Rose Canyon Fisheries

A Commercial-Scale Proposal to Define the Regulatory Pathway to Farming the U.S.A.'s Exclusive Economic Zone

Presented to the

Marine Fisheries Advisory Committee

San Diego, CA – April 30, 2015

Don Kent, M.Sc.

President/CEO,

Hubbs-SeaWorld Research Institute & Rose Canyon Fisheries

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So Cal's Fishing History

- From the early thirties and up until the late seventies, So Cal was known as the **<u>Tuna Capital of the World</u>**
- Over 40,000 people were employed by the tuna industry including 16 canneries
- Tuna was being served in over 80% of all U.S. households

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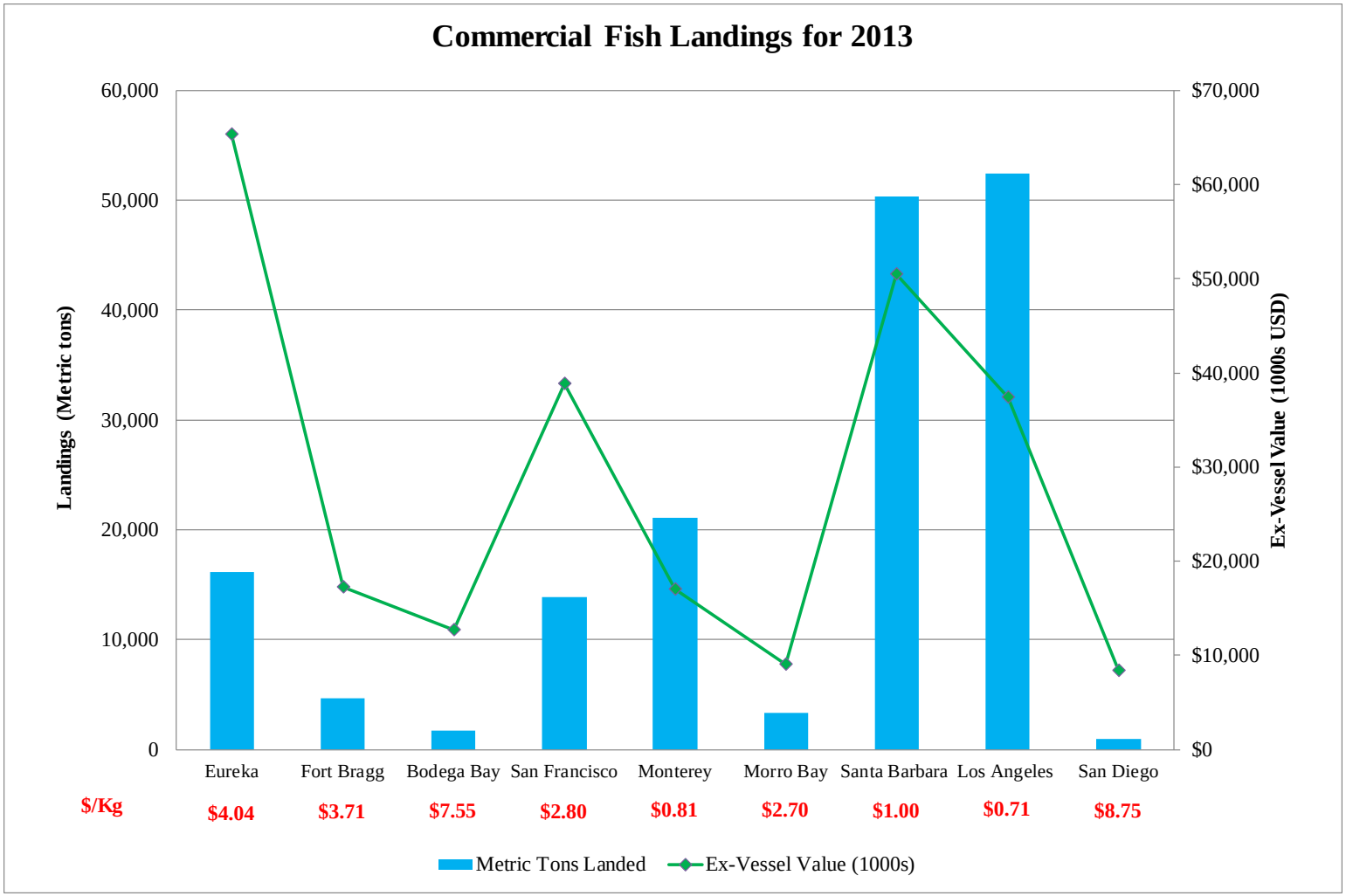
California's Commercial Fishing



2013 Total: **$256 Million, 165K Metric Tons**

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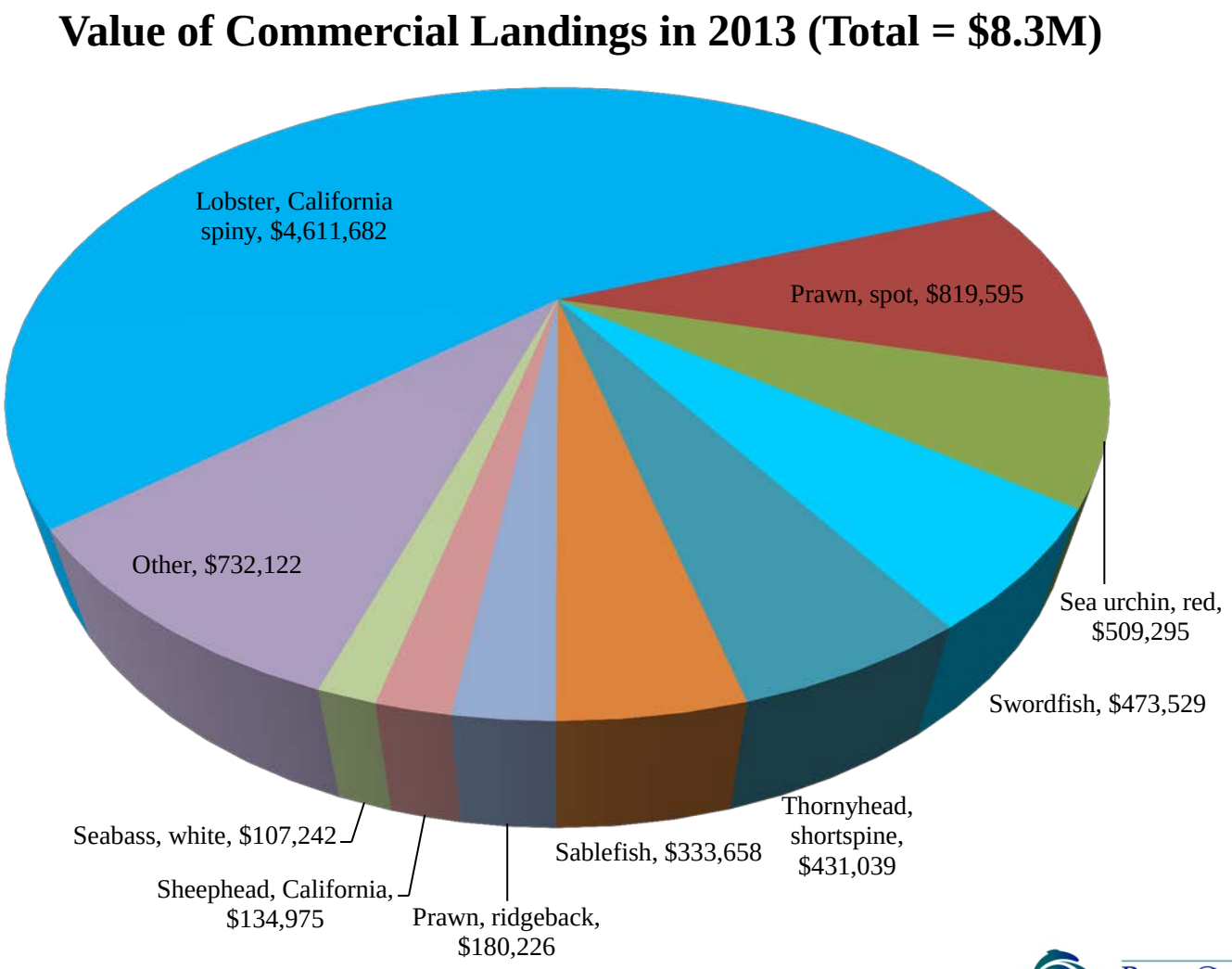
San Diego Commercial Fishing



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California Agriculture (2012 statistics)

- 81,500 farms
- Over 400 commodities
- $43.5 billion total revenue
- #1 state with 11.3% of U.S. farm cash receipts
  - 11% for crops
  - 7.1% for livestock
- $12 billion in livestock sales
- <0.5% is aquaculture

Source of Income	Sales
Aquaculture	$54
Chickens, All	$720
Cattle and Calves	$3,299
Eggs, Chicken	$393
Hogs and Pigs	$39
Honey	$23
Milk and Cream	$6,900
Turkeys	$311
Wool and Mohair	$5
Other Livestock	$412
Total	$12,155

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CALIFORNIA DEPARTMENT OF FOOD & AGRICULTURE

CALIFORNIA
CA GROWN

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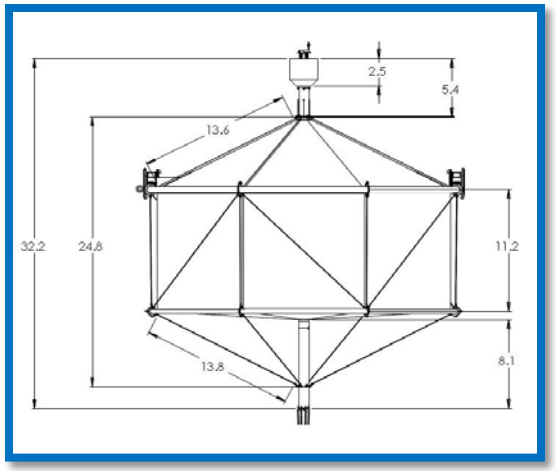
Rose Canyon Fisheries - The Project

- A commercial scale, state-of-the-art, offshore aquaculture project
  - Evaluate both economic and environmental sustainability
  - Scale up to 5,000 metric tons (11 million pounds) annual production
  - Annual sales in excess of $50-80 million with potential 2:1 economic benefit to the region



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Species to be Cultured

- Yellowtail Jack (*Seriola lalandi*)
  - Native to California Coast
  - Sold as "Hamachi" from Japanese fish farms
  - HSWRI has been culturing this species since 2003
- White Seabass (*Atractoscion nobilis*)
  - Native to California Coast
  - Commercially and recreationally important
  - HSWRI has been rearing this species for three decades
- Striped Bass (*Morone saxatilis*)
  - "Common" with project range
  - Anadromous (spawns in fresh water and matures in sea water)
  - Cannot be cauht commercially
  - HSWRI has cultured this species since early 1970s

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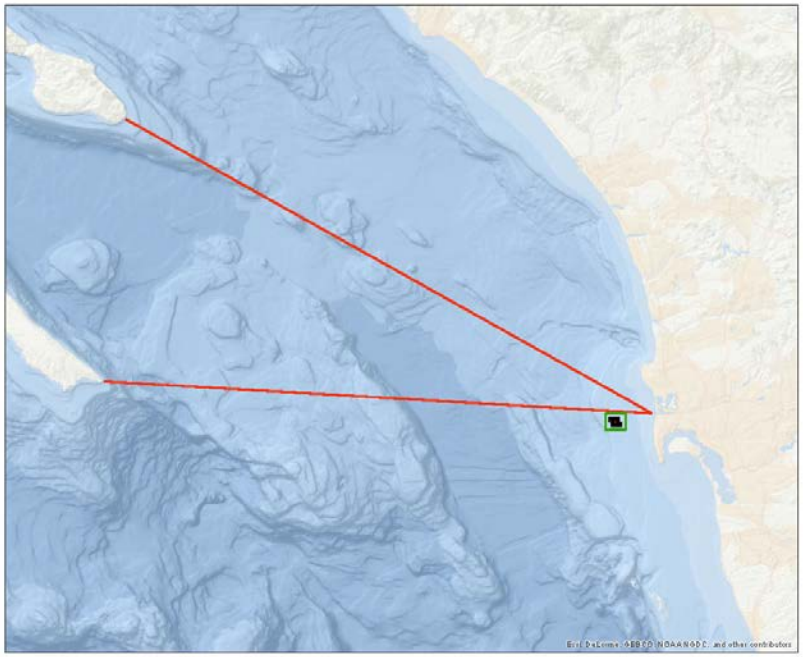
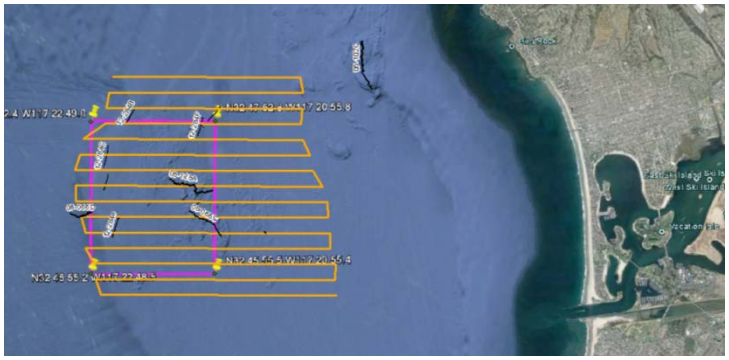
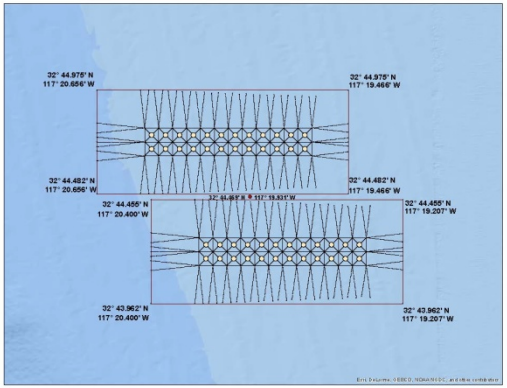
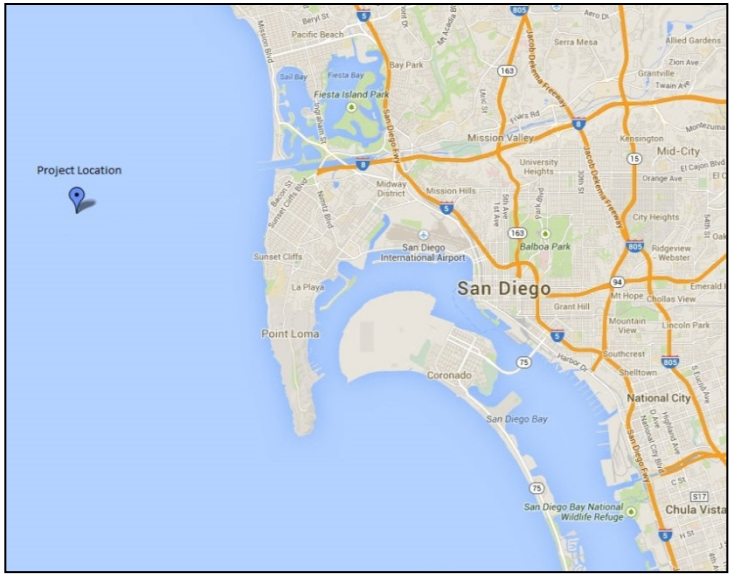
The Proposed Farm Site









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Permits Required

- **Federal permits/reviews:**
  - **Environmental Protection Agency**:
    - NPDES permit (National Pollutant Discharge Elimination System)
    - Lead agency for NEPA review process is the EPA
  - **U.S. Army Corps of Engineers**: Rivers and Harbors Act-Section 10 permit (including NOAA- EFH (Essential Fish Habitat), ESA (Endangered Species Act), and marine mammal/wildlife interactions)
  - **U.S. Coast Guard**-Aids to Navigation Permit (issued after ACoE)
  - **NOAA** has convened an Inter-agency Working Group to coordinate review process
- **CA State permits/reviews:**
  - **CA Dept. of Fish & Wildlife** aquaculture registration
  - **CA Coastal Commission** certification of consistency with Coastal Act

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San Diego is Ideal

- Mild Mediterranean climate
  - Shaded from storm events
  - Low wave energy
- Existing commercial fishing
- Proximity to So Cal markets
- HSWRI and NOAA are here

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Potential Economic Benefits

Net Sales	$81,791
Expenses:	
Production Costs	$54,818
Sales and Admin	$4,799
Total Expenses	$59,617
Net Earnings	$22,174
Income Taxes:	
Federal	$7,761
State	$1,960
Local	$111
Total Income Taxes	$9,832
Economic Impact	
Direct	$58,948
Indirect	$17,684
Induced	$41,264
Total Economic Impact	$117,896

Source: NOAA Southwest Fisheries Science Center

- Project:
  - Annual sales in excess of $80 million
  - Supporting over 200 seafood jobs
- Region
  - Contribute over $117 million to regional economy
- State
  - Represent a 31% increase in seafood ex-vessel sales
- Nation
  - Help to reduce the growing trade deficit in seafood imports

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Addressing Stated Concerns

Commercial and Recreational Fishing Impacts

- Avoid critical habitats
- Select sites of little import to all other fishing

Minimizing Environmental Impacts

- Avoiding entanglements
- Locating farms to eliminate habitat degradation

Minimizing Net Loss of Protein

- Alternate protein sources for feeds (e.g., processing waste for fish meal)

Preventing Escapement Impacts

- Advanced net pen technology for high energy seas
- Use endemic species from known stocks

Ensuring Product Quality

- Locate farms in cleaner offshore environment
- Adhere to existing USDA/FDA standards

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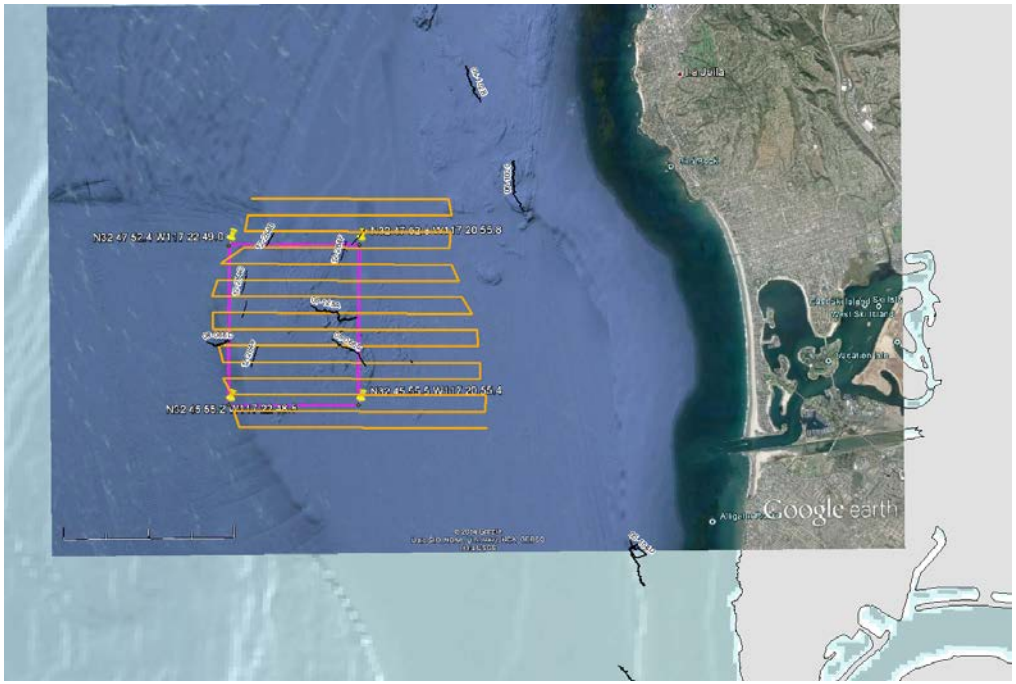
NOAA Survey

- Originally sited to meet multiple requirements and avoid conflicts
  - In deep, clean water with good current and sandy bottom
  - Outside coastal zone with its more numerous conflicting uses
- In response to commercial fisherman, recreational fishers and the Navy, we moved the farm site southeast to avoid any potential conflict and habitat concerns



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"Maximizing the Value of Offshore Aquaculture Development in the Context of Multiple Ocean Uses"

PI: Sarah Lester sarah.lester@ucsb.edu

Funded By: Sea Grant

Project Objectives:

- Assess potential conflicts and environmental impacts associated with open ocean aquaculture development
- Develop a dynamic spatial bioeconomic model for aquaculture in the Southern California Bight
- Demonstrate how tradeoff analysis can inform spatial planning for offshore aquaculture to maximize and minimize impacts and conflicts

UCSB msi Marine Science Institute DONALD BREN SCHOOL OF ENVIRONMENTAL SCIENCE & MANAGEMENT UNIVERSITY OF CALIFORNIA, SANTA BARBARA Rose Canyon FISHERIES

Avoid Entanglements

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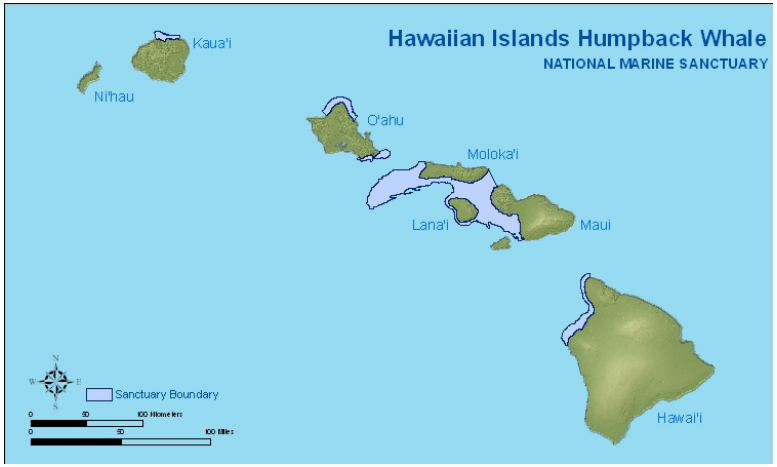
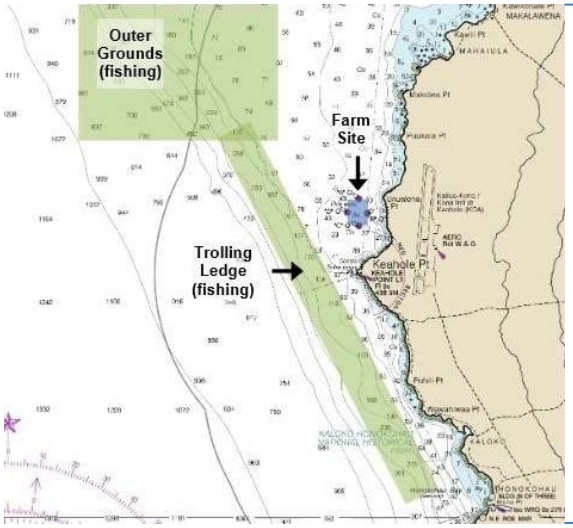
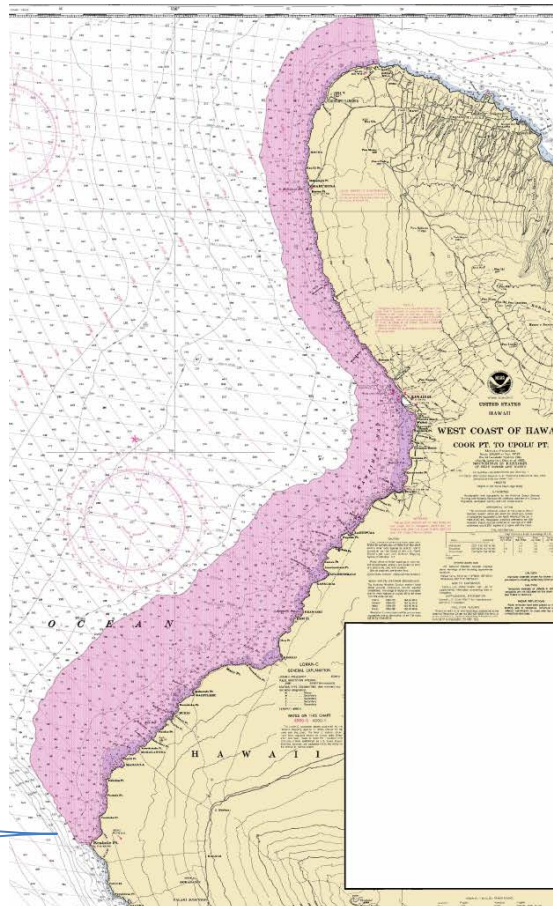
Blue Ocean Mariculture (Keahole Pt, Hawaii)

Formerly Kona Blue Farms

"Since 2005, an Open-Ocean 6 cell grid system, located within the Hawaiian Islands National Marine Whale Sanctuary, has operated without any negative interaction with marine mammals due to the design and selection of materials used in its fabrication and assembly"







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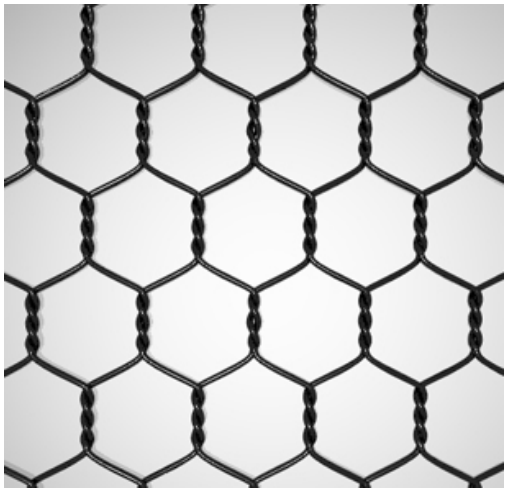
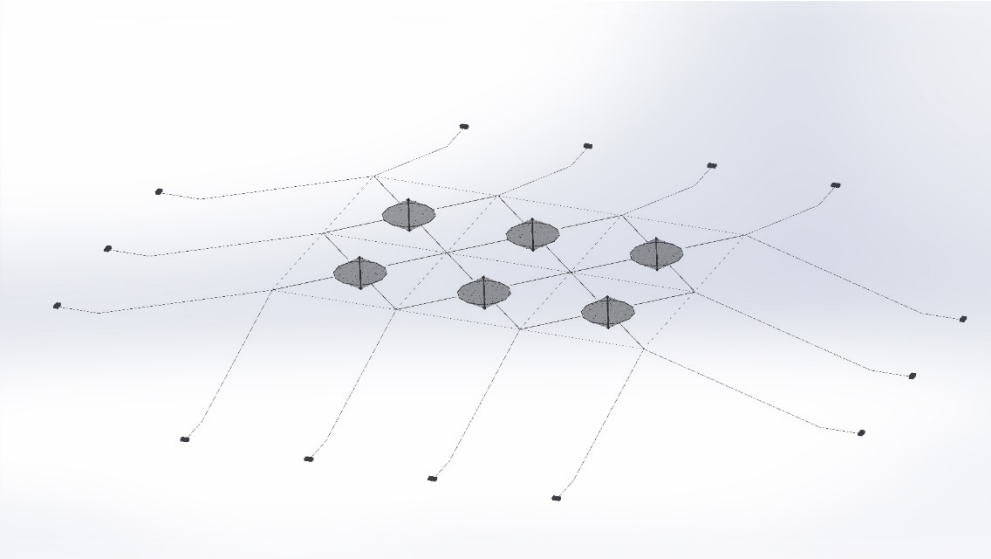
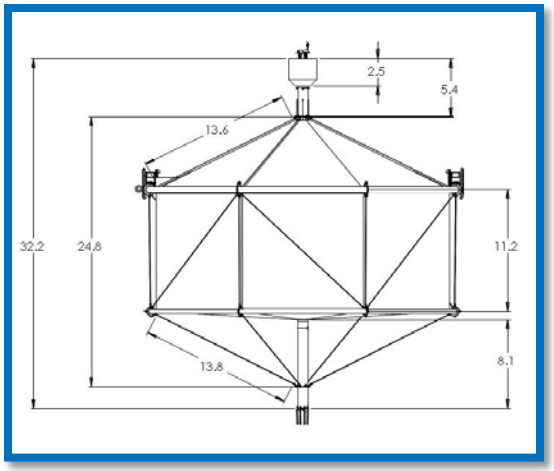
Mooring and Cage System







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Sustainable Marine Aquaculture in the Southern California Bight: A Case Study on Environmental and Regulatory Confidence

Dale Keifer-Science System Applications
Jack Rensel- Science System Applications
Randy Lovell- CDFW
James Morris- NOS
Paul Olin- California Sea Grant Extension
Ken Riley – NOS
Jerry Schubel – Aquarium of the Pacific
Diane Windham - NOAA

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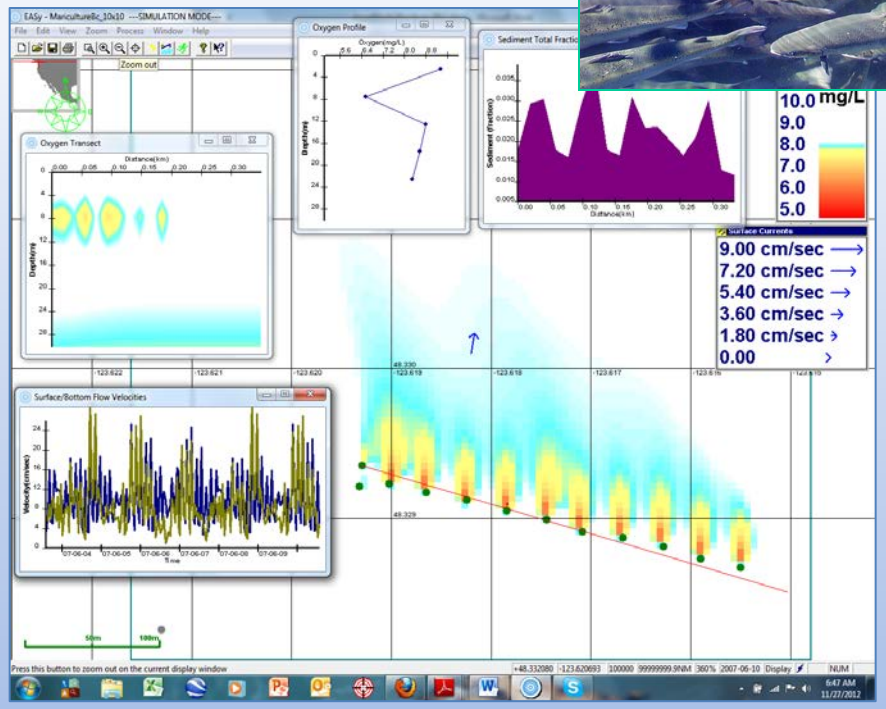
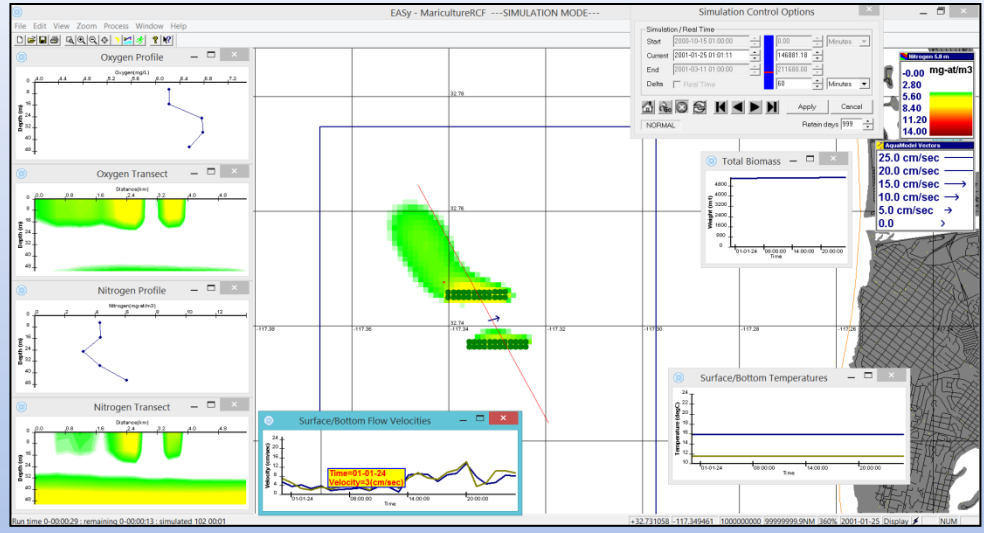
Computer Modeling of Net Pen Effects

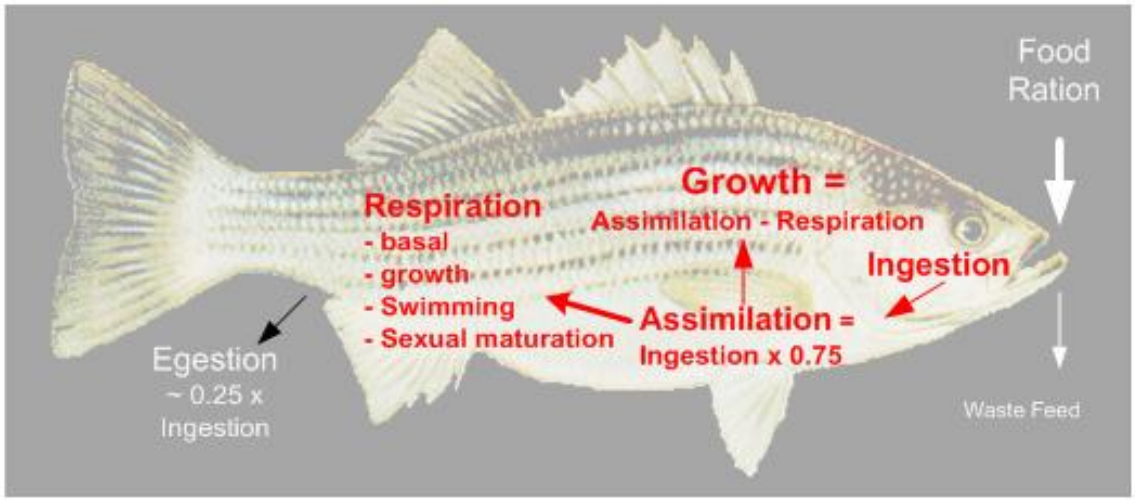
Workshop on Marine Finfish Aquaculture in the Southern California Bight, Long Beach Ca. April 2015

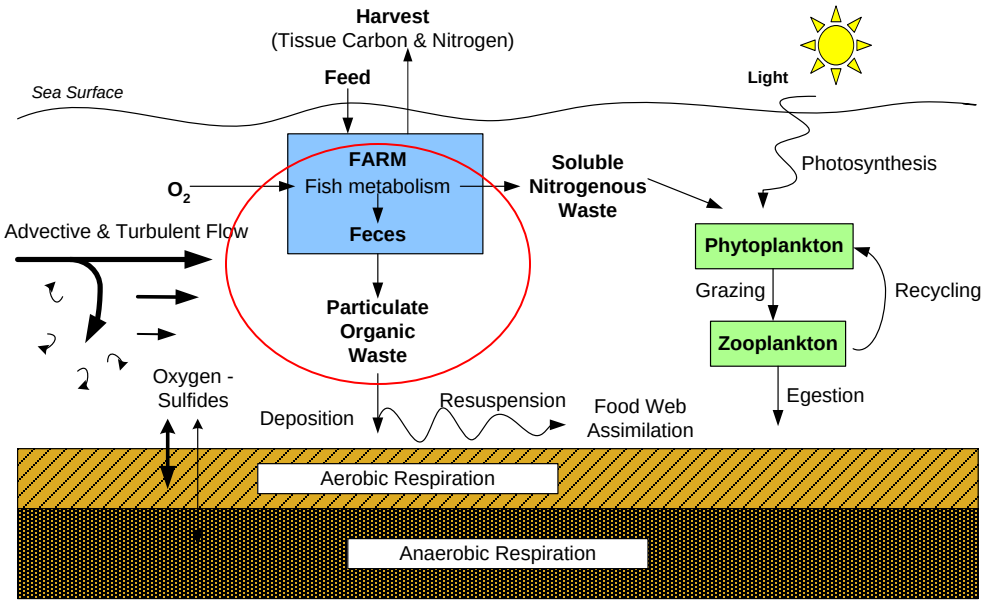
Jack Rensel, Ph.D.





Modeling Potential Impacts





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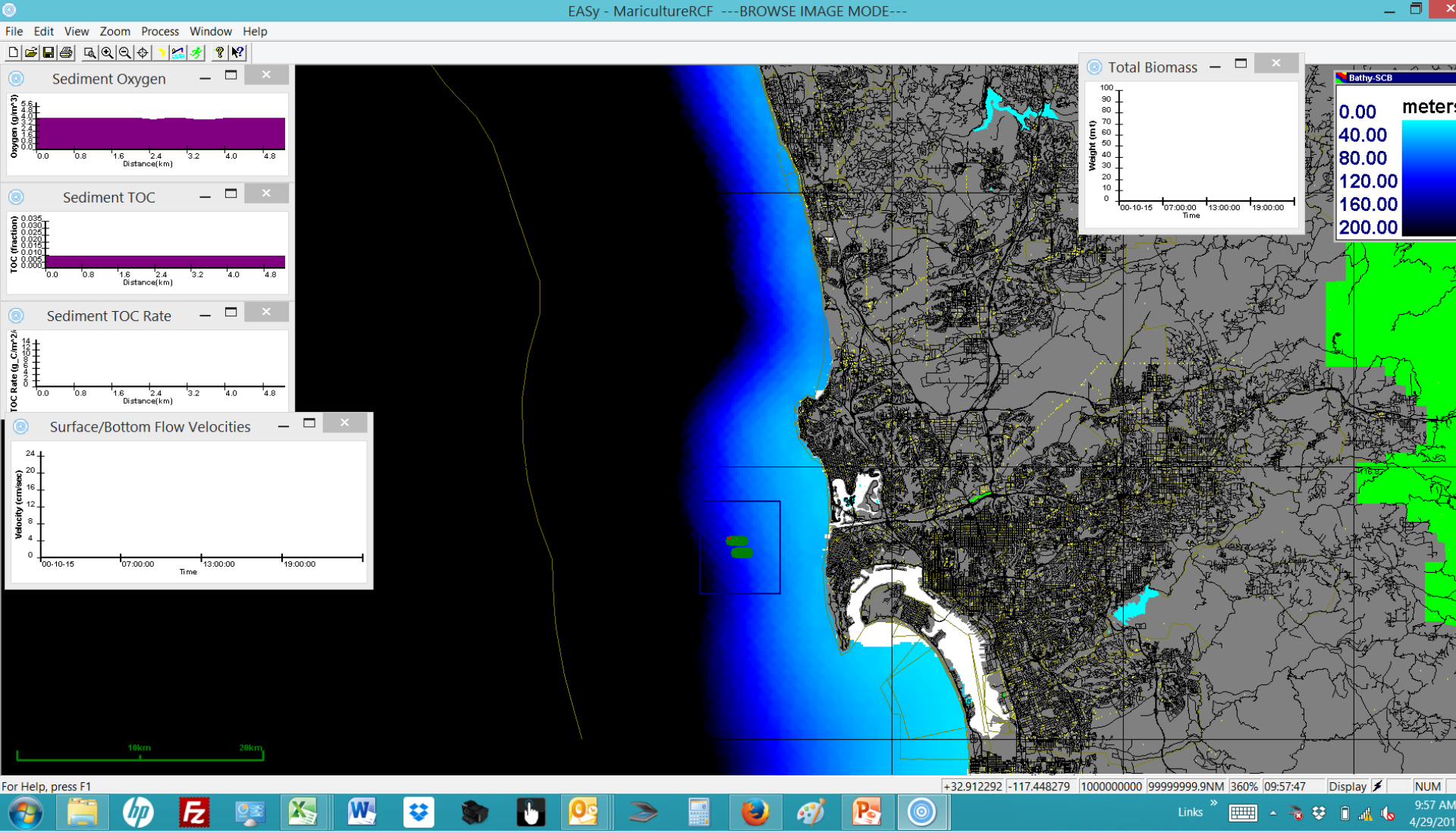
EASy - MaricultureRCF ---BROWSE IMAGE MODE---
File Edit View Zoom Process Window Help
Sediment Oxygen
Oxygen (g/m^3)
Distance(km)
Sediment TOC
TOC (fraction)
Distance(km)
Sediment TOC Rate
TOC Rate (g_C/m^2/
Distance(km)
Surface/Bottom Flow Velocities
Velocity (cm/sec)
Time
Total Biomass
Weight (mt)
Time
Bathy-SCB
meters
0.00
40.00
80.00
120.00
160.00
200.00
10km
20km
For Help, press F1
+32.912292 -117.448279 1000000000 99999999.9NM 360% 09:57:47 Display NUM
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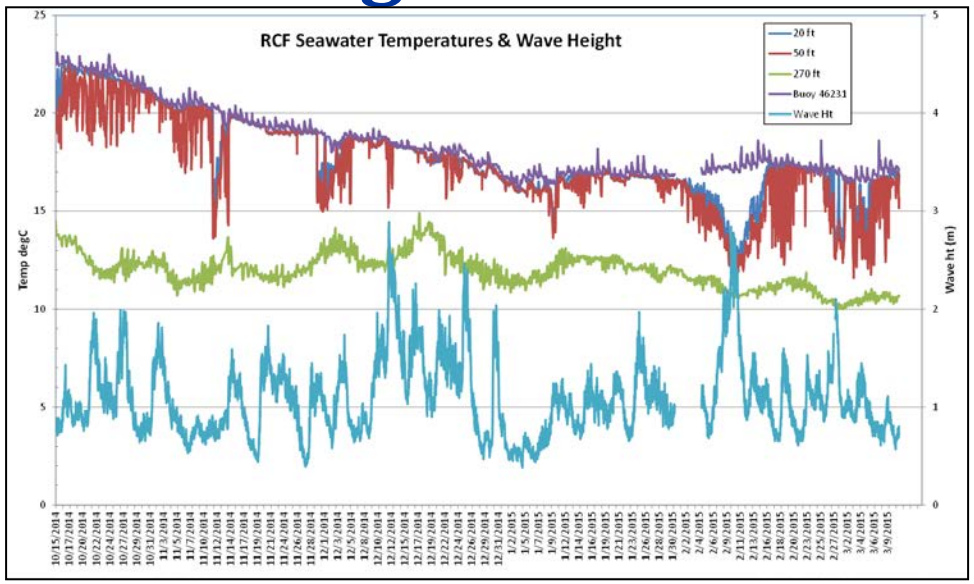
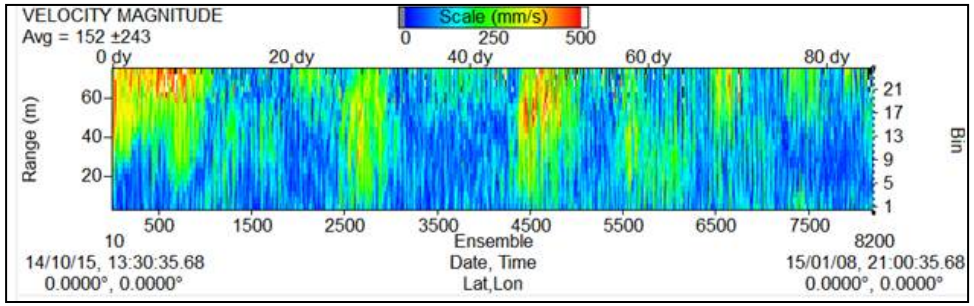
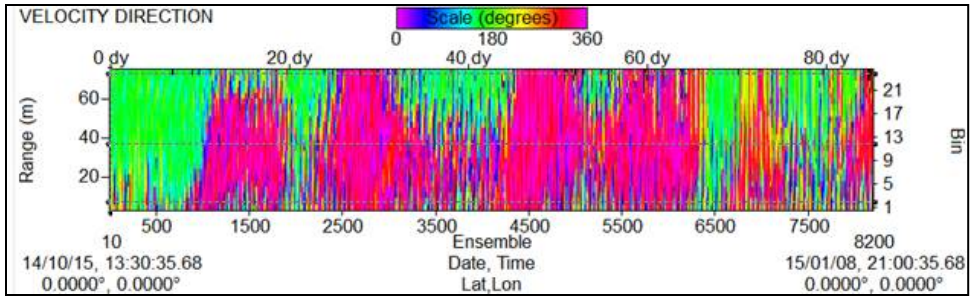
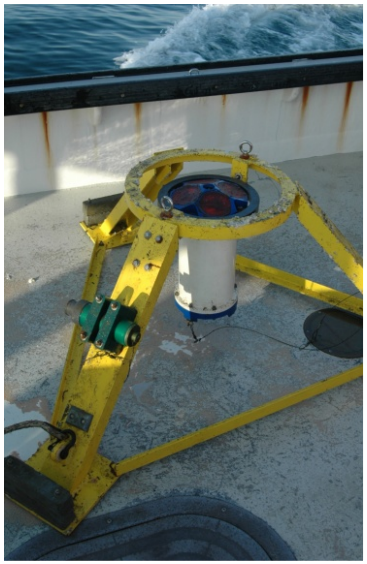
Evaluating the Site









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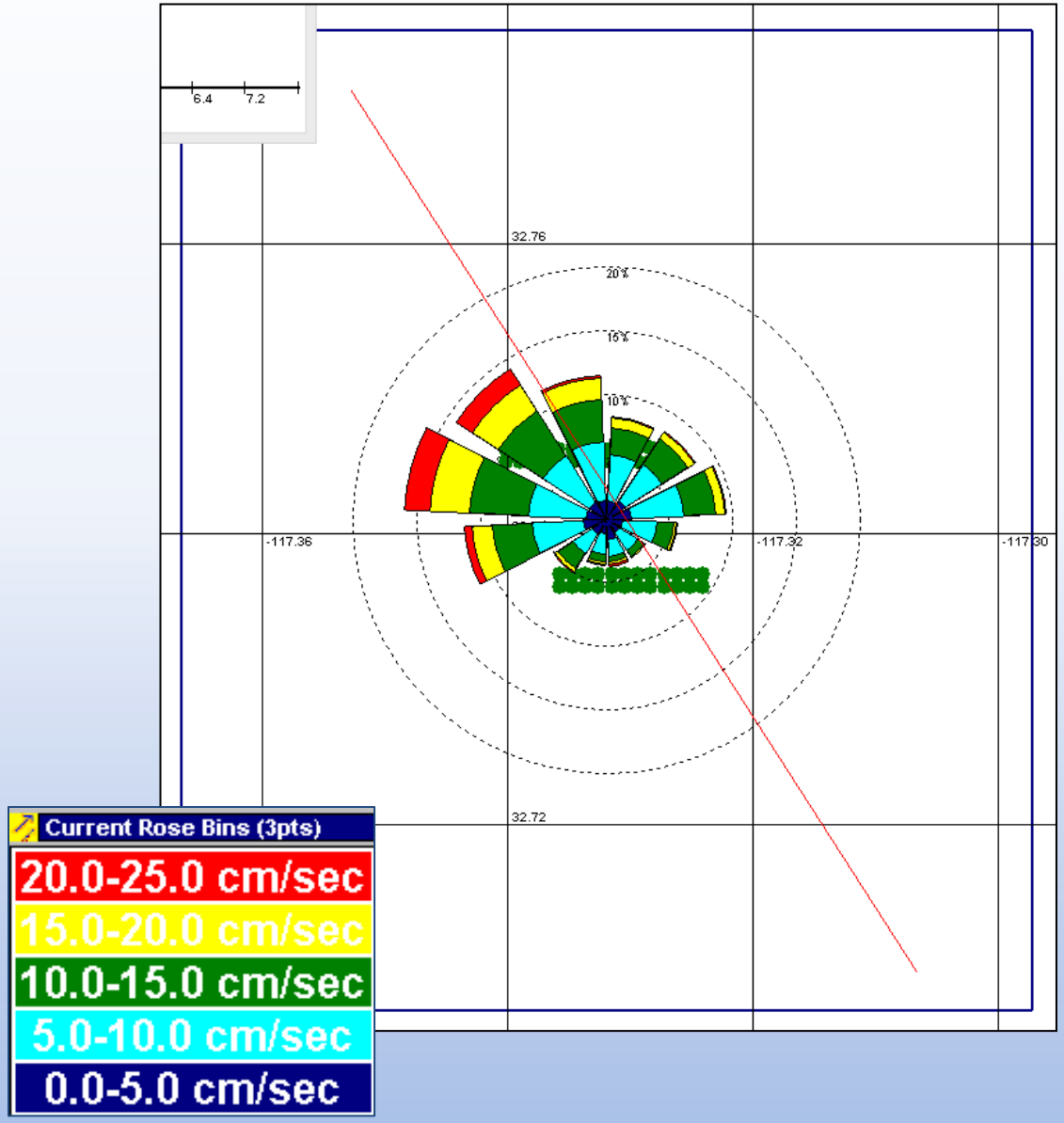
AquaModel Current Vector Rose



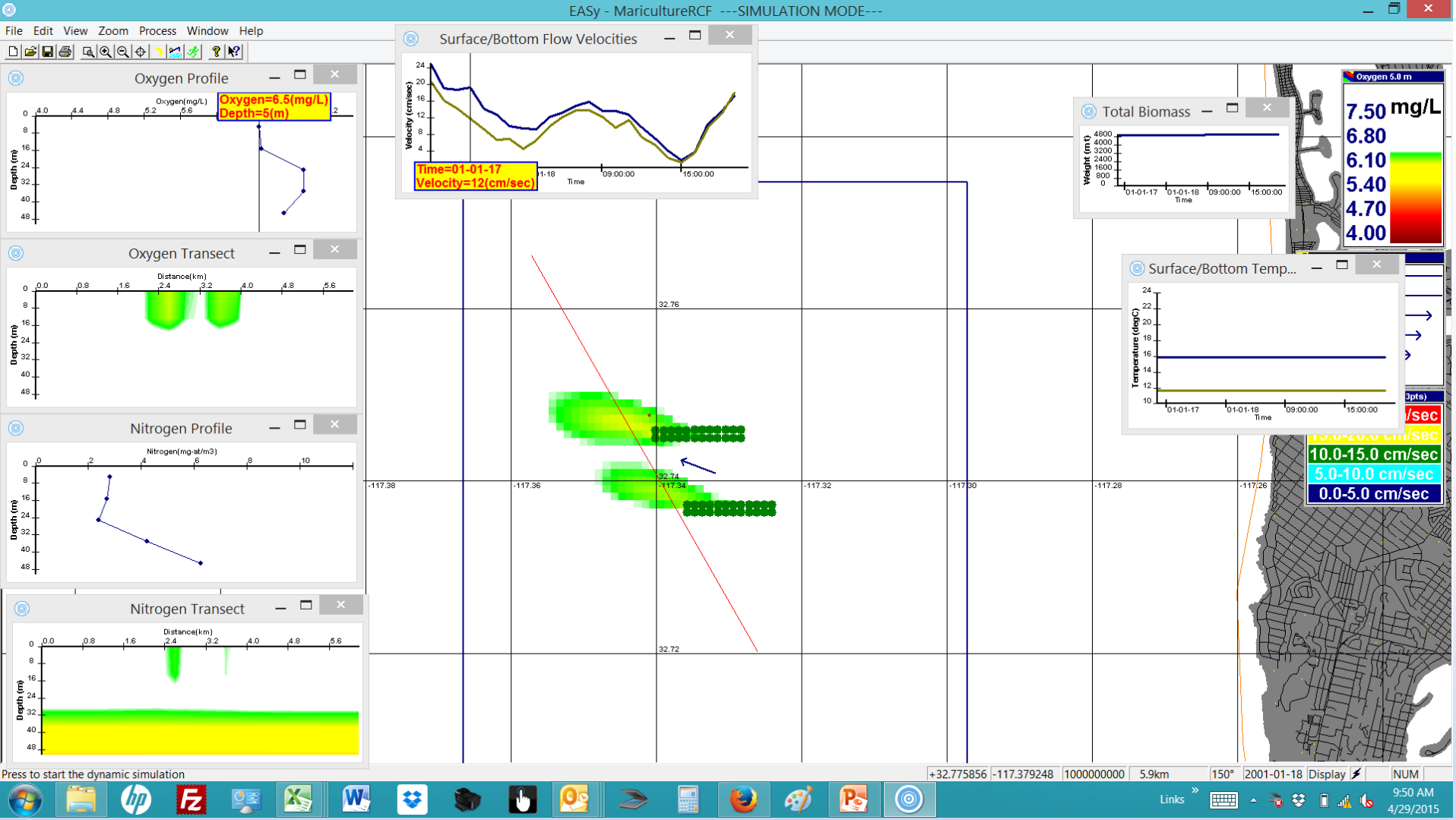
RCF Site
S. Ca. Bight

- Many depths measured
- 5m depth example here
- Five month duration
- 20 min time intervals

Relative current speeds are strong & near-ideal for the fish and the environmental effects

Strongest and most persistent currents are offshore to the NW

Raw Data Courtesy of HSWRI, Mike Shane et al.



- Small decrease of dissolved oxygen outside the cages that disappears as the current speed increases toward the mean.
- Striped bass biomass of ~ 5,000 metric tons (project build out)
- The next few slides shows subsequent 20 minutes model time steps.

EASy - MaricultureRCF ---SIMULATION MODE---

File Edit View Zoom Process Window Help

Surface/Bottom Flow Velocities

Velocity (cm/sec)

Time

Oxygen Profile

Oxygen(mg/L)

Depth (m)

Oxygen Transect

Distance(km)

Depth (m)

Nitrogen Profile

Nitrogen(mg-at/m3)

Depth (m)

Nitrogen Transect

Distance(km)

Depth (m)

Total Biomass

Weight (mt)

Time

Surface/Bottom Temp...

Temperature (degC)

Time

Oxygen 5.0 m

7.50 mg/L
6.80
6.10
5.40
4.70
4.00

10.0-15.0 cm/sec
5.0-10.0 cm/sec
0.0-5.0 cm/sec

Simulation Control Options

Simulation / Real Time

Start	2000-10-15 01:00:00	0.00	Minutes
Current	2001-01-18 20:01:00	137941.00	
End	2001-03-11 01:00:00	211680.00	
Delta	Real Time	60	Minutes

Apply Cancel

NORMAL

Retain days 999

Run time 0-02:32:55 : remaining 0-01:21:45 : simulated 95 19:01

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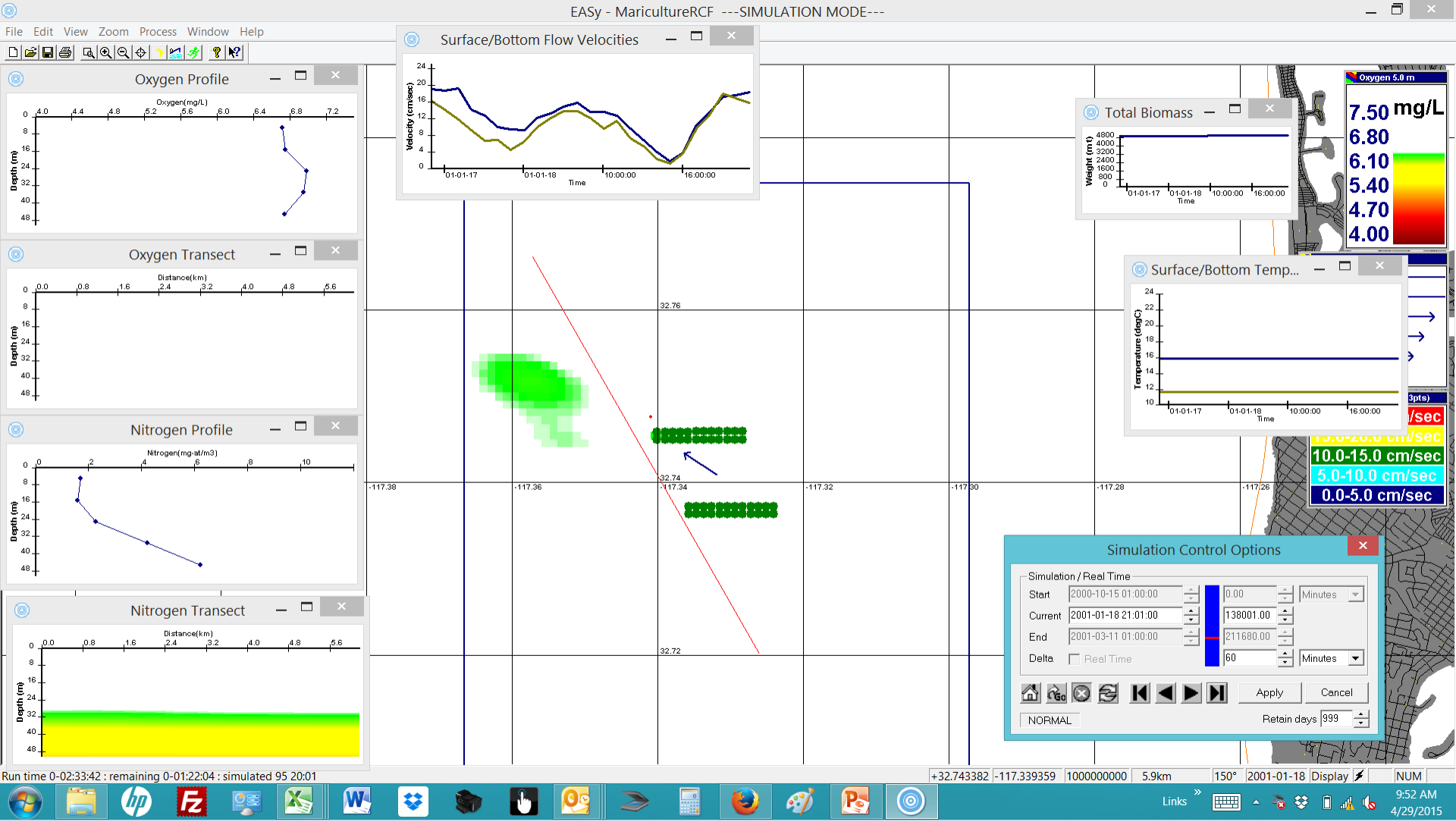
4/29/2015


EASy - MaricultureRCF ---SIMULATION MODE---
File Edit View Zoom Process Window Help
Surface/Bottom Flow Velocities
Velocity (cm/sec)
Time
Oxygen Profile
Oxygen(mg/L)
Depth (m)
Oxygen Transect
Distance(km)
Nitrogen Profile
Nitrogen(mg-at/m3)
Nitrogen Transect
Total Biomass
Weight (mt)
Surface/Bottom Temp...
Temperature (degC)
Oxygen 5.0 m
7.50 mg/L
6.80
6.10
5.40
4.70
4.00
10.0-15.0 cm/sec
5.0-10.0 cm/sec
0.0-5.0 cm/sec
Simulation Control Options
Simulation / Real Time
Start 2000-10-15 01:00:00
Current 2001-01-18 21:01:00
End 2001-03-11 01:00:00
Delta Real Time
Minutes
Apply
Cancel
NORMAL
Retain days 999
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+32.743382 -117.339359 1000000000 5.9km 150° 2001-01-18 Display NUM
Links
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4/29/2015

EASy - MaricultureRCF ---SIMULATION MODE---

File Edit View Zoom Process Window Help

Surface/Bottom Flow Velocities

Velocity (cm/sec)

Time

Oxygen Profile

Oxygen(mg/L)

Depth (m)

Oxygen Transect

Distance(km)

Depth (m)

Nitrogen Profile

Nitrogen(mg-at/m3)

Depth (m)

Nitrogen Transect

Distance(km)

Depth (m)

Total Biomass

Weight (mt)

Time

Surface/Bottom Temp...

Temperature (degC)

Time

Oxygen 5.0 m

7.50 mg/L
6.80
6.10
5.40
4.70
4.00

10.0-15.0 cm/sec
5.0-10.0 cm/sec
0.0-5.0 cm/sec

Simulation Control Options

Simulation / Real Time

Start	2000-10-15 01:00:00	0.00	Minutes
Current	2001-01-18 22:01:00	138061.00	
End	2001-03-11 01:00:00	211680.00	
Delta	Real Time	60	Minutes

Apply Cancel

NORMAL

Retain days 999

Run time 0-02:34:26 : remaining 0-01:22:21 : simulated 95 21:01

+32.738012 -117.316966 1000000000 5.9km 150° 2001-01-18 Display NUM

Links

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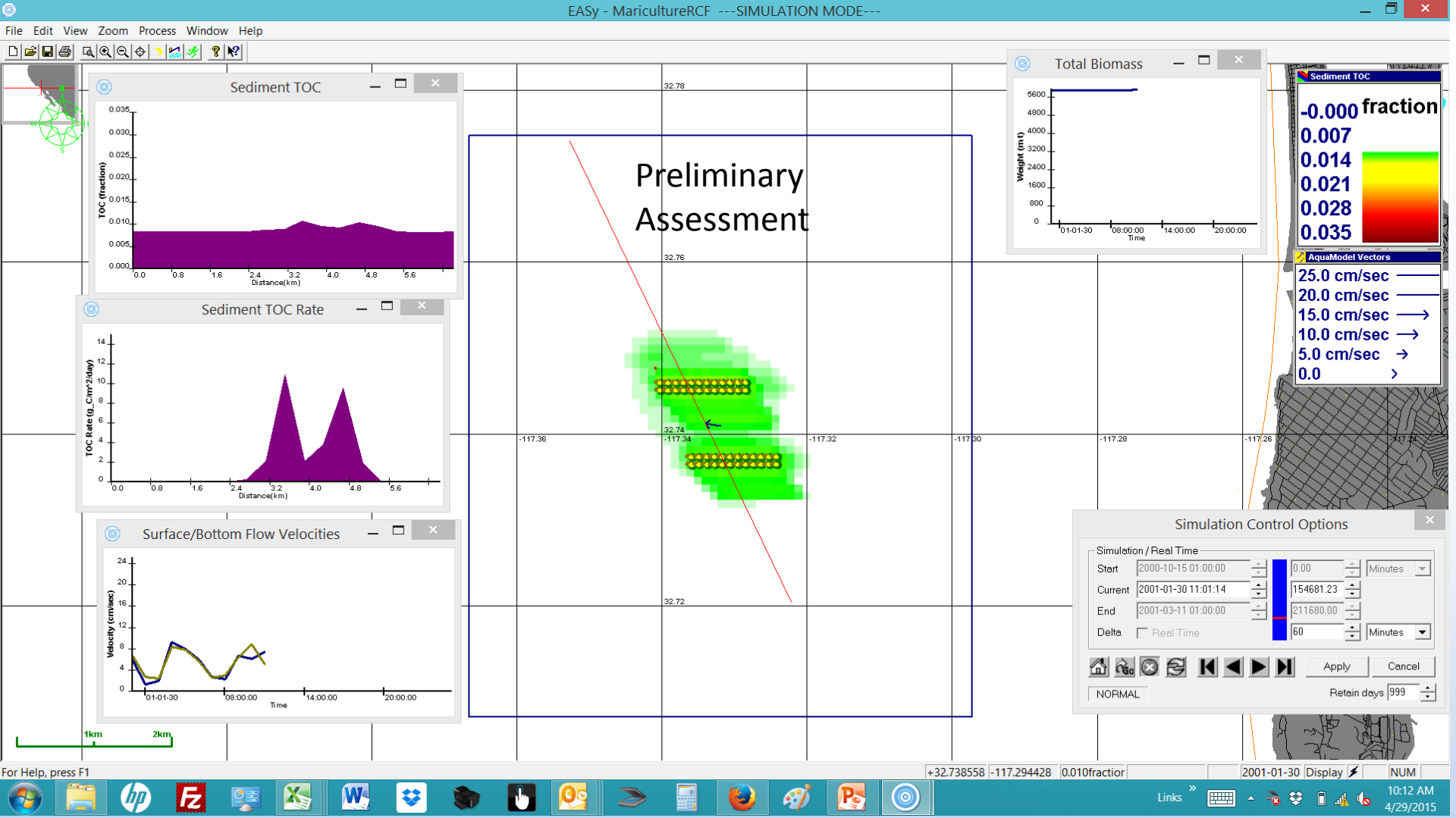
4/29/2015



- Background sediment total organic carbon = 0.008 fraction = 0.8% dry weight
- Increase of 0.2% TOC immediately under the cages at **5,600 metric tons** fish
- Experience in other locations of similar temperatures has shown that this amount of increased TOC should not produce adverse changes in the sediment chemistry or benthic infauna

National Aquaculture Act of 1980

Established the policy that it is in our Nation's interest, and it is the national policy ***to encourage the development of aquaculture in the United States****. Under this act, the* ***Secretary of Commerce is authorized*** *to provide advisory, educational, and technical assistance and* ***to encourage the implementation of aquaculture technology*** *in rehabilitation and enhancement of publicly owned fish and shellfish stocks, and* ***in the development of private commercial aquaculture enterprises.***

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NATIONAL STRATEGIC PLAN FOR FEDERAL AQUACULTURE RESEARCH (2014-2019)

Strategic Goals

1. Advance Understanding of the Interactions of Aquaculture and the Environment
2. Employ Genetics to Increase Productivity and Protect Natural Populations
3. Counter Disease in Aquatic Organisms and Improve Biosecurity
4. Improve Production Efficiency and Well-being
5. Improve Nutrition and Develop Novel Feeds
6. Increase Supply of Nutritious, Safe, High-quality Seafood and Aquatic Products
7. Improve Performance of Production Systems
8. Create a Skilled Workforce and Enhance Technology Transfer
9. Develop and Use Socioeconomic and Business Research to Advance Domestic Aquaculture

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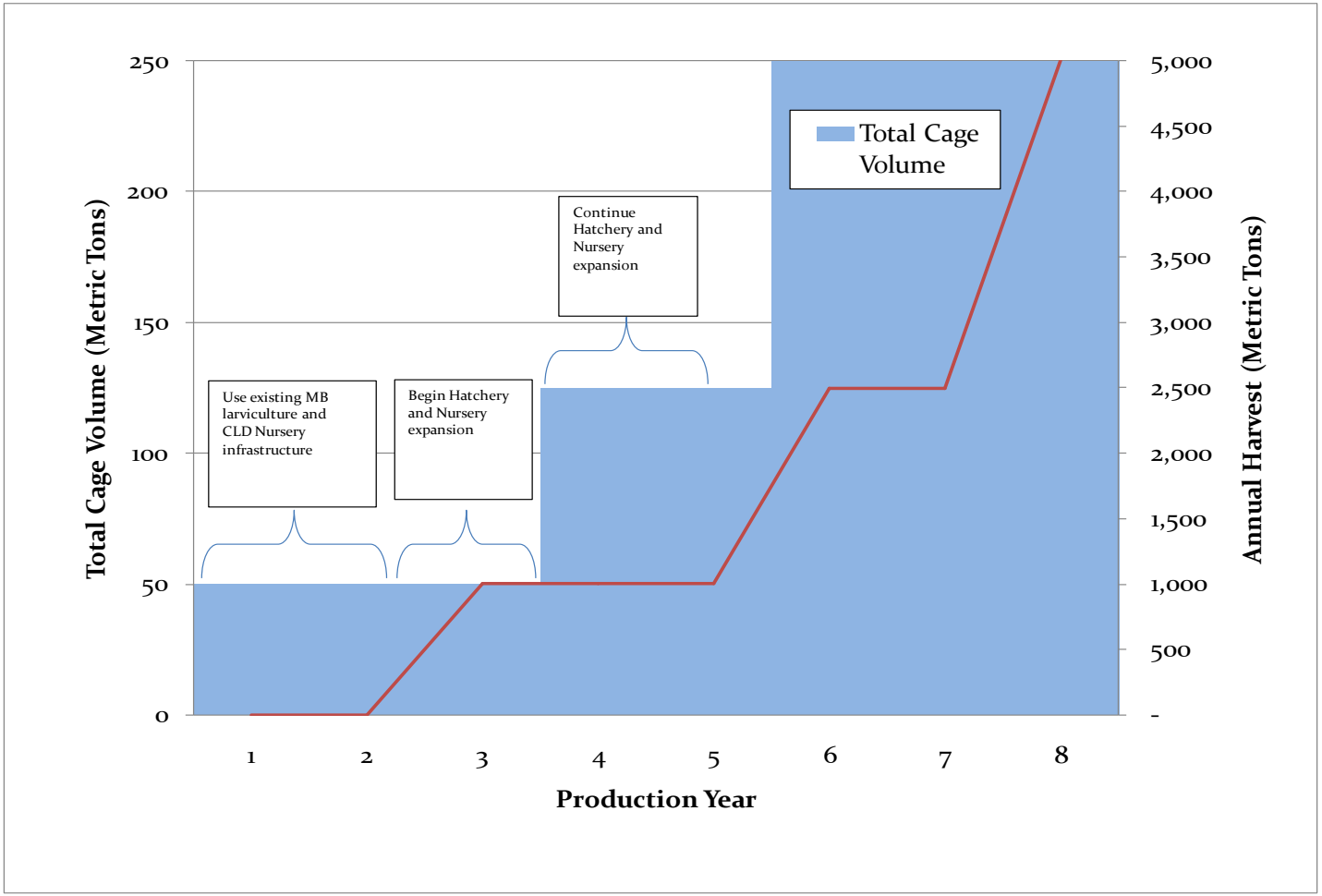
Farm Expansion



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Collaborative Organizations

Fish Health

University of Minnesota Driven to Discover
Middle Tennessee State University
Washington State University
Wisconsin University of Wisconsin–Madison
NOAA Fisheries
Hiroshima University
Auburn University
University of California Irvine
UC Davis Veterinary Medicine

Nutrition

NOAA Fisheries
USDA ARS
USDA/ARS
SIU Carbondale
Southern Illinois University Carbondale
Schillinger Genetics
UABC
Universidad Autónoma de Baja California
University of Idaho
Auburn University

Community

The Maritime Alliance "Promoting Blue Tech & Blue Jobs"
San Diego Regional EDC
Economic Development Committee
San Diego Regional Chamber of Commerce
The Nature Conservancy Protecting nature. Preserving life.
WWF World Wildlife Fund

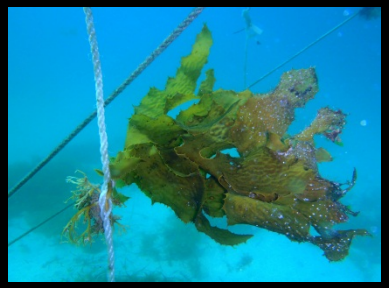
Production

openblue
OceanSpar
Baja Aquaculture, Inc.
Ocean Farm Technologies
Earth Ocean Farms

Environmental Effects

Rensel Associates Aquatic Science Consultants
NOAA Fisheries
Sea Grant California
NOAA National Ocean Service
California Department of Fish & Wildlife

Rose Canyon Fisheries



OFFSHORE AQUACULTURE IN CALIFORNIA: SCIENCE TOOLS TO SUPPORT COASTAL PLANNING AND DECISION-MAKING

Kenneth Riley and James Morris

NOAA National Ocean Service
National Centers for Coastal Ocean Science
Ken.Riley@noaa.gov

Aquaculture Coastal Planning Tools

Marine Spatial Planning

- Regional ocean mappers
- State siting atlases
- Habitat digitizer (delineate habitats from geo-referenced images)

Examples:

- NOAA Digital Coast
- Connecticut Shellfish Aquaculture Atlas
- North Carolina Shellfish Aquaculture Siting Tool

Environmental Models

AquaModel

- *Gulf of Mexico*
- *Hawaii*
- *California*

Farm Aquaculture Research Model (FARM)

- *Long Island Sound*
- *Chesapeake Bay*

Tool and Data Center

- Marine Cage Culture and the Environment
- Guidelines for Environmental Monitoring Offshore Aquaculture Operations
- Best Management Practices for Offshore Aquaculture in the US Caribbean

Coastal Aquaculture Planning Portal

Partnership with OCM

COMING SOON

DIGITAL COAST
NOAA COASTAL SERVICES CENTER

Search

Home | About | Data | Tools | Training | Apply It | Stories | GeoZone Blog

Narrow Results

Data Type

Socioeconomics (13)
Hydrography (5)
Elevation (22)
Imagery (5)
Land Cover (16)
Ocean Planning (10)
Benthic (9)

Focus Area

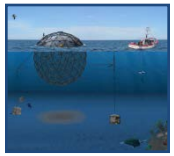
Climate Adaptation (11)
Coastal Conservation (18)
Coastal Economy (15)
Coastal Hazards (23)
Community Resilience (33)
Land Use Planning (21)
Ocean Planning (20)
Water Quality (10)

Function

Change (11)
Classification (13)
Data Analysis (20)

Number of Items to Display

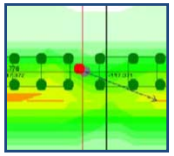
- All - Reset



CanVis Visualization Software for Marine Aquaculture Simulation and Planning

NOAA National Ocean Service

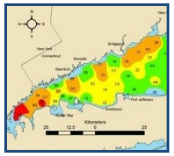
CanVis is an easy-to-use visualization tool for coastal managers and stakeholders to "see" potential community impacts from aquaculture in estuaries and the coastal ocean.



AquaModel – Environmental Simulation of Offshore Aquaculture Operations

NOAA National Ocean Service

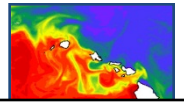
AquaModel provides real-time, three-dimensional simulation of water column and benthic impacts related to offshore aquaculture operations.



Shellfish FARM Model – Coastal Planning and Aquaculture Siting

NOAA National Ocean Service

Ecological carrying capacity model used to evaluate shellfish aquaculture, eutrophication, and nutrient bioextraction.



Hawaii Aquaculture Marine Mapper

NOAA National Marine Fisheries Service

Interactive online map viewer designed to assist coastal managers and industry siting offshore aquaculture

Featured Tool

NOAA's State of the Coast

Delivers quick facts and detailed statistics through interactive visualizations about coastal communities, ecosystems and the economy

Tools Resources

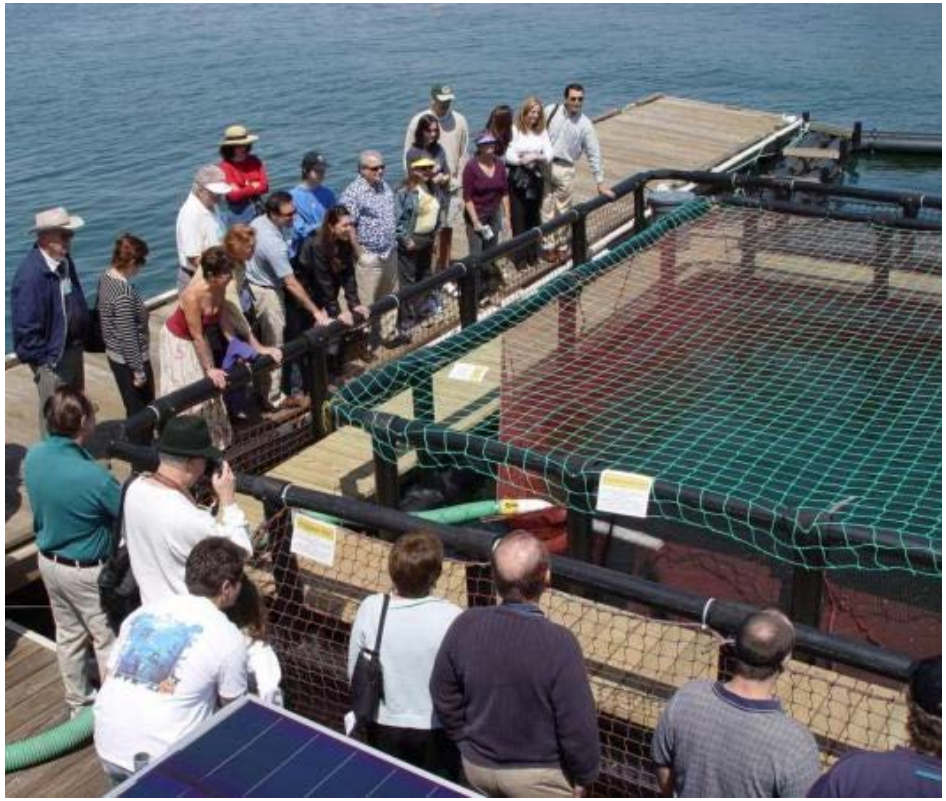
Hurricane Planning and Response

Data, tools, and additional resources you need to get ready for the next big storm

Aquaculture in Southern California Bight

- What is the opportunity?
- How much space will it take up?
- What will the industry look like?
- What are the environmental impacts?

Southern California Aquaculture Opportunity at a Glance

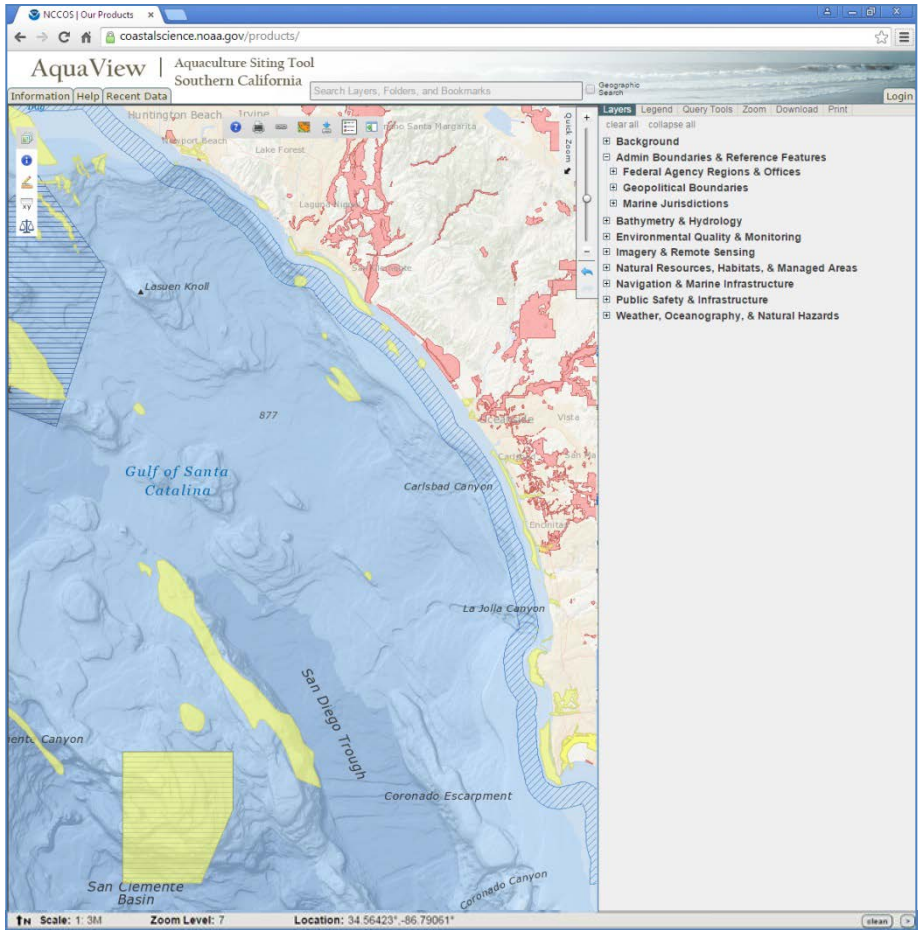


- Rose Canyon Project would be first commercial-scale demonstration project in federal waters
- Preliminary MSP studies suggest that >500 km^2 of coastal ocean could support aquaculture development
- Economic projections suggest offshore aquaculture in Southern California Bight could become $1 billion/year industry

California AquaView

A Planning and Siting Guide for Offshore Aquaculture in Southern California

- ✓ Data for site-selection
- ✓ Identifies unsuitable areas
- ✓ Mapping for co-siting
- ✓ Identifies use conflicts
- ✓ Tool for industry and managers



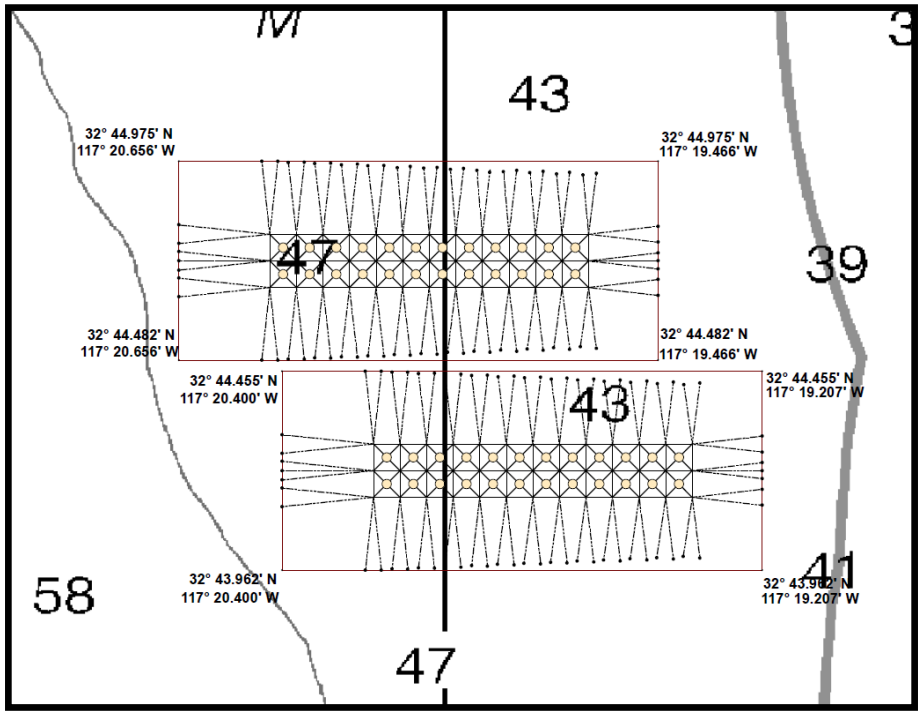
Mapping Habitat Areas of Particular Concern in Southern California Bight

What will the industry look like?

Rose Canyon FISHERIES

Southern California Bight

5000 mt / 11.0 million lbs



Location: 4.5 miles offshore

Species: yellowtail jack, white seabass, and striped bass

48 Ocean Spar Net Pens
Cage volume: 11,000 m^3
Surface footprint: 0.48km^2
Anchoring footprint: 3.25 km^2

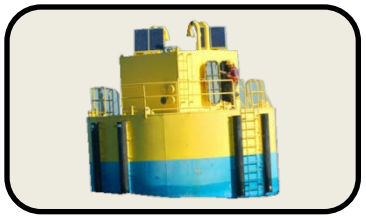
What will the industry look like?

Creating the Simulation

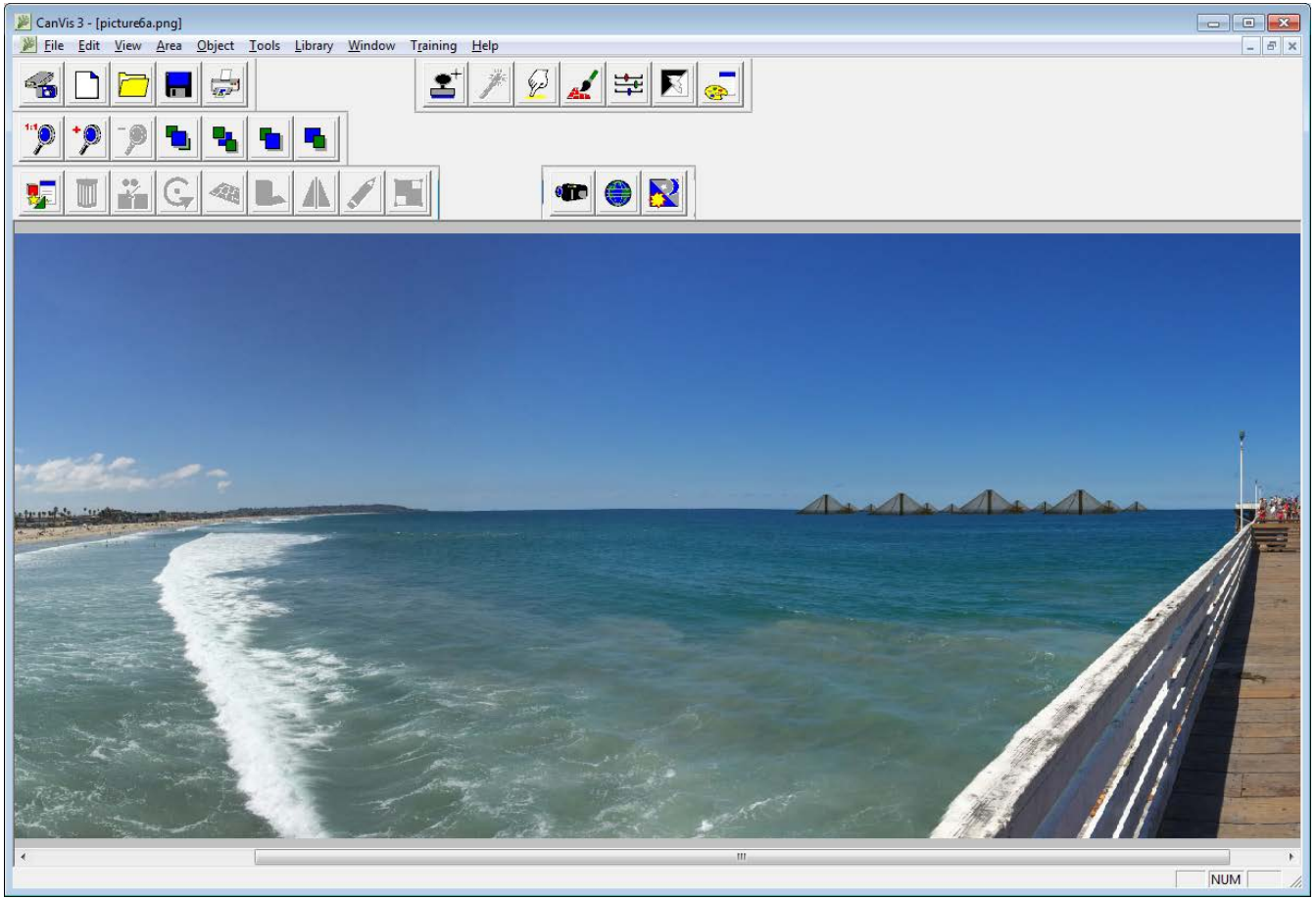
Crystal Pier (872 ft long)
San Diego, California

CanVis:

Aquaculture Image Library



Create Photo Realistic Simulations



For Demonstration Purposes – Images Are Not Drawn To Scale
Free Software Available (http://coast.noaa.gov/digitalcoast)

What will the industry look like?

What will the industry look like?

Expected Results and Project Benefits

- Provide tools and services to help coastal planners and managers make timely and confident decisions siting farms within the coastal ocean
- Develop environmental models and identify thresholds for pollutant effects (nutrient enrichment) that may indicate local and ecosystem level impacts
- Builds upon existing national data systems and develops specialized operational tools for marine spatial planning

What is Needed

- Permitting review process that:
  - brings management agencies together and
  - Clearly defines the process
- Educational outreach that:
  - balances concerns with benefits and
  - authoritatively reports scientific facts, not rhetorical fears
- Public appreciation that:
  - farms will support existing, and underutilized, seafood industry infrastructure and
  - will create may more domestic seafood jobs

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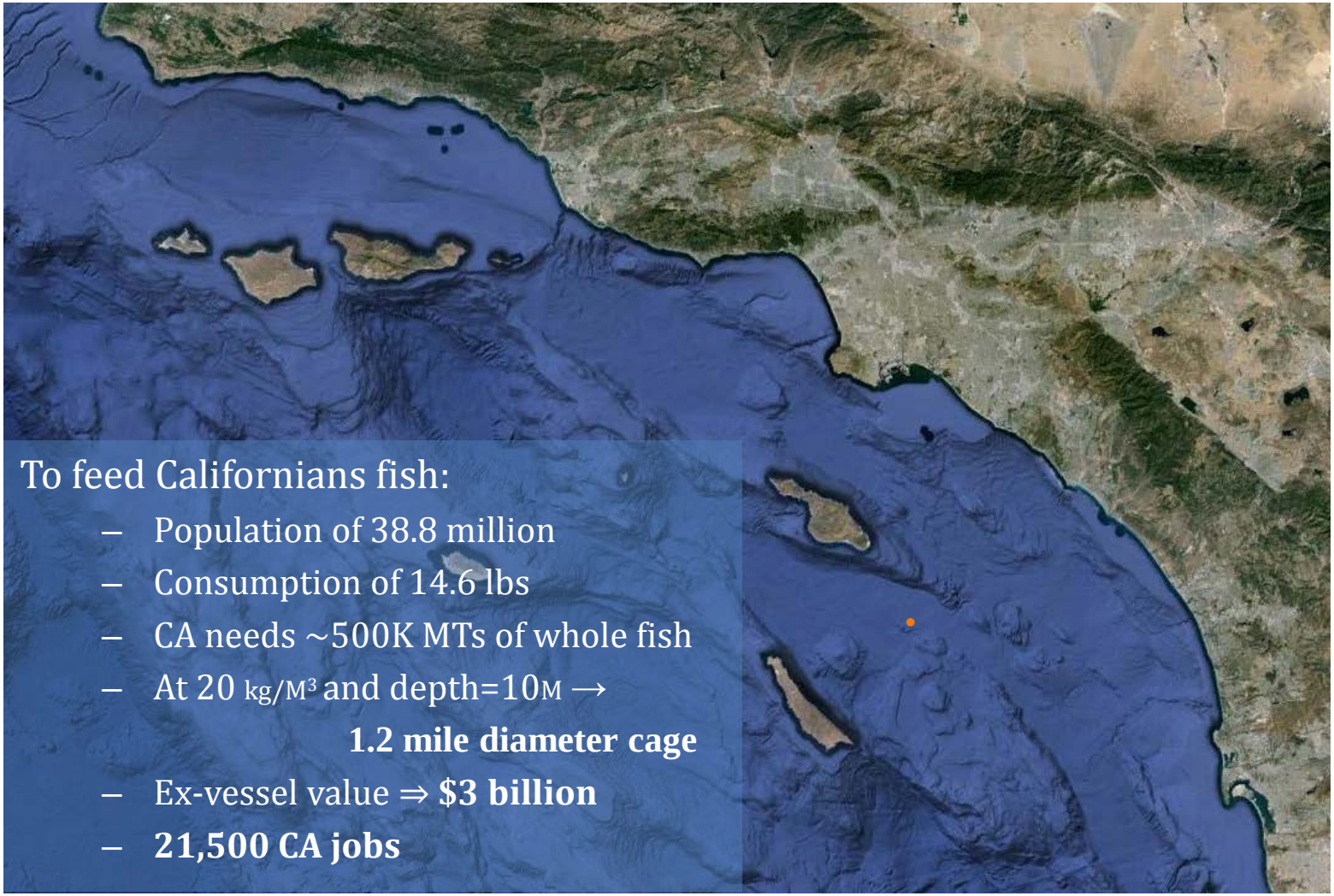
Space needed:



To feed Californians fish:

- Population of 38.8 million
- Consumption of 14.6 lbs
- CA needs ~500K MTs of whole fish
- At 20 kg/M^3 and depth=10M →

  1.2 mile diameter cage
- Ex-vessel value ⇒ **$3 billion**
- **21,500 CA jobs**

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FAO Sustainability Criteria

Sustainable Development:

1. *conserves land, water, plant genetic resources,*
2. *is environmentally non-degrading,*
3. *technologically appropriate,*
4. *economically viable and*
5. *socially acceptable*

Managing the Environmental Costs of Aquaculture:

It is apparent from this study that aquaculture has, from an ecological efficiency and environmental impact perspective, clear benefits over other forms of animal source food production for human consumption. In view of this, where resources are stretched, ***the relative benefits of policies that promote fish farming over other forms of livestock production should be considered****.*

Hall, S.J., A. Delaporte, M. J. Phillips, M. Beveridge and M. O'Keefe. 2011. Blue Frontiers: Managing the Environmental Costs of Aquaculture. The WorldFish Center, Penang, Malaysia.

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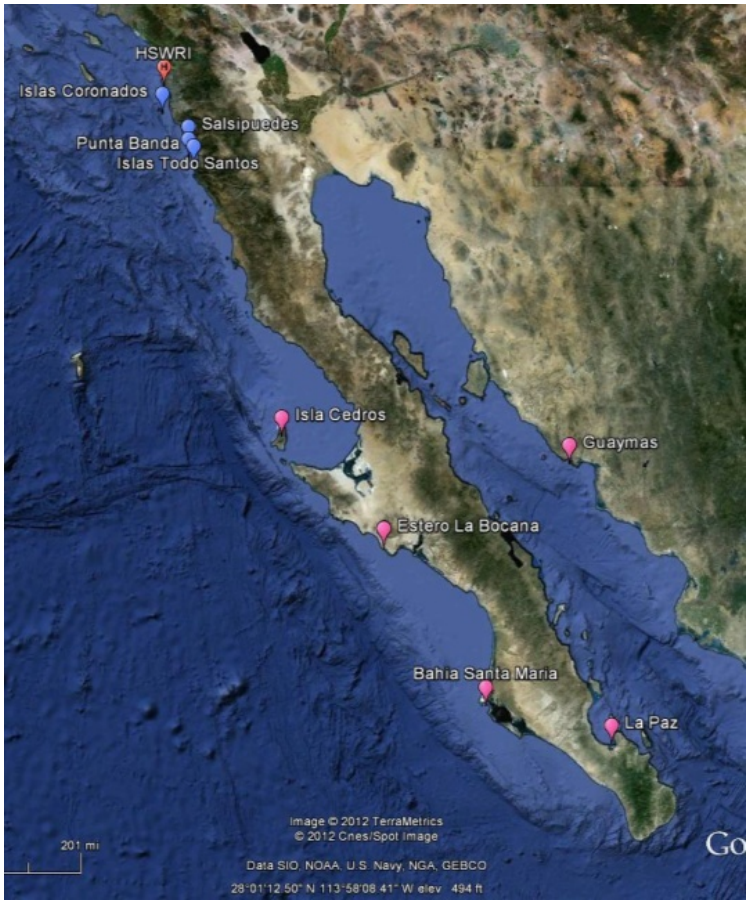
If Not Here, Then Where?

- 12 Mexican farms have requested juvenile fish
- Any species we can grow in San Diego, can be grown in Baja California
- It is less than a day's driving time to California's seafood markets
- Technology and know-how is San Diego's edge; simplified permitting is Mexico's



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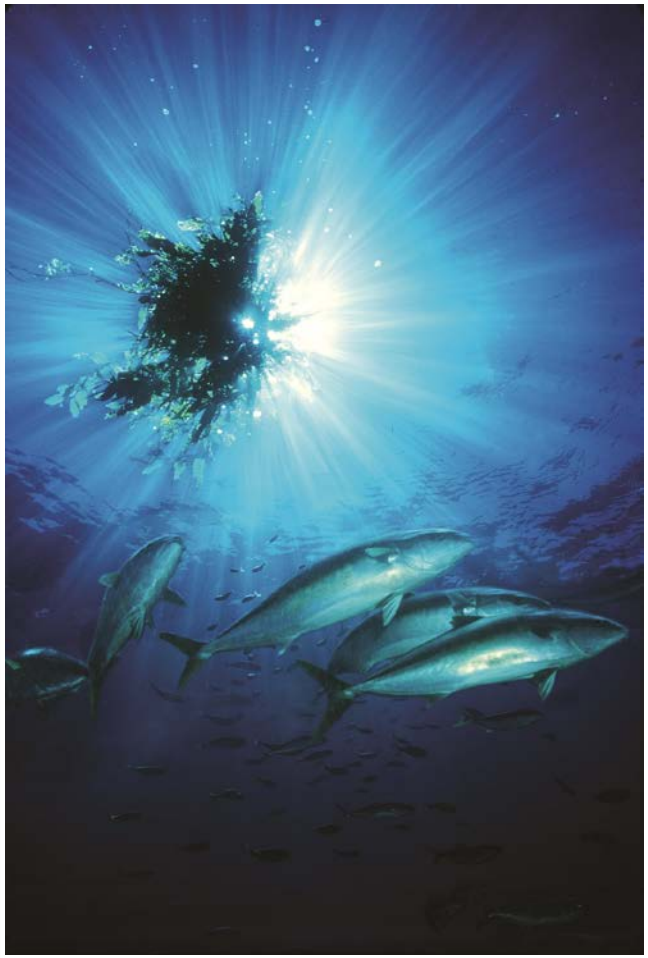
Conclusion



Eventually producing 5,000 metric tons (11 million pounds) of fish annually, RCF will demonstrate a new domestic source of seafood to meet growing demand

This may encourage a new national industry thereby creating significant economic benefits in our coastal communities by providing safe, healthy, sustainable and locally sourced seafood

Rose Canyon FISHERIES

Rose Canyon Fisheries

An innovative collaboration between

HUBBS-SEAWORLD RESEARCH INSTITUTE

cuna del mar

"With Earth's burgeoning populations to feed, we must turn to the sea with new understanding and new technology. We must learn to farm the sea as we have farmed the land"

Capt. Jacques Cousteau

Rose Canyon FISHERIES