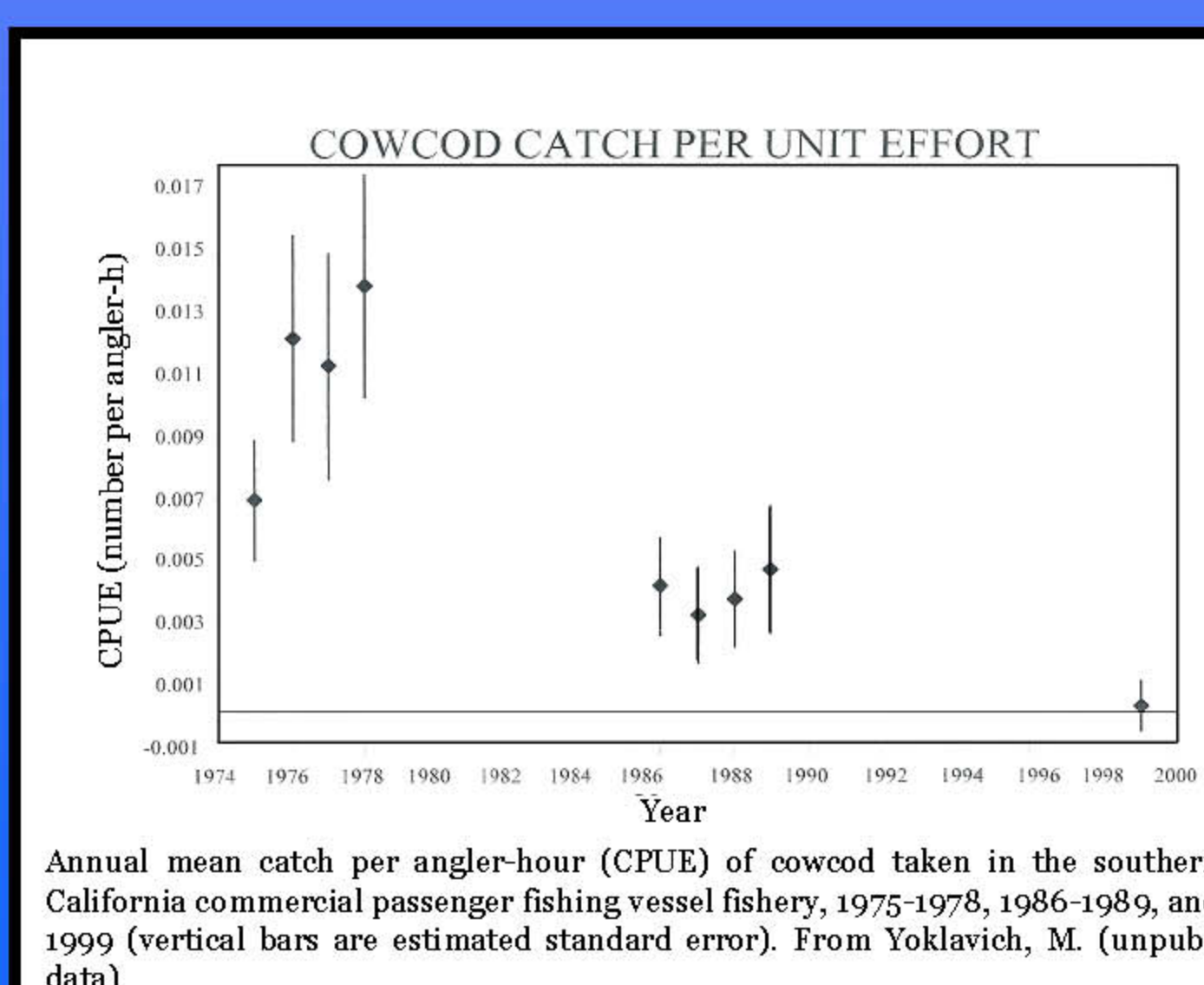


Cowcod Conservation Areas

This preliminary marine benthic habitat map of the Cowcod Conservation Areas is based on previous geologic, sedimentologic maps and multibeam bathymetric data recently collected around Santa Barbara Island. From this map we are able to target sites that may be promising habitats for Cowcod rockfish. We have tentatively identified the rugged volcanic outcrops and lava flows exposed on the crest of Tanner-Cortes Banks and on the shelf of Santa Barbara Island as high potential sites for future study within the CCA. In addition, differentially eroded Miocene sedimentary rocks that locally crop out on island and ridge flanks in the CCA have been selected as secondary targets as they may contain well-developed overhangs, caves, and crevices that could attract rockfishes.



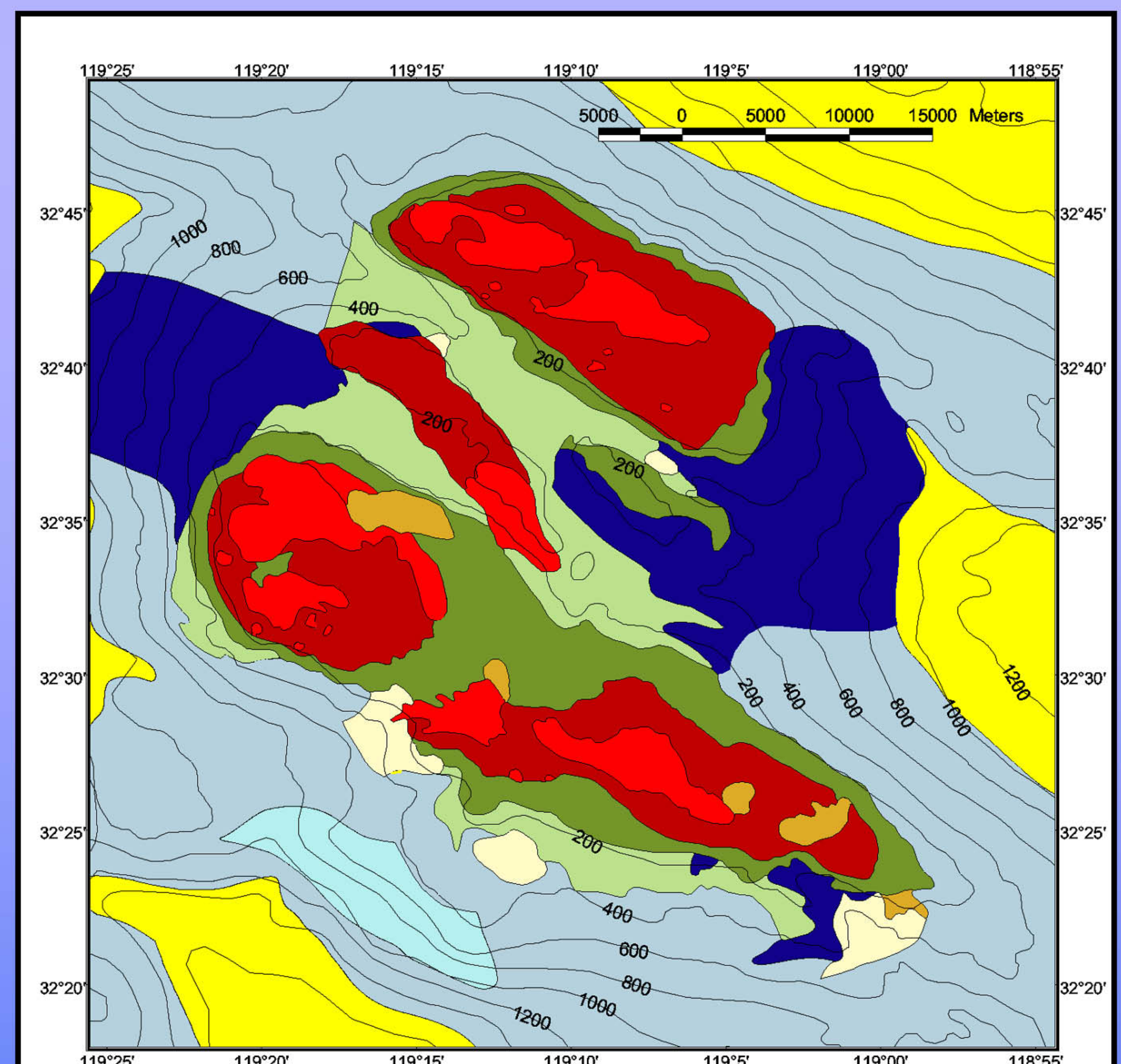
Maps of mud percentage and mean grain size of surface sediments in the Tanner-Cortes Banks area along with geomorphologic maps were useful in assessing substrate type and sediment cover. Geologic maps were also used to determine Habitat types.



Annual mean catch per angle-hour (CPUE) of cowcod taken in the southern California commercial passenger fishing vessel fishery, 1975-1978, 1986-1989, and 1999 (vertical bars are estimated standard error). From Yoklavich, M. (unpub. data)



Cowcod (*Sebastes levis*)



Tanner-Cortes Banks

The crest of Tanner-Cortes Banks is irregular and composed of rugged outcrops of Miocene volcanic rocks surrounded by flat marine terraces. These terraces were constructed both from erosion and deposition. The inner terraces were eroded into bedrock while the outer terraces are progradational features resulting from the deposition of materials eroded from the inner terraces and the volcanic core of the Banks. Pockets of Quaternary unconsolidated materials (sand and gravel) are concentrated in the swale between Tanner and Cortes Banks and locally along the upper flank of the Banks.

Acknowledgements

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