

**Zonificación para el cultivo de moluscos como
mecanismo para ayudar a mejorar la calidad de las
aguas costeras en lagunas y bahías de PR**

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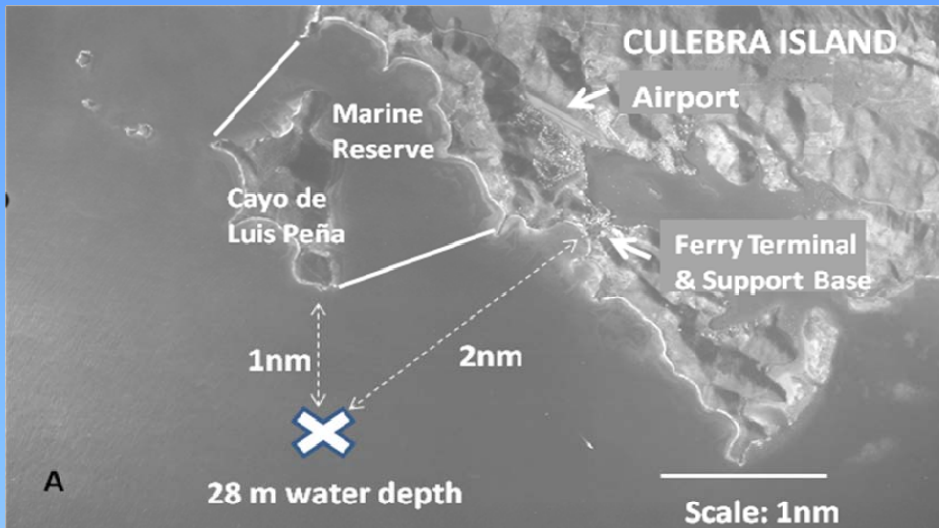


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Caribbean Coral Reef Institute



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Brian O'Hanlon & Pesquera Delly, Guaymas, Mexico

Site Selection Criteria for Open Ocean Aquaculture

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Introduction

Recent technological advances in offshore cage systems allow for the development of aquaculture operations in the open ocean. This offshore industry is rapidly expanding throughout the world. Indeed, during the past 20–30 years, the salmon industry has driven such technological advances, reaching a point where state-of-the-art aquaculture cages with 100 m of diameter or more, capital cost under US\$7/m³, and widespread applications have been extensively exposed to high-energy environments (Scott and Muir, 2000). The technology is in place, as over the past decade a variety of modern submersible, semisubmersible, and floating cages have been designed and built to “conform” with waves and strong currents associated with the

ABSTRACT

With aquaculture steadily expanding, the need for suitable space has been followed by the development of more efficient, cost-effective, and environmentally sustainable methodologies. Avoiding possible conflicts between the development of commercial aquaculture operations and the environmental impact in coastal areas, utilizing the offshore environment offers the greatest potential for expansion of the industry in most regions throughout the world. Although currents and greater depths generally increase the assimilation capacity and energy of the offshore environment and offer many advantages for aquaculture, a number of challenges associated with developing any activity in the open ocean environment must be taken into consideration. This article summarizes these advantages and challenges, focusing on the first and most crucial step for project development: site selection criteria for open ocean aquaculture. Although most of the concepts and criteria are common to other marine net pen aquaculture operations, we review and present those conditions that are inherent to the open ocean environment and must be considered before developing any offshore aquaculture activity. These encompass basic premises; assumptions; logistics; infrastructure; availability of manpower, services, and materials; legal framework; socioeconomic and political issues; and oceanographic, biological, environmental, and technological criteria. There are no defined set of criteria, as most are interacting and not fixed but interdependent (e.g., depth vs. current velocity). However, suitable sites must meet basic crucial standards summarized here.

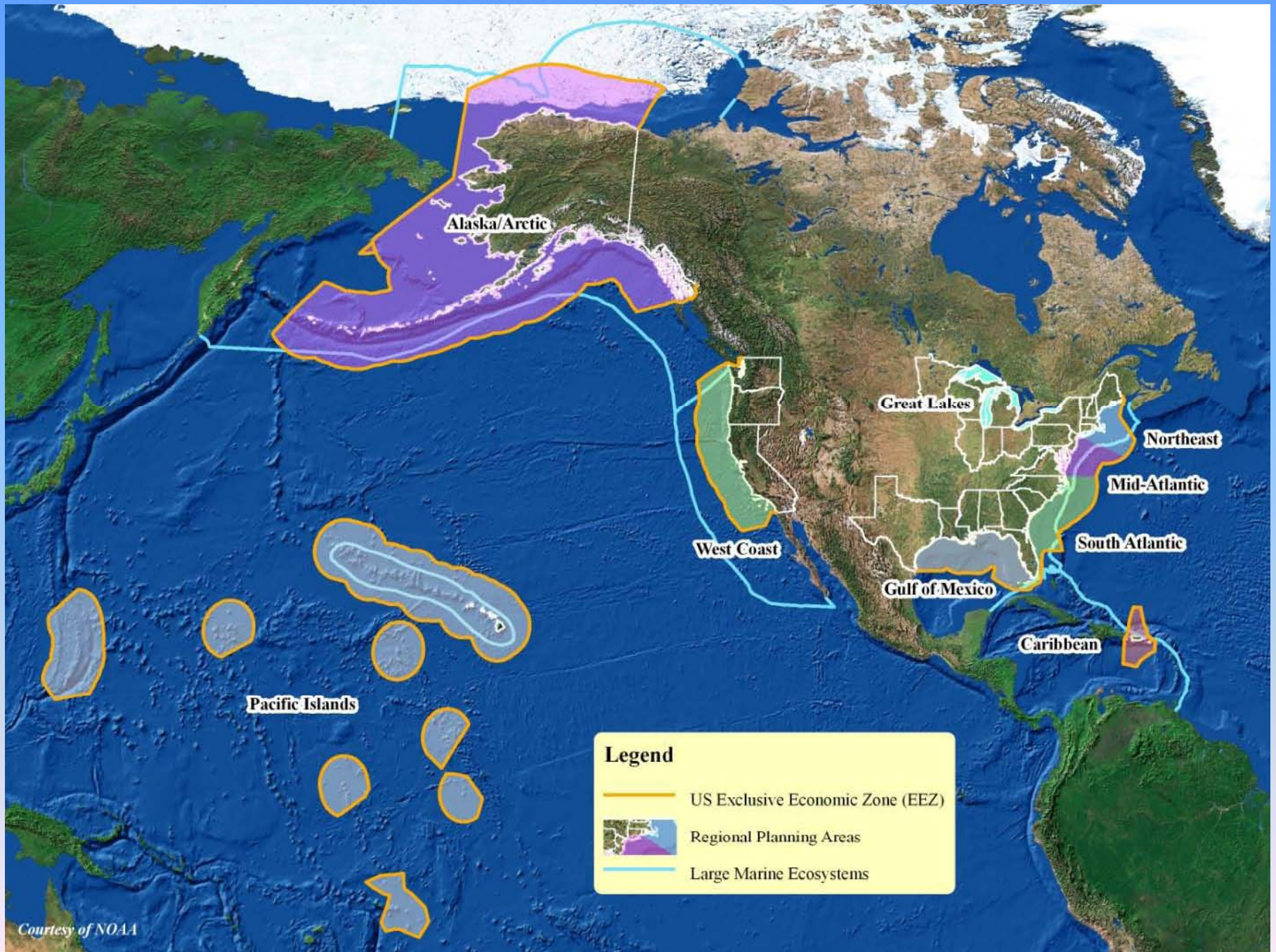
Site selection is one of the most important decisions for the establishment of a fish farm operation. Satellite images, hydrographic charts, maps, Google Earth, and Geographic Information Systems can all provide important information for preliminary work on site assessment; however, a very careful *in situ* survey is mandatory to evaluate the suitability of the area.

Keywords: Open ocean aquaculture, Offshore fish farming, Selection criteria for ocean fish farming

high-energy environment generally associated to offshore areas.

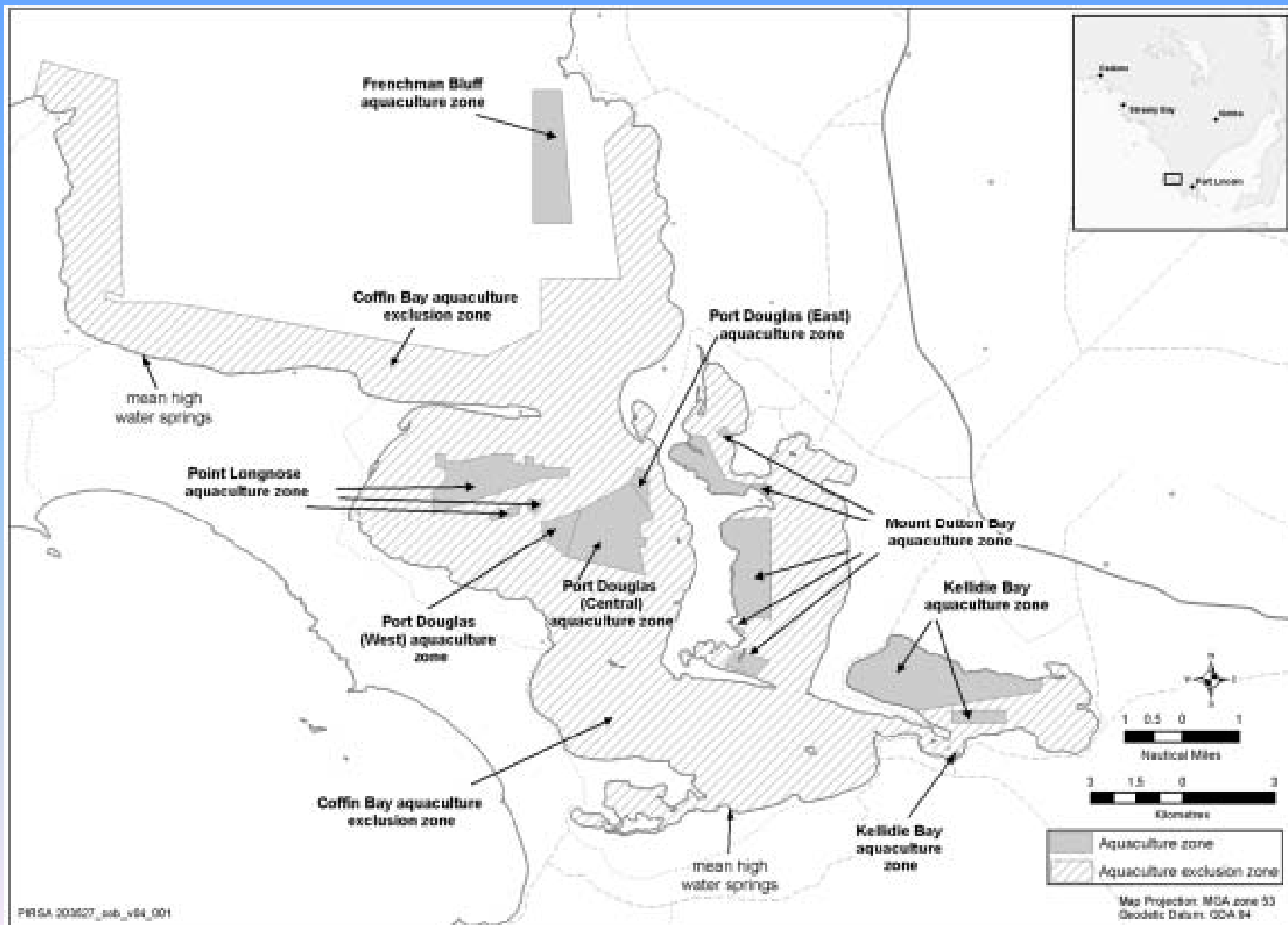
In addition to the attainable benefit of higher potential profits, offshore aquaculture may provide the benefits of (1) overall reduction in conflicts with other users and in objections from adjacent landowners; (2) avoidance of the ecological carrying capacity limitations of inshore waters; (3) access to larger volumes of high-quality water for finfish or filter-

feeding organisms; (4) reduction of overall ecological impacts; (5) possible reduction of regulatory and permit requirements; and (6) ability to culture high-value, open ocean species (Srickney and McVey, 2002). Although the economical feasibility of such operations is still being evaluated, the potential benefits described signal the feasibility of raising a variety of marine finfish species in offshore environments to increase production while

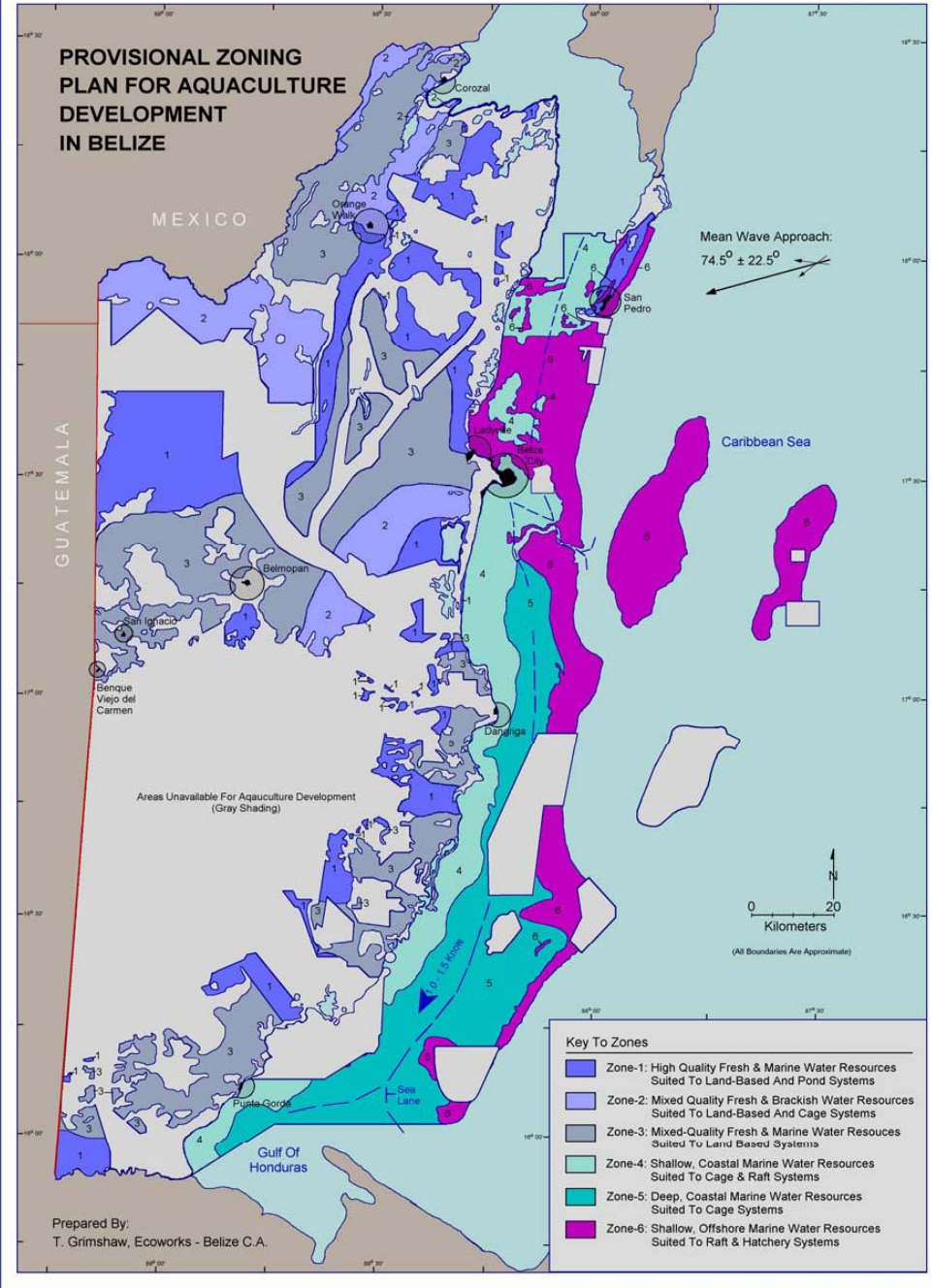


Courtesy of NOAA

Coffin Bay, Australia



**PROVISIONAL ZONING
PLAN FOR AQUACULTURE
DEVELOPMENT
IN BELIZE**



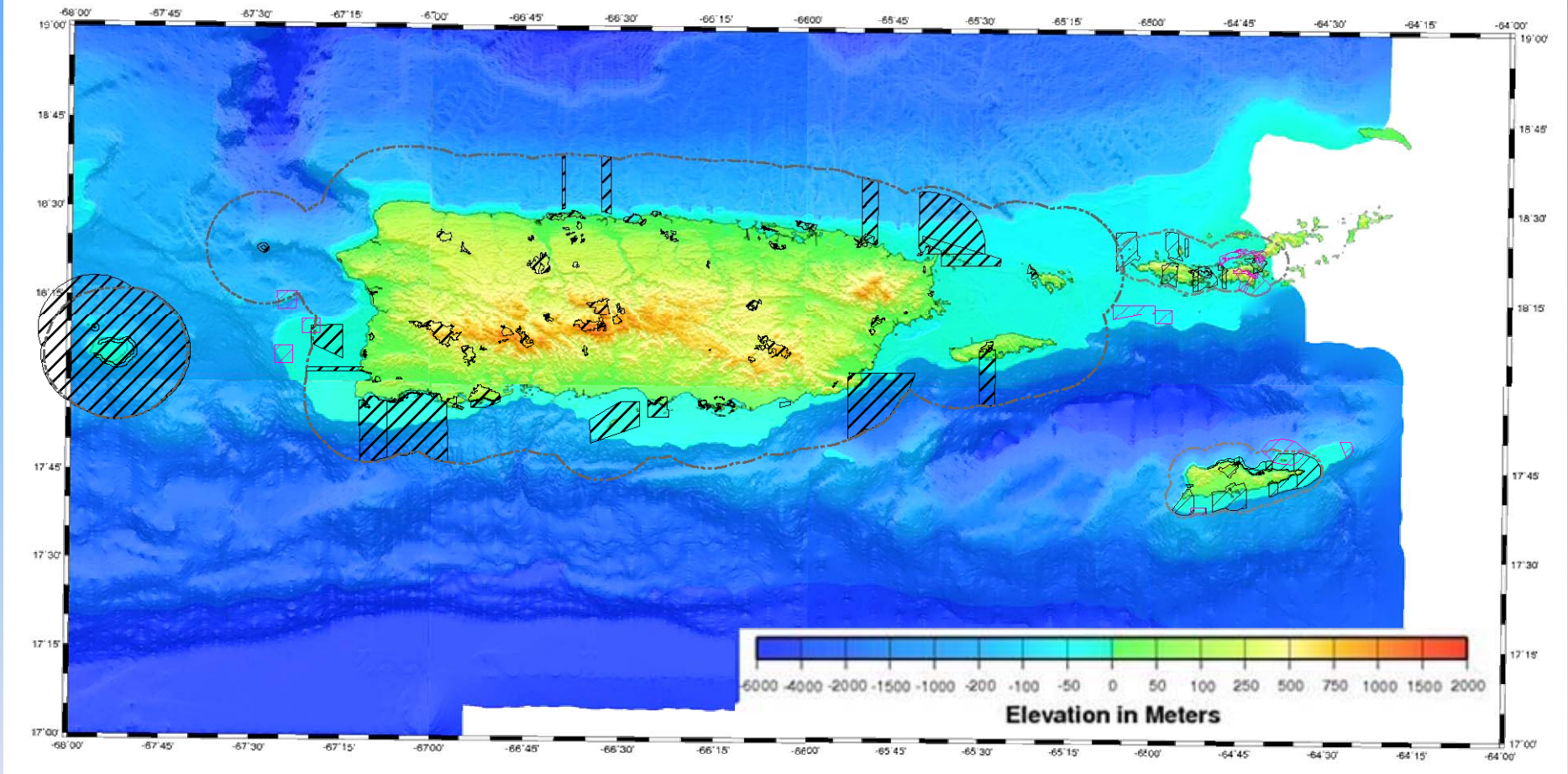
Prepared By:
T. Grimshaw, Ecoworks - Belize C.A.

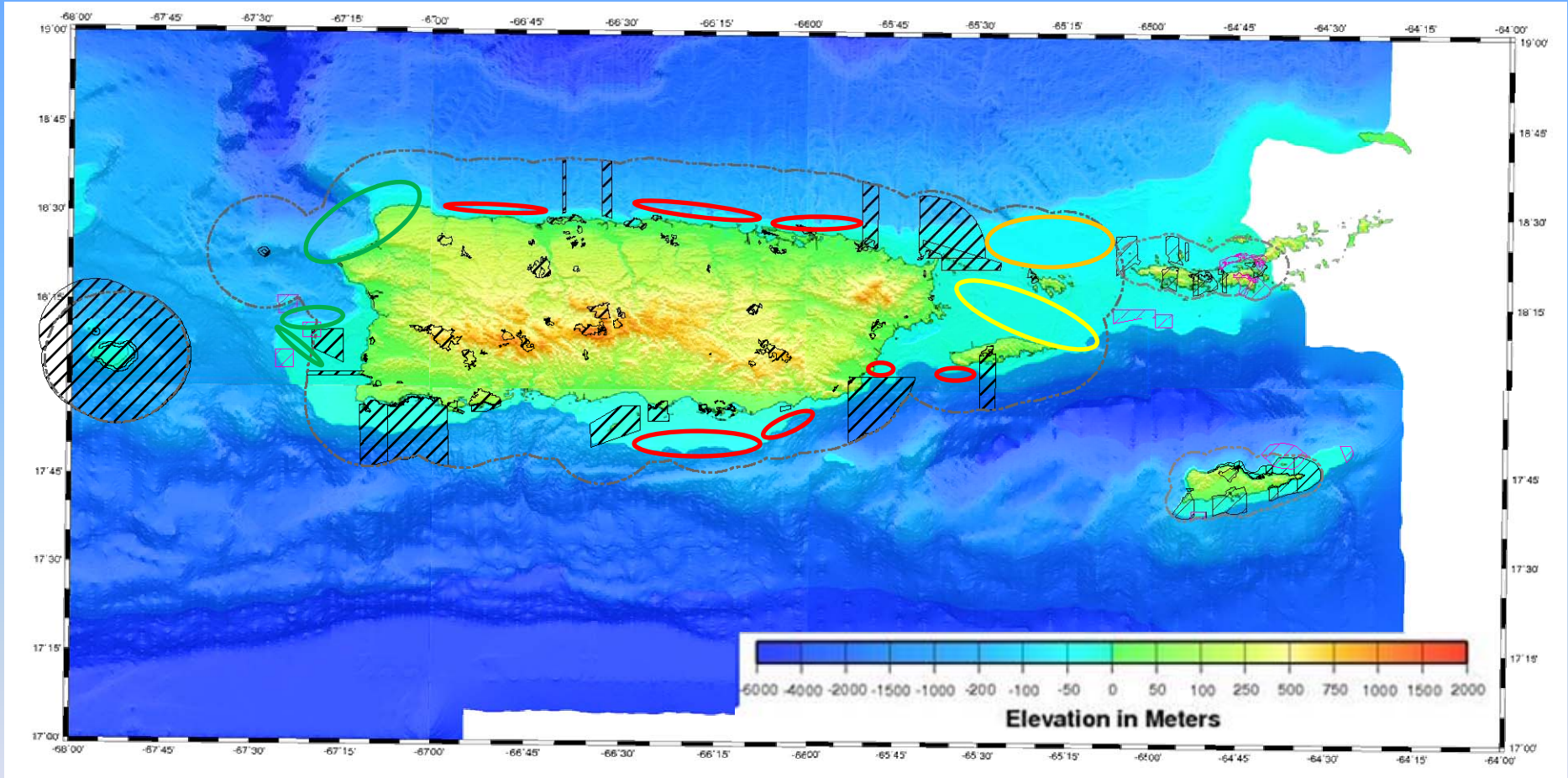
Key To Zones

- Zone-1: High Quality Fresh & Marine Water Resources Suited To Land-Based And Pond Systems
- Zone-2: Mixed Quality Fresh & Brackish Water Resources Suited To Land-Based And Cage Systems
- Zone-3: Mixed-Quality Fresh & Marine Water Resources Suited To Land Based Systems
- Zone-4: Shallow, Coastal Marine Water Resources Suited To Cage & Raft Systems
- Zone-5: Deep, Coastal Marine Water Resources Suited To Cage Systems
- Zone-6: Shallow, Offshore Marine Water Resources Suited To Raft & Hatchery Systems

Weather Observations and Prediction Zones , Buoy Location







SITUACION:

MERMA EN LA DENSIDAD DE OSTIONES Y ALMEJAS

NUMERO DE COLIFORMES ALTOS EN LAGUNAS Y BAHIAS

EUTROFICACION EN LAGUNAS Y BAHIAS

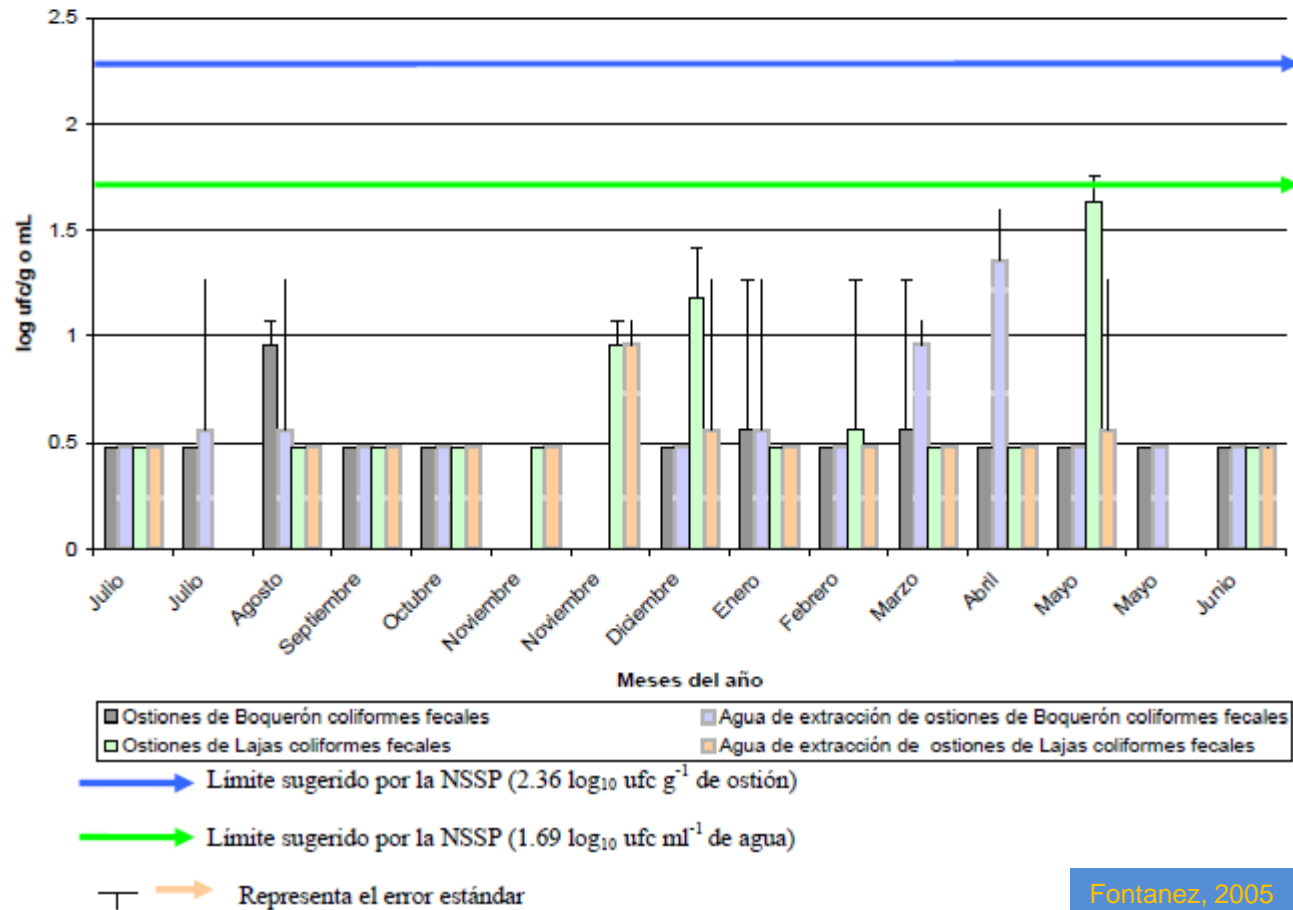
RECURSO POCO VALORADO POR SER INVERTEBRADO

TAZA DE CRECIMIENTO ALTA (OSTIONES 1 mm/dia)



Crassostrea rhizophorae
Netherlands Antilles, Curaçao, Spaanse Water
NMR 54930. Common size 60 mm

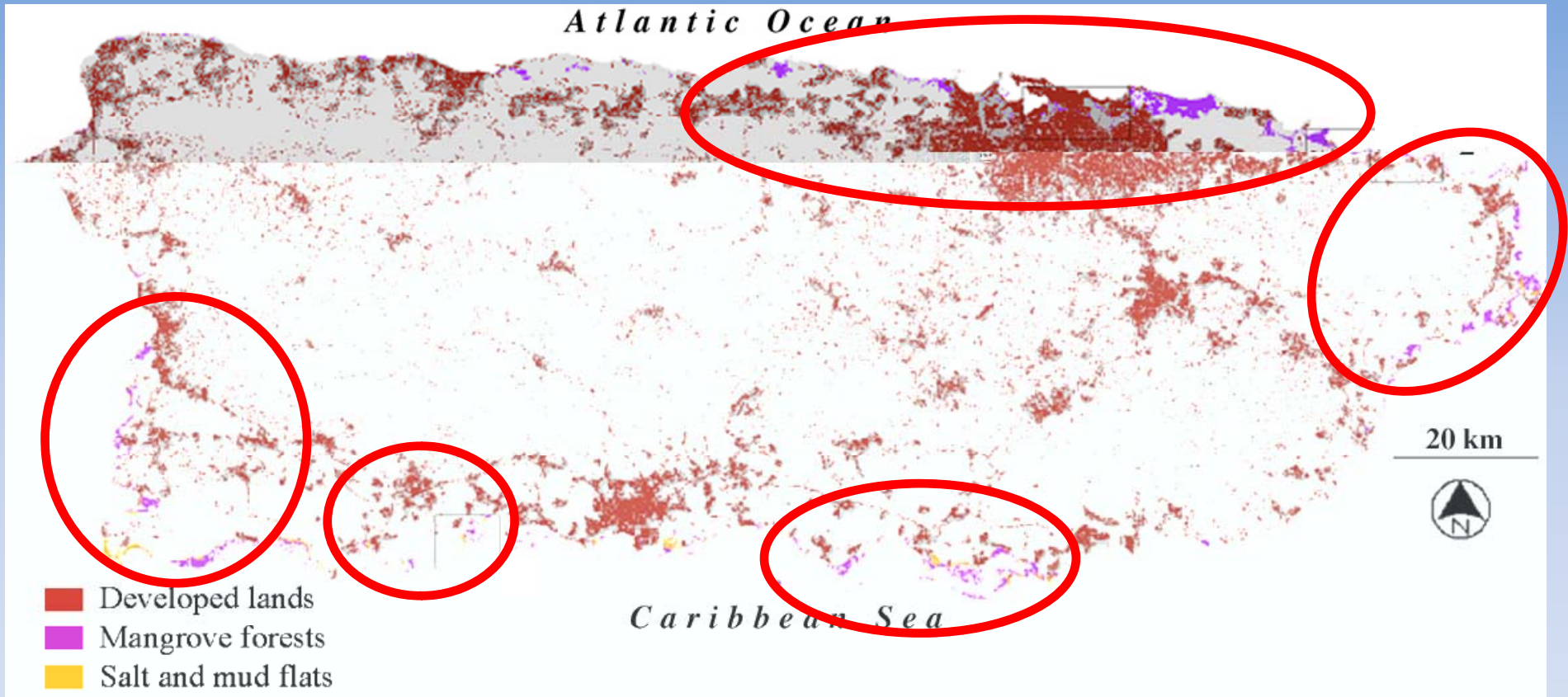
Figura 3. Densidad de coliformes fecales en ostiones (*Crassostrea rhizophorae*) y en las aguas de extracción de bivalvos de la zona suroeste de Puerto Rico durante el período de julio de 2003 a junio de 2004.



Criterios para establecer zonas de cultivo de moluscos:

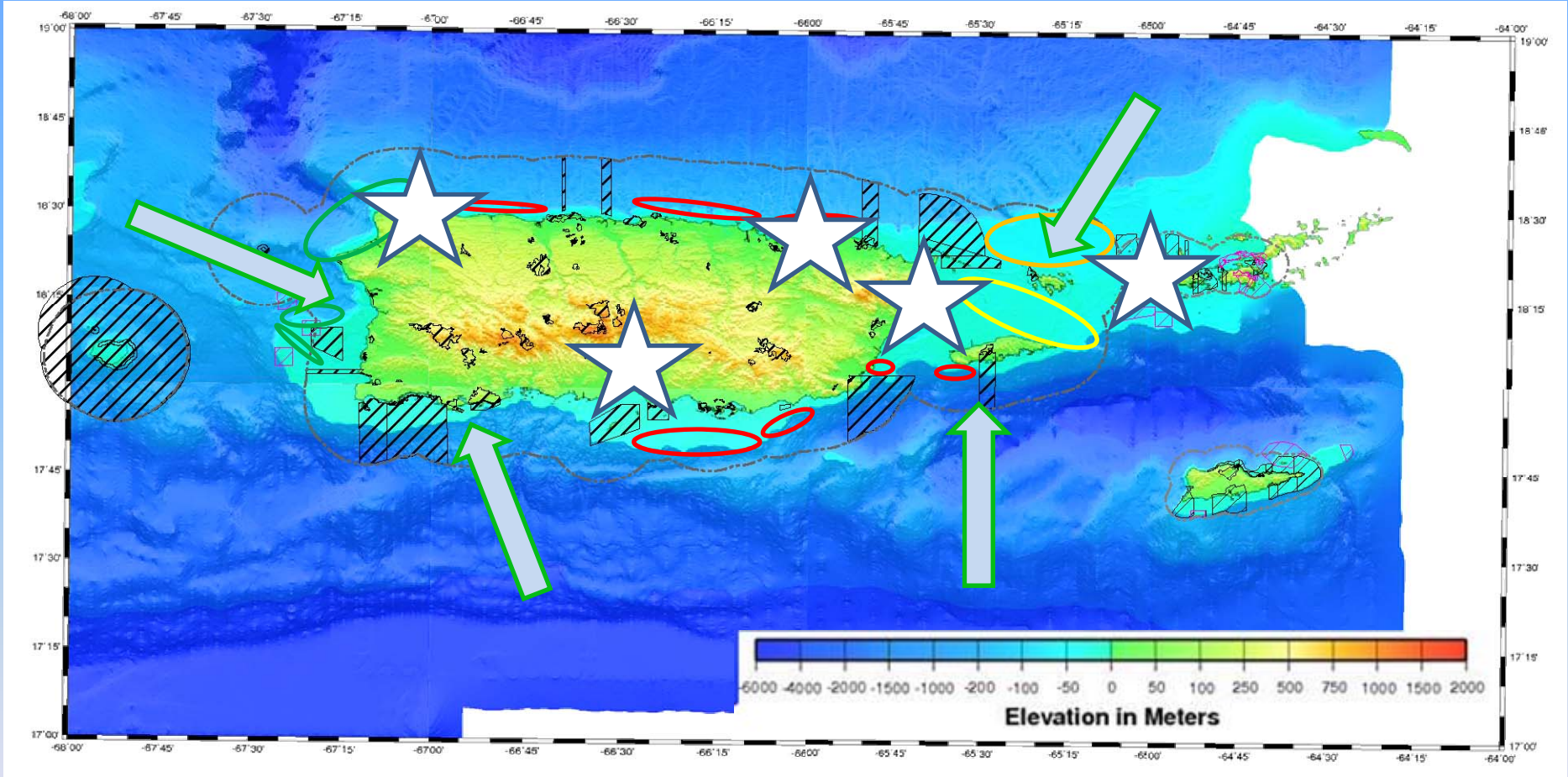
- Areas de mangle con densidades bajas de ostiones y almejas
- Areas de mangle con concentracion de nutrientes acuaticos altos
- Areas protegidas con poco oleaje
- Aguas con corrientes
- Acceso a la mar cerca de muelles o rampas

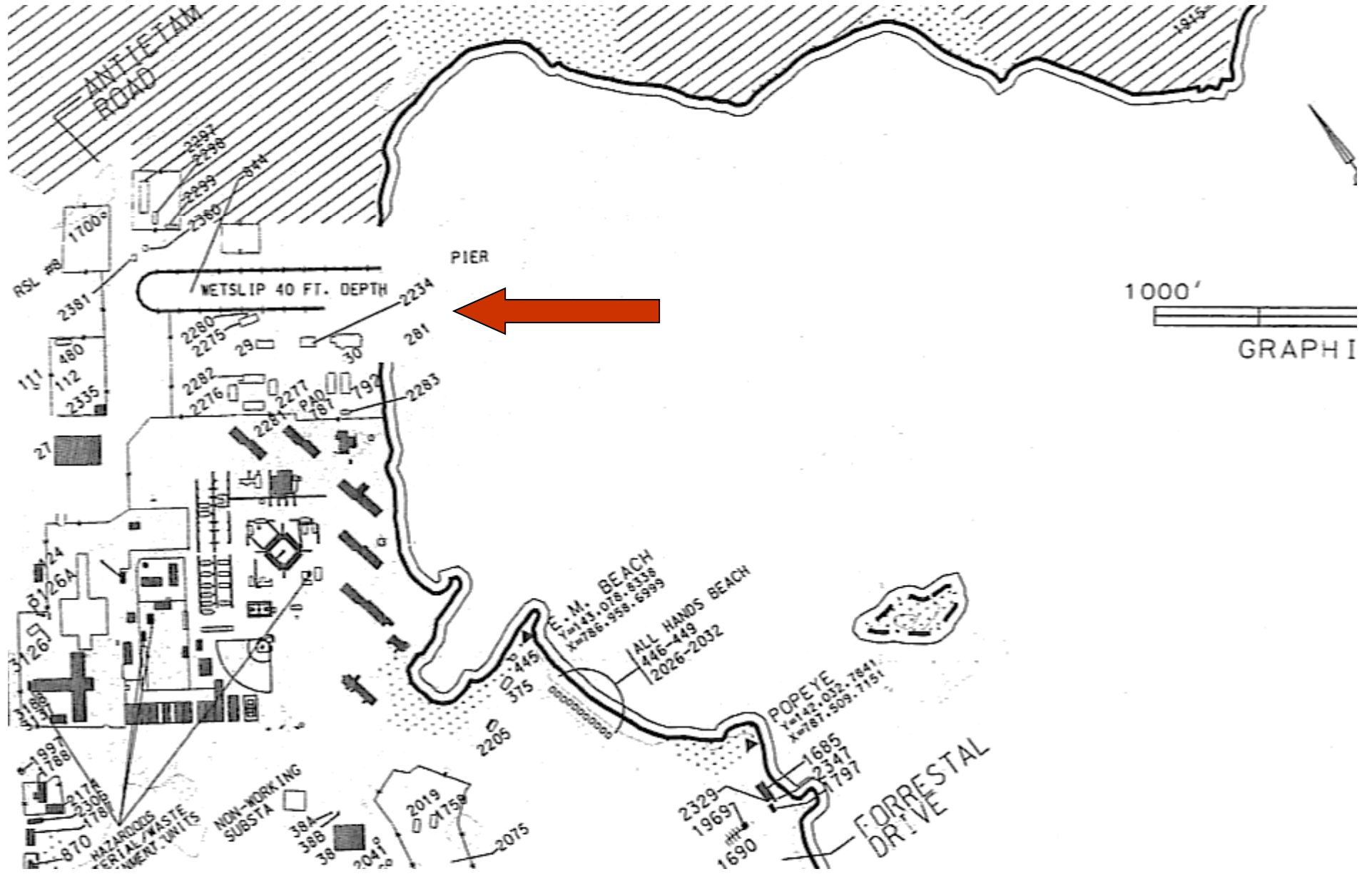
Areas potenciales para zonas de cultivo de moluscos en PR



Forest Ecology and Management 257 (2009) 75–84

Conversion and recovery of Puerto Rican mangroves: 200 years of change
Sebastian Martinuzzi, William A. Gould, Ariel E. Lugo, Ernesto Medina





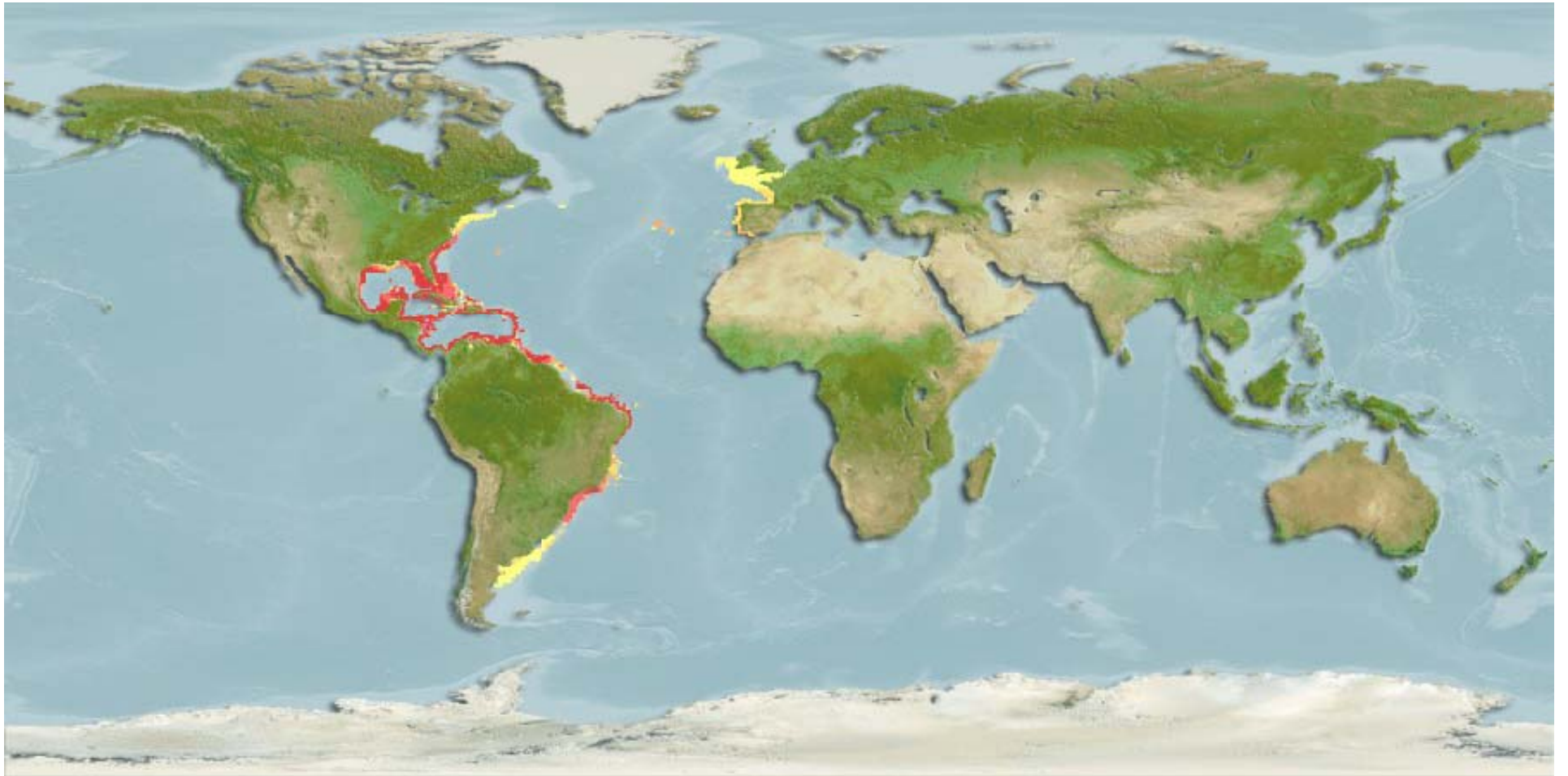
Beneficios de Zonas de Cultivo de Moluscos

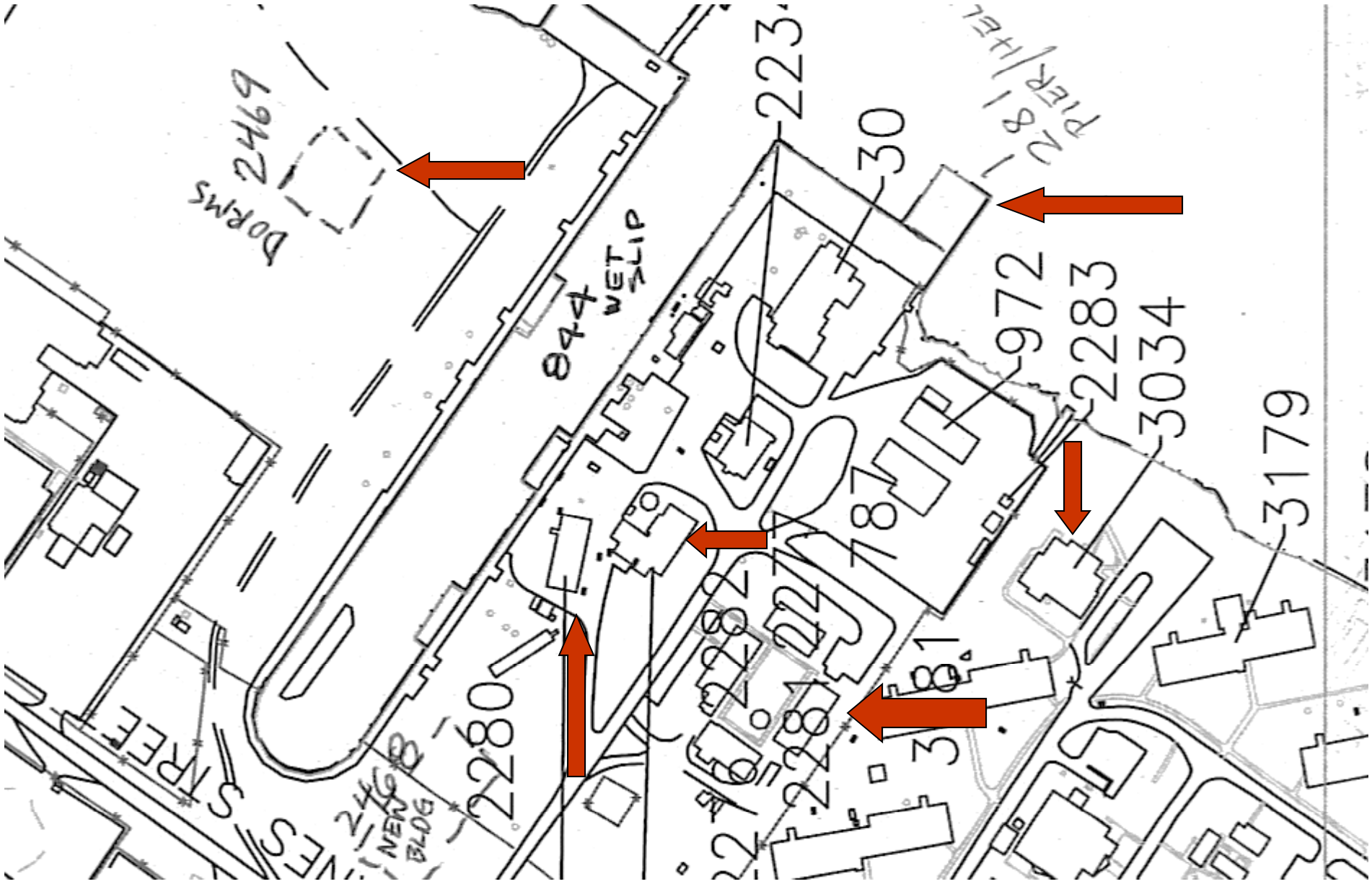
- Escoge mejor ambiente para moluscos “a priori”
- Reduce el tiempo de evaluación de permisología
- Previene conflicto entre usuarios de la zona
- Estimula y aumenta la actividad de la economía local
- Puede proveer actividad económica donde se necesita
- Facilita la administración de la Zona Costera
- Estableces un filtro viviente que reduce nutrientes, partículas y coliformes

CONCLUSIONES

- Se necesitan datos de la densidad de ostiones y almejas por lagunas y bahias para poder ayudar a establecer mapas de zonificación de cultivo
- Cultivo de moluscos en las lagunas y bahias de PR establece la función ecológica de este grupo, la cual ayuda en aumentar la calidad del agua en la cual viven, mejorando el “EFH” para demás organismos
- La zonificación del ambiente marino nos ayuda a cumplir con la nueva Política del “National Ocean Council ” y es un proceso de colaboración

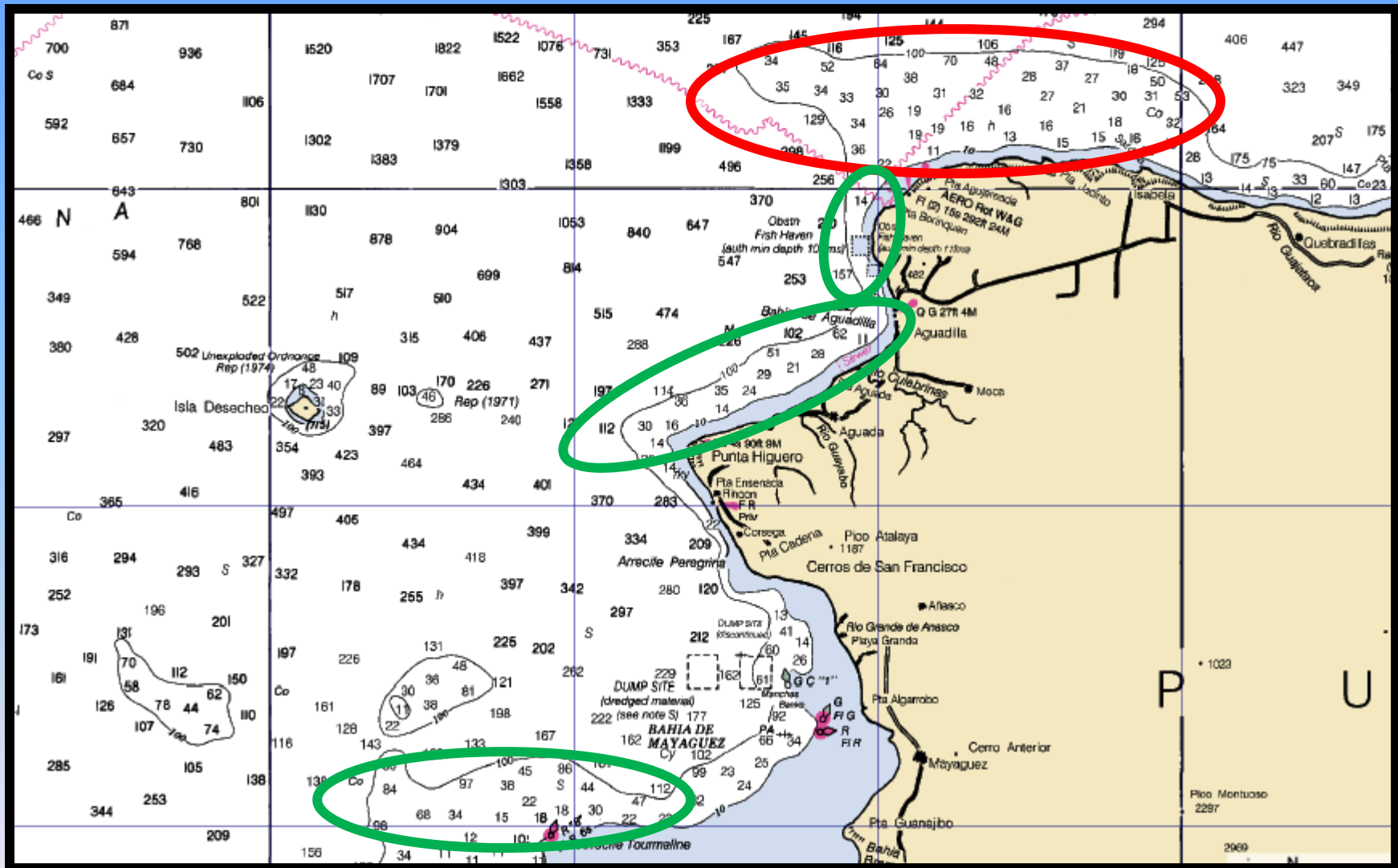
PREGUNTAS ???? ?



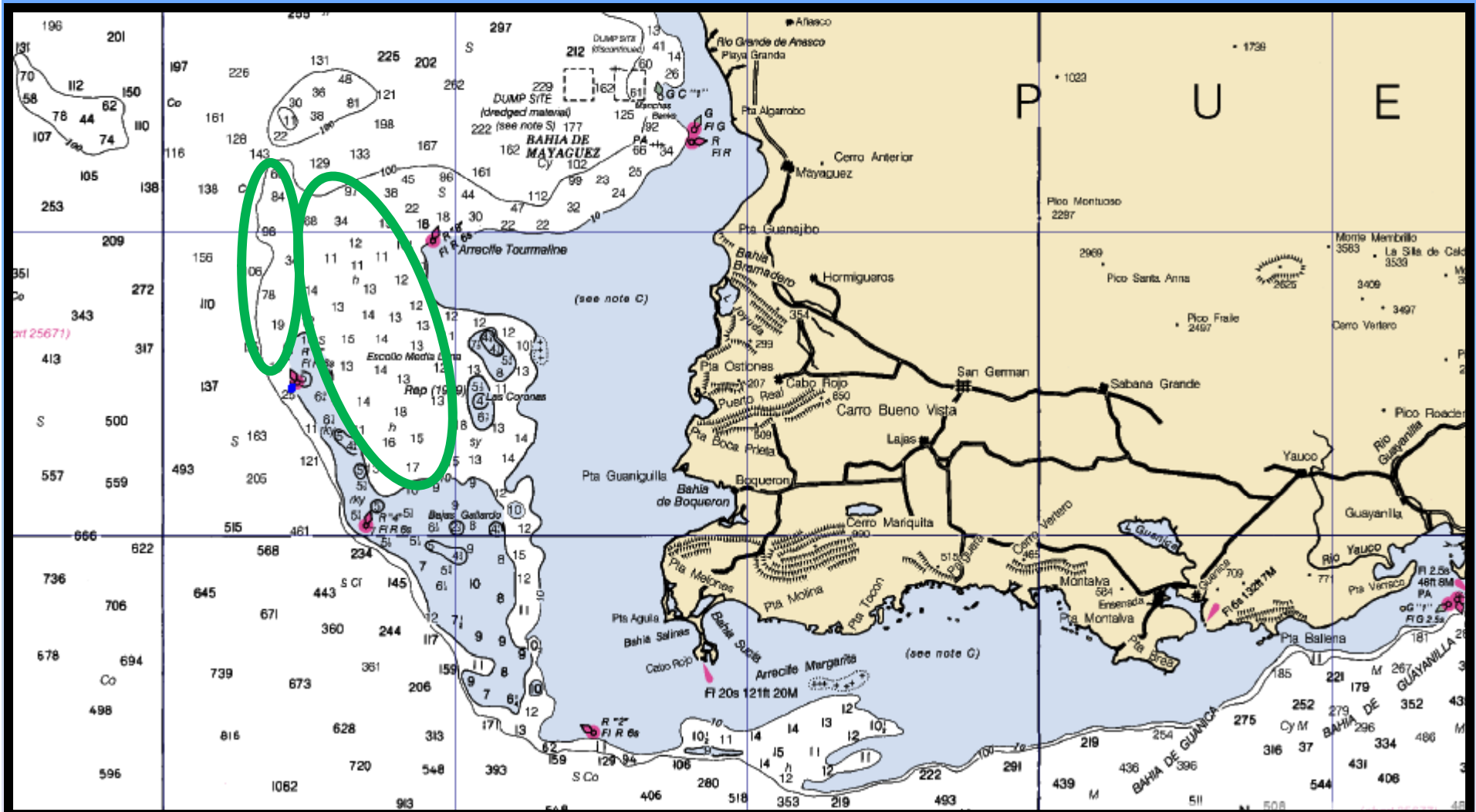




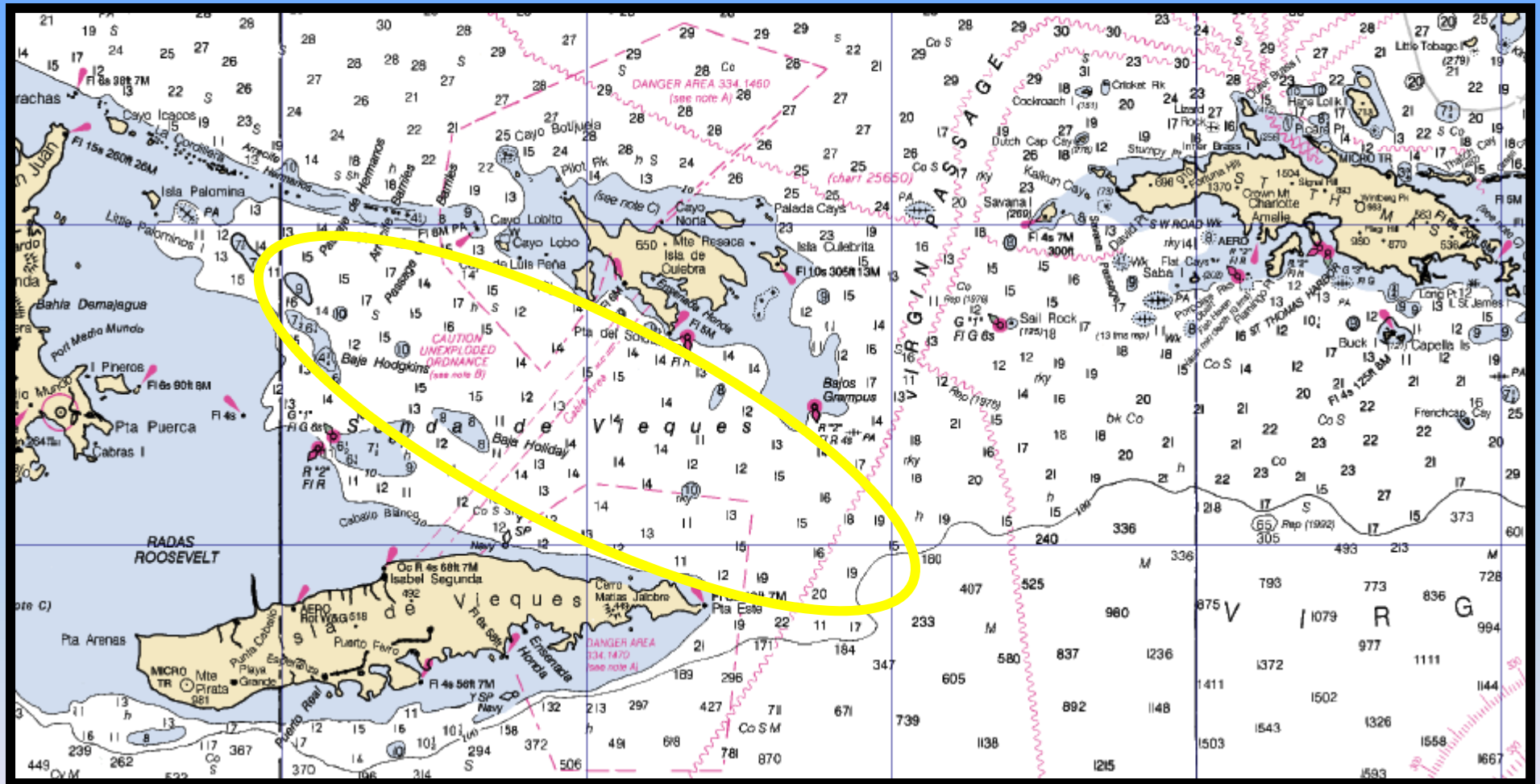
NW Coast



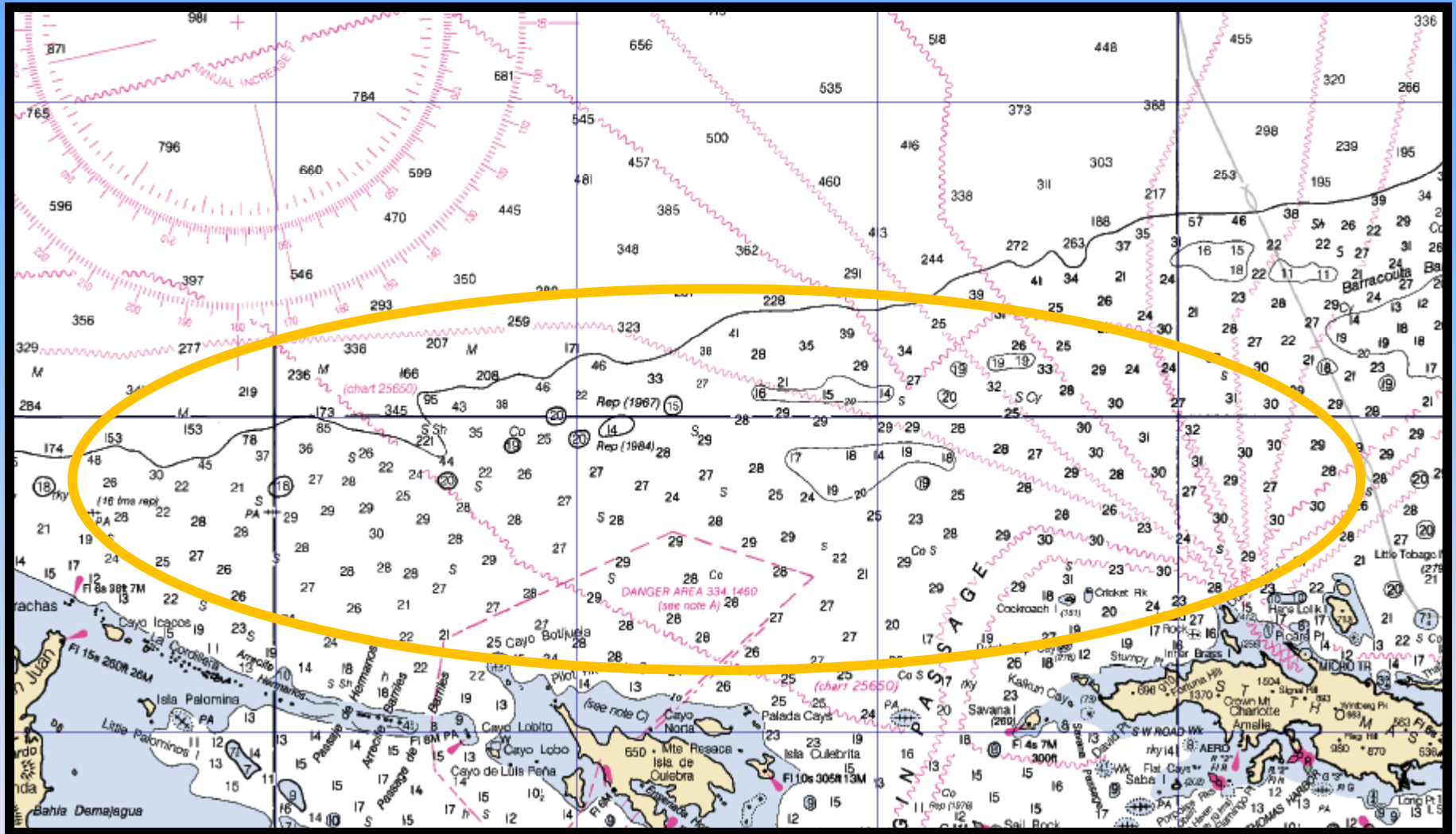
SW Coast



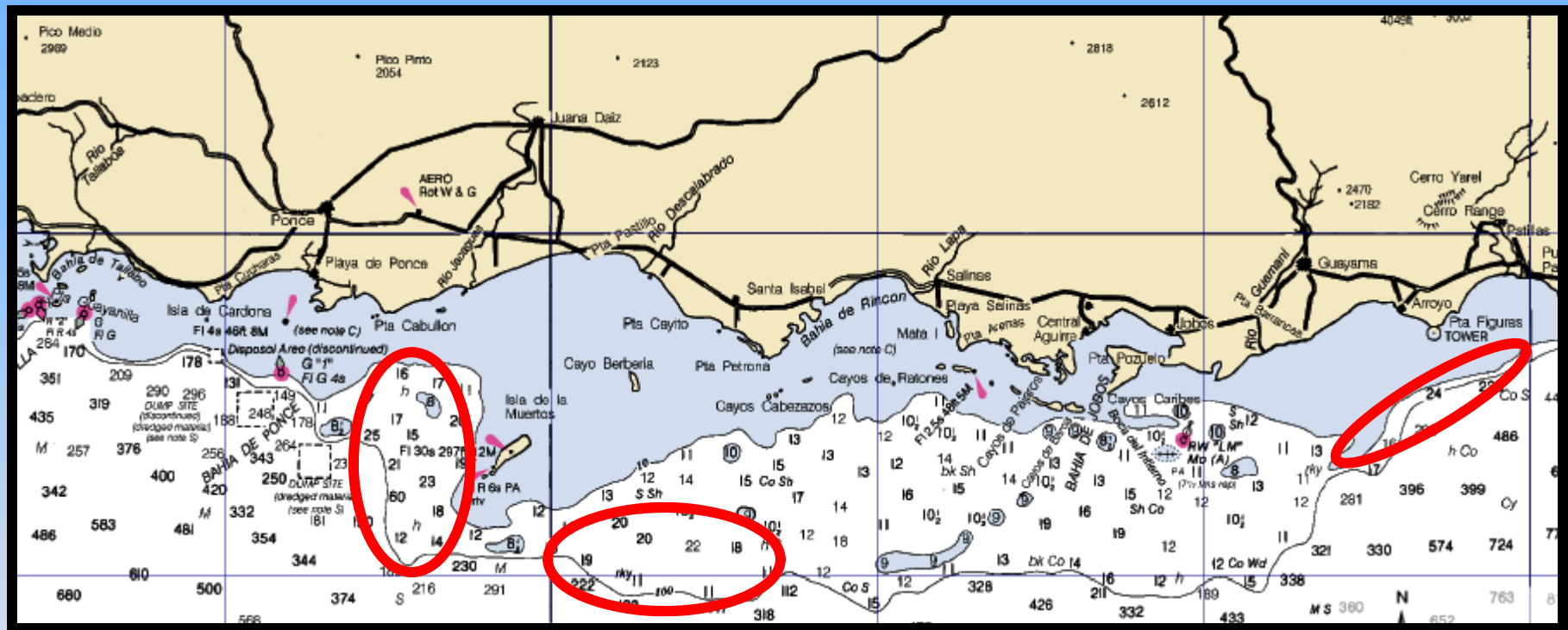
East Coast, Vieques Sound



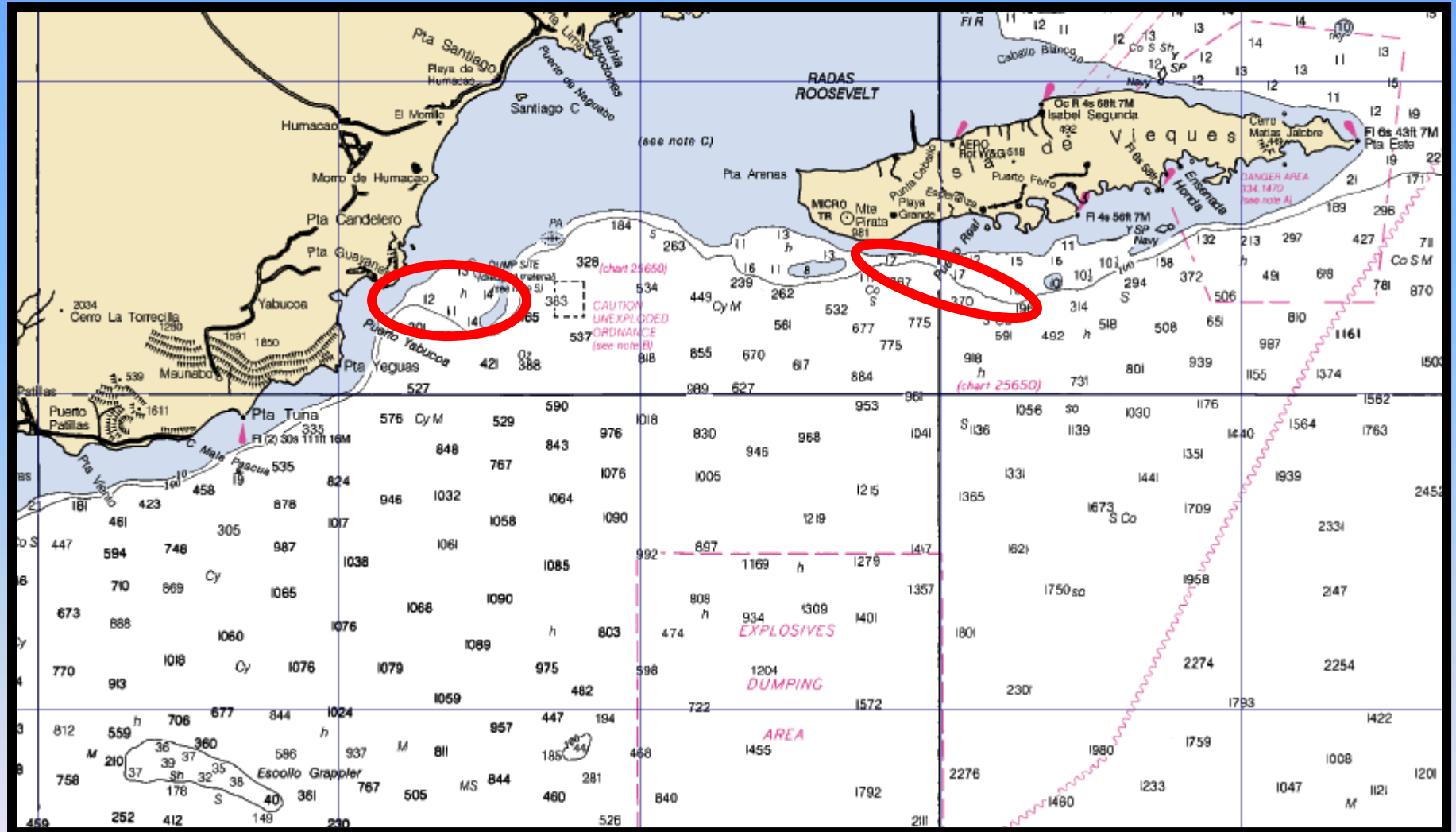
NE Coast, N of Culebra Island



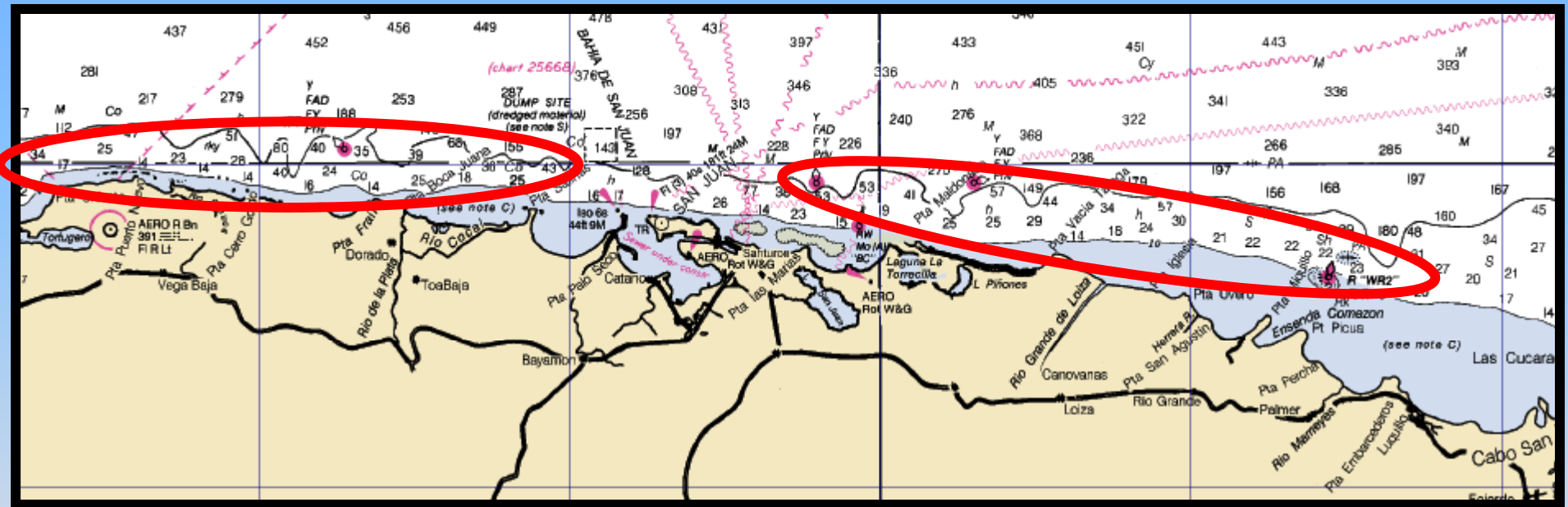
South Coast



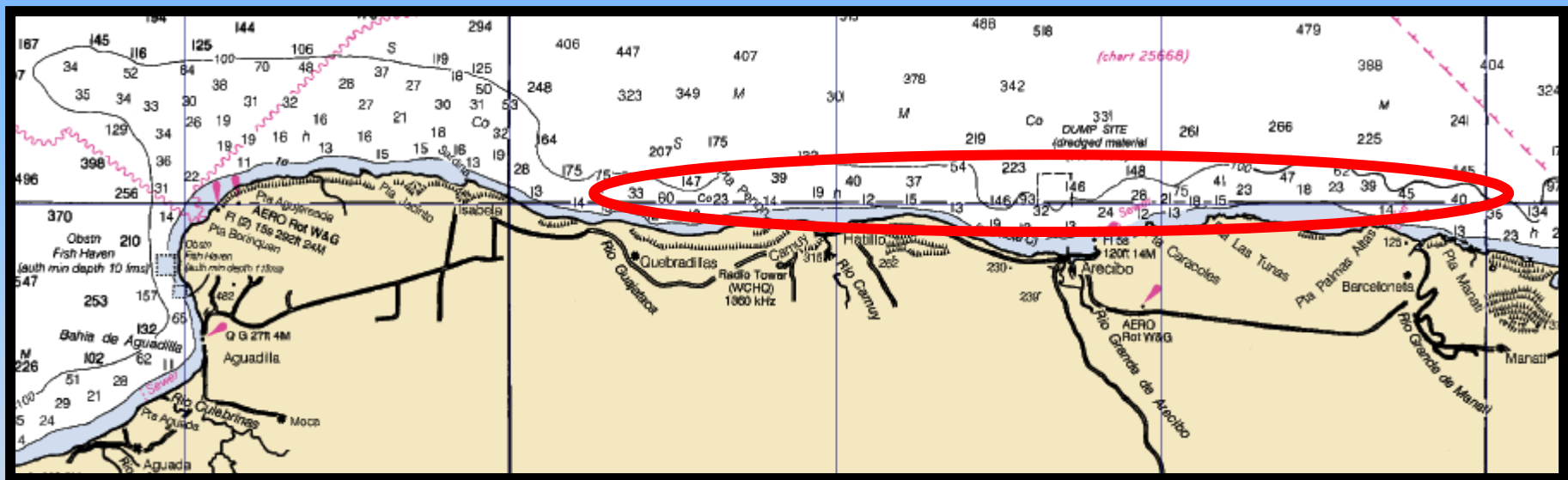
SE Coast & SW Vieques Island

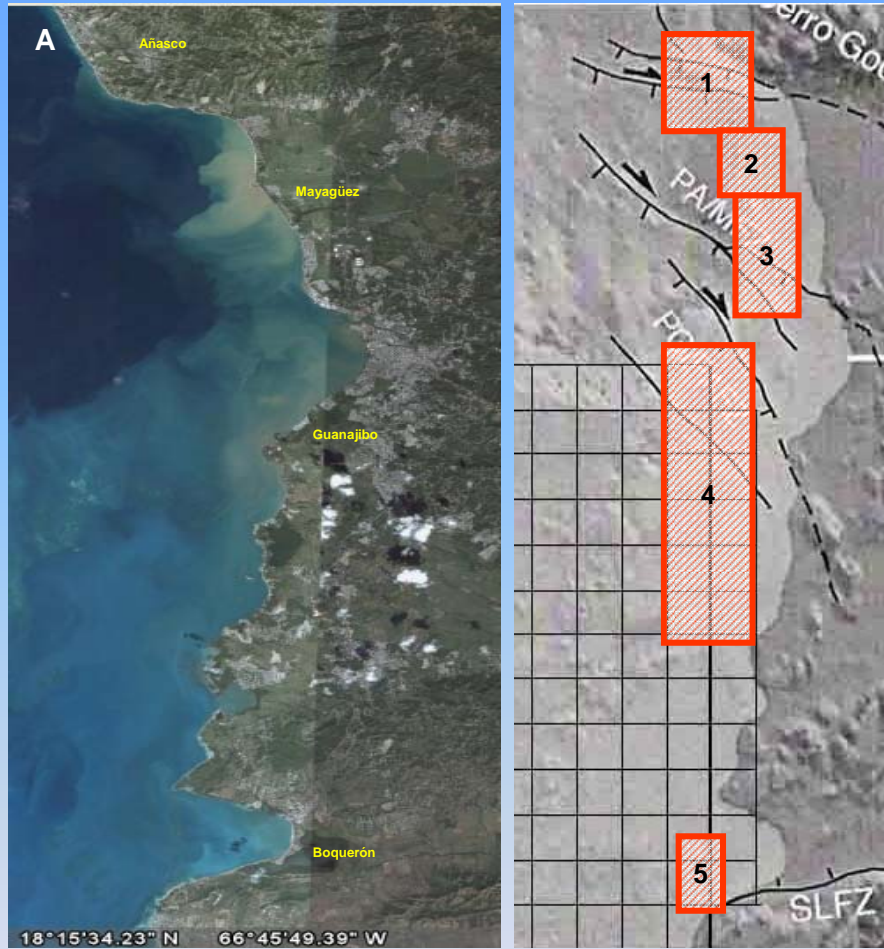


North Coast

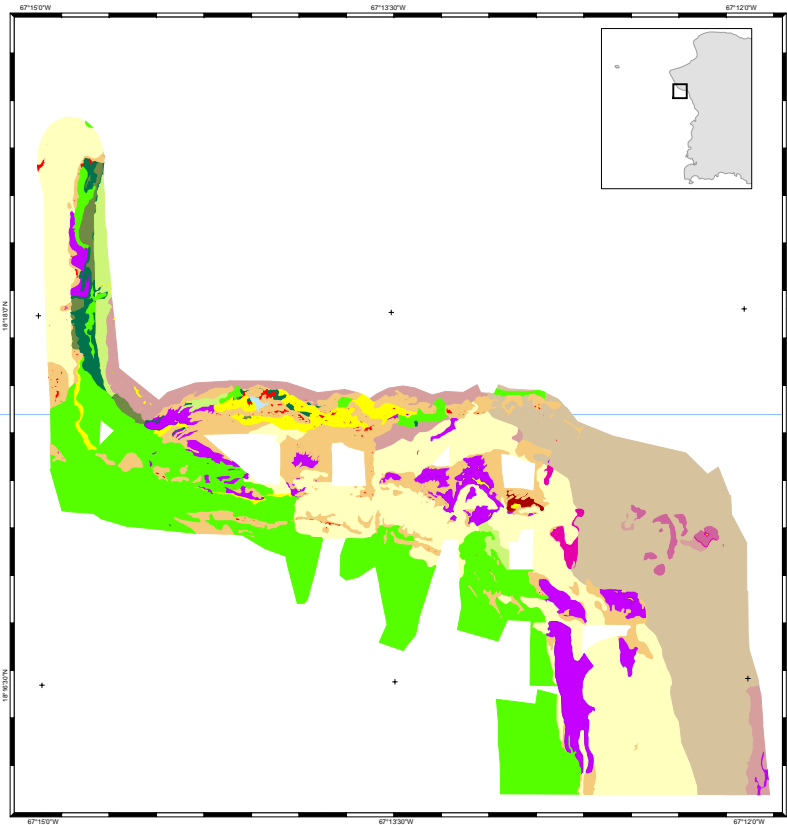


North Coast





Benthic Habitats of the Añasco Shelf Añasco 1 Section



- Habitat type**
- corals_high relief
 - coral_patch
 - corals_low relief
 - gorgonian_patch
 - gorgonian_plain
 - elevated_gorgonians
 - grass_coral
 - grass_invertebrates
 - dense_grass
 - grass_sparse
 - dense_algae
 - sparse_algae
 - sand_invertebrates
 - sand_ripple
 - fine_sand
 - mud_bare
 - mud_invertebrates

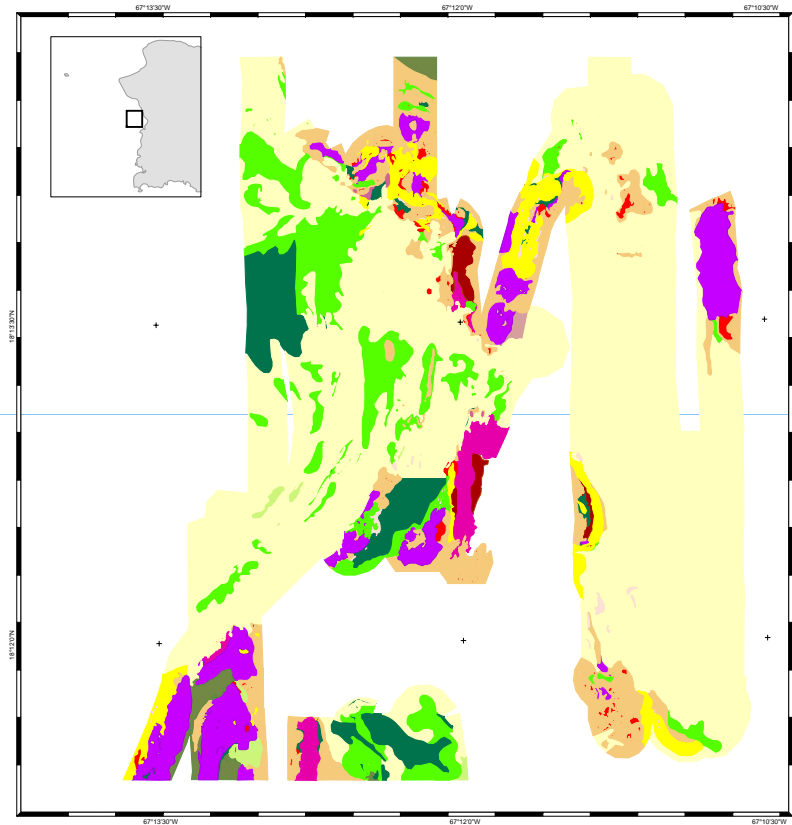
Map generated from visual interpretation of SSS images collected in May, 2000 and processed at 1 m resolution.

Datum: WGS 84

NOAA Award NA04NOS4260206
UPRM Award R-PUPR-05 and R-PUPR 1-06



Benthic Habitats of the Mayagüez Shelf Mayagüez Section



- Habitat type**
- corals_high relief
 - coral_patch
 - corals_low relief
 - gorgonian_patch
 - gorgonian_plain
 - elevated_gorgonians
 - grass_coral
 - grass_invertebrates
 - dense_grass
 - grass_sparse
 - dense_algae
 - sparse_algae
 - sand_invertebrates
 - sand_ripple
 - fine_sand
 - mud_bare
 - mud_invertebrates

Map generated from visual interpretation of SSS images collected in May, 2000 and processed at 1 m resolution.

Datum: WGS 84

NOAA Award NA04NOS4260206
UPRM Award R-PUPR-05 and R-PUPR 1-06



**DETERMINACIÓN DEL PERFIL MICROBIOLÓGICO DE LA ALMEJA
(*Lucina pectinata* Gmelin, 1791), DEL OSTIÓN DE MANGLE (*Crassostrea
rhizophorae* Guilding, 1828) Y LAS AGUAS DE EXTRACCIÓN DE BIVALVOS
DE LA ZONA SUROESTE DE PUERTO RICO**

Por

Yaritza Fontáñez Barris

Tesis sometida en cumplimiento parcial de los requisitos para el grado de

MAESTRO EN CIENCIAS

en

Ciencia y Tecnología de Alimentos

**UNIVERSIDAD DE PUERTO RICO
RECINTO UNIVERSITARIO DE MAYAGÜEZ**

2005

