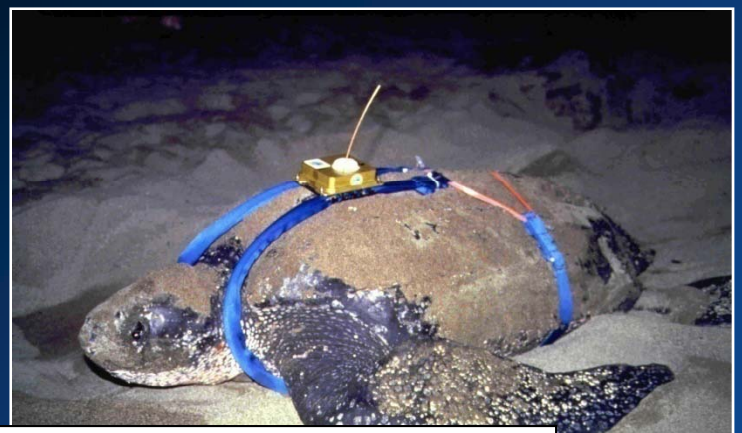
Lessons Learned: Ecosystem Impacts and Permitting Insight from Marine Cage Culture Operations

Don Kent
The Hubbs-SeaWorld Research Institute Experience

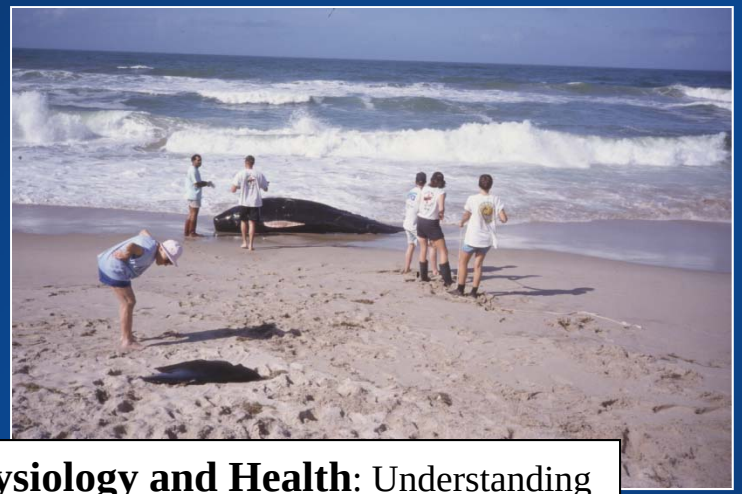
Presented at the
Workshop for Development of Sustainable Practices for Marine Cage Culture Operations in the U.S. Caribbean
Nov. 2-3, 2010, San Juan, Puerto Rico

Core Areas of Research

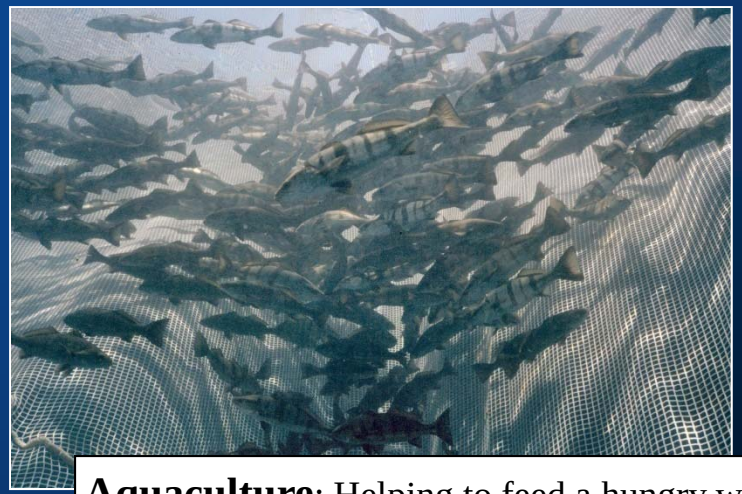


Ecology: Understanding the oceans and its inhabitants

Bioacoustics: It's not a silent world

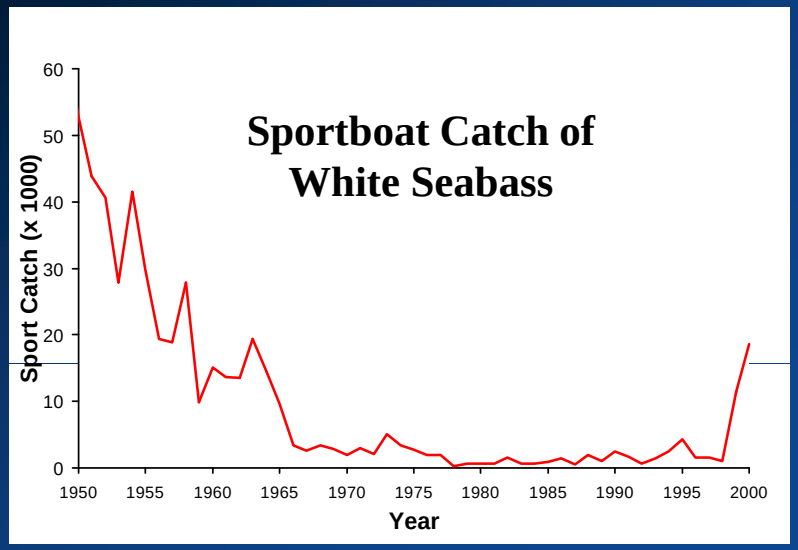


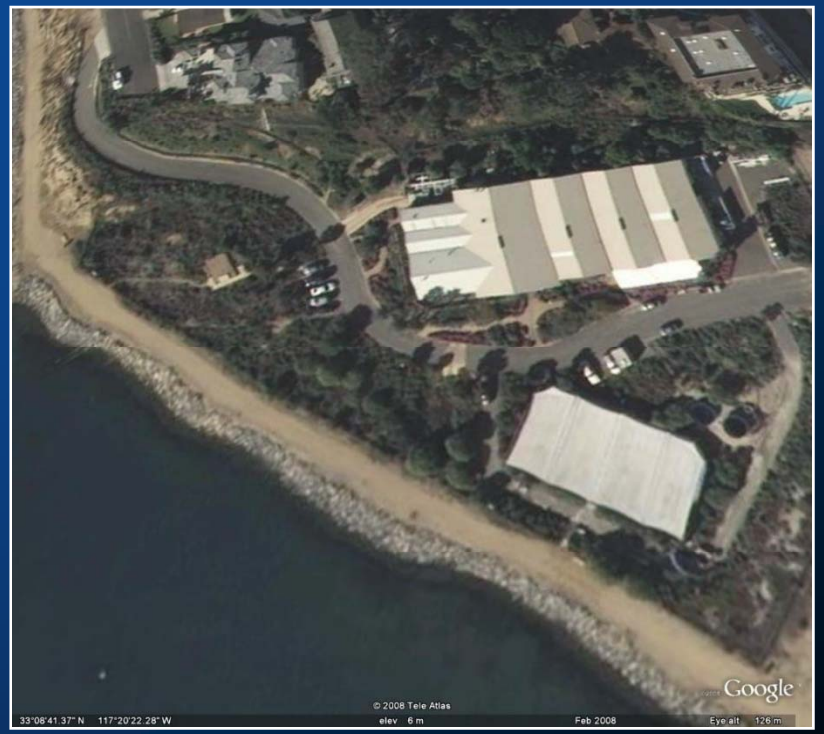
Physiology and Health: Understanding how animals respond to a changing world



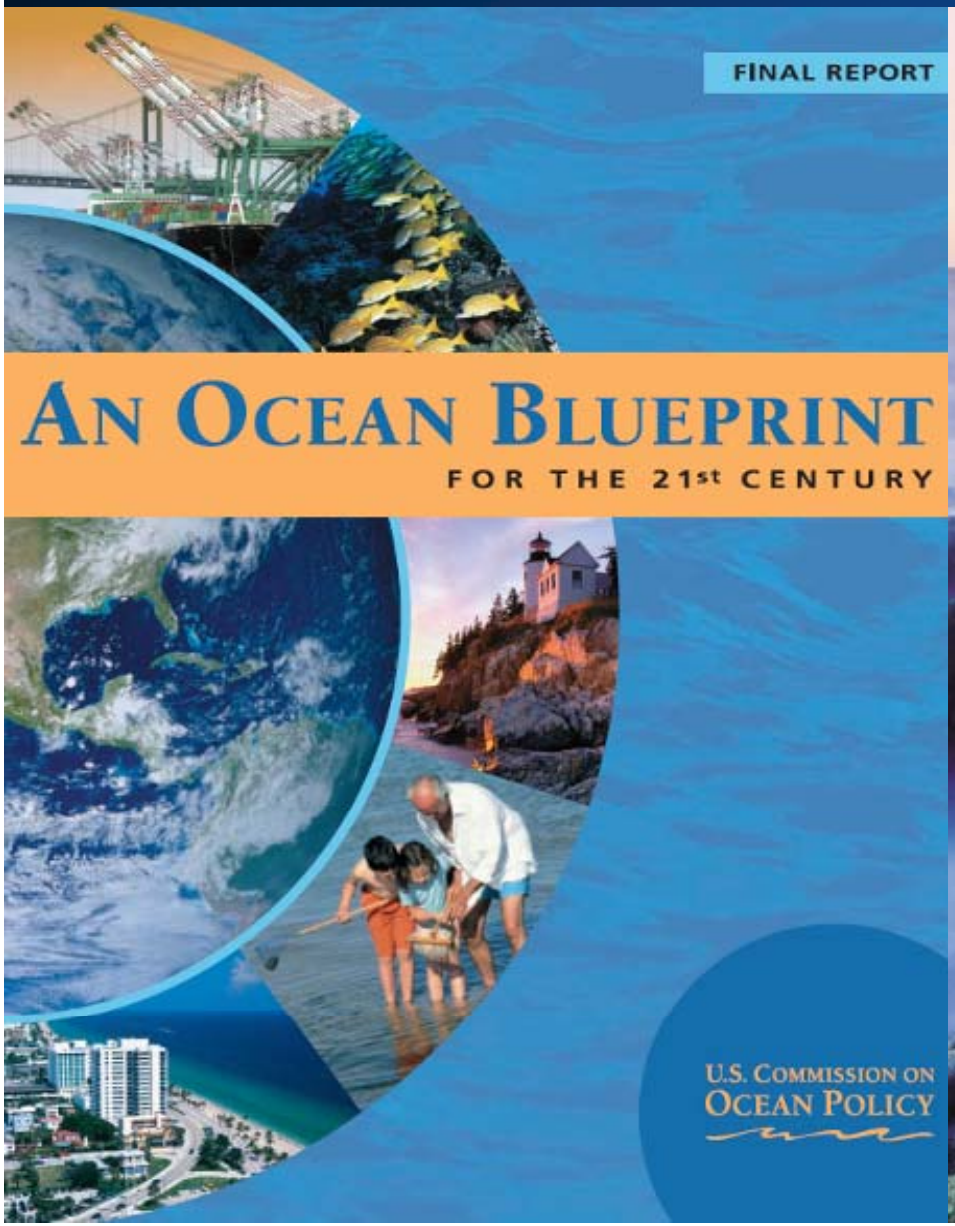
Aquaculture: Helping to feed a hungry world

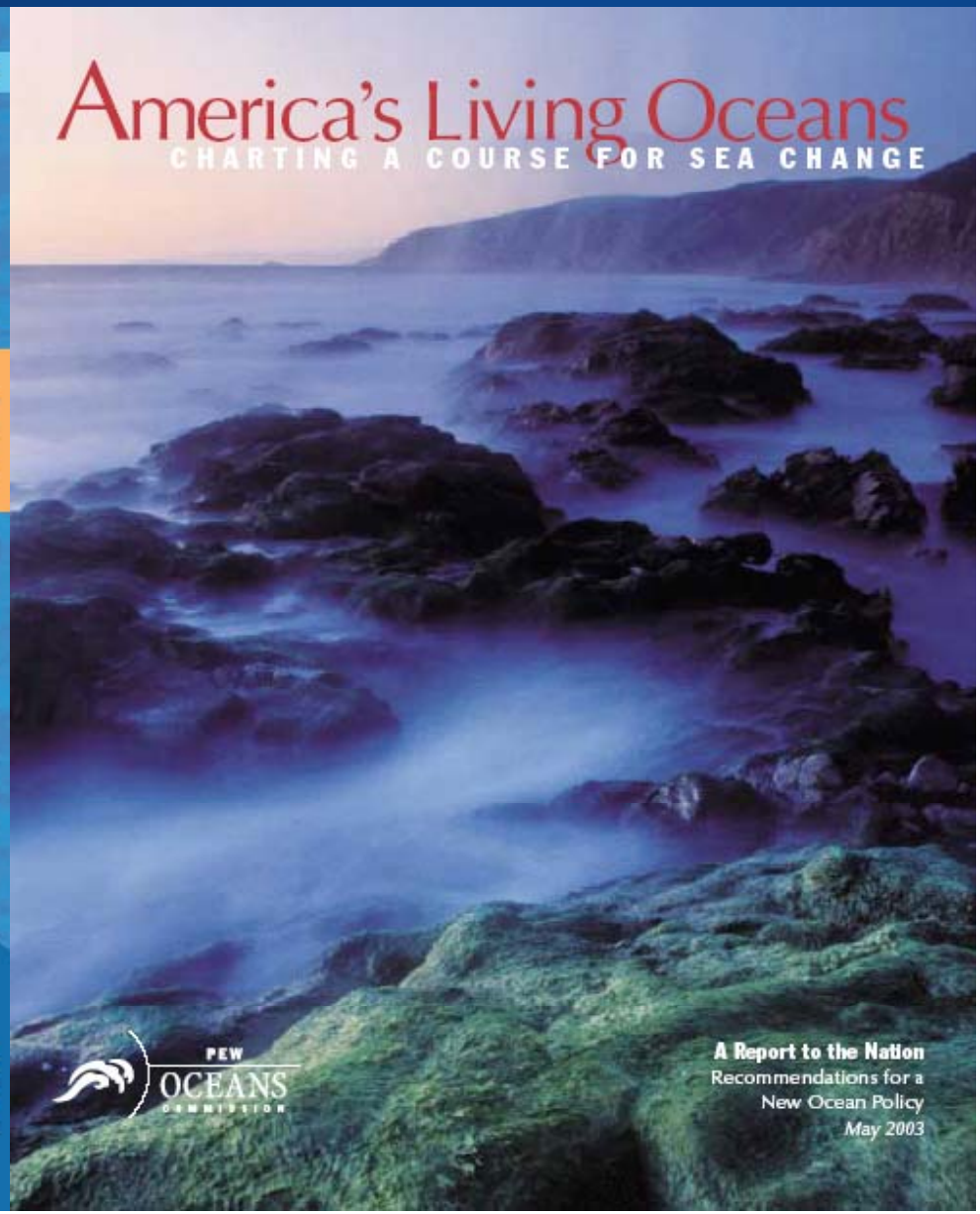
Aquaculture





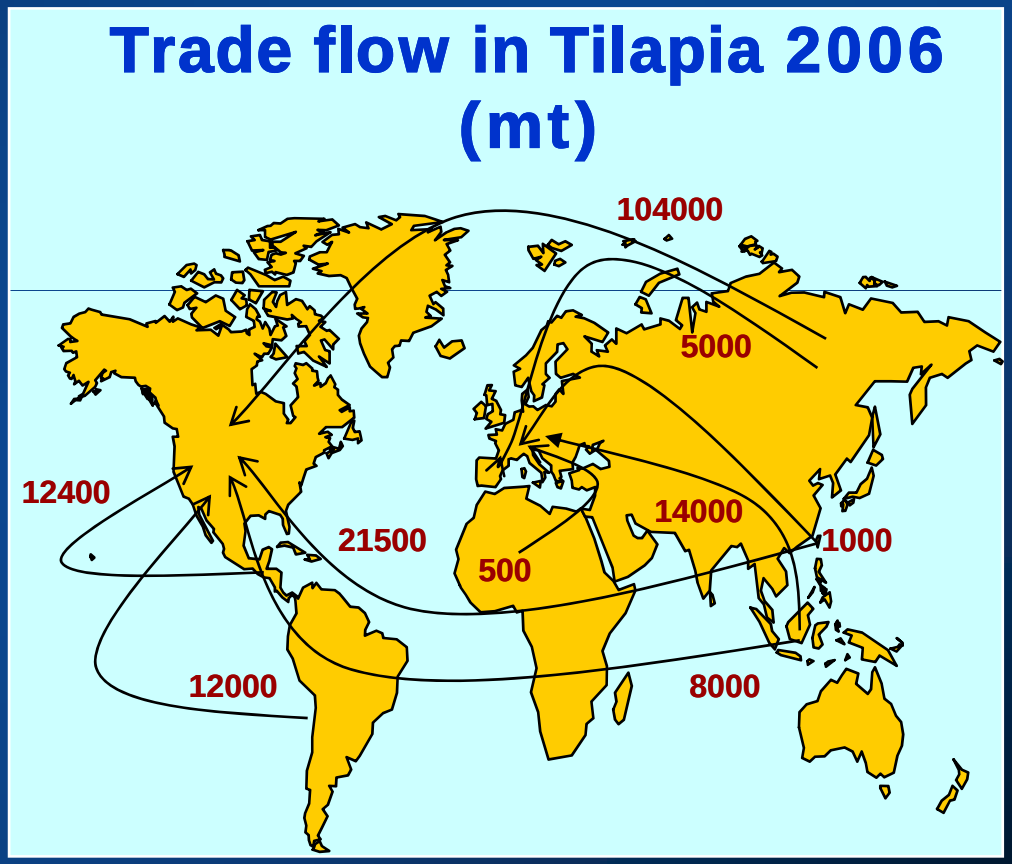
The Need for Demonstration Projects





Benefits of a Domestic Industry

- Create U.S. jobs
- Promote feed efficiency
- Use domestic ingredients
- Minimize carbon footprint
- Meet our environmental and food security standards



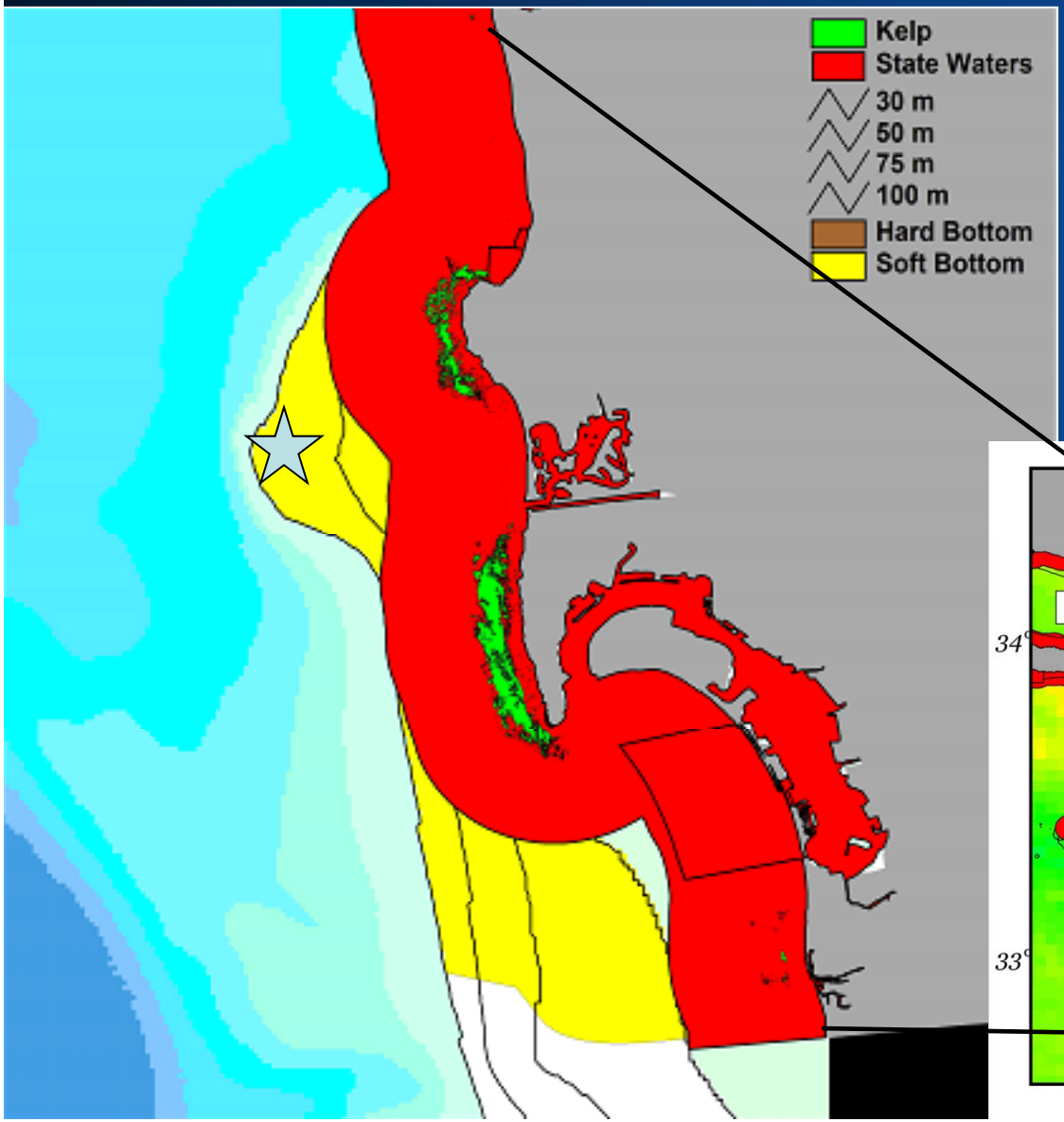
HSWRI proposes to:

- Permit, install and operate a commercial scale fish farm
- Location to be five miles off the coast of San Diego in federal waters (EEZ)
- Project to assess ability to increase domestic supply of seafood in an environmentally sustainable manner
- San Diego has the opportunity to lead the nation in the development of offshore aquaculture

Site Requirements

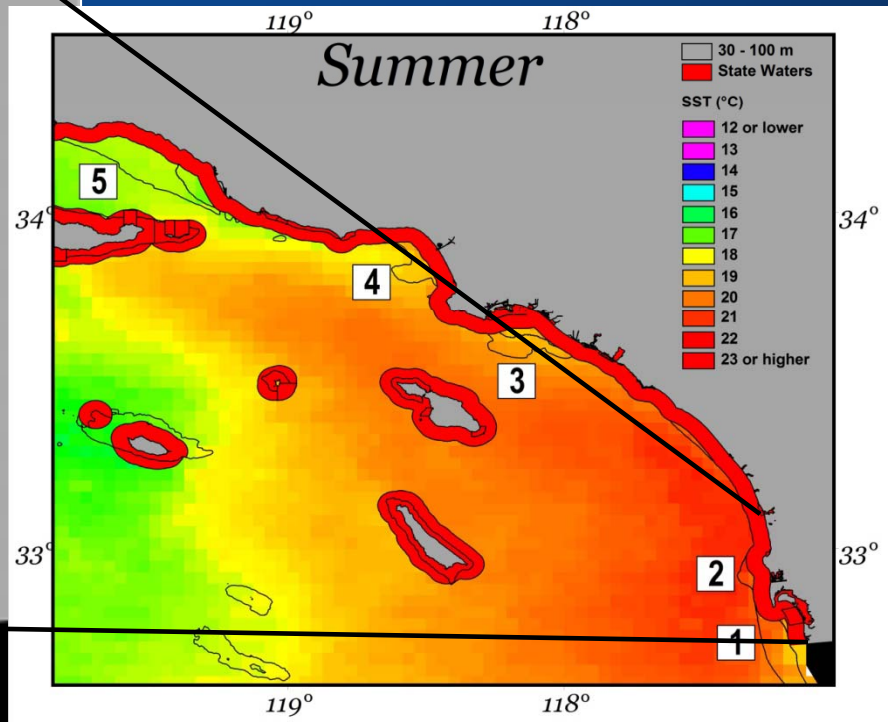
- Need
  - Greater than 100 feet and less than 350 feet deep
  - Clean water with consistent current
- Southern California area offers a nearly ideal climate
  - Consistent (i.e., predictable) water temperature
  - Infrequent extreme weather and wave conditions
- Avoid user and habitat conflicts
  - Outside busy coastal zone (and contaminants)
  - Sandy bottom (no kelp or hard-bottom habitat)
- Close to existing infrastructure
  - Commercial fishing industry
  - Market and distribution centers

Proposed Project Location

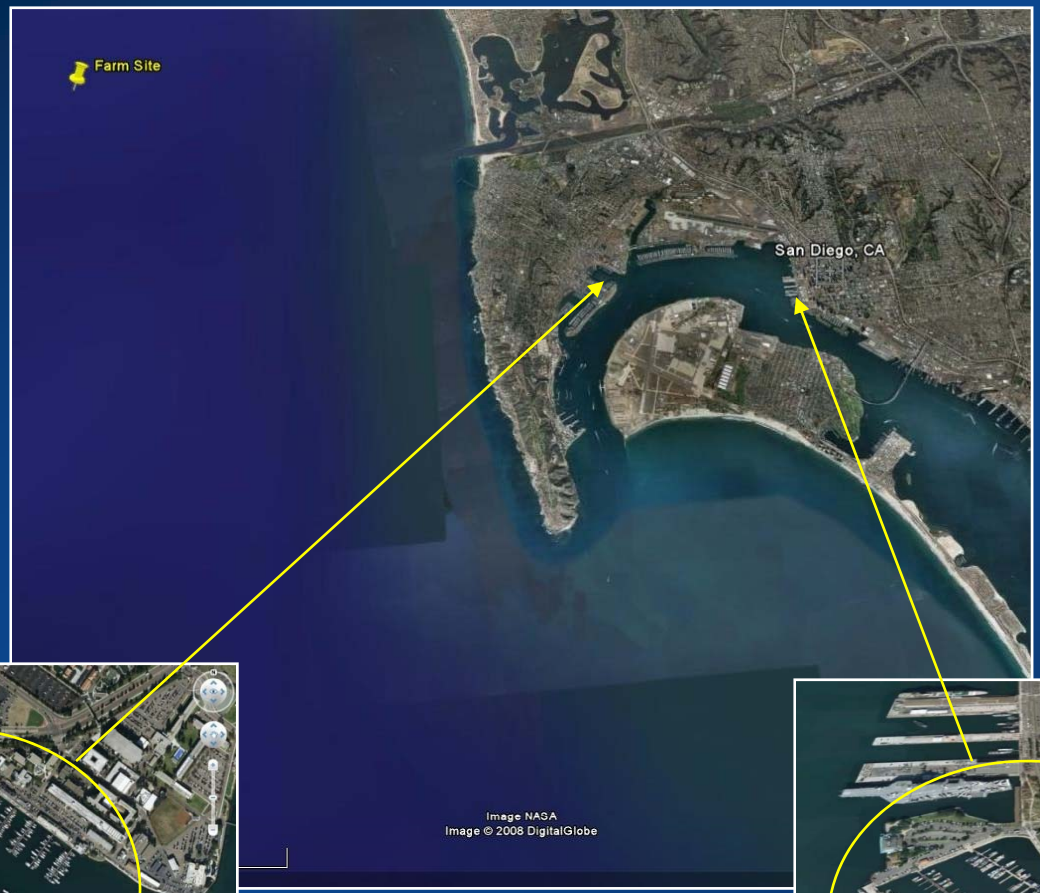


★ **Site Avoids:**

- Coastal conflicts
- US Navy ops
- Fishing grounds
- Kelp & reefs
- Pollution



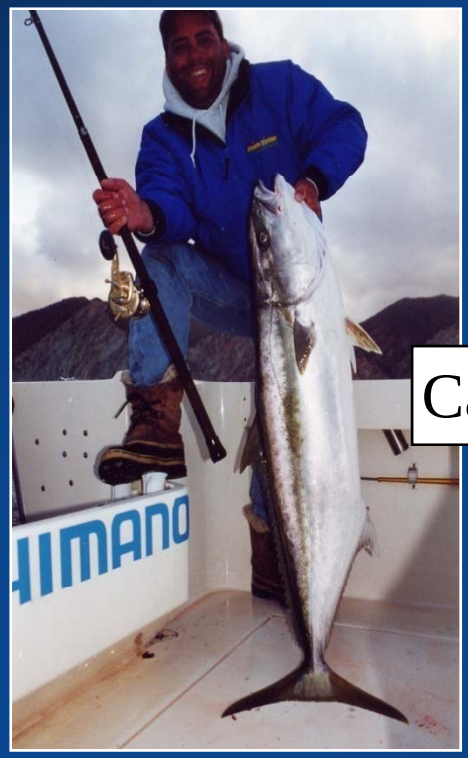
San Diego has Everything Needed



Species to be Cultured

Striped Bass

White Seabass



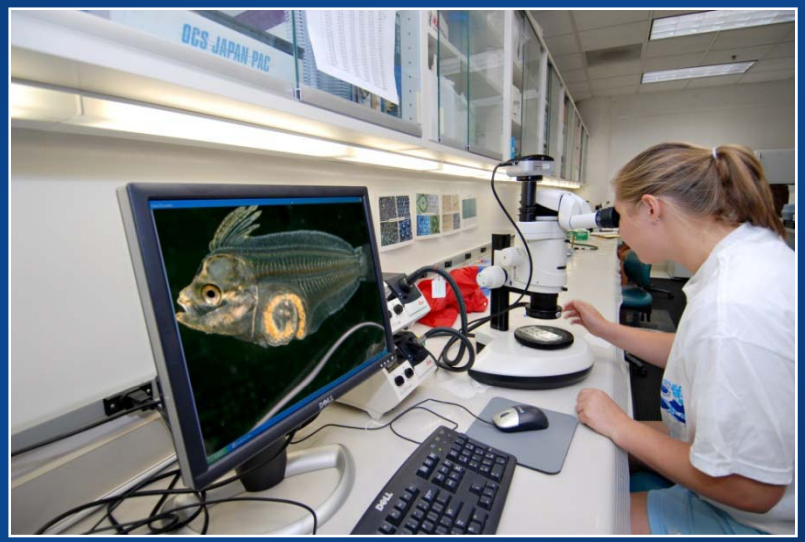
California Yellowtail

California Halibut

Identified Concerns

1. Using wild fish to feed farmed fish
2. Impacts of escapes on wild stocks
3. Polluting the bottom and algal blooms
4. Potential spread of disease
5. Competition with commercial fishermen
6. Farm domination of the offshore environment

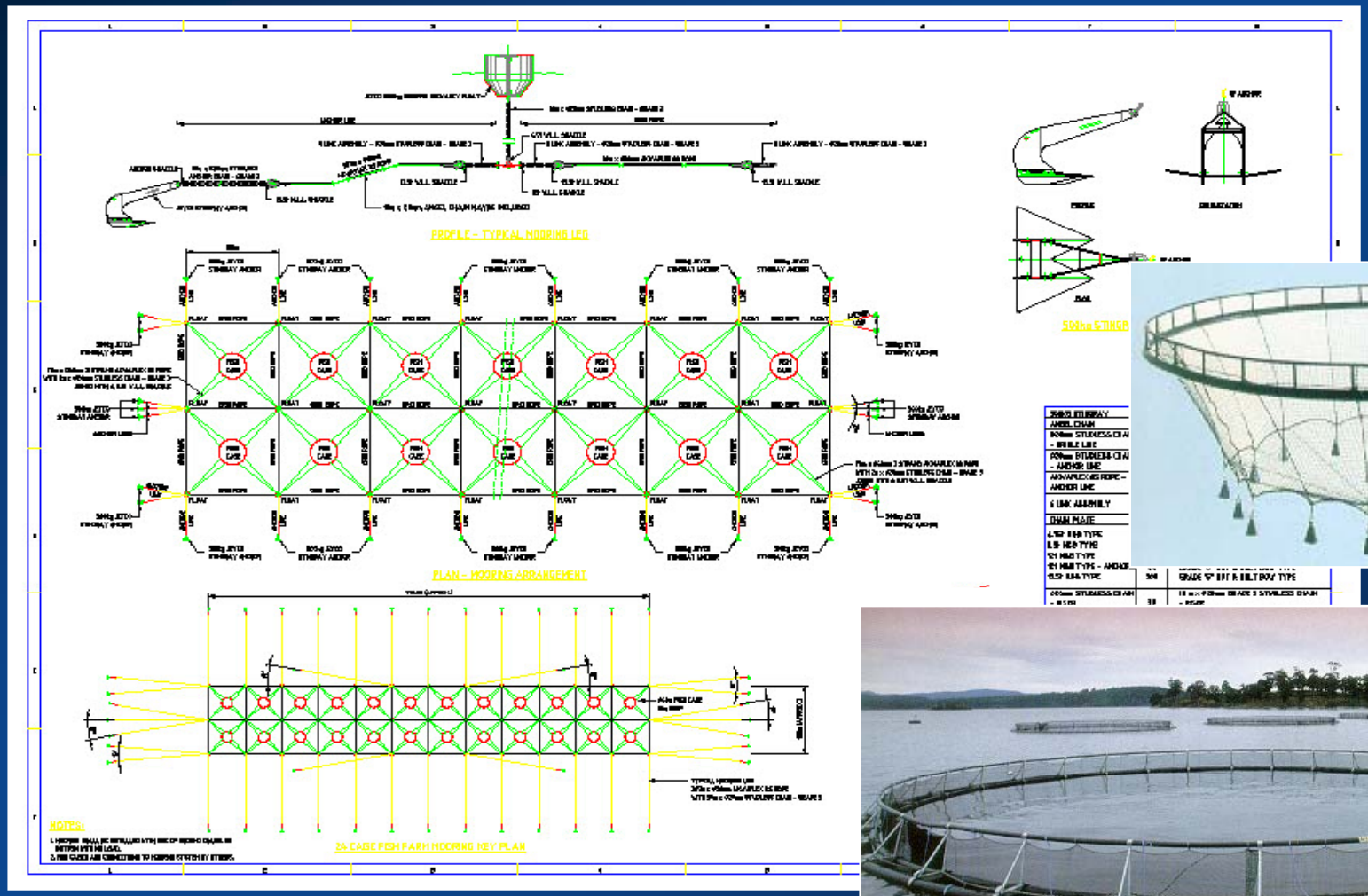
Marine Finfish Nutrition



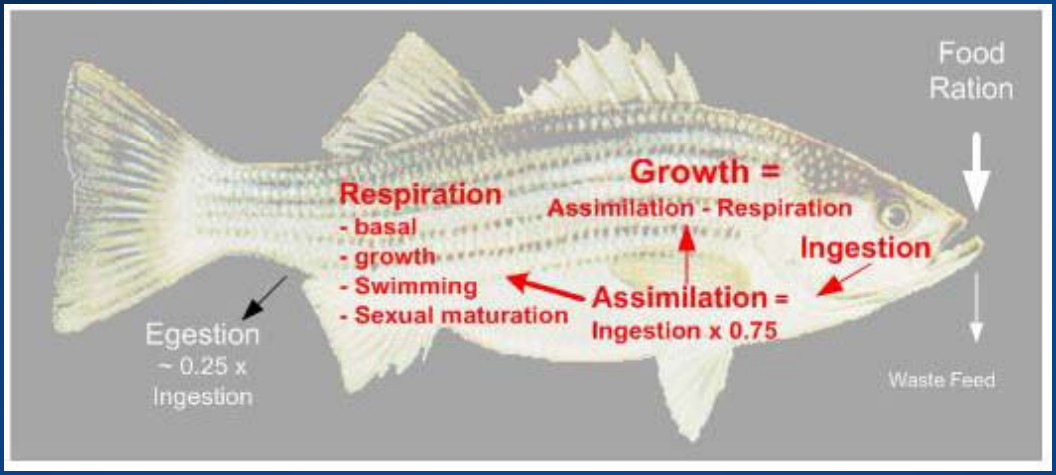
- Species specific diets
- Life stage specific
- Micronutrients
- Alternative proteins
- Live feeds
- Microencapsulated diets

Concern 2.
Impacts of Escapes on Wild Stocks

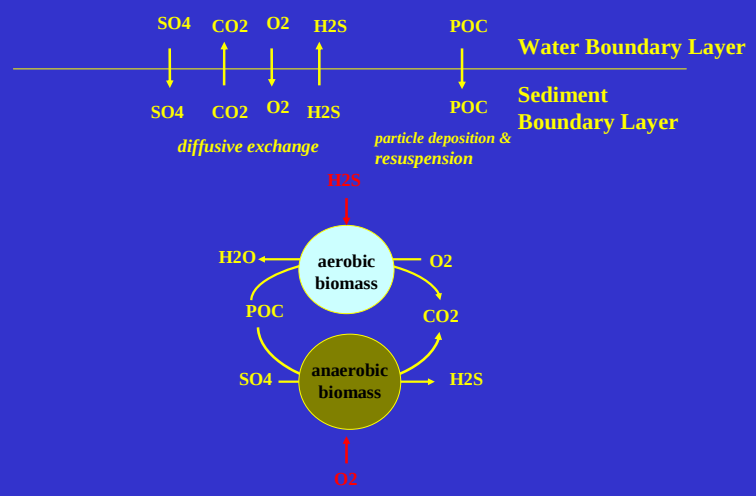
Technology is well-established and is engineered to the proposed site

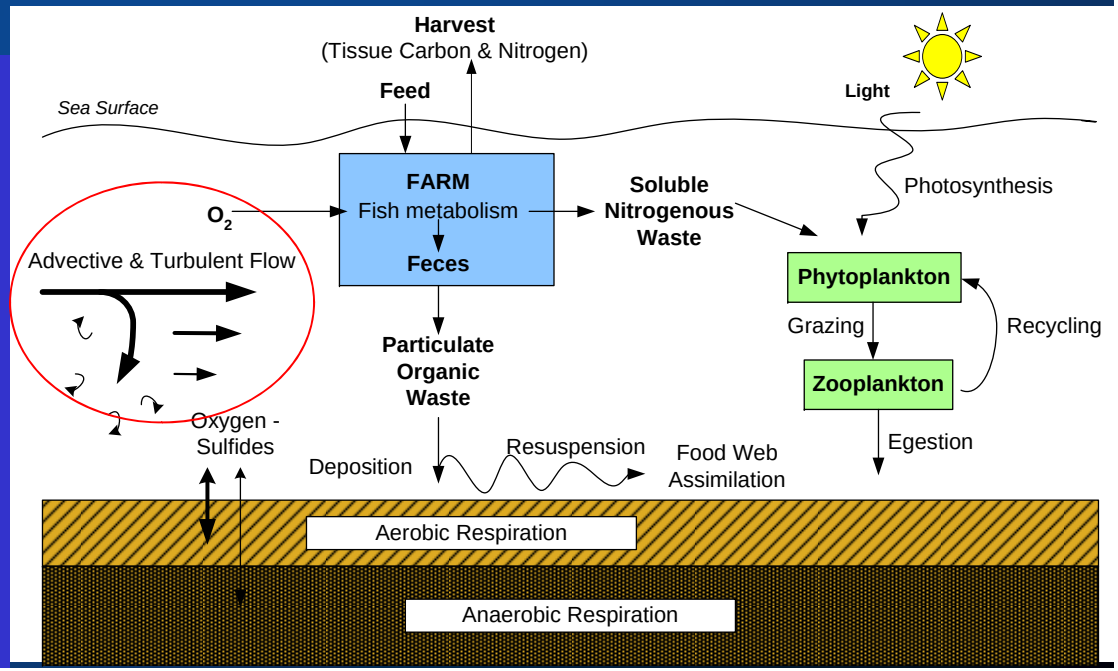


Concern 3.
Polluting the Bottom and Algal Blooms



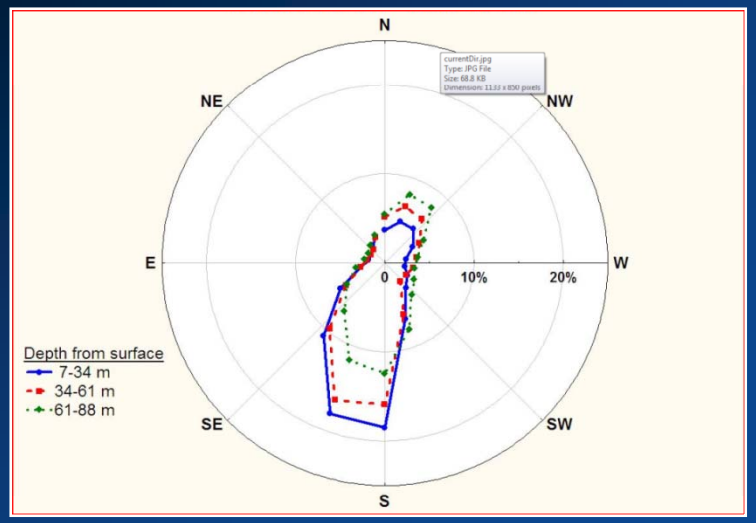
Benthic Dynamics

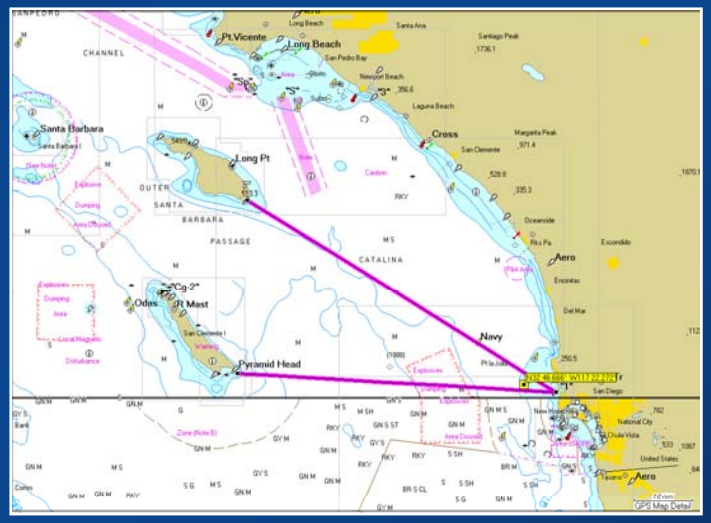


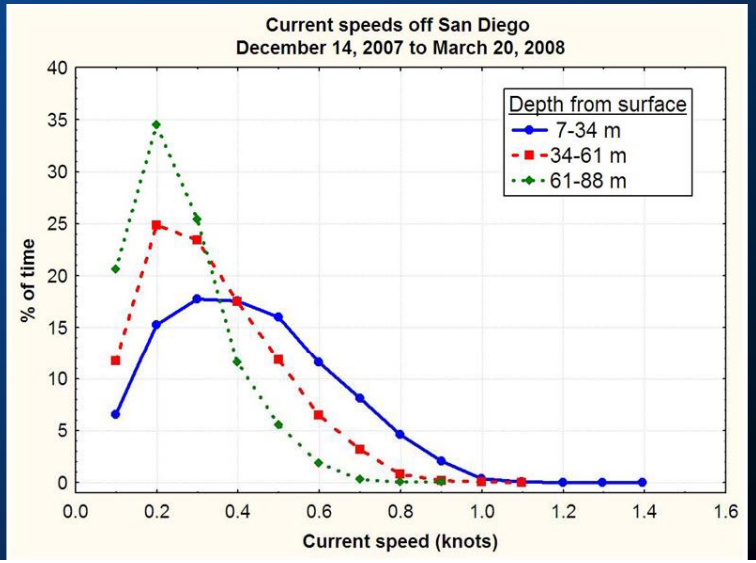


Concern 3.
Polluting the Bottom and Algal Blooms

Evaluating the Site

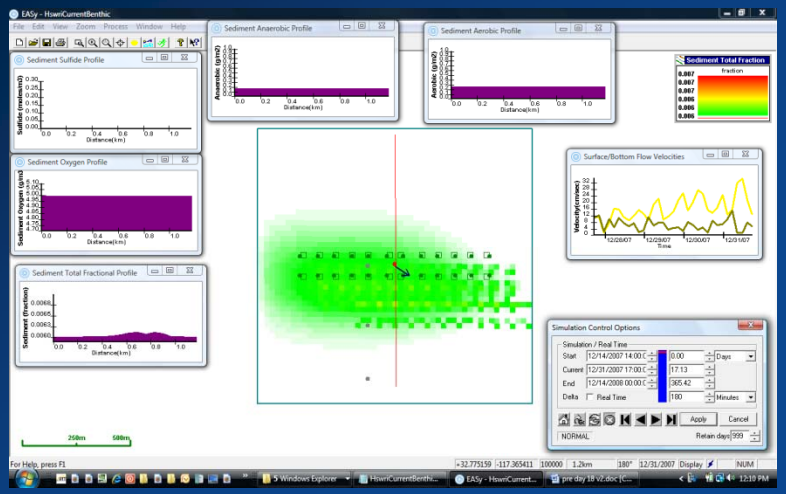




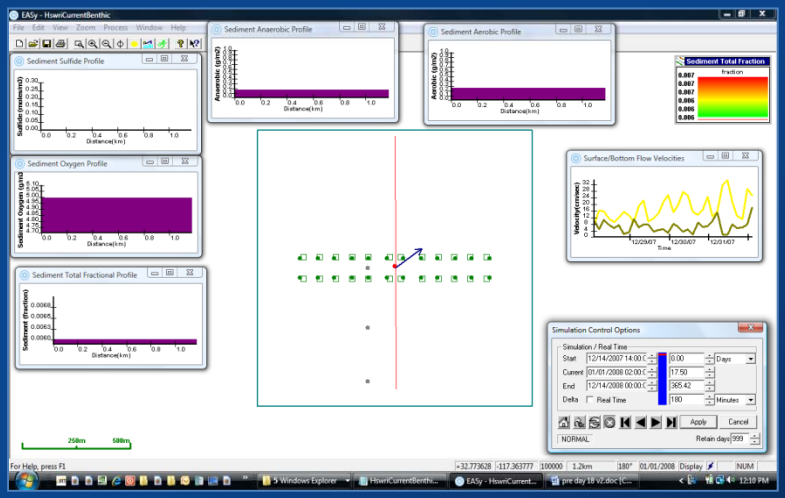


Concern 3.
Polluting the Bottom and Algal Blooms

Bottom Sediment Simulation



17 days w/o current
(scale is amplified 30x to discern TOC dusting)



+9 hours with average current

Results:

1. Simulation scale is amplified 30x in order to show dispersion
2. Depth and current combine to disperse carbon to very low levels
3. Peak TOC within footprint is 0.0062g C/g sediment (~1%) above ambient
4. Increased TOC is probably not detectable using existing standard chemical analyses

Concern 3.
Polluting the Bottom and Algal Blooms

Conclusions from Environmental Model

- Infauna may be a better indicator of effect than direct chemical analysis of the sediments
- The HSWRI demonstration site far exceeds any standards utilized in any jurisdiction worldwide

Concern 4.
Potential Spread of Disease

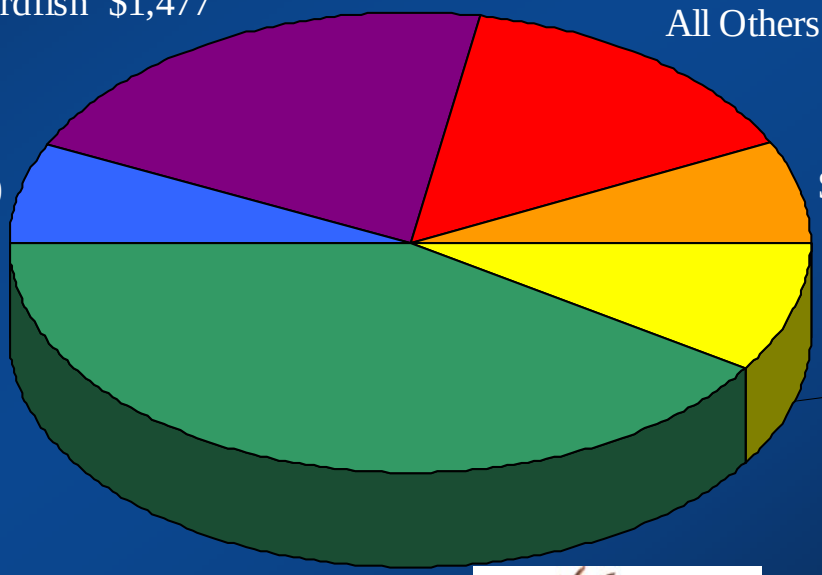
HSWRI: ***Healthy Oceans – Healthy Planet***

Healthy [Marine] Ecosystem =

A [marine] system <u>intact</u> in its physical, chemical, and biological components and their relationships, such that it can <u>respond and adapt</u> to changes and stressors. -FAO

Concern 5.
Competition with Commercial Fishermen

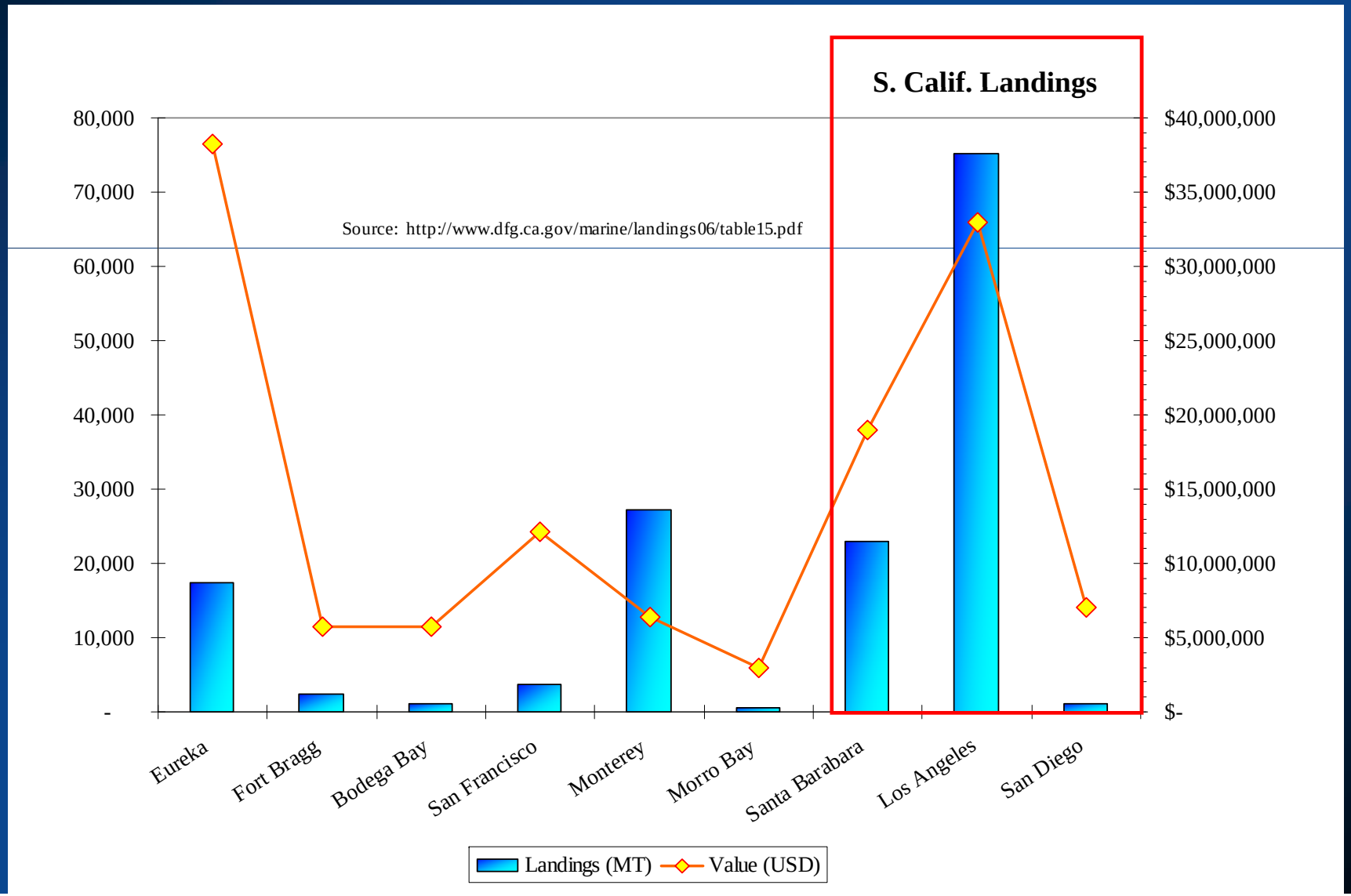
Value of Fish Landed in San Diego for 2006
(Values are in $1,000 USD)



Total harvest = $7 million

Concern 5.
Competition with Commercial Fishermen

2006 Landing Weight and Value by Port



Concern 6.
Farm Domination of the Offshore Environment

S. Calif. Fishing Areas:

194 x 100 sq. mi. = 19,400 sq mi

Commercial Fishing:

100K mt worth $59 MM/19K sq mi =

$3,041/sq. mi.

Offshore farms:

100K mt/yr in 40 farms in 20 sq. mi.
worth $300 MM at $3/kg =

$15 million/sq. mi.

Source: **CDFG Fish Bull 109**

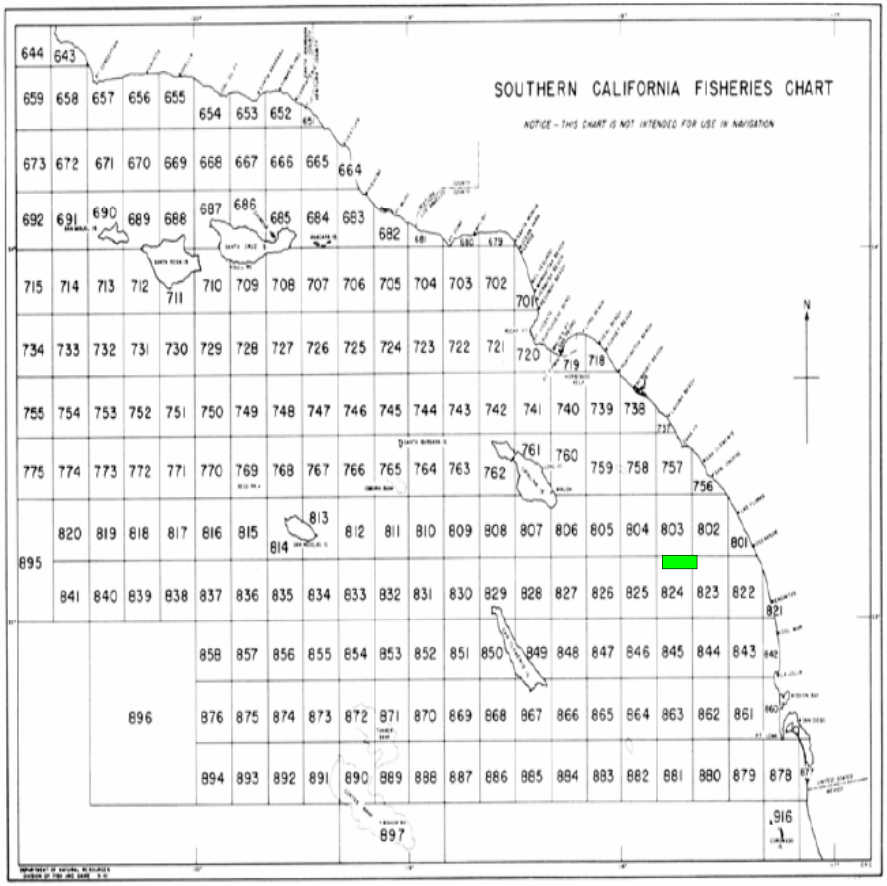
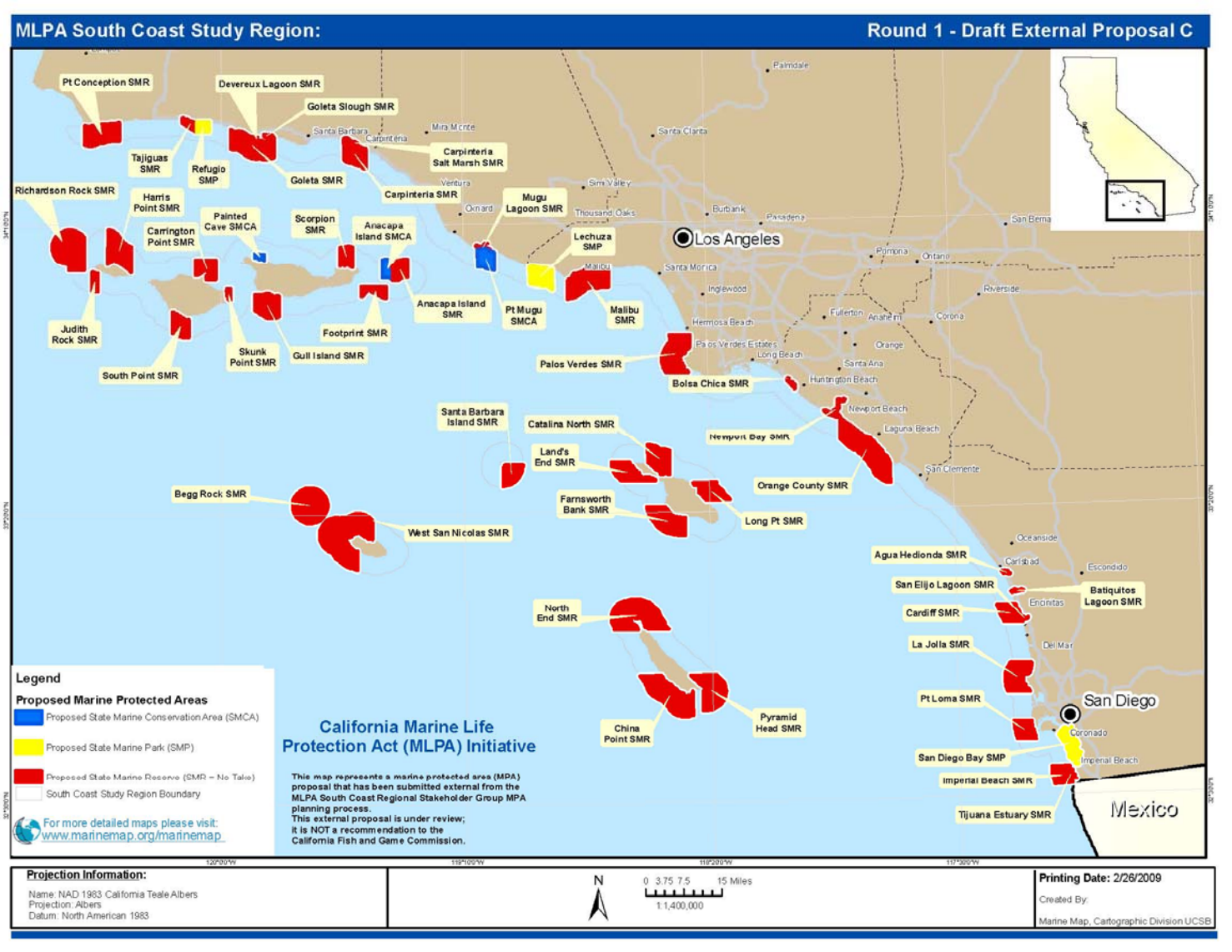


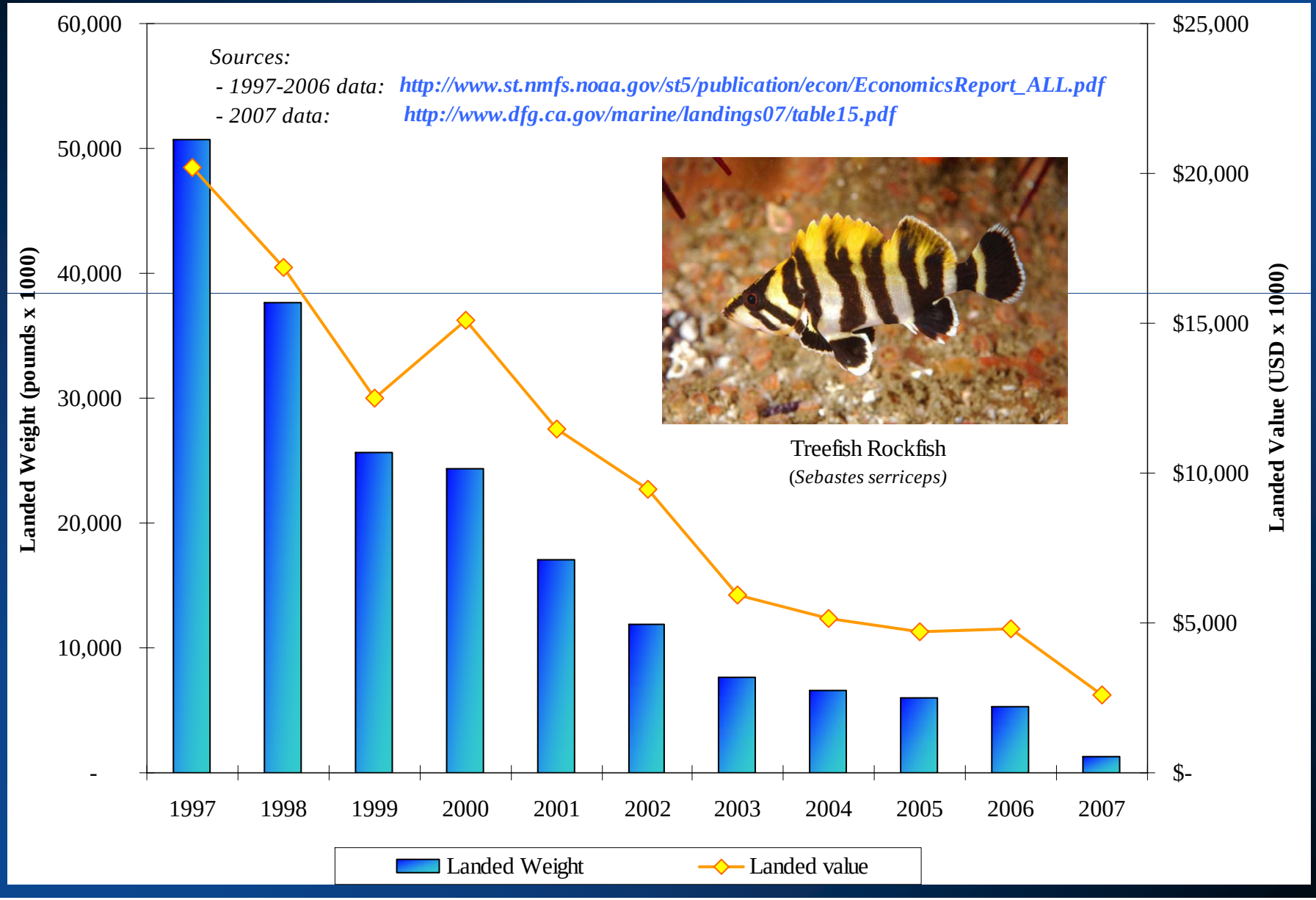
FIGURE 36. Chart showing Fish and Game block areas.

Concern 6.
Farm Domination of the Offshore Environment

Farms would not interfere with MPAs



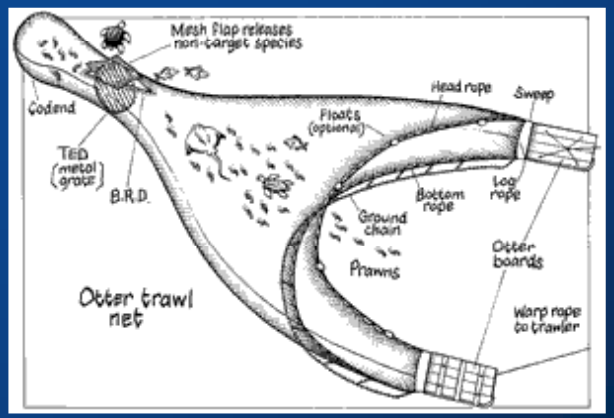
Potential Net Environmental Gain

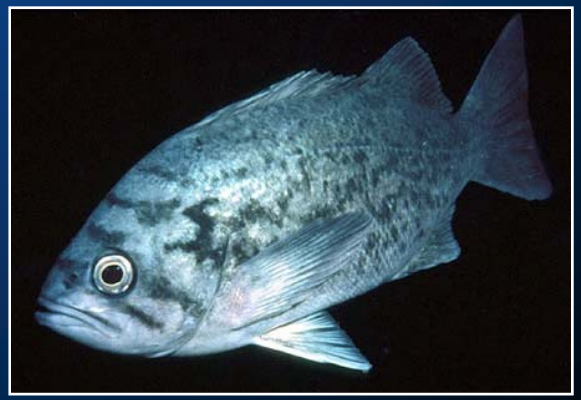


Near-shore Rockfish Harvested in 2006
All are marketed as *Pacific* or *Red Snapper*

China, Mexican, Pacific ocean perch, aurora, bank, black-and-yellow, black, blackgill, blue, bocaccio, bronzespotted, brown, canary, chilipepper, copper, darkblotched, flag, gopher, grass, greenblotched, greenspotted, greenstriped group bolina, group deep nearshore, group gopher nearshore, group red, group rosefish, group shelf, group slope, group small, honeycomb, kelp, olive, quillback, redbanded, rosethorn, rosy, shortbelly, speckled, splitnose, starry, swordspine, treefish, *unspecified*, vermilion, widow, yelloweye

Other MLMA Listed Rockfish: calico, scorpionfish





Sustainability

Sustainable Development is the management and conservation of the natural resource base and the orientation of technological and institutional change in such a manner as to ensure the attainment and continued satisfaction of human needs for present and future generations. Such sustainable development (in the agriculture, forestry, and fisheries sectors) conserves land, water, plant, and animal resources, is environmentally non-degrading, technically appropriate, economically viable, and socially acceptable.

(FAO,1995. *Code of Conduct for Responsible Fisheries*. Rome, FAO, 41p.).

Permit Process

- Consultations
  - NOAA requires a Biological Assessment completed by applicant [species (striped bass), marine mammals, habitats, etc.]
- Federal permits
  - Army Corps of Engineers
    - Section 10 permit (includes USCG Aids to Navigation)
    - NEPA review (public scoping process begins mid-April)
  - Environmental Protection Agency NPDES
- State reviews
  - Dept. of Fish & Game aquaculture registration
  - Coastal Commission consistency certification

All materials available to the public: ***Visit www.hswri.org/offshore for more information***

Permitting Communications

- In Oct 2008 we applied then conducted bi-weekly meetings to coordinate NEPA process:
  - USACoE, EPA, USCG, CDF&G, NOAA, CCC, HSWRI and 3rd party environmental consultant
  - Discussed roles and responsibilities and scope of EIS
  - All agreed to make process efficient by reviewing internal processes with each other to minimize overlap
- Timelines don't really mean much
  - Jan 2009 permit deemed complete. So within 15 days, NOI and Public Intent should be published
  - Fall of 2009 we had draft NOI
  - Shortly after HSWRI put applications on "hold"

Why Hubbs-SeaWorld Research Institute?

Offshore Aquaculture Demonstration Project

Mission – *"To return to the sea some measure of the benefits derived from it."*

- We seek to achieve this mission through scientific discovery, effective conservation, and innovative education programs that benefit the ecological, economic, social and aesthetic values of coastal and ocean resources.

Legacy

- Hubbs-SeaWorld Research Institute's founders envisioned and established an independent, non-advocacy-based research organization, filled with scientists who were productive, creative and results-oriented.

Core values

- Scientific integrity and honesty
- Shared knowledge for responsible ocean stewardship
- Public service
- Highest standards for animal care and welfare

National and international reputation for scientific excellence

- Diverse fields of study encompassing numerous species and habitats
- Largest marine conservation hatchery on the U.S. west coast
- Participation in advisory boards and blue-ribbon panels established by resource managers and "think tanks"

National and international recognition of breakthrough work in aquaculture

- NOAA/NMFS Sustainable Fisheries Leadership Award, June 2007
- HSWRI's Mark Drawbridge, President, California Aquaculture Association, 2008

Unparalleled track record

- More than 40 years of excellence in marine and coastal research
- More than 30 years of leading aquaculture research
- Proven success with white seabass (restored as a Southern California game fish)
- Proven success with net pens (the only California entity with offshore experience)

Critical capabilities already in place

- Fish health assessment
- Environmental monitoring programs
- Fish nutrition, including reduced-fishmeal feeds
- Fish genetics and physiology
- Fingerling transportation capabilities
- Life-support systems technology and engineering

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The Domestic Aquaculture Imperative

Offshore Aquaculture Demonstration Project

- "The answers to our problems don't lie beyond our reach. **They exist in our laboratories and our universities, in our fields and our factories**, in the imaginations of our entrepreneurs and the pride of the hardest-working people on Earth…I do not accept a future where the jobs and industries of tomorrow take root beyond our borders…It is time for America to lead again."

President Barack Obama, February 24, 2009, *Address to Joint Session of Congress*

- "With Earth's burgeoning human populations to feed, we must turn to the sea with new understanding and new technology. **We need to farm it as we farm the land.**"

Jacques Cousteau, *The Ocean World of Jacques Cousteau*, 1973

- "**Aquaculture**, probably the fastest growing food-producing sector, **now accounts for almost 50 percent of the world's food fish** and is perceived as having the greatest potential to meet the growing demand for aquatic food."

State of World Aquaculture: 2006, Food and Agriculture Organization of the United Nations

- "**Imports comprised over 80 percent of the U.S. edible seafood supply in 2006.**"

NOAA 10-Year Plan for Marine Aquaculture, October 2007

- "It should be noted that the United States national policy as stated in their National Aquaculture Act of 1980: is to 'encourage the development of aquaculture' as a **way of 'reducing the United States trade deficit in fisheries products, for augmenting existing commercial and recreational fisheries, and for producing other renewable resources, thereby assisting the United States in meeting its future food needs.'**"

State of World Aquaculture: 2006, Food and Agriculture Organization of the United Nations

- "… ***a well-managed system of offshore aquaculture*** … And when we get this right, these farmed fish can provide a healthy source of food and reduce pressure on the ocean ecosystems."

George W. Bush, June 15, 2006, *10-Year Plan for the NOAA Aquaculture Program*, Interim Final, November 2006

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5 June 2009

Fact Sheet

Offshore Aquaculture Demonstration Project

The Project

A commercial-scale, offshore aquaculture demonstration project

- Beta test at 1,000 metric tons a year (eight net pens)
- Scale up to 3,000 metric tons a year (24 net pens)
- Scaled to assess both commercial feasibility and environmental sustainability

Sited to meet multiple requirements and avoid conflicts

- In deep, clean, temperate water with good current and sandy bottom
- Outside busy (and potentially contaminated) coastal zone

Conducted by San Diego-based Hubbs-SeaWorld Research Institute

- 45 years' experience in marine research (over 30 in aquaculture)
- Nationally and internationally respected for innovative conservation science
- The only California entity with net pen experience and success

The Need

86 percent of U.S. edible seafood supplies are imported

- Nearly 50 percent of all seafood is farmed

Globally, China accounts for 70 percent of all farmed seafood

Seafood imports account for $9 billion of annual trade deficit

- Second largest contributor to national trade deficit (after oil)

"We must learn to farm the sea as we farm the land."
Jacques Cousteau

The Product

Striped bass grown from fingerlings to market size

- Species established in California waters, spawning and rearing parameters known
- Year-round production and harvest key to commercial viability
- Established dockside value is $6.50 to $8.50 per kilogram

Proven market value essential given upfront costs

- Scaled to obtain necessary funding (federal funding for demonstration projects is inadequate at less than 10% of needed start-up costs)
- Project profitability begins in fourth year of operation

The Regulatory Elements

Army Corps of Engineers

- Rivers and Harbors Act, Section 10, 33 USC 403 navigable waters permit

U.S. Environmental Protection Agency

- National Pollutant Discharge Elimination System permit

California Department of Fish & Game

- Aquaculture registration and oversight

California Coastal Commission

- Consistency review anticipated

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The Rationale for Striped Bass

Offshore Aquaculture Demonstration Project

Hardy species found in the Pacific and Atlantic oceans, and the Gulf of Mexico

- An established species in the proposed project location
- Escaped fish would not pose environmental issues
- Proven by HSWRI research to be well suited for culture in local waters

Designated a recreational species in California

- Poses no conflict/competition with commercial fishing
- Promises a significant growth opportunity for California industry
- Cultured striped bass and hybrid striped bass already being marketed
- Currently grown in inland ponds and tank systems

Several farm sources for fingerlings assure steady, competitively priced supply

Proven market value, interest level and growth opportunity

- Product will be superior to that grown in inland ponds and tank systems
- Value consistent with cultured species such as European seabass and seabream
- Established interest from several market segments
  - Sushi and high-end restaurants
  - Restaurant and hotel chains
  - Live fish markets
  - Seafood brokers, traders and wholesalers
- Anticipated production volume established by previous HSWRI research

HSWRI has 30 years' experience with experimental and pilot-scale culture of this species

No competition for ocean-farmed striped bass

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The Specific Location

Offshore Aquaculture Demonstration Project

Southern California area is probably the nation's most promising location

- Mild, Mediterranean-like climate allows year-round production
- Water temperatures vary little – range from 12° to 22° C
- Wave heights rarely exceed seven meters
- Coastal islands and peninsulas offer sources of shelter from extreme conditions
- Excellent variety of locally established fish species with high market-value

Close to existing seafood industry infrastructure

- Commercial fishing industry
- Distribution and transportation centers (including LAX)
- Major market centers

Proposed site meets multiple requirements and avoids potential conflicts

- Federal (exclusive economic zone) waters more than three miles offshore
  - Outside coastal zone to avoid conflicts with nearshore uses
  - Away from coastal contamination
- Sandy bottom
  - Away from vulnerable kelp and/or hard-bottom habitats
- Not in U.S. Navy or commercial shipping lanes
- 100- to 300-foot depth with appropriate currents

Close to HSWRI headquarters

- HSWRI team to provide project management
- HSWRI scientific staff to provide expertise and environmental monitoring

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The Need for Commercial Scale

Offshore Aquaculture Demonstration Project

Is domestic offshore aquaculture financially and environmentally sustainable?

- Near universal agreement that demonstration projects are needed
  - NOAA, FAO, Pew Foundation, U.S. Commission on Ocean Policy
- Only commercial-scale demonstration projects can answer the questions
- Anything smaller fails to address the make-or-break issues

The only feasible way to obtain funding is at a commercial scale

- Four open-ocean projects in U.S., three of which are commercial
  - Two in Hawaii and one in Puerto Rico
- The fourth does not produce significant amount of fish and is federally funded
  - University of New Hampshire
- Federal funding limits are about 10% of commercial-scale operation requirement

Funding is dependent on a likely ROI from a subsequent business operation

- Commercial-scale project results are immediately transferable to private sector

Scale is necessary to use existing commercial fishing and processor capabilities

- Commercial infrastructure only cost-effective at commercial-scale volumes

The promise outweighs the risks

- Demonstration project by nature does not have a foregone conclusion
- If unsuccessful, demonstration project simply sunsets
- If successful, will lead to viable, sustainable, domestic offshore aquaculture industry

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Outreach to over 80 groups including state, federal and local government, aquaculture, commercial fishing, local businesses, marine laboratories, media relations, NGOs, educational, retail and wholesale seafood companies.

Hubbs-SeaWorld Research Institute
Unified Port of San Diego
Mindful Investors
King's Seafood Co. Since 1945
California Restaurant Association — Prepare to be Inspired
The City of San Diego · State of California · Semper Vigilans
San Diego Port Tenants Association
the alliance — global aquaculture
San Diego magazine — A CURTCO MEDIA PUBLICATION
CleanFish — fish you can trust.
The San Diego Union-Tribune
Darden Restaurants
Sea Grant California
California Fisheries & Seafood Institute
San Diego Coastkeeper
San Diego Regional EDC
Sierra Club — Founded 1892
The International Culinary Schools — at The Art Institutes
The Culinary Institute of America
Fish Farming International
United States Senate
Chesapeake Fish Co.
WWF
The Great Seal of the State of California — Eureka
Driscoll
Aquarium of the Pacific
American Tuna — Pole Caught "Wild Albacore"
NOAA — National Oceanic and Atmospheric Administration · U.S. Department of Commerce
California State Assembly
The Ocean Harvest
California Coastal Commission
SAC — Sportfishing Association of California
Surfrider Foundation
Resources Agency California Department Fish & Game
EHL
National University System Institute for Policy Research
United States Congress
The Sportfishing Conservancy — www.sportcon.org
The Security Network — Fostering Innovation Through Collaboration
U.S. Department of the Interior · Minerals Management Service
Monterey Bay Aquarium — Charter Member
New England Aquarium
San Diego Regional Chamber of Commerce

Reason for "Hold"

- NOAA
  - Promoting Marine Spatial Planning
  - Announced redrafting of Aquaculture Policy
- Legislative
  - AB 4363 is wholly restrictive of aquaculture and would require multiple years to realize if passed
- Internal decision
  - Spent $500K and over a year's work
  - Couldn't commit to a years NEPA process that could be reversed by legislative mandate or Administrative policy
  - Did not want to waste the time of the agencies involved

Closing Observations (con't.)

- We spent one year and $500K to prepare to enter the NEPA process
- We explored the potential to develop cage farming 10 miles south of San Diego in Mexican waters working with an existing tuna farm
  - Took two weeks to generate the permit application materials for an experimental permit for 10K tons of annual production
  - After six weeks, we had a permit in-hand
- The USA is spending too much time talking about developing aquaculture instead of using the existing technologies to develop an expanded domestic capability

NATIONAL AQUACULTURE ACT OF 1980

Act of September 26, 1980, Public Law 96-362, 94 Stat. 1198, 16 U.S.C. 2801, et seq.

(c) POLICY.-- Congress declares that aquaculture has the potential for reducing the United States trade deficit in fisheries products,[(5)] for augmenting existing commercial and recreational fisheries and for producing other renewable resources, thereby assisting the United States in meeting its future food needs and contributing to the solution of world resource problems. *It is, therefore, in the national interest, and it is the national policy, to encourage the development of aquaculture in the United States.*

A Chronology of National Studies and Reports Relevant to Aquaculture Development

- 1969. *Our Nation and the Sea*. United States (Stratton) Commission of Marine Science, Engineering, and Resources.
- 1973. *NOAA Aquaculture Survey*. Mardela Corporation, Burlingame.
- 1975 and 1976. Draft *National Aquaculture Development Acts*.
- 1976. *National Plan for Marine Fisheries*. NOAA.
- 1976 and 1977. Draft *National Aquaculture Organic Acts*.
- 1977. Draft *Aquaculture Policy Act.*
- 1977. *NOAA Aquaculture Plan*. NOAA.
- 1978. *National Aquaculture Act*.
- 1977. *Food and Agriculture Act.*
- 1978. *Constraints and Opportunities of Aquaculture in the United States*. National Research Council, U.S. Academy of Sciences.
- 1979. *The Role of the Department of Agriculture in Aquaculture*. National Research Council, U.S. Academy of Sciences.
- 1983. National Aquaculture Development Plan. Joint Sub-committee on Aquaculture.
- 1985. *Aquaculture and Capture Fisheries: Impacts in U.S. Seafood Markets*. NMFS.
- 1990. *Aquaculture Policy for the National Marine Fisheries Service*. Office of Research and Environmental Information.
- 1991. *Strategic Fisheries Plan*. NMFS.
- 1992. *Marine Aquaculture - opportunities for growth*.
- 1993. *Aquaculture and the Federal Role*. Congressional Research Service.
- 1994. *Role of the National Marine Fisheries Service in Marine Aquaculture*. NMFS.

A Chronology of National Studies and Reports Relevant to Aquaculture Development (con't.)

- 1995. *FAO Code of Conduct for Responsible Fisheries*.
- 1997. Draft *Marine Aquaculture Act*.
- 1997. NOAA Fisheries Strategic Plan
- 1997. FAO *Technical Guidelines for Aquaculture Development*.
- 1998. *Aquaculture Policy Statement*. NOAA
- 1999. *Aquaculture Policy Statement*. DOC
- 2000. National Aquaculture Act of 2000
- 2000. *New Priorities for the 21st Century*. NOAA
- 2002. Draft *Code of Conduct for Responsible Aquaculture Development in the United States EEZ*. NOAA.
- 2002. *The Rationale for a New Initiative in Marine Aquaculture*. NMFS.
- 2003. Draft *Offshore Aquaculture Act*. NOAA
- 2004. *Ocean Blueprint for the 21st Century*, Chapter 22, *Setting a Course for Sustainable Marine Aquaculture*. United States Ocean Policy Commission.
- 2007. NOAA 10-Year Plan for Marine Aquaculture
- 2008. NOAA's Aquaculture Policy
- 2008. Overcoming Technical Barriers to the Sustainable Development of Competitive Marine Aquaculture in the United States
- 2008. Offshore Aquaculture in the United States: Economic Consideration, Implications and Opportunities. NOAA Report.

"The answers to our problems don't lie beyond our reach. They exist in our laboratories and our universities, in our fields and our factories, in the imaginations of our entrepreneurs and the pride of the hardest-working people on Earth."

"I do not accept a future where the jobs and industries of tomorrow take root beyond our borders…It is time for America to lead again."

President Barack Obama
Address to Joint Session of Congress
February 24, 2009

Eight permitted farms in this area in 2002/2003

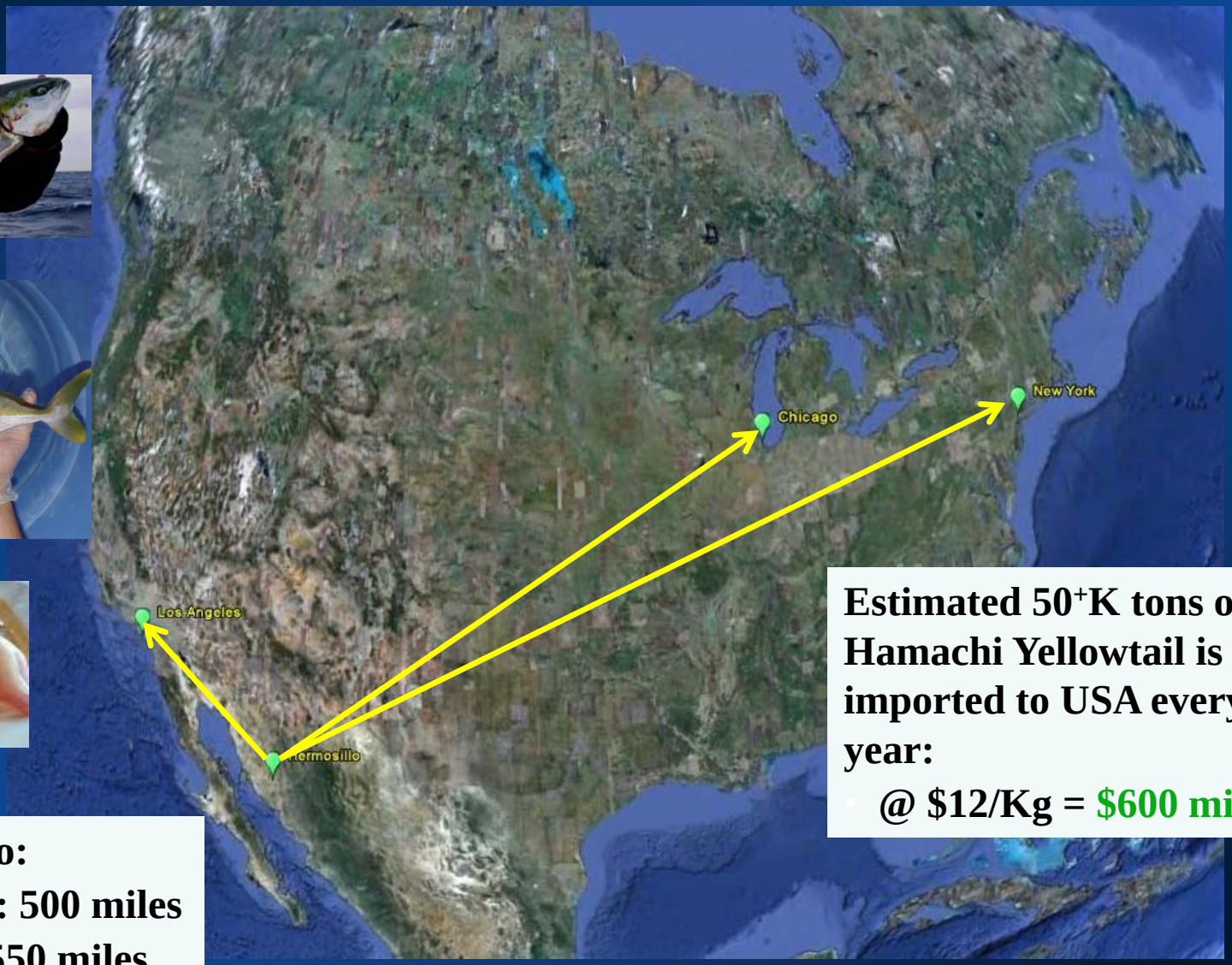
- **Mexican tuna production in 2004 = 5,000 MT**
- **Permitted Production = 16,000 + MT**
- **Mexican operations represent 15% of world farmed tuna production**
- **Existing cage infrastructure can support 50K ton annual production of other species**

Baja California Tuna Farming

Mexico Summary

- Mexico is uniquely poised to expand and to be a major world producer
  - Significant investment already available
  - Established permitting process resulting from synergy between industry and regulatory agencies
  - Proximity to:
    - US and global markets
    - US technologies and expertise
  - Well established fishing industry ready to adapt to aquaculture and shrimp farming industry ready to diversify

The Sonoran Marketing Plan



Estimated 50^{+}K tons of Hamachi Yellowtail is imported to USA every year:

- **@ $12/Kg = $600 million**

- **Hermosillo to:**
- **Los Angeles: 500 miles**
- **Chicago: 1,550 miles**
- **New York: 2,200 miles**

From the day I took office, I've been told that addressing our larger challenges is too ambitious; such an effort would be too contentious. I've been told that our political system is too gridlocked, and that we should just put things on hold for a while.

For those who make these claims, I have one simple question: How long should we wait? How long should America put its future on hold?

President Barack Obama

January 27, 2010

Remarks by the President in State of the Union Address

"There are risks and costs to a program of action. But they are far less than the long range risks of comfortable inaction…we need men who can dream of things that never were."

John F. Kennedy

Thank You!

Lessons Learned: Ecosystem Impacts and Permitting Insight from Marine Cage Culture Operations

Don Kent
The Hubbs-SeaWorld Research Institute Experience

Presented at the
Workshop for Development of Sustainable Practices for Marine Cage Culture Operations in the U.S. Caribbean
Nov. 2-3, 2010, San Juan, Puerto Rico