

CURRENT HABITAT ISSUES

The Habitat Committee (HC) will meet on Friday and Saturday, September 11 and 12, to discuss initiation of the salmon essential fish habitat review, the California Central Valley Biological Opinion, Monterey Bay National Marine Sanctuary issues, offshore aquaculture, and other issues.

Council Action:

Consider comments and recommendations developed by the HC at its September 2009 meeting.

Reference Materials:

1. Agenda Item B.1.b, Supplemental HC Report.

Agenda Order:

- a. Agenda Item Overview
- b. Report of the Habitat Committee
- c. Reports and Comments of Agencies and Advisory Bodies
- d. Public Comment
- e. **Council Action:** Consider Habitat Committee Recommendations

Jennifer Gilden
Stuart Ellis

PFMC
08/20/09

HABITAT COMMITTEE REPORT

Queets and Western Strait of Juan de Fuca Coho Overfishing Report

The Habitat Committee (HC) discussed the status of the Queets and Western Strait of Juan de Fuca coho overfishing report. The Salmon Technical Team (STT) is meeting this week and trying to determine if the overfishing problem is related to fisheries, management data, or productivity. If the problem is productivity, further analysis will be conducted to determine if the productivity problems are marine or freshwater based. If the STT determines that freshwater production is indeed an issue, the HC, working with the relevant state and tribal entities, will develop a review of freshwater habitat issues that may be contributing to reduced productivity and with recommendations to address those habitat issues. The HC made plans to respond to the coming STT request, and is prepared to assist in coordinating the collection of habitat information for the overfishing review. The HC will report further on this matter in November.

Salmon Essential Fish Habitat (EFH) Five-Year Review

The HC received a briefing from Bryant Chesney, National Marine Fisheries Service (NMFS) Southwest Region, on the work plan for the salmon EFH five-year review. The current designations of EFH for Pacific Coast salmon were approved by NMFS in September 2000 and are in need of review.

In collaboration with the Northwest Region, Southwest Region, Northwest Fisheries Science Center and Southwest Fisheries Science Center, the Pacific Council received a \$100,000 grant for a joint proposal to support the five-year review of Pacific salmon EFH. The funds will be used to conduct a comprehensive assessment of Pacific Coast salmon EFH, focusing on information that has become available since the initial designation in 2000. Project funding will be administered by the Pacific Council conducting the assessment. Funding will be used to support special scientific, stakeholder, or public meetings, outreach, supplies and printing, travel and Council contract work and/or staffing necessary to develop, analyze, draft, and review the pertinent salmon EFH information.

An oversight panel has been established to provide assistance and direction to accomplish this task. The panel is chaired by the Northwest Region and will be responsible for planning, coordinating assignments within their respective organizations, providing sideboards for contract work, and reviewing preliminary draft documents and products.

Further review, including final stakeholder and public involvement, will occur through the normal Council review process, which will include all Council advisory bodies, in particular the Habitat Committee and Scientific and Statistical Committee. Under the grant to the Council, the contractor and/or Council staff will review and synthesize information on:

- the distribution and abundance of Pacific Coast salmonids to further refine existing spatial datasets,
- the impassible man-made barriers in each basin, review existing barrier designation criteria and recommend changes if necessary
- existing and emerging threats to the EFH of Pacific Coast salmon.
- potential conservation measures to address those threats
- specific habitat types or locations important to the life history of Pacific Coast salmon that can be used to designate Habitat Areas of Particular Concern.

This information will be used to draft a report for the Council for subsequent review by the public through the Council process. It will provide the basis for the Pacific Coast salmon EFH five-year review and will be presented to the Pacific Council in summer 2010. The Council will review the document for submittal to NMFS and consider whether a Fishery Management Plan Amendment process is warranted.

The Habitat Committee can assist this process in the following ways:

- Help the Oversight Panel to determine the project scope and scale.
- Facilitate communication between the contractor and our respective agencies to identify new data and identify agency concerns.
- Provide input to update the list of threats to salmon EFH.

The HC believes it would be efficient if a framework were developed during the current EFH review process to facilitate the integration of new data and information for subsequent EFH reviews. Such a framework would facilitate coordination between management agencies.

California State Board of Forestry Action

The HC received a report from Dick Butler of NMFS regarding the California Board of Forestry and ongoing discussions of state forestry practices relative to the impacts on listed coastal California coho Evolutionarily Significant Units.

For the last 10 years, NMFS representatives have been working with Bureau of Forestry (BOF) to develop forest practice rules that address listed coho incidental take issues. NMFS has been urging the BOF to develop either no-take rules (similar to those under the northwest forest plan) or move forward on the development of an ESA Section 10(a)(1)(B) statewide permit (HCP) that authorizes incidental take of listed salmonids.

NMFS is concerned about California forest practices for many reasons, including the fact that NMFS has found them not to provide for the protection and conservation of salmon and steelhead and their freshwater habitats (Agenda Item B.1.b, Attachment 1).

NMFS has repeatedly stressed the need for BOF rules that are adequately protective of salmon and steelhead. In NMFS' opinion, the BOF has not appropriately addressed this issue. Therefore, there is a risk that NMFS may be forced to take ESA enforcement actions against forest operators and the State of California. This could be avoided if the BOF could create adequate rules and/or engage in a habitat conservation planning process that would adequately protect these fish.

The HC recommends that the Council direct the HC to draft a letter for consideration and approval at the November meeting addressed to the Governor of California that:

- encourages continued BOF discussions that result in state forest management practices that fully address the needs of listed salmon and steelhead ESUs, and
- highlights the need for quick action to avert ESA take enforcement by initiating a request to consult with NMFS on California forest practices.

NMFS Marine Fisheries Habitat Assessment Improvement Plan

The HC received a presentation by HC member Waldo Wakefield (NMFS) on the current status of the NMFS Marine Fisheries Habitat Assessment Improvement Plan (HAIP). Recently, the HAIP working group incorporated comments from an internal review by the NMFS Offices of Science and Technology and Habitat Conservation. In mid-August, NMFS Science and

Technology sent the draft plan out for review to all NMFS science centers, NMFS regional offices, fisheries management councils, and state marine fisheries commissions. The HAIP working group will be meeting in mid-October to present the current status of the plan to the NMFS Science Board and incorporate comments from the major round of reviews. Currently, the HAIP report will be published by end of November or early December.

A National Habitat Assessment Workshop is being planned for May 2010 and will coincide with the National Stock Assessment Workshop. Objectives of the workshop are, in part, to strengthen and focus the NMFS national habitat science community, and to establish approaches for implementing recommendations from the HAIP Plan. A significant portion of the National Habitat Assessment Workshop will be devoted to defining ways to improve scientific support for managers.

PFMC
09/13/09



UNITED STATES DEPARTMENT OF COMMERCE
National Oceanic and Atmospheric Administration
NATIONAL MARINE FISHERIES SERVICE
Southwest Region
501 West Ocean Boulevard, Suite 4200
Long Beach, California 90802-4213

September 8, 2009

In response refer to:
SWR/F/SWR3:CAA

Mr. Stan Dixon
Chair, California Board of Forestry and Fire Protection
P.O. Box 944246
Sacramento, California 94244-2460

Dear Chairman Dixon:

This letter from NOAA's National Marine Fisheries Service (NMFS) is in response to the State Board of Forestry and Fire Protection's (BOF), July 24, 2009, 45-day Rule Re-notice (Rule Notice) and requests for comments and assistance regarding the development of the BOF Anadromous Salmonid Protection Rules, 2009 (previously named Threatened or Impaired Watershed Rules, 2009 [T/I rules]). NMFS appreciates the invitation and opportunity to participate in the BOF appointed Technical Advisory Committee (TAC), literature review process, Forest Practice Committee and BOF meetings of the last 2 ½ years leading up to this Rule Notice.

NMFS would like to take this opportunity to acknowledge the work by the BOF/TAC staff and Chair, Mr. Chris Zimny, Mr. Pete Caffereta and Mr. Gary Nakamura. The February 2009 proposed rule prepared primarily by Mr. Caffereta and Mr. Zimny was the outcome of the TAC process, well-done and science-based. The July 24, 2009, Rule Notice includes a number of significant changes to the February 2009 BOF staff proposal per requests of BOF members during Forest Practice Committee meetings and BOF meetings. In addition, changes and improvements have been incorporated into the proposed Rule Notice based on recommendations by California Department's of Forestry and Fire Protection (CalFire) and Fish and Game (CDFG). The BOF staff report of 2008 outlines that the formulation of the TAC and the literature review process involved was intended "as a pilot for developing science-based information for regulation development...and...to be highly transparent involving stakeholders, scientists and other responsible government agencies". NMFS found Mr. Zimny and Mr. Caffereta, in all cases, endeavoring to meet that goal.

According to the BOF, changes to the T/I Rules are warranted to (1) protect and restore habitat conditions for coho salmon and other anadromous salmonids in California river systems, (2) increase fish population abundance and (3) improve the conservation status of threatened salmonid species. NMFS concurs that changes to the T/I rules are warranted and directs the BOF to refer to NMFS' previous communications with the BOF on T/I Rules; in particular the NMFS June 22, 2009 letter to the BOF regarding the May 8, 2009 T/I 45-day Rule Notice.



Noticed Rules

NMFS is concerned that the current Rule Notice contains modifications and optional amendments proposed by BOF members that lack a scientific basis and depart significantly from the February 2009 BOF staff proposal. Several most notable changes include: (1) reduced riparian canopy retention standards for all watercourses including the option of an angular canopy density versus overstory canopy standards; (2) increasing Quadratic Mean Diameter of riparian zone trees to only commercial thinning and the deletion of a minimum basal area retention standard in Class I zones; (3) removed linkages to the biological and physical characteristics of the floodprone area; (4) greater allowances for timber activities closer to watercourses (e.g., road-building; use of heavy ground-based equipment); (5) options not to adopt Class II and III watercourse protections and (6) allowance of variances from standard operating provisions absent a comprehensive understanding of watershed processes and adequate multi-agency review.

Status of Salmonids and Actions to Prevent Their Extinction

Nearly all of California's salmon and steelhead are critically at risk of becoming extinct in the foreseeable future. For millions of years salmon and steelhead have successfully persisted in abundance often under catastrophic and shifting environments (e.g., marine mammal predation, prolonged drought, uncontrolled wildfires, marine and freshwater conditions, changing climate, etc). However the human configured landscape developed over the last two centuries and harvest pressures have expanded. Thus, the persistence and recovery of salmonids (and the sustainability of our natural resources) will require re-thinking our land and water resource conservation values to work towards a mutual benefit to both mankind and the environment. NMFS acknowledges that a full suite of land/water use activities, including forestry practices on private lands, and direct take of salmonids significantly affect persistence of salmon and steelhead in California.

To that end, Federal, State and local entities are enacting laws and policies to prevent extinction and develop a plan for their recovery. Actions are occurring across both freshwater and marine environments to include among many others:

- The State of California and NMFS, on recommendation of the Pacific Fishery Management Council, issued a closure on all commercial offshore fishing for salmon;
- NMFS' Biological Opinion for the Central Valley Project and the State Water Project advises the Bureau of Reclamation and the Department of Water Resources to provide fish passage above Shasta, Folsom and Nimbus dams to ensure avoidance of jeopardy to Central Valley salmonids;
- Discussions regarding the removal of the Klamath dams and restoration of the Klamath Basin;
- Freshwater fishing regulations to be proposed by NMFS and supported by a number of fishing organizations for the central coast of California that include low flow and timing closures; and

- ❑ The development of Habitat Conservation Plan (HCP's) for industrial timber companies, which are targeted at sound timber management practices and the conservation of anadromous salmonids on nearly 780,000 acres of forest land in northern California.

No single entity can recover salmon and steelhead in California; actions must be unified and strategic. However, the forestlands of California play a critical role for ensuring freshwater survival and the likelihood of long term recovery of salmonids. The decisions by this BOF will have a significant influence on the future of California's salmon.

Noticed Rules and Habitat Conservation Plans

The State of Washington and several industrial timber companies in California have, or are seeking, for their forestry operations a section 10(a)(1)(B) permit (*e.g.*, habitat conservation plan [HCP]) that authorizes incidental take of listed salmonids under the Endangered Species Act (ESA) of 1973, as amended (16 U.S.C. 1531 *et seq.*). Staff from the NMFS Southwest Region, California, reviewed the standard prescriptions under these HCPs and coordinated with the NMFS Northwest Regional Office staff from Washington and Oregon regarding the Washington State Forest Practice HCP and other forest landowner HCPs. NMFS found the following in regards to the current Rule Notice before the California BOF:

- ❑ The July 24, 2009, BOF Rule Notice contains substantively less protective standards for salmonids for nearly all watercourses than those standards under west coast forestry HCPs that authorize incidental take of federally listed salmonids.
- ❑ Decisions regarding timber harvest operations and riparian protection under these HCPs are the outcome of data collection, watershed analysis and monitoring. In a number of cases, riparian protections for timberlands with HCPs have become more restrictive than the initial standard because watershed analysis information indicates a significant deficiency in properly functioning aquatic conditions for salmonids (*e.g.*, expanded no harvest Class I's due to critical lack of large woody debris).
- ❑ Extensive monitoring is conducted in Washington that informs a Washington State Department of Natural Resources comprehensive database that includes an updated and standardized set of information and mapping tools regarding salmonids, their habitats and upslope/watershed conditions. This information system is publicly available and used by landowners, foresters, agencies, tribal representatives, and others to inform harvest planning and review. No such comprehensive and standardized information system regarding salmonid habitats currently exists for California's forestlands.
- ❑ The ESA section 7 consultation and biological opinions for these HCPs provide a context describing how forest management practices and/or the measures of the HCP are anticipated to affect processes that support salmonid habitats (*e.g.*, sediment introduction to streams, large wood recruitment, canopy as an influence on instream temperature conditions, etc.).

Taking into consideration these analyses, the current BOF Rule Notice (optional amendments inclusive) and the lack of a statewide watershed analyses program, NMFS advises the BOF take

the most conservative approach and avoid approving Rules that may allow the unauthorized take or harm to California's salmon and steelhead.

Noticed Rules and the Listing of Northern California Steelhead on June 7, 2000

The administrative record outlining the process and final adoption of the current T/I Rules in March 2000 (now termed the Anadromous Salmonid Protection Rules, 2009) and the inadequacy of the current rules is detailed in the Northern California steelhead Federal Register Notice (FRN) of June 7, 2000 (65 FR 36074). The new title of the Rule Notice (e.g., Anadromous Salmonid Protection Rules, 2009) was changed between the May 8, 2009, 45-day Rule notice and the July 24, 2009, 45-day Rule notice. The specific inadequacies of the Forest Practice Rules to provide for salmonids is outlined in 65 FR 36074 and include: "(1) protective revisions that are not supported by scientific literature; (2) provisions that are scientifically inadequate to protect salmonids including steelhead; (3) inadequate and ineffective cumulative effects analyses; (4) dependence upon registered professional foresters (RPFs) that may not possess the necessary level of multidisciplinary technical expertise to develop THPs protective of salmonids; (5) dependence by CDF on other State agencies to review and comment on THPs; (6) failure of CDF to incorporate recommendations from other agencies; and (7) inadequate enforcement due to staffing limitations. NMFS further concluded that until a comprehensive scientific peer review process was implemented and appropriate changes to the Forest Practice Rules and the THP approval process were made, properly functioning habitat conditions would not exist on non-Federal lands in the northern California steelhead ESU." NMFS recommends the BOF determine which measures from the current Rule Notice can fulfill the issues outlined in the FRN and those outstanding and to devise a timeline to discuss and resolve those issues to ensure these Anadromous Salmonid Protection Rules are meeting their full intent.

NMFS Recommendations

NMFS recommends the BOF adopt highly protective Rules and make them permanent on September 9, 2009. We recommend the BOF include Optional Amendments 20, 21, 22, 23, and 107 in the Anadromous Salmonid Protection Rules. We oppose the adoption of Optional Amendments 9, 26, 27, 100, 101, 102, 103, 104, 105, and 106 as these would not provide sufficient protection of salmonids and their habitats and may, in combination with other activities, increase the likelihood and risk of unauthorized harm and take of anadromous salmonids. At this time, the Central California Coast coho salmon Evolutionarily Significant Unit is critically at risk of extinction. Reduced protections on forestlands could result in accelerated localized extinctions.

For the last 10 years, NMFS representatives have been recommending the BOF develop either no-take rules (e.g., similar to those for the federally listed northern spotted owl and marbled murrelet) or move forward on the development of a section 10(a)(1)(B) statewide permit (e.g., habitat conservation plan [HCP]) that authorizes incidental take of listed salmonids under the Endangered Species Act (ESA) of 1973, as amended (16 U.S.C. 1531 *et seq.*). Adopting the most protective proposed rules would be a step in the right direction towards the development of an HCP and ESA compliance. However NMFS finds the proposed Anadromous Salmonid Protection Rules are not no-take rules, are unlikely to meet the intent of the Rules themselves and are not likely to abate the risk of extinction for listed salmonids where these Rules are implemented.

As described in the June 22, 2009, letter to the BOF, NMFS supports the concept of conducting watershed analysis and assessment for a spatially explicit management alternative but recommends the BOF not adopt this alternative at this time. NMFS recommends the BOF develop a structured process, establish a system similar to Washington State and work through the appropriate Federal processes (e.g., HCP) that provide for alternative management planning without risk of unauthorized incidental take or harm to federally listed salmonids. NMFS additionally recommends the BOF not adopt the Class II measures outlined for the Southern Subdistrict of the Coast Forest District at this time.

Even the most protective measures in the proposed Anadromous Salmonid Protection Rules are still less protective than timberland operations that have secured NMFS' authorization for incidental take under HCPs. NMFS recommends CalFire, landowners and timber harvest plan submitters ensure compliance with the ESA in approving, and operating under, CalFire approved timber harvest plans. To this end and depending on the decision of the BOF, NMFS is intending to re-initiate discretionary reviews of timber harvest plans (including post harvest reviews) and become more engaged in pre-harvest inspections and the timber harvest approval process. NMFS' goals in participating will be to ensure no take or harm occurs to federally listed salmonids and that the habitats supporting salmonid essential behavioral patterns such as spawning, rearing, migrating, feeding, etc. are not being impaired through timber operations.

NMFS urges the BOF to adopt Rules that provide the greatest possible protections to anadromous salmonids and their habitats. This action would (1) set the stage for furthering the discussions regarding a statewide HCP initiated by the California Natural Resources Agency in 2006 and (2) increase assurances that industrial and non-industrial forest landowners without an HCP are not subject to discretionary timber harvest reviews by NMFS.

Thank you and if you have any questions or would like to meet with staff regarding comments in this letter please contact Charlotte Ambrose at (707) 575-6068.

Sincerely,



 Rodney R. McInnis
Regional Administrator

Enclosures

1. June 22, 2009 letter to CA Board of Forestry and Fire Protection
2. Federal Register Notice

cc: Diane Windham, NMFS, Sacramento
Charlotte Ambrose, NMFS Santa Rosa

Dick Butler, NMFS, Santa Rosa
Maria Rea, NMFS, Sacramento
Irma Lagomarsino, NMFS, Arcata
Dan Torquemada, NMFS Office of Law Enforcement
John McCamman, CDFG, Sacramento
Mark Stopher, CDFG Redding
Glenda Marsh, CDFG Sacramento

OCEAN ACIDIFICATION AND SEA LEVEL RISE

Dr. John Stein, the Deputy Science Director of the Northwest Fisheries Science Center, will provide an informational report on ocean acidification and sea level rise resulting from global climate change.

Council Task:

Discussion.

Reference Materials:

None.

Agenda Order:

- a. Agenda Item Overview
- b. Northwest Fisheries Science Center Report
- c. Reports and Comments of Management Entities and Advisory Bodies
- d. Public Comment
- e. Council Discussion

**Jennifer Gilden
John Stein**

PFMC
08/20/09



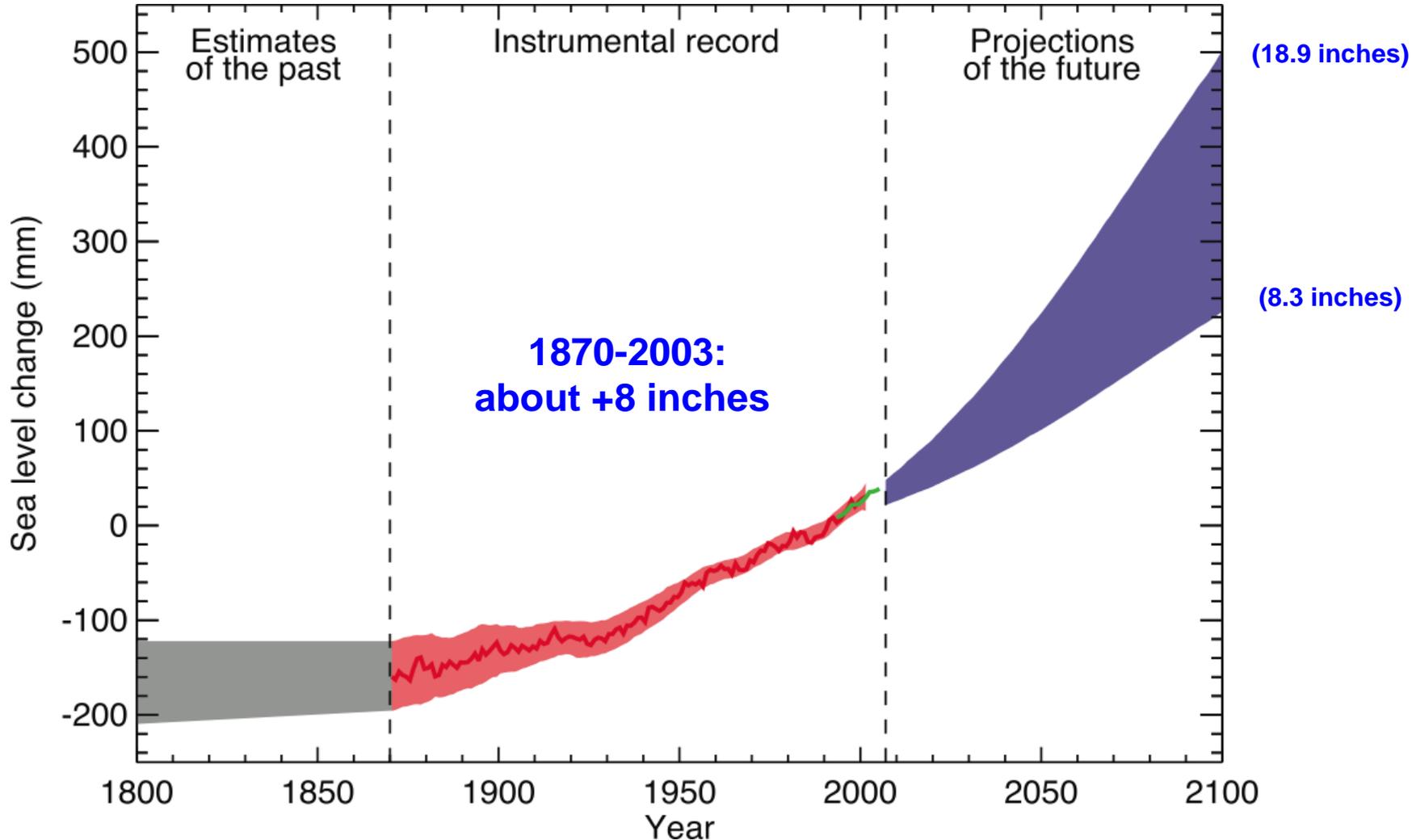
Sea Level Rise and Ocean Acidification

John Stein
Northwest Fisheries Science Center

200th Session of the PFMC
Foster City, California
September, 2009

**NOAA
FISHERIES
SERVICE**

Projections of Global Sea Level Rise Relative to 20th Century Changes from the A1B (medium emissions) scenario

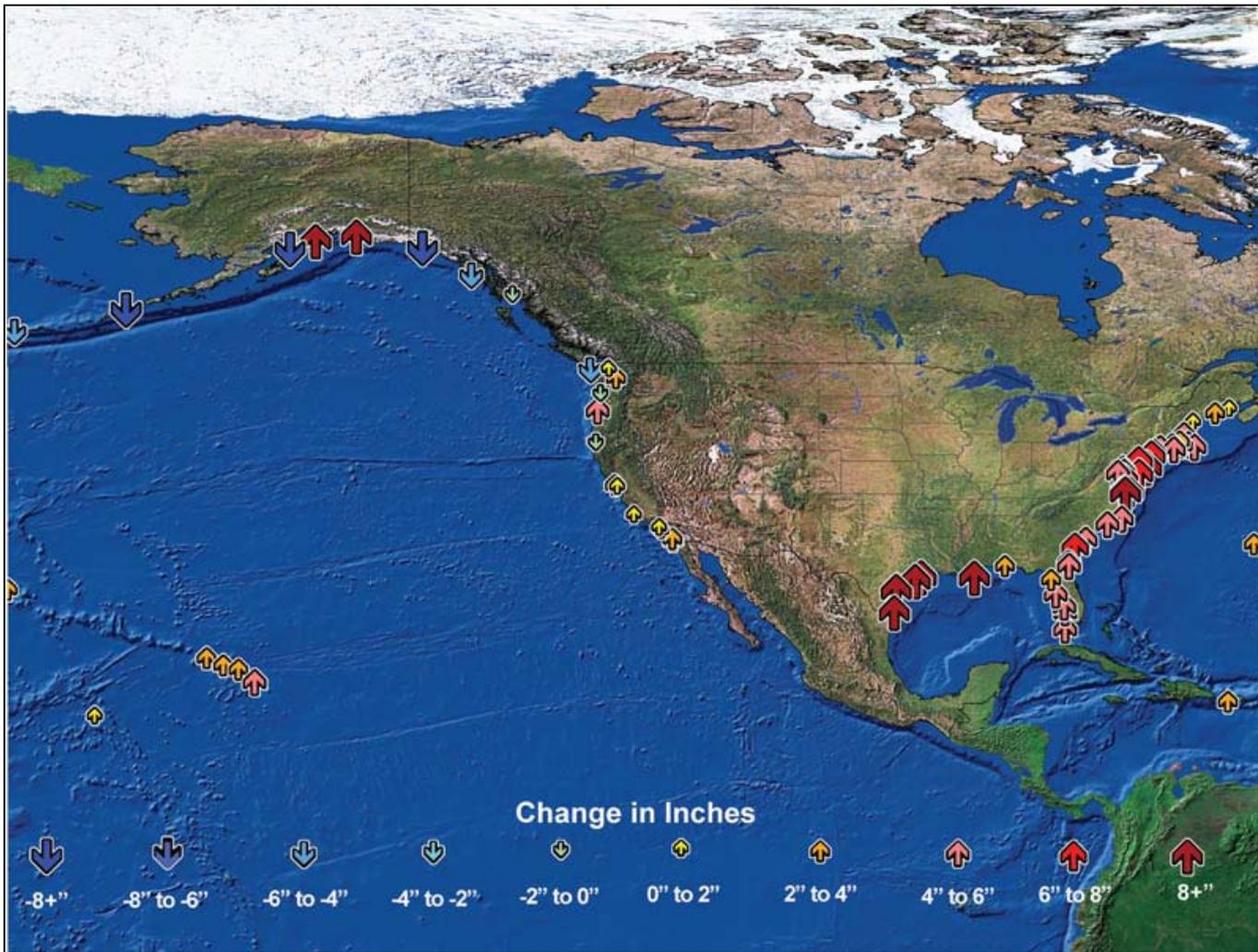


Changes relative to the 1980 to 1999 mean

Drivers of Sea Level Rise (SLR)

Major determinants:

- Global SLR driven by the thermal expansion of the ocean;
- Global SLR driven by the melting of land-based ice;
- Atmospheric dynamics, i.e., wind-driven “pile-up” of waves along the coast; and
- Local tectonic processes (*uplift*) and subsidence

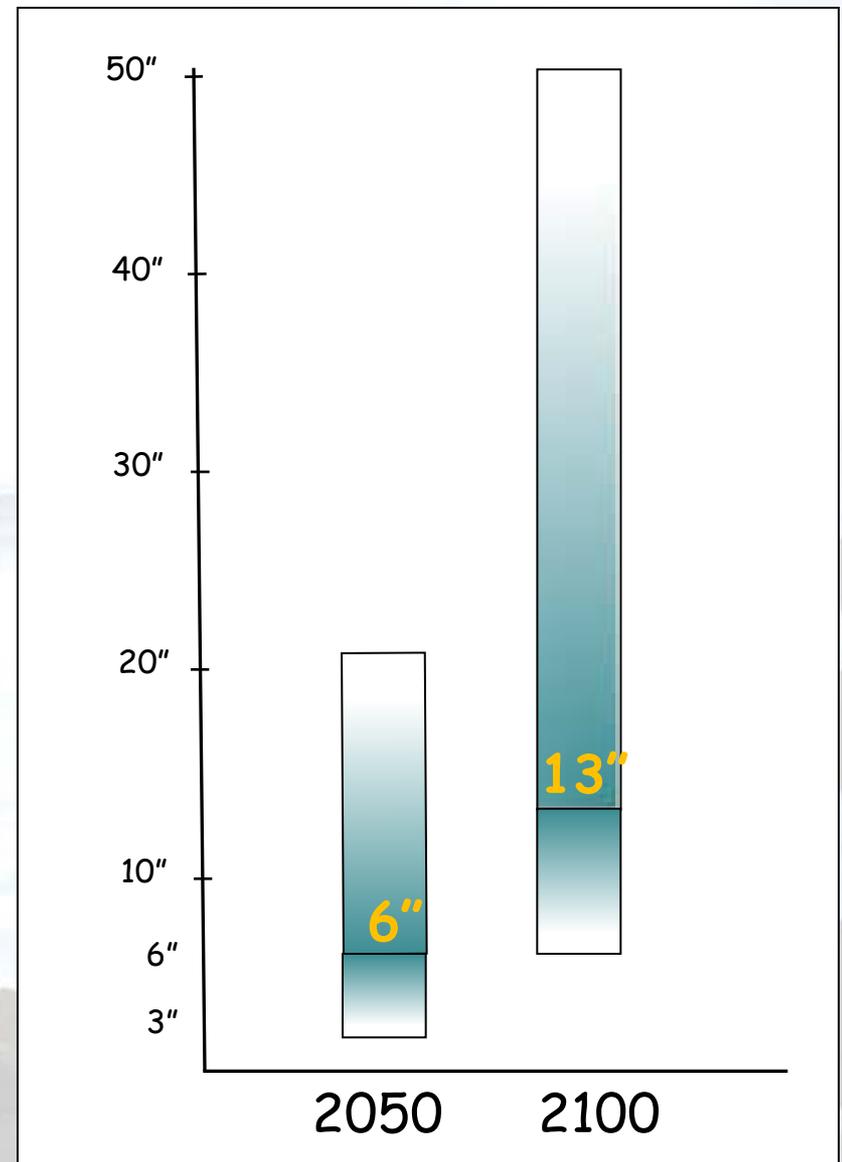


Relative Sea-Level Changes on U.S. Coastlines
 Observed changes in relative sea level from 1958 to 2008 for locations on the U.S. coast.

Coasts

Rising sea levels will increase the risk of flooding, erosion, and habitat loss along much of Washington's 2,500 miles of coastline.

- **Global SLR: 7-23"** by 2100
- **Medium** estimates of SLR for **2100:**
 - +2" for the NW Olympic Peninsula
 - +11" for the central/southern coast
 - +13" for Puget Sound
- Higher estimates (up to 4 feet in Puget Sound) cannot be ruled out at this time.



Projected sea level rise (SLR) in Washington's waters relative to 1980-1999, in inches. Shading roughly indicates likelihood.

Risks from SLR

- coastal flooding
- inundation of low-lying areas
- coastal erosion
- salt water intrusion into coastal aquifers
- contamination from coastal landfills/toxic sites
- loss of nearshore habitat
- bluff land sliding

Impacts are highly dependent on location and daily to seasonal fluctuations in sea level, and interactions between these events and other factors, not just changes in mean sea level.



Whidbey Island (4 February 2006)

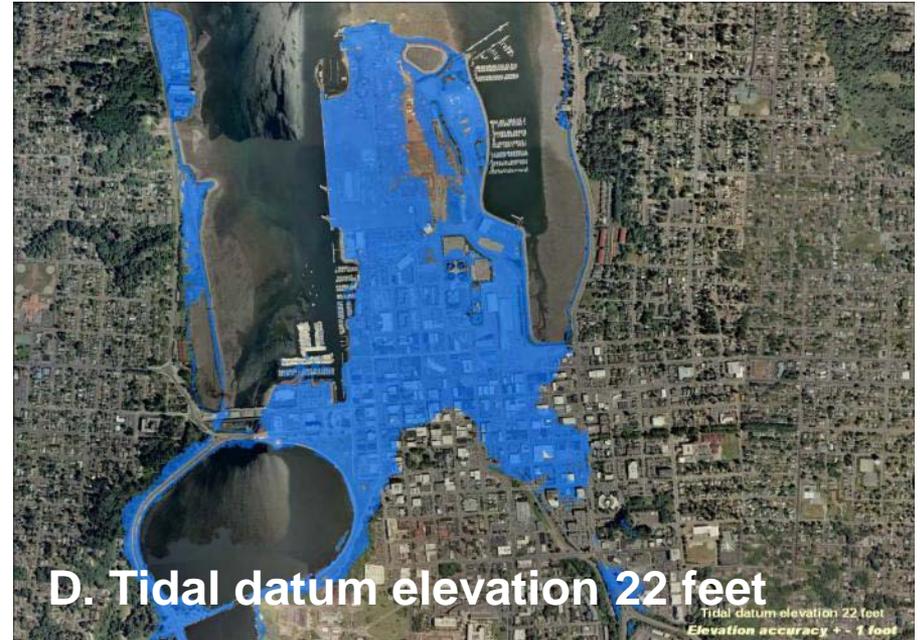
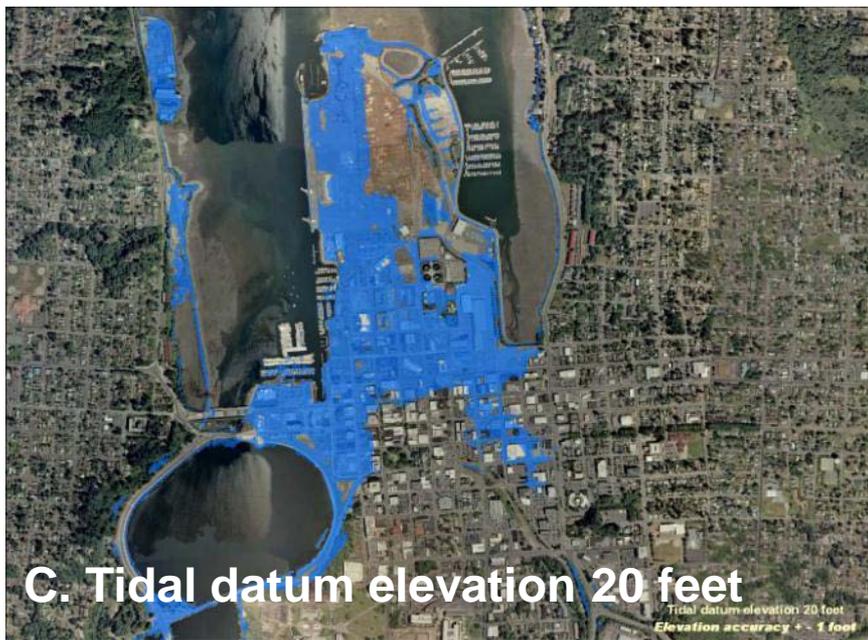
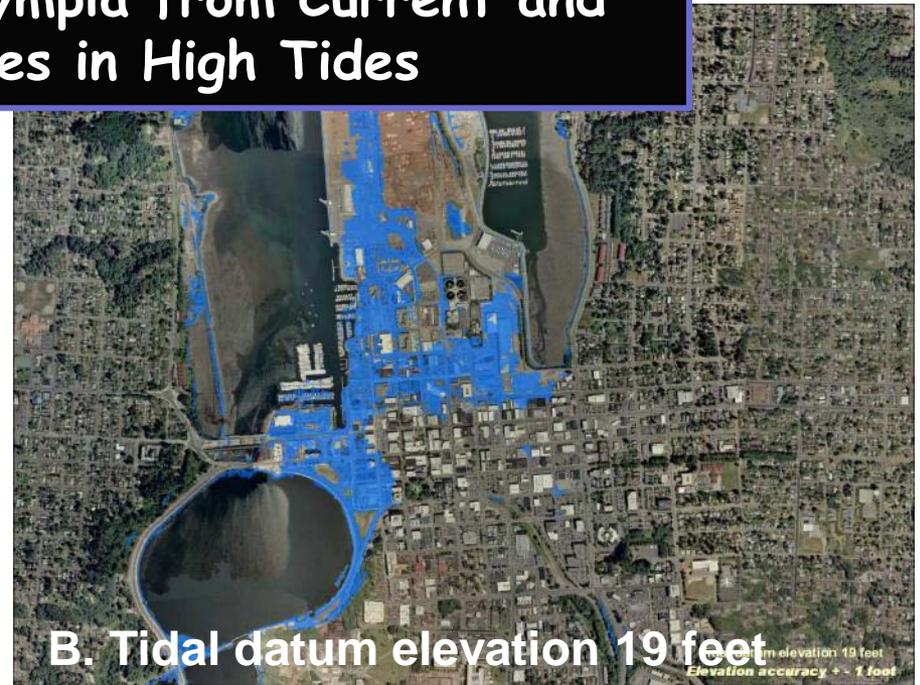


Camano Island State Park (4 February 2006)

Northwest/Southwest Coastal Areas

- SLR will increase erosion of coasts and cause loss of beaches and significant land area
- South Puget Sound is among the most vulnerable parts of the west coast
- Climate models suggest increased SW winds; combined with SLR will accelerate coastal erosion
- SLR of 50" by 2100 in areas of Puget Sound experiencing subsidence
- Interaction between heavier winter rainfall and SLR will intensify cycle of beach erosion and bluff landslides
 - Factor in NW, less of factor in SW, if drier and storm tracks shift northward
- But in SW evidence of increased variability—more frequent very dry or very wet winters.

Inundation Levels in Olympia from Current and Projected Changes in High Tides



Sea level rise in SF Bay

Figure 1.8

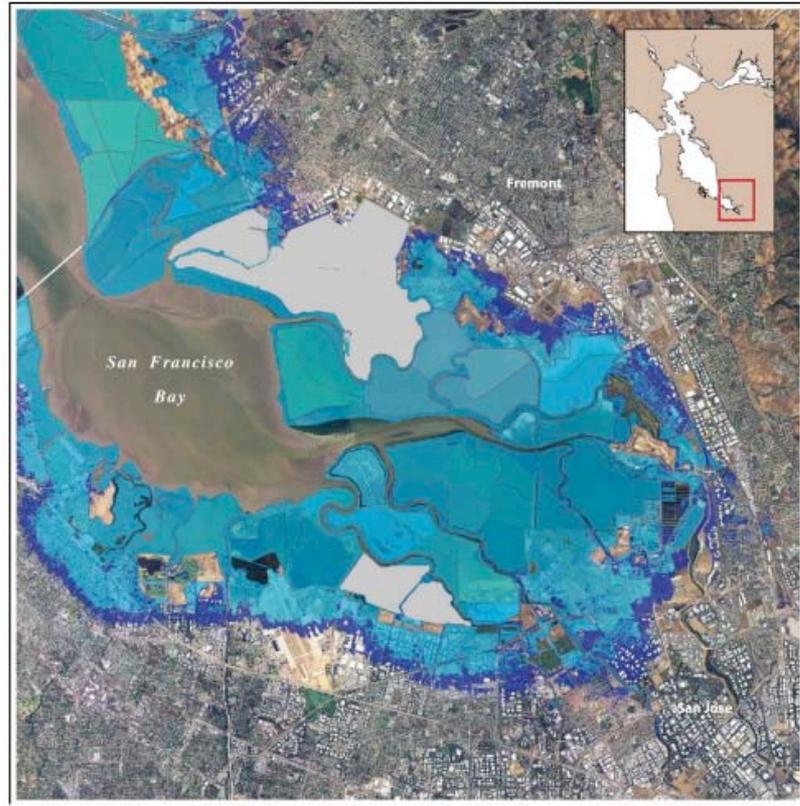
Central Bay South Shoreline Areas Vulnerable To Sea Level Rise



NOTE: Inundation data from Knowles, 2000. Additional salt pond elevation data by Siegel and Bachand, 2002. Inundation data does not account for existing levees or other shoreline protection. Aerial imagery is NADP 2005 data.

Figure 1.7

South Bay Shoreline Areas Vulnerable To Sea Level Rise

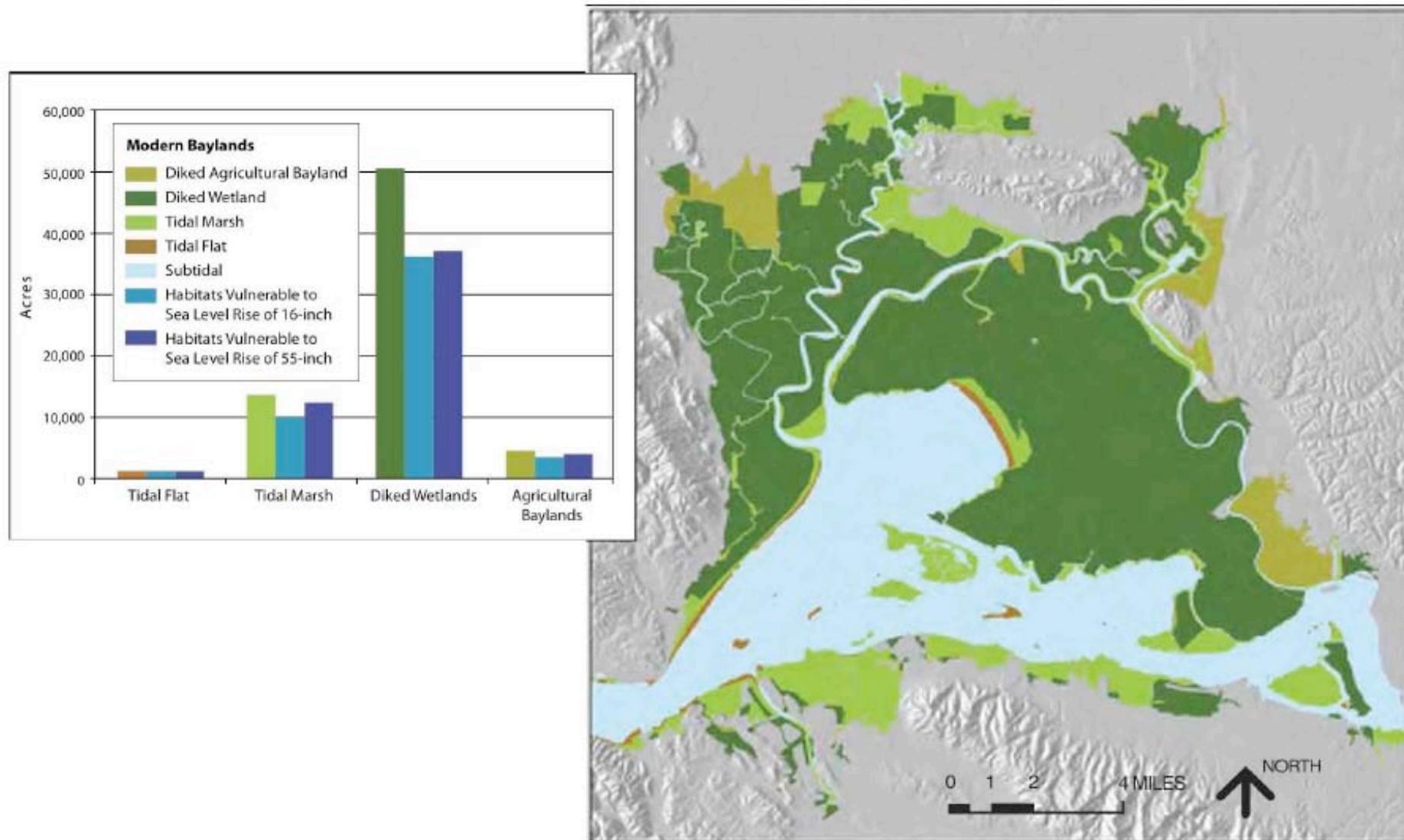


NOTE: Inundation data from Knowles, 2000. Additional salt pond elevation data by Siegel and Bachand, 2002. Inundation data does not account for existing levees or other shoreline protection. Aerial imagery is NADP 2005 data.

- Between 1900 and 2000, sea level increased 7 inches in San Francisco Bay
- Recent analyses indicate sea levels could rise an additional 55 inches in the next 100 years
- Estimated \$100 billion worth of public and private development at risk

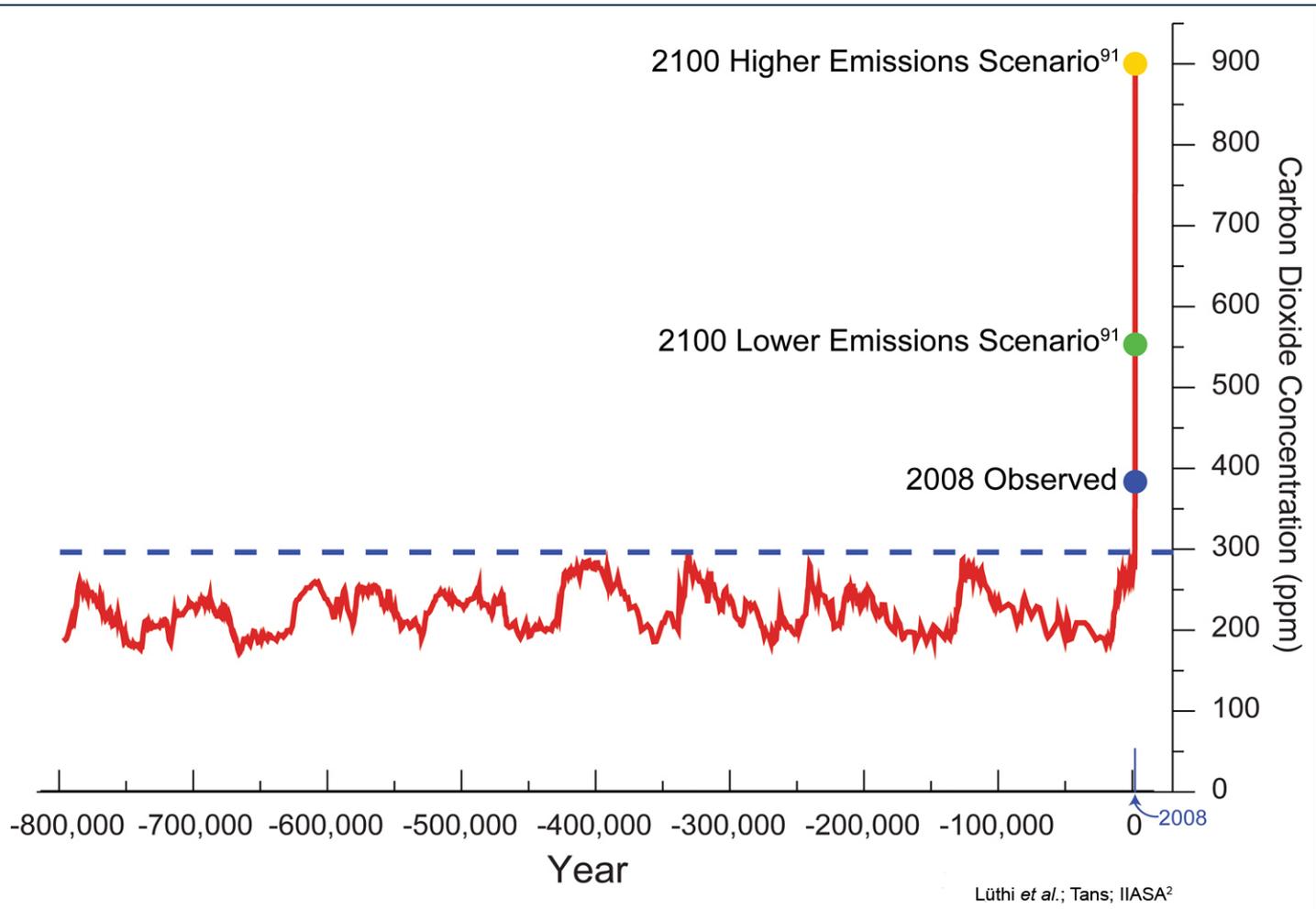
Figure 3.4 Suisun Marsh Habitats Vulnerable to Sea Level Rise

SOURCE: Baylands (EcoAtlas 2009), Hillshade (USGS NED)



Adapting to Sea Level Rise

- Protecting the shoreline (levees/seawalls)
- Redesign of structures, enhancing wetlands and beaches
- Planned retreat from the coastline
- States/counties and private interests are beginning to take SLR into account (e.g., levees, bridges, sewage treatment plants)

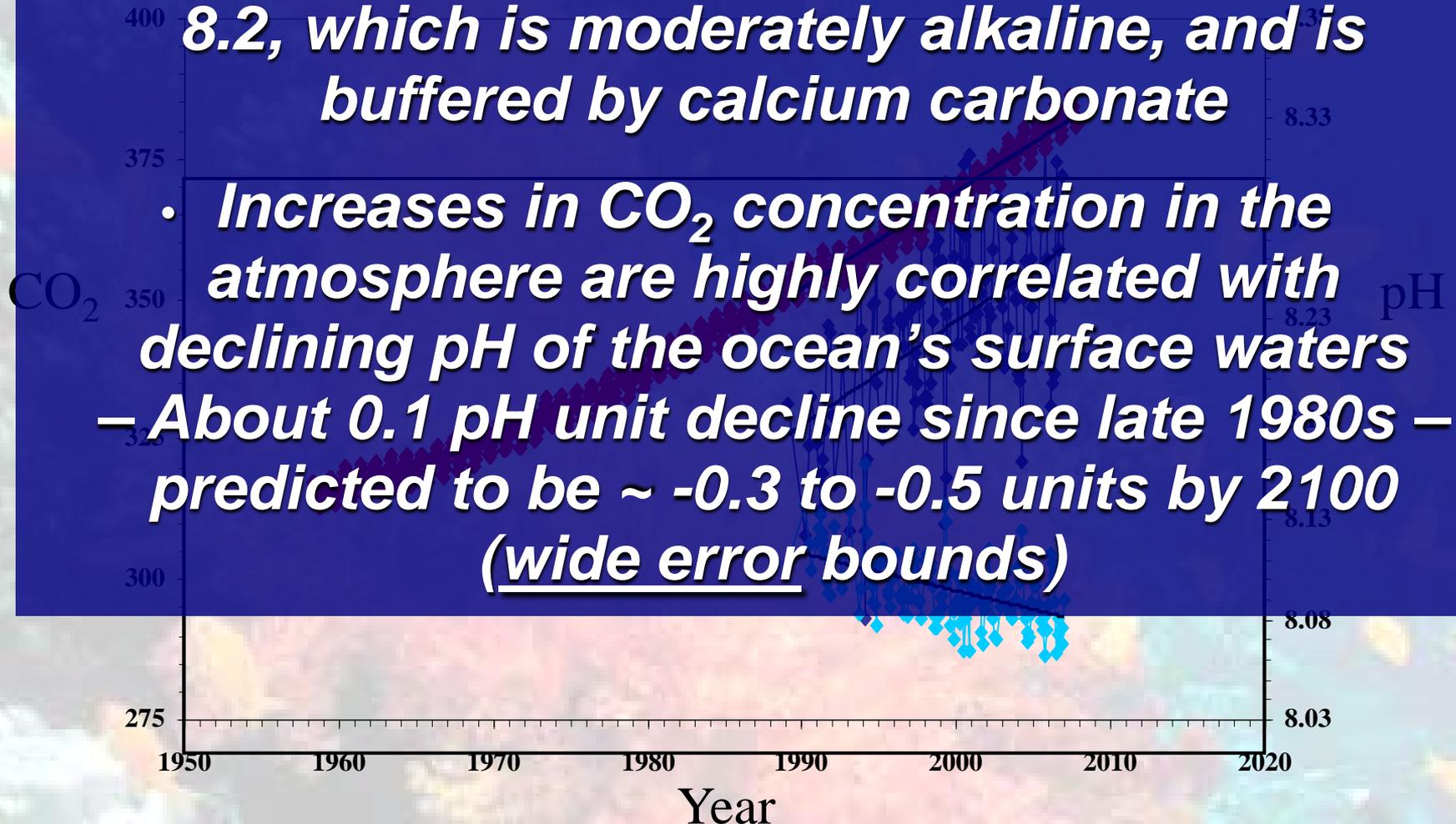


Lüthi *et al.*; Tans; IIASA²

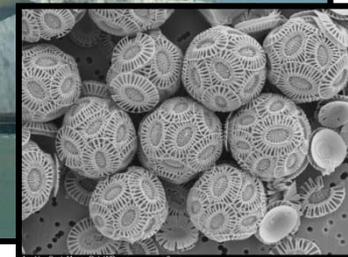
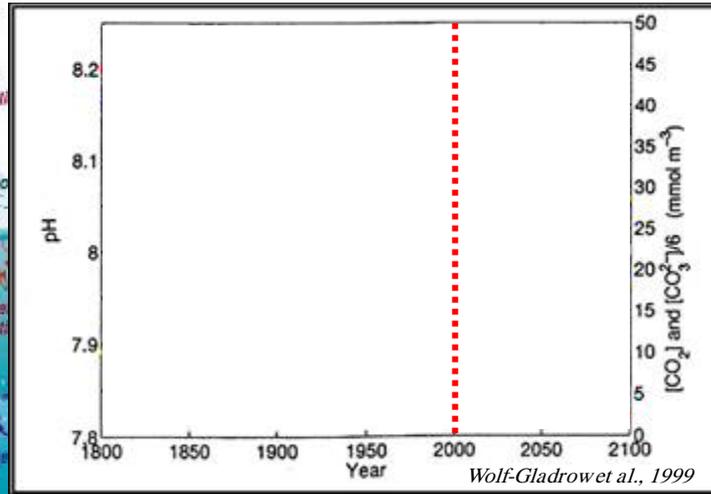
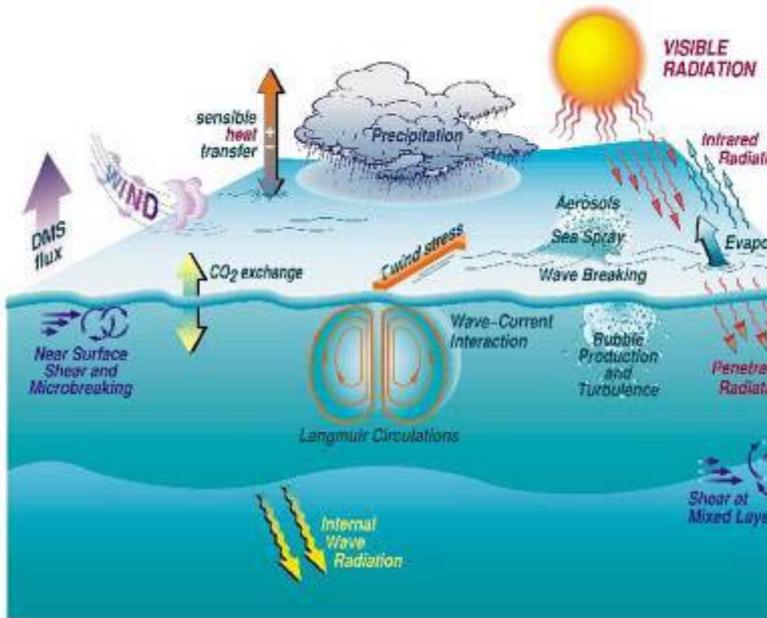
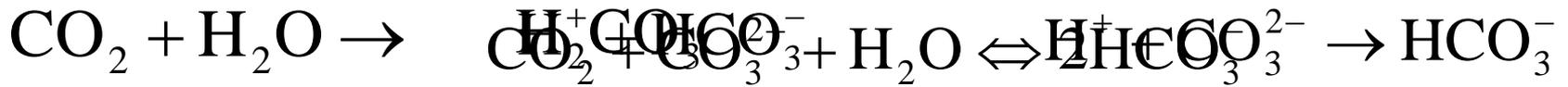
Ocean Acidification: Global Warming's *Evil Twin*

- **Average pH of the world's oceans is about 8.2, which is moderately alkaline, and is buffered by calcium carbonate**

- **Increases in CO₂ concentration in the atmosphere are highly correlated with declining pH of the ocean's surface waters**
 - **About 0.1 pH unit decline since late 1980s – predicted to be ~ -0.3 to -0.5 units by 2100 (wide error bounds)**



Ocean Acidification

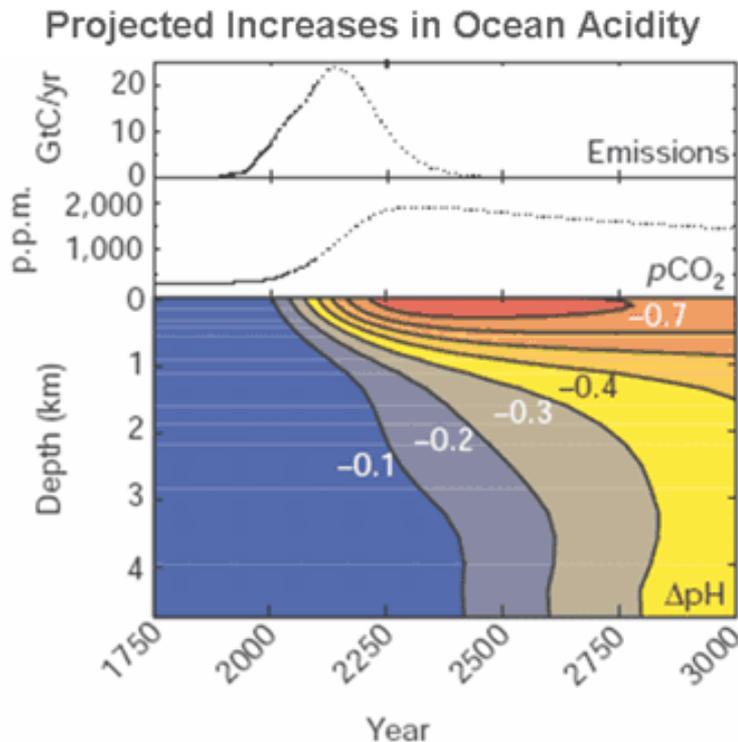


Ocean Acidification - Impacts to ocean and coastal marine ecosystems

➤ Decrease in pH 0.1 over the last two centuries

➤ 30% increase in acidity; decrease in carbonate ion of about 16%

These changes in pH and carbonate chemistry may have serious impacts on open ocean and coastal marine ecosystems.



2005 Fishery Landings Value = \$3.933 Billion (First Sale)



Value:

Bivalves: \$732M ex-vessel commercial value
 Crustaceans: \$1,265M ex-vessel commercial
 Combined : \$1,997M ex-vessel commercial value
 (51% of commercial catch by \$)

What we know about ocean CO₂ chemistry

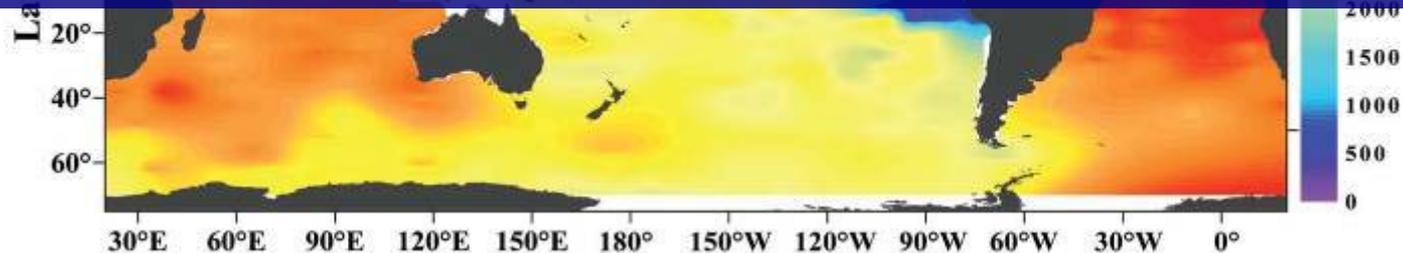
...from observed aragonite and calcite saturation depths in the global oceans

Aragonite Saturation Depth

- Can calculate the pH at which calcium carbonate precipitates vs. dissolves – called the “saturation state” (generally closer to dissolution with increasing depth). Saturation depth much shallower in the North Pacific vs. North Atlantic

B Calcite Saturation Depth

- Because the ocean mixes slowly, 1/2 of anthropogenic CO₂ is stored in the upper 10% of the world's oceans

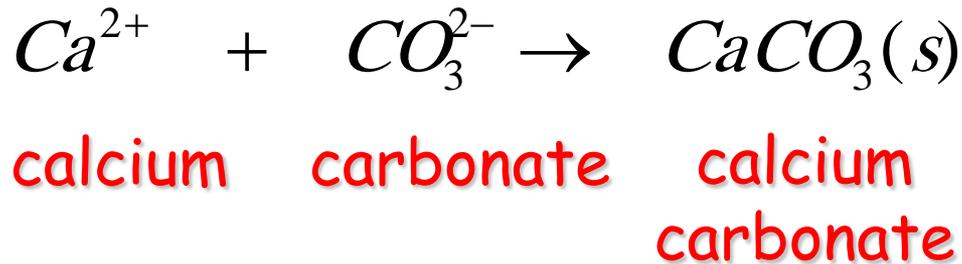


What we know about the ocean chemistry of *...saturation state*



Saturation State

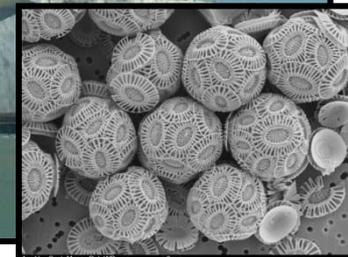
$$\Omega_{phase} = \frac{[Ca^{2+}][CO_3^{2-}]}{K_{sp,phase}^*}$$



$\Omega > 1 =$ precipitation

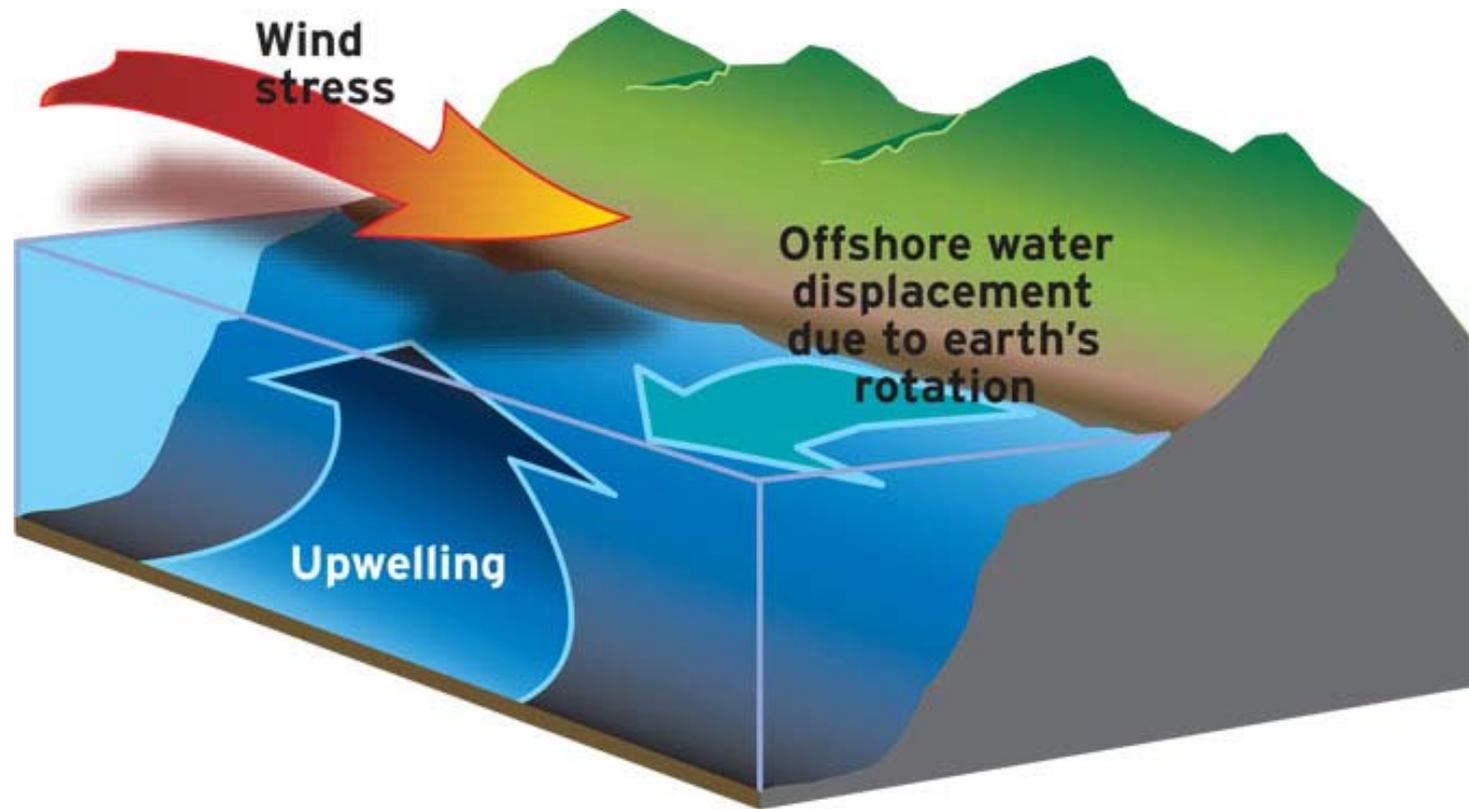
$\Omega = 1 =$ equilibrium

$\Omega < 1 =$ dissolution



Natural processes that could accelerate the ocean acidification of coastal waters

➤ Coastal Upwelling



Seasonal Invasion of Corrosive Waters on West Coast North America

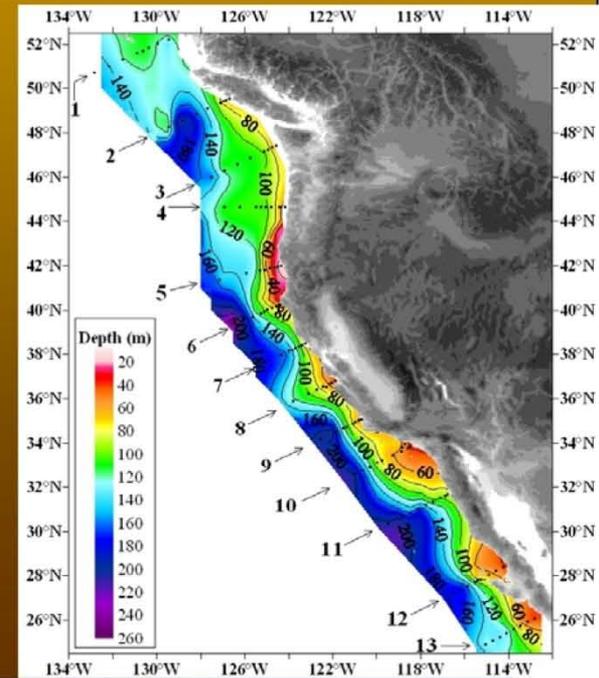
Inflow of corrosive waters across shelf and over extensive, productive ecosystems

upwelling of undersaturated waters (Ω_{arag} values < 1.0) on to shelf seas

ASH (Ω_{arag} values = 1.0) shoaling: 1m/a

Intermediate CO_2 rich corrosive waters (Ω_{arag} values < 1.0)

Depth of corrosive water along the shelf (m)



Schematic by C. Turley

Feely et al. Science (2008)

Concern for Many Marine Organisms and Ecosystems



- Reduced calcification rates
- Significant shift in key nutrient and trace element speciation
- Shift in phytoplankton diversity
- Reduced growth, production and life span of adults, juveniles & larvae
- Reduced tolerance to other environmental fluctuations
- Changes to fitness and survival
- Changes to species biogeography
- Changes to key biogeochemical cycles
- Changes to food webs
- Changes to ecosystem & their services
- **Uncertainties great - research required**

NMFS Research: Phytoplankton Response Studies

Possible fertilization effect of increased CO_2 (carbon) as phytoplankton nutrient

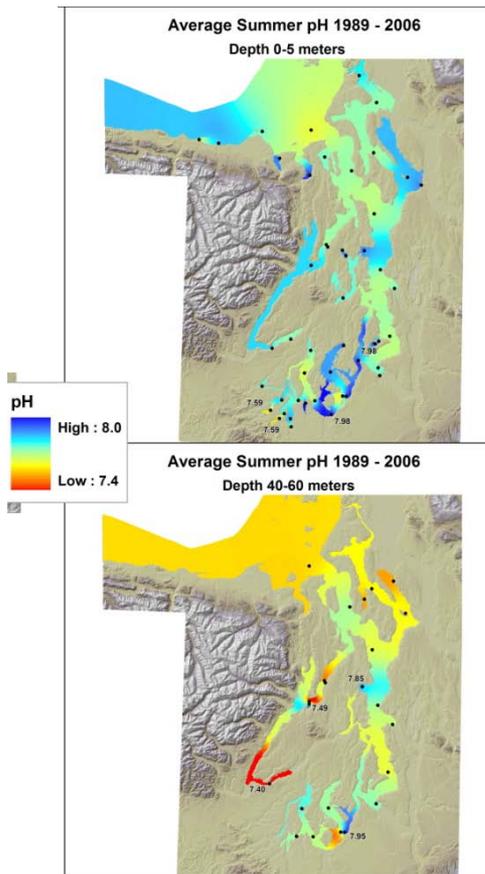
Studies with some phytoplankton indicate that reductions of 0.3-0.5 pH units have little impact on productivity, but may differentially impact species dominance

Unknown - interaction between Temp and CO_2



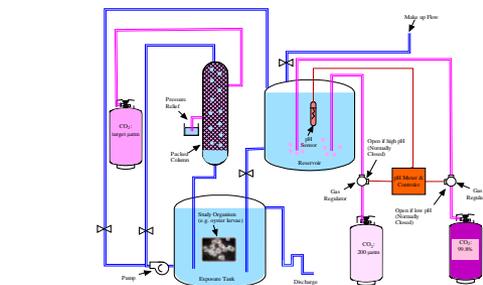
NMFS Research: Predicting ecological effects of OA

1 Patterns of acidification

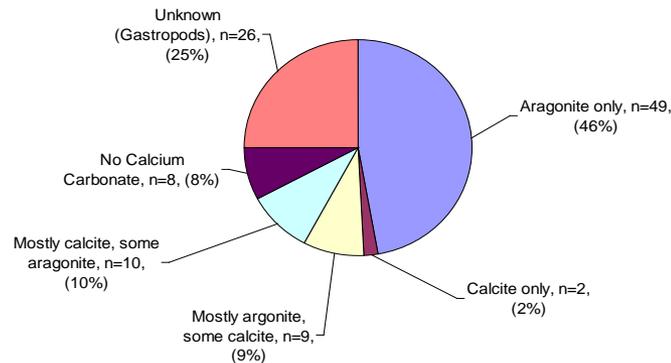


e.g. Puget Sound pH maps

2 Estimating species vulnerability

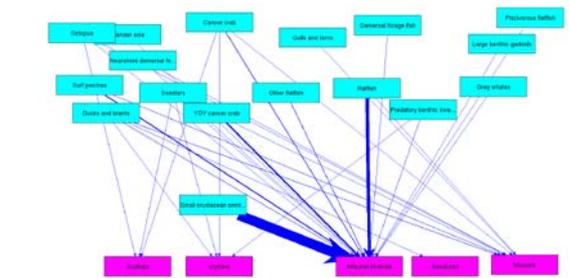
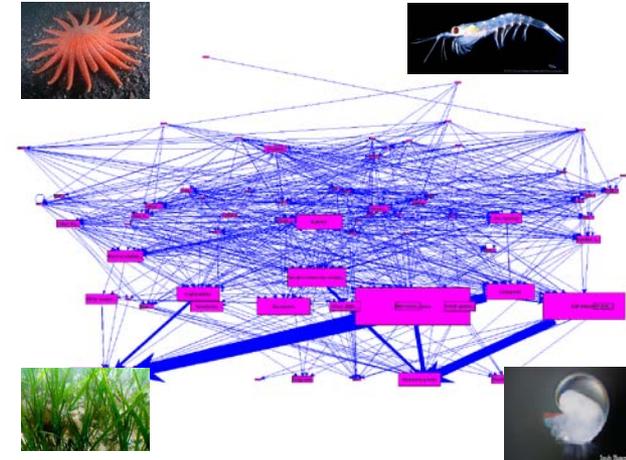


e.g. Treatment experiments



e.g. Survey of mineralogy of Puget Sound mollusks

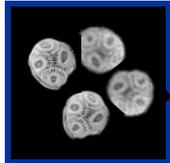
3 Impacts on food webs



e.g. Complete and bivalve-centric Puget Sound food webs

NMFS Research

Potential Effects on Open Ocean Food Webs

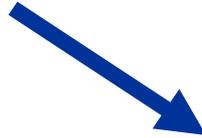


Coccolithophores



ARCOD@ims.uaf.edu

Copepods



Vicki Fabry

Pteropods

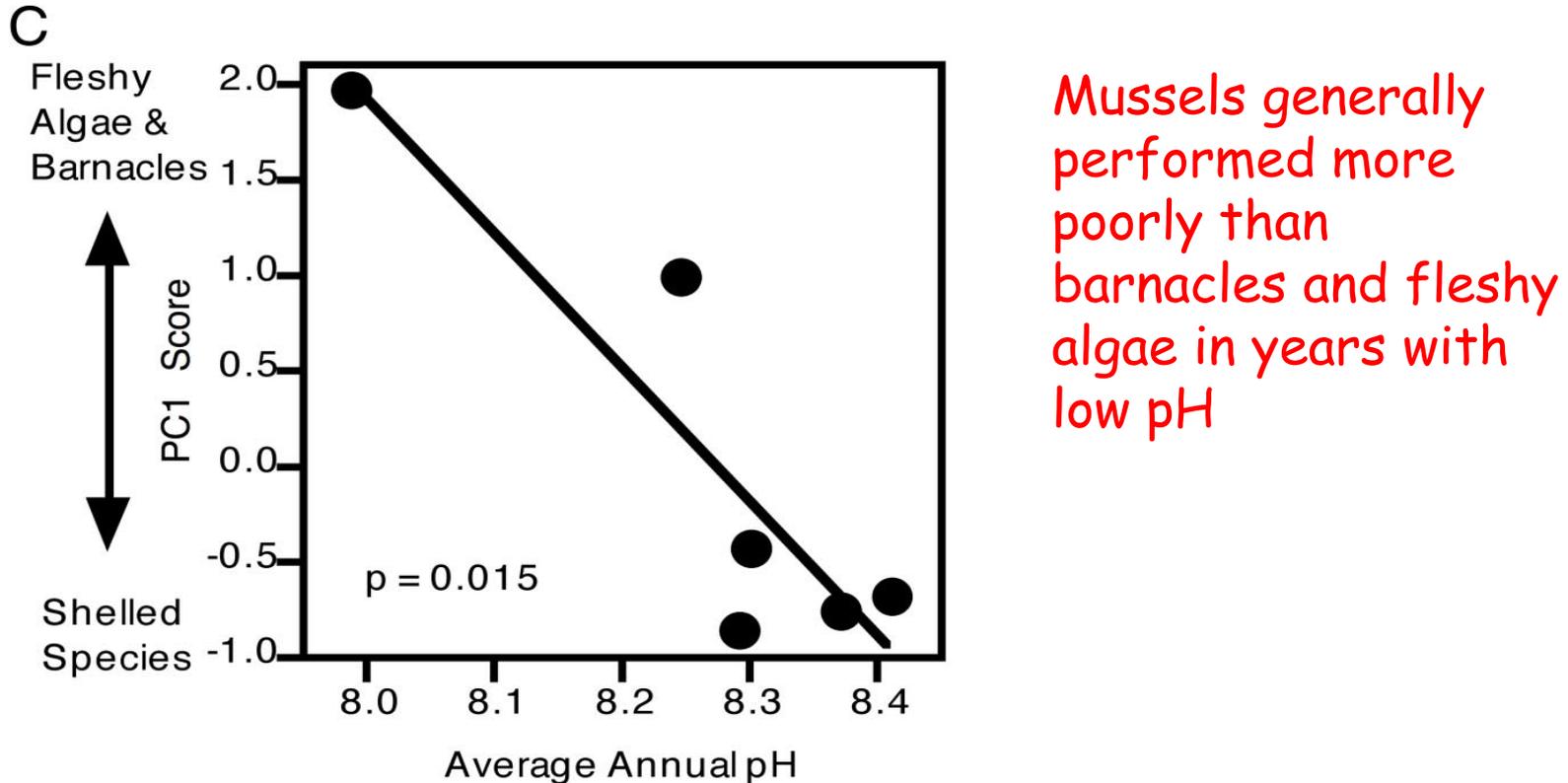


Barrie Kovish

Pacific Salmon

Other Examples - Ecosystem Change

Mussels on Tatoosh Island

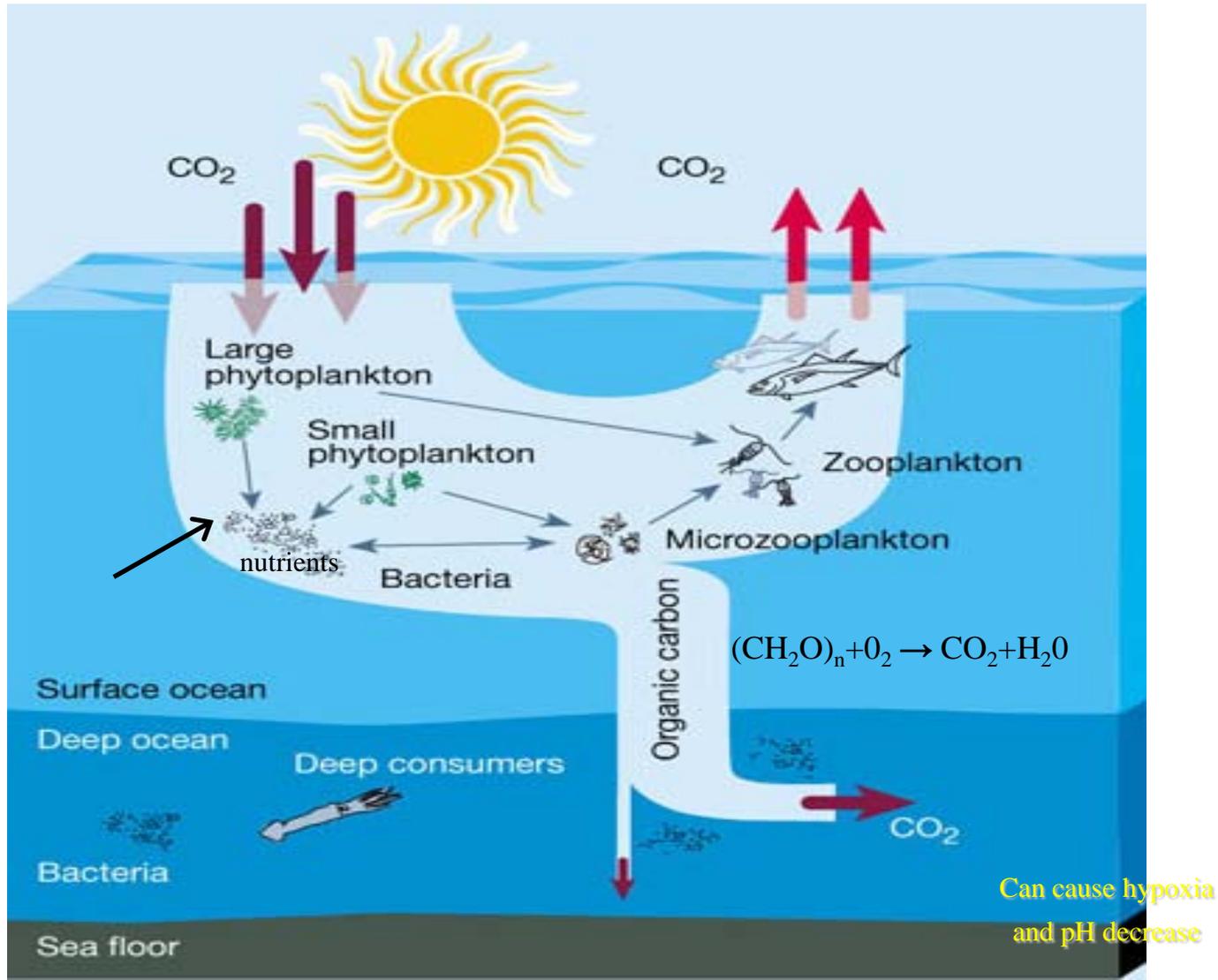


Mussels generally performed more poorly than barnacles and fleshy algae in years with low pH

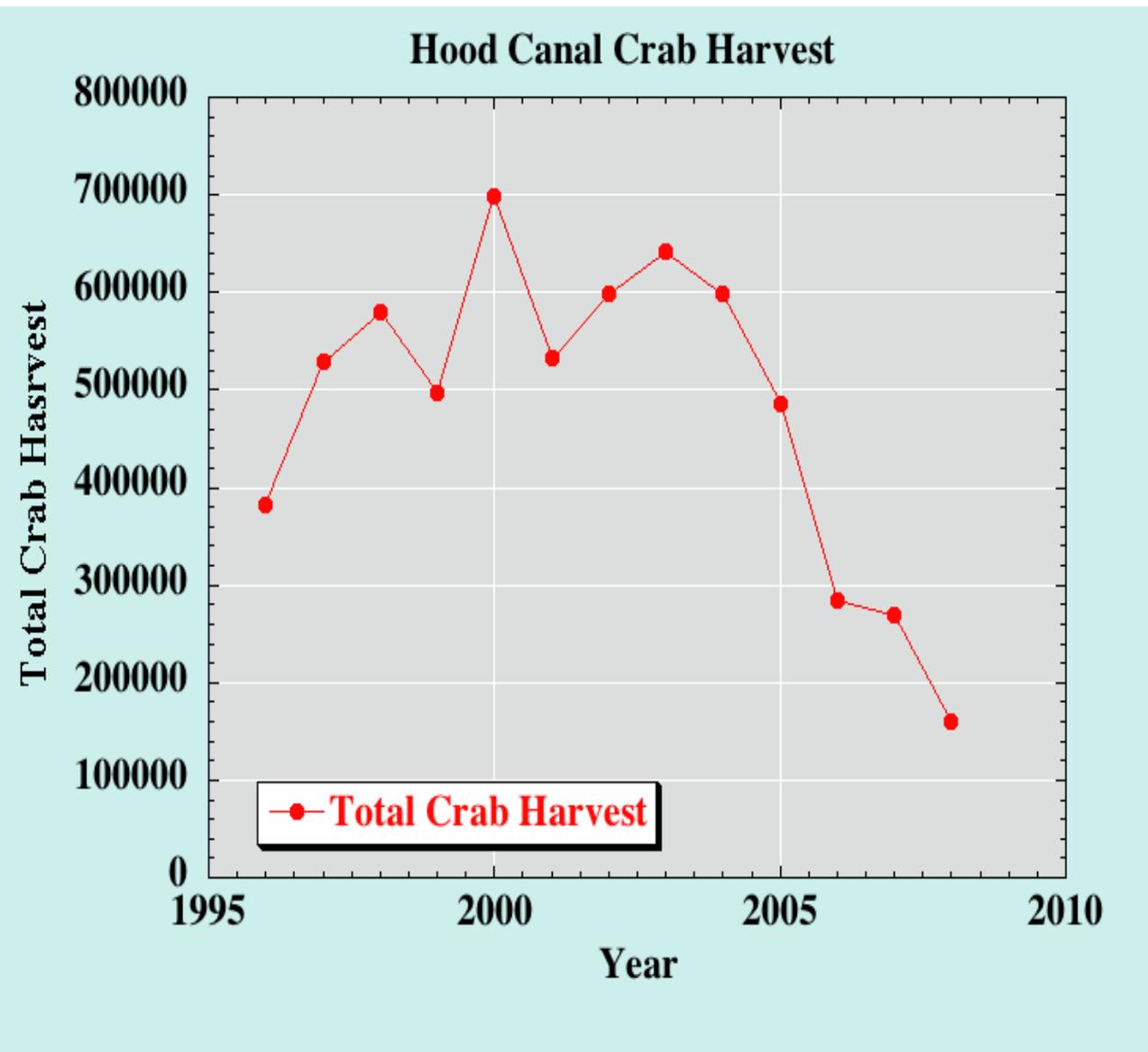
Wootton, et al. 2008. Dynamic patterns and ecological impacts of declining ocean pH in a high-resolution multi-year dataset. Proc. National Acad. Science.

Natural Processes that can Accelerate the Ocean Acidification of Ocean Water Masses

Biological Remineralization of Organic Matter



Could OA be a factor?



Total crab harvest in Hood Canal has been on the decline since 2003.

“The decline in overall crab abundance in Hood Canal since 2005 appears to be, in part, the result of detrimental environmental conditions that probably impacted juvenile survival” - Randy Hatch

What we know about the biological impacts of ocean acidification *...and sensitivity to CO₂/pH perturbation*

Much of our present knowledge stems from

- abrupt CO₂/pH perturbation experiments
- with single species/strains
- under short-term incubations
- with often extreme pH changes

Hence, we know little about

- responses of genetically diverse populations
- synergistic effects with other stress factors
- physiological and micro-evolutionary adaptations
- species replacements
- community to ecosystem responses
- impacts on global climate change





CONCLUSIONS--SCIENCE

- **Our footprint** in the oceans is now clearly detectable – It is warmer, more acidic, and less diverse.
- Since the beginning of the industrial age surface ocean pH (~0.1), carbonate ion concentrations (~16%), and aragonite and calcite saturation states (~16%) have been decreasing because of the uptake of anthropogenic CO₂ by the oceans, i.e., ocean acidification. *By the end of this century pH could have a further decrease by as much as 0.3-0.4 pH units.*
- Possible responses of ecosystems are speculative but could involve changes in species composition & abundances - could affect marine food webs, commercial shellfish, etc. *More research on impacts and vulnerabilities is needed.*
- An observational network for ocean acidification is under consideration. Modeling studies need to be expanded into coastal regions. Physiological response, mitigation and adaptation studies need to be developed and integrated with the models. *Estuaries should be included in this study.*

Possible Policy and Management Considerations

- **Adaptation:**
 - Observation network
 - Ecosystem model
 - Spatial hazard assessment
 - Infrastructure for authoritative decision support
- **Mitigation:**
 - For migratory resources – any feasibility to buffer a site (e.g., key spawning area)
 - Hatchery/aquaculture facilities – informed siting
 - Shellfish – buffer key enclosed bays
 - Reduce the effect of those stressors on marine ecosystems that we can more directly affect

To Close

- CO_2 is changing the ocean - ocean acidification and sea level rise are two of the impacts
- OA can be thought of as a toxicological issue, but the difference is that the input is global not local
- There is uncertainty - who will be the winners and losers, what are the resulting ecosystem consequences, are there interactions with other stressors and what is the rate of change
- The North Pacific appears to be at higher risk for OA and the west coast appears to be lower relative risk to SLR
- Sustained, coordinated research is needed, and mitigation and adaptation needs to be addressed

Science, Service, Stewardship



GLOBAL CLIMATE CHANGE IMPACTS IN THE U.S.

www.globalchange.gov/usimpacts

**NOAA
FISHERIES
SERVICE**

NOAA



STATUS OF LEGISLATION

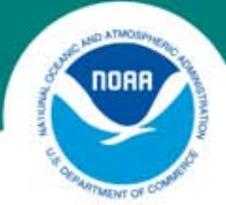


Omnibus Public Land Management Act of 2009

Federal Ocean Acidification Research and Monitoring Act of 2009 (H.R. 146)

- Introduced June and November 2007, respectively
- Senate Bill passed on 20 March 2009
- House Bill passed in 25 March 2009
- Signed by the President 30 March 2009

Goal: To establish an interagency committee to develop an ocean acidification research and monitoring plan and to establish an ocean acidification program within the National Oceanic and Atmospheric Administration.



FORAM ACT OF 2009

The purposes of this subtitle are to provide for —

1. Development and coordination of a comprehensive interagency plan to:
 - a) monitor and conduct research on the processes and consequences of ocean acidification on marine organisms and ecosystems; and
 - b) establish an interagency research and monitoring program on ocean acidification;
2. Establishment of an ocean acidification program within NOAA;
3. Assessment and consideration of regional and national ecosystem and socioeconomic impacts of increased ocean acidification; and
4. Research adaptation strategies and techniques for effectively conserving marine ecosystems as they cope with increased ocean acidification.

PROPOSED OFFSHORE AQUACULTURE DEMONSTRATION PROJECT

Mr. Don Kent of the Hubbs-Sea World Research Institute will provide an informational report on a proposed offshore aquaculture demonstration project.

Council Task:

Discussion.

Reference Materials:

1. Agenda Item B.3.a, Attachment 1: Fact sheet on the offshore aquaculture demonstration project.

Agenda Order:

- a. Agenda Item Overview
- b. Hubbs Sea World Research Institute Proposal
- c. Reports and Comments of Management Entities and Advisory Bodies
- d. Public Comment
- e. Council Discussion

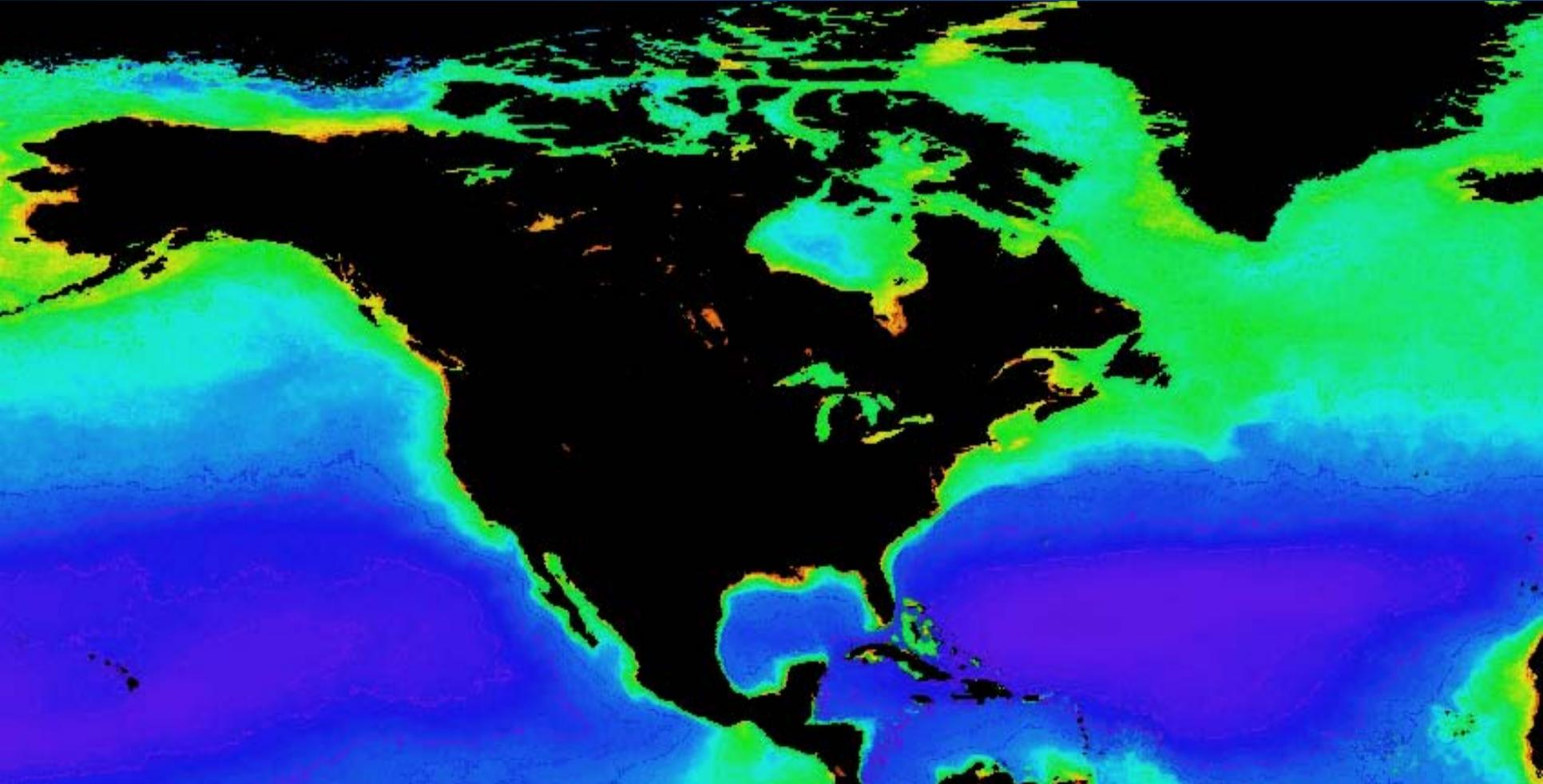
Jennifer Gilden
Don Kent

PFMC
08/20/09



Development of Marine Aquaculture

A National Imperative



Hubbs-SeaWorld
Research Institute

Presented to
Pacific Fisheries Management Council
September 12-13, 2009



HSWRI Founders

envisioned an independent, highly creative and results oriented scientific research organization



Since 1963

“to return to the sea some measure of the benefits derived from it.”



H-SWRI Headquarters
Mission Bay Laboratory, San Diego, CA



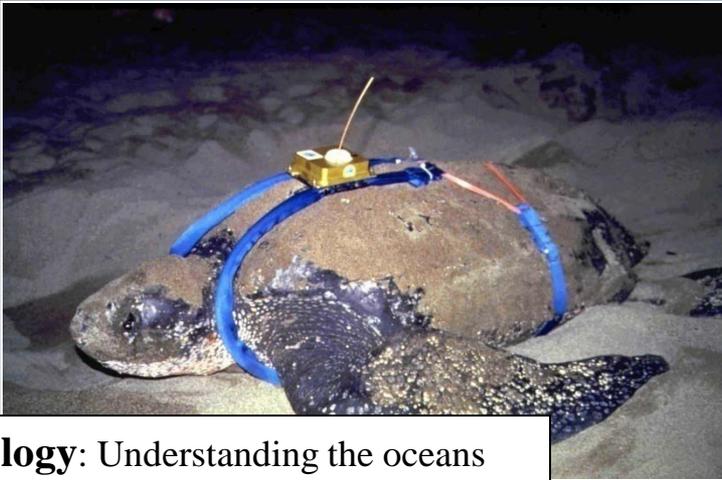
Leon Raymond Hubbard Jr. Marine Fish Hatchery
Carlsbad, CA



Laboratories in Orlando &
Melbourne Beach, FL



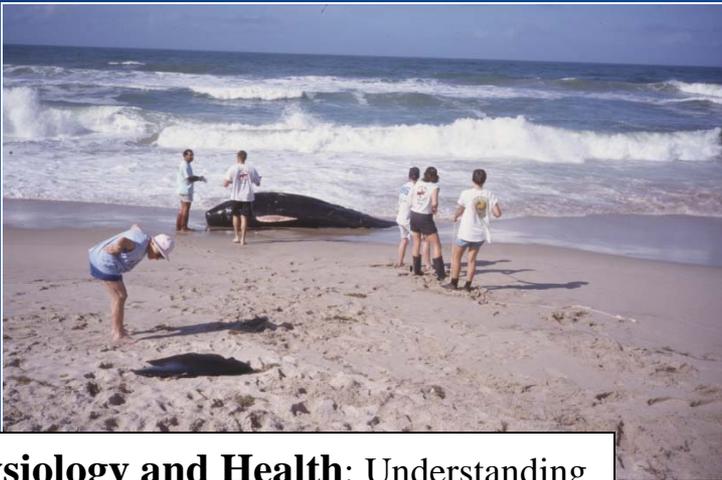
Core Areas of Research



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



Physiology and Ocean Health



Establishing cleaning and treatment protocols for marine animals after oil spills

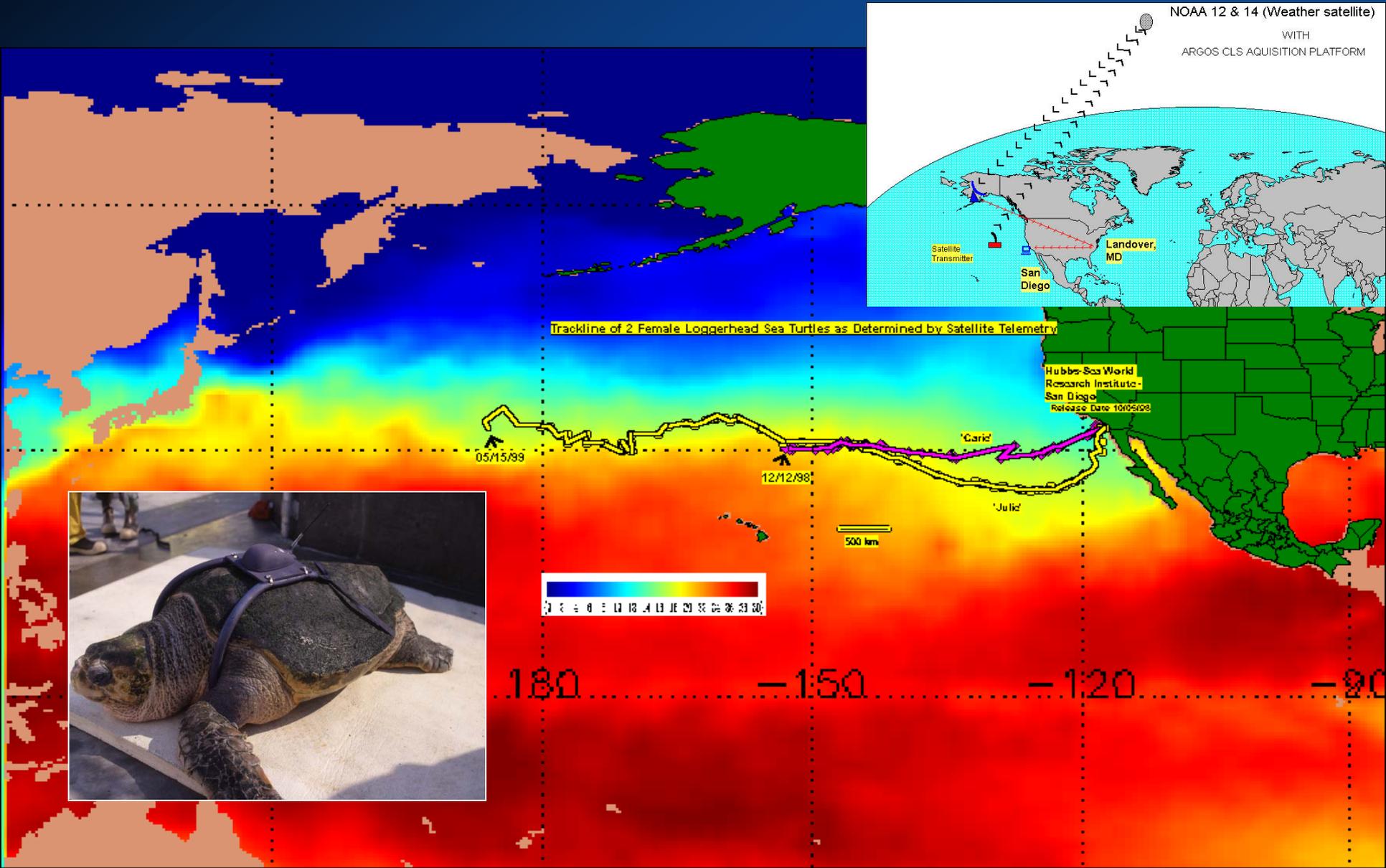


Discovering new marine mammal viruses and studying their impact on population health



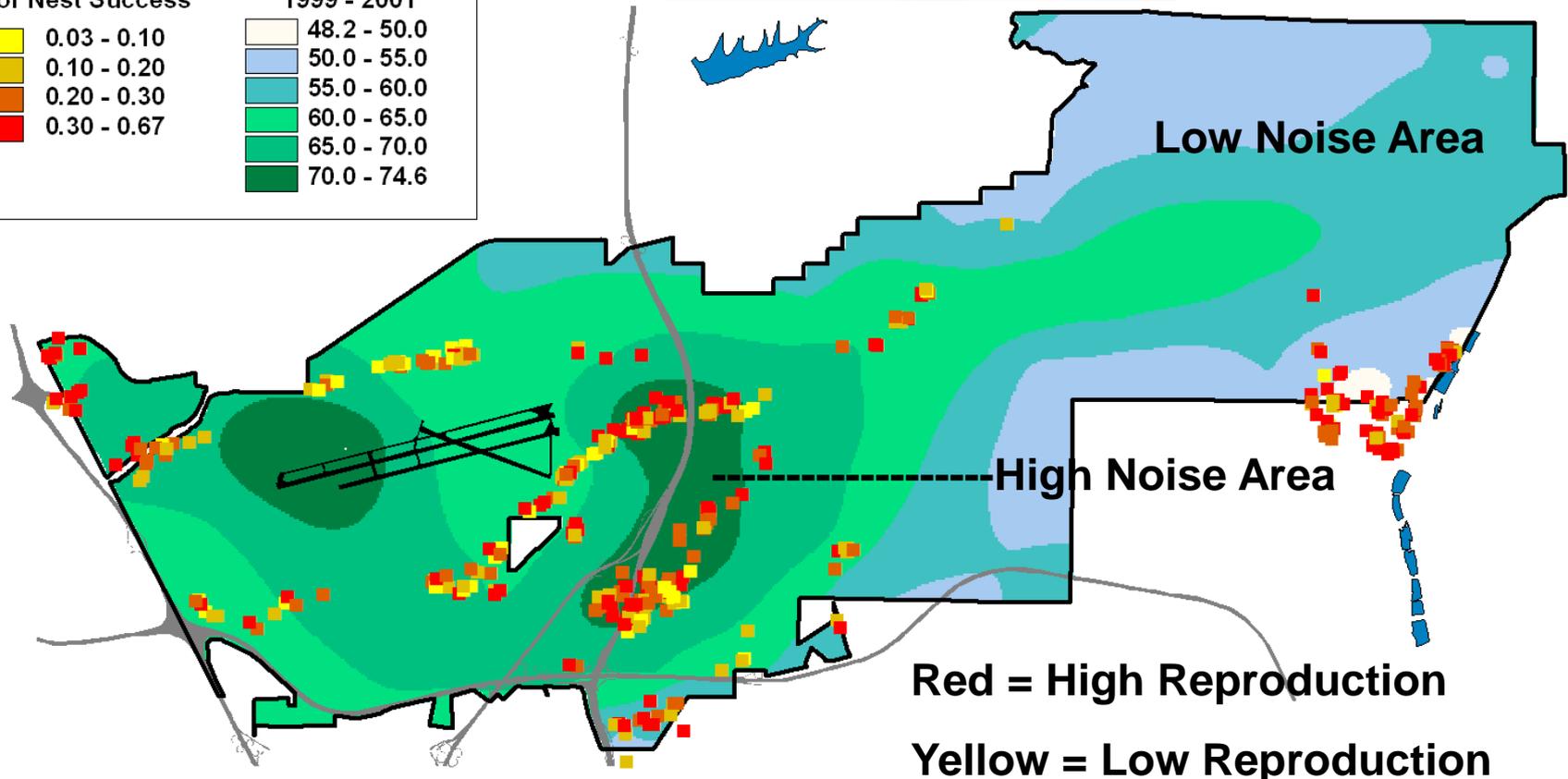
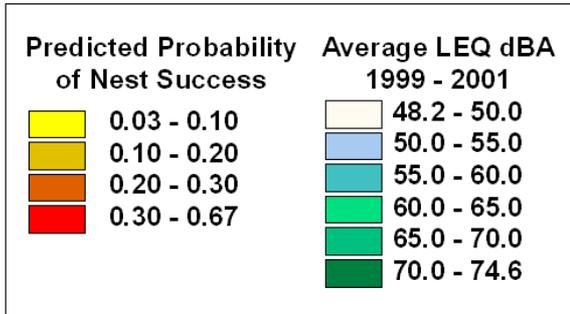


Ecology: Understanding the Ocean and its Inhabitants

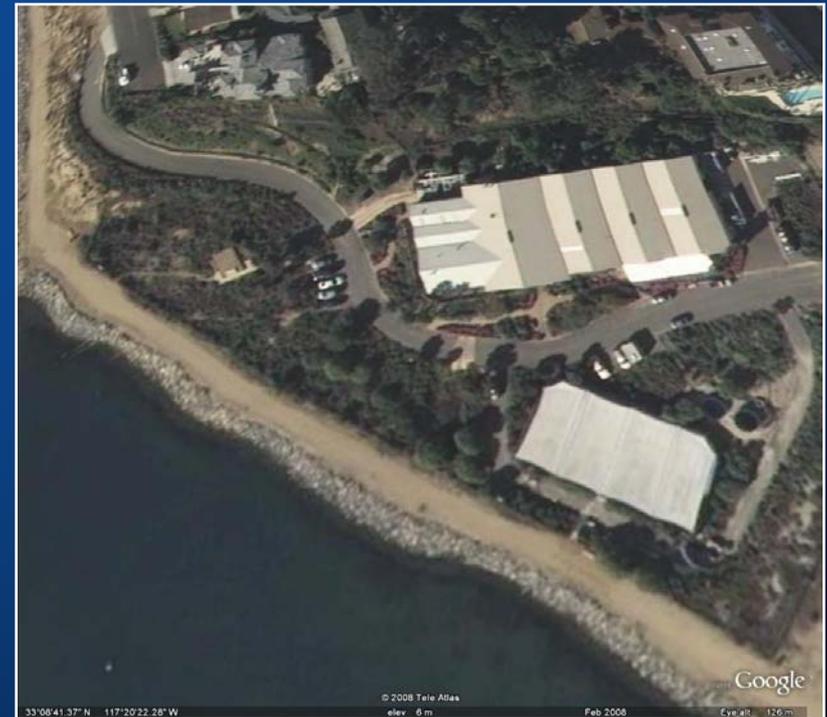
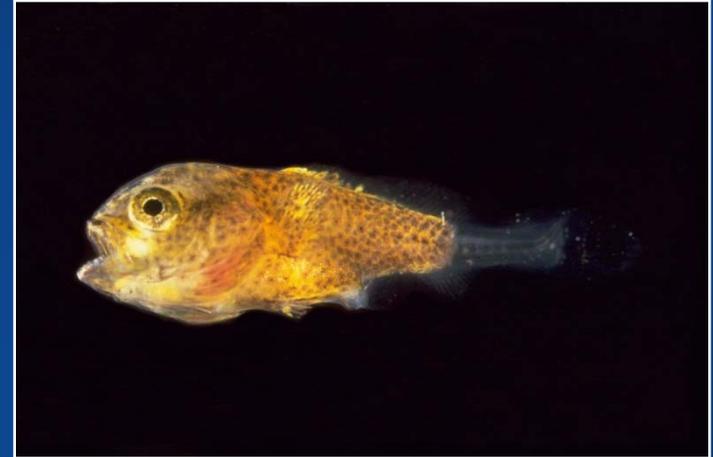
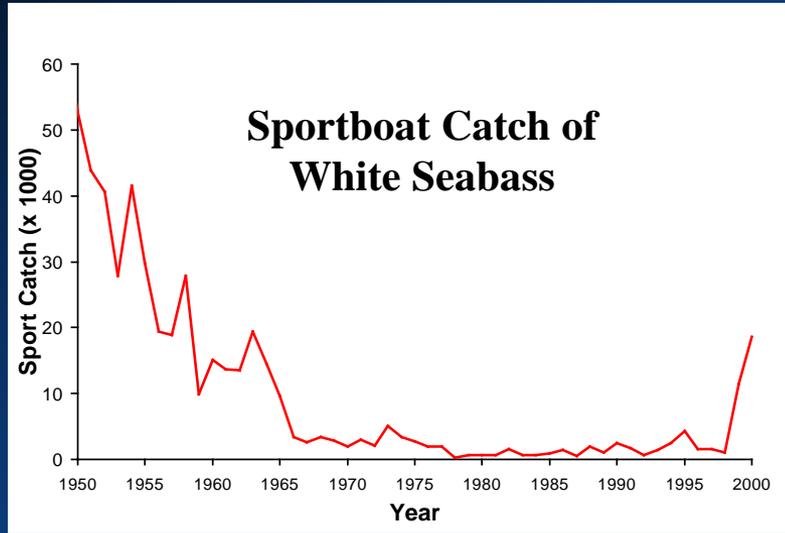




Bioacoustics

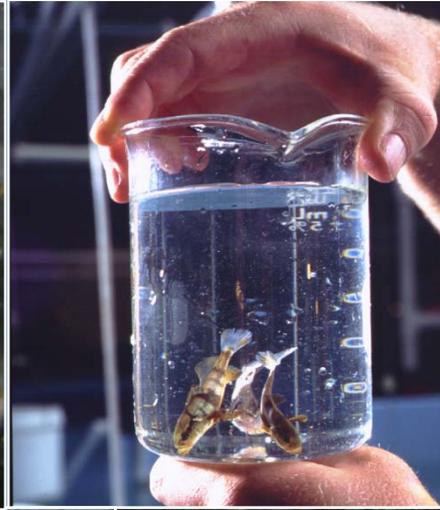


Aquaculture





Hatchery Production





Location of White Seabass Hatchery and 14 Satellite Growout Facilities





The Aquaculture Imperative



The San Diego Union-Tribune
Saturday, February 24, 2007

UNION-TRIBUNE EDITORIAL
Hatch fish farming
Aquaculture belongs in U.S. waters

Hardly a month goes by without a health study concluding that Americans should eat more fish. There's just one problem – the world doesn't have nearly enough fish. Wild stocks leveled off years ago, and scientists warn of crashing populations caused by overfishing. Meanwhile, human population growth and rising worldwide wealth are driving sharp increases in demand for seafood.

The answer is aquaculture, a fancy word for seafood farming. The industry is growing rapidly around the world – everywhere but the United States, where environmental opposition and red tape have stymied would-be farmers.

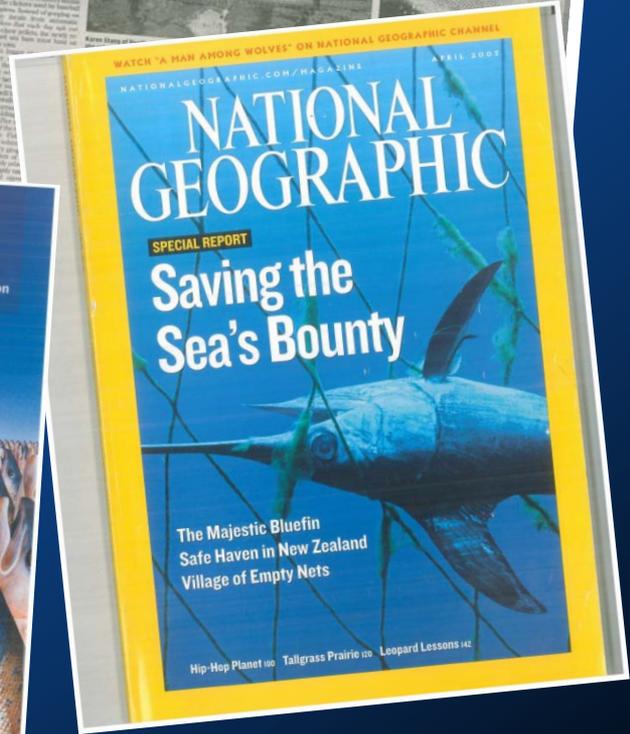
Congress has a perfect opportunity this year to clear away obstacles. The National Marine Fisheries Service, a federal agency, is promoting a bill to create a regulatory system for aquaculture in federal waters, which extend from three to 200 miles offshore. This bill deserves passage.

Aquaculture got a bad rap because of the environmental abuses in other countries. Yet Americans import 70 percent of their seafood each year, with about 40 percent of it farmed. This should be a U.S. industry, under U.S. supervision.

The right way to farm fish is being demonstrated in San Diego at the Hubbs-SeaWorld Research Institute. The institute has been raising hatchlings in Carlsbad for years to replenish wild stocks of threatened species. Lately it's been honing commercial-scale technologies at SeaWorld, Santa Catalina and Esenada.

Researchers raise California yellowtail, rockfish, sea bass and other species in deep-water pens. Waste is flushed naturally. Workers monitor health and nutrition to yield food that recently won a sushi competition in Japan.

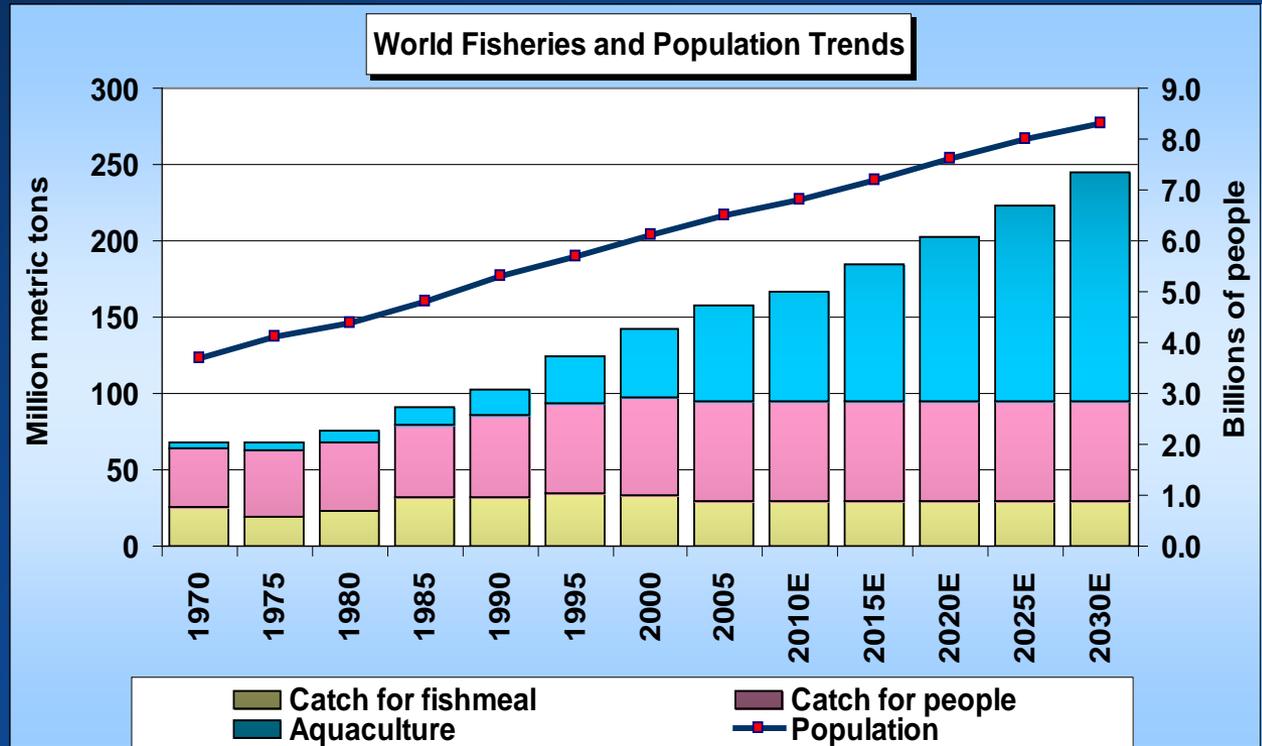
It's time for environmentalists to embrace responsible aquaculture, and for Congress to release this industry into the wild.





Increasing Global Demand

40 million more tonnes of aquatic food will be required by 2030 to maintain the current per capita”
FAO 2006



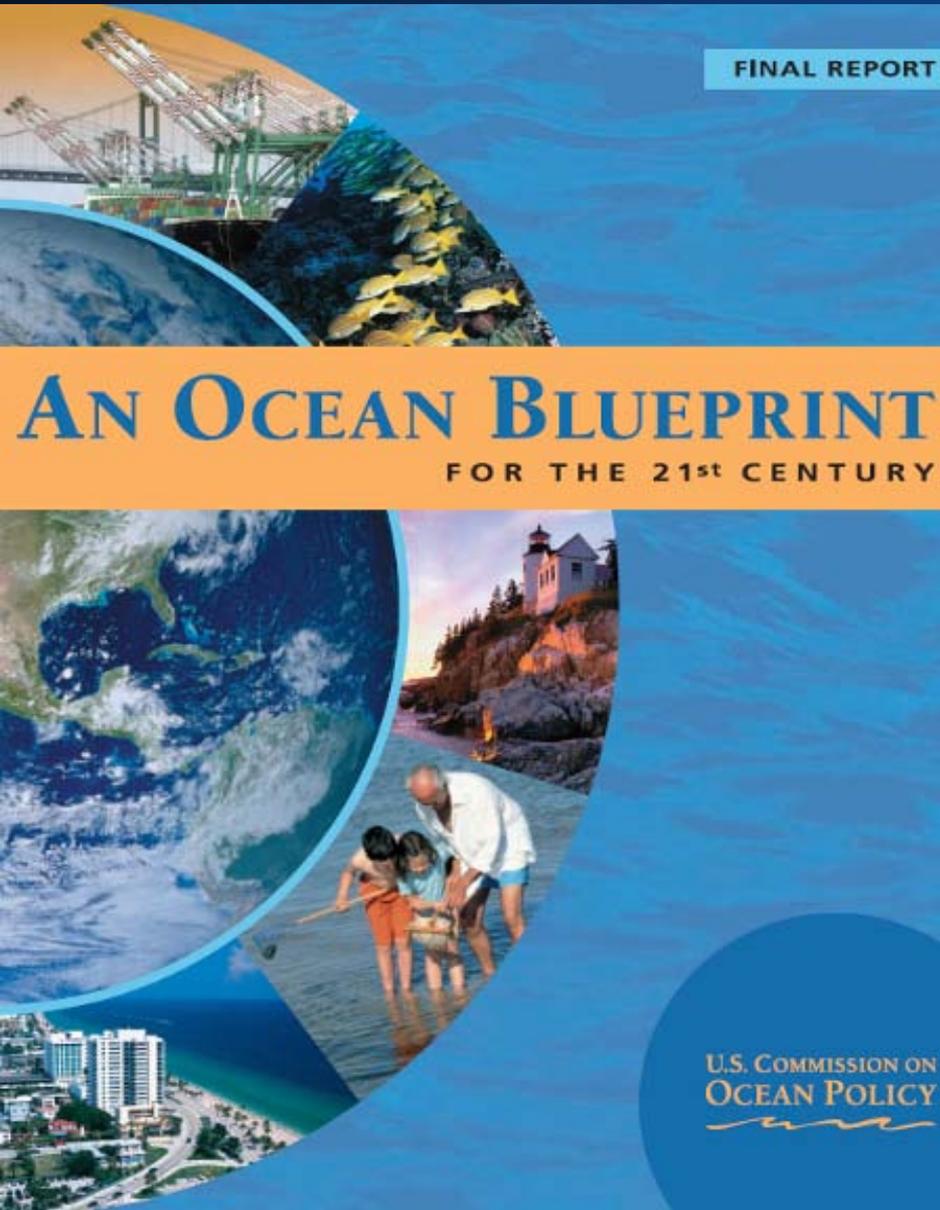
Courtesy: Jingjie Cho, NOAA Aquaculture

At a landed price of \$3/kg this is **\$125 billion.**

At retail prices - **\$500+ billion.**



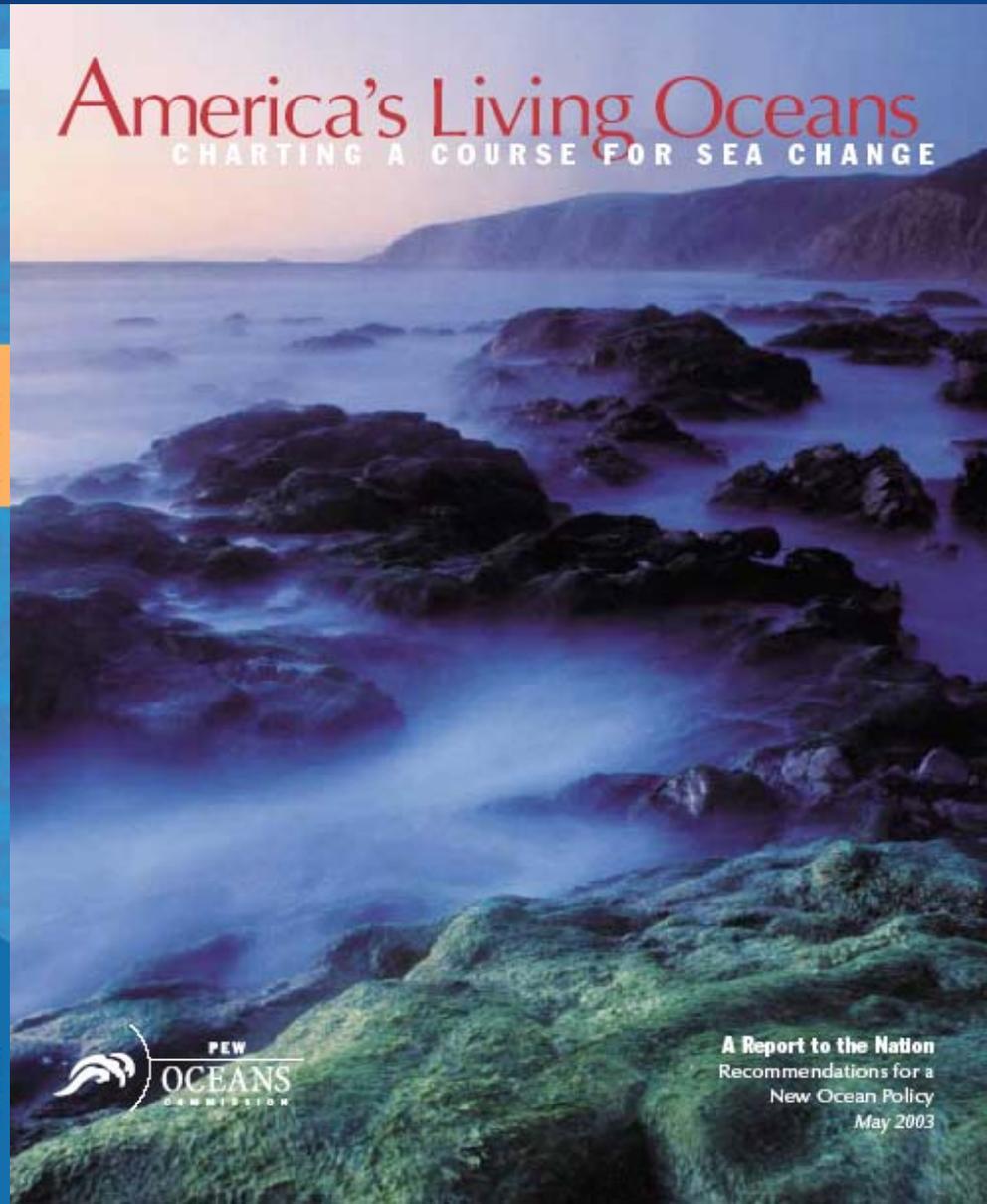
The Need for Demonstration Projects



FINAL REPORT

AN OCEAN BLUEPRINT FOR THE 21ST CENTURY

U.S. COMMISSION ON
OCEAN POLICY



America's Living Oceans CHARTING A COURSE FOR SEA CHANGE

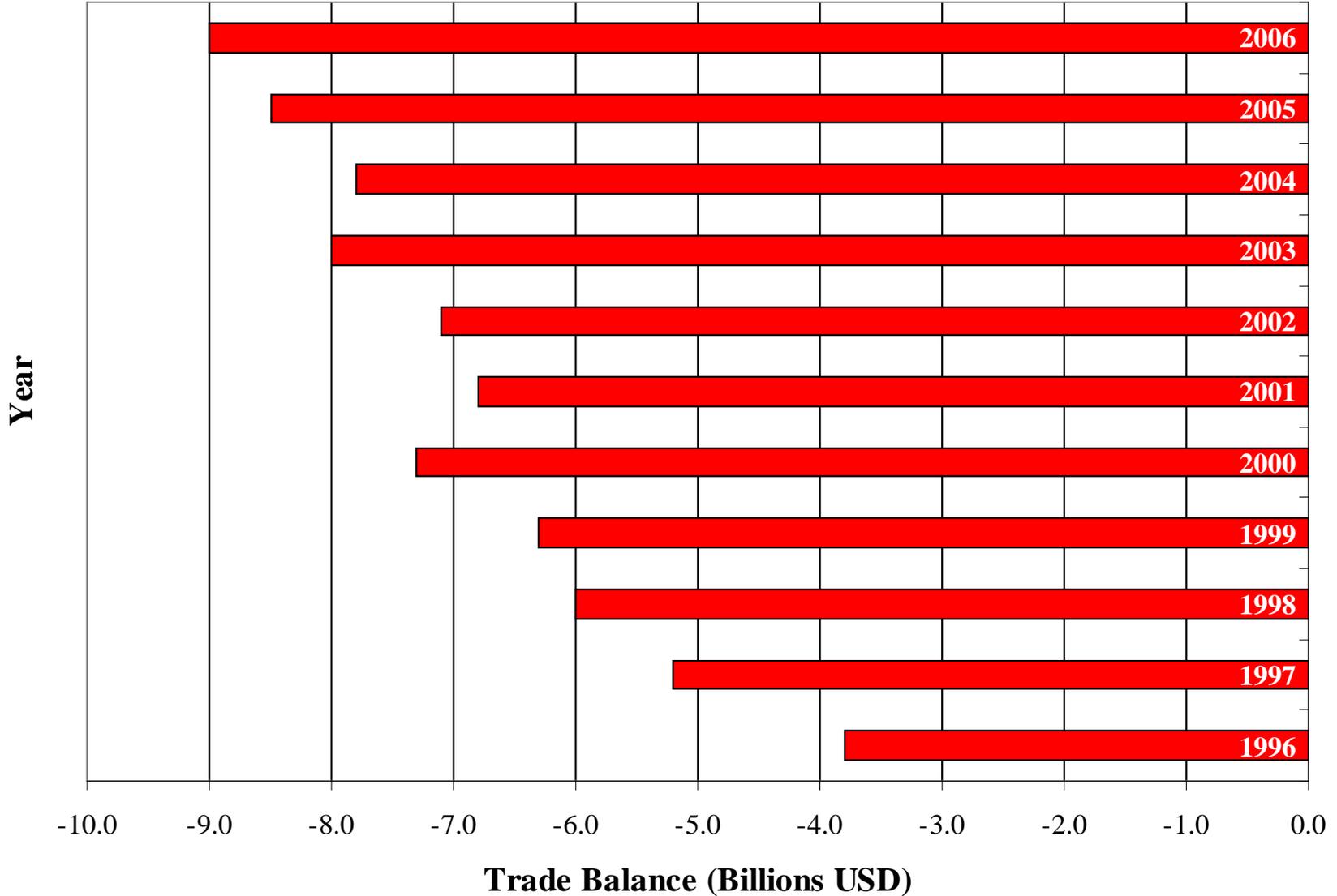


A Report to the Nation
Recommendations for a
New Ocean Policy
May 2003



The Economic Imperative

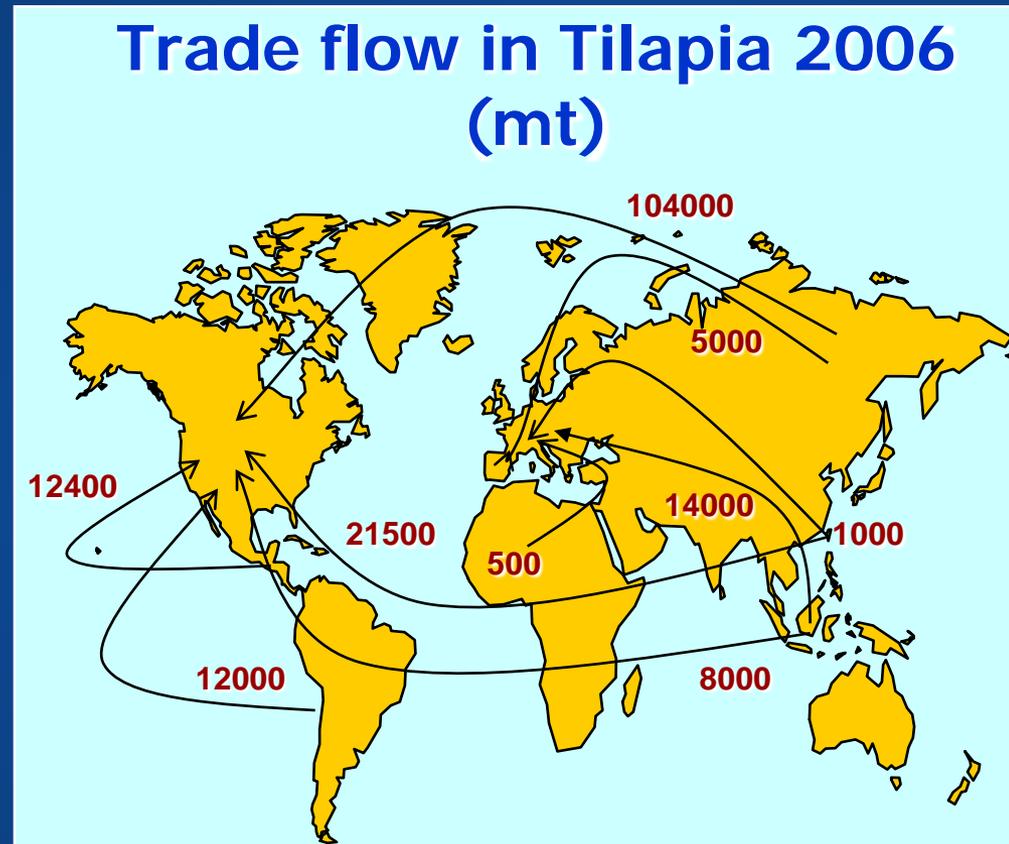
U.S. Seafood Trade Deficit





Benefits of a Domestic Fish Farming Industry

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





California's Living Resources Industries

Between 1990 and 2000 California has lost:

- 725 jobs in fishing, aquaculture and seafood processing
- Over \$40 million in wages and
- Over \$160 million in the Gross State Product



Catalina Demonstration Project

NOAA/Saltonstall Kennedy Funded



- Reached marketable size in 18 months
- 97% survival and no disease related mortality
- Zero escapes
- Product quality was deemed “excellent”
- “...net cages can influence the fish community in a positive way”*

* Oakes and Pondella; 2009; J. World Aquaculture Soc.; Vol. 40, No. 1; pp 1-21



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)
- Assess ability to increase domestic supply of seafood in an environmentally sustainable manner
- Highlight to the nation San Diego's leadership in the development of offshore aquaculture



Site Requirements

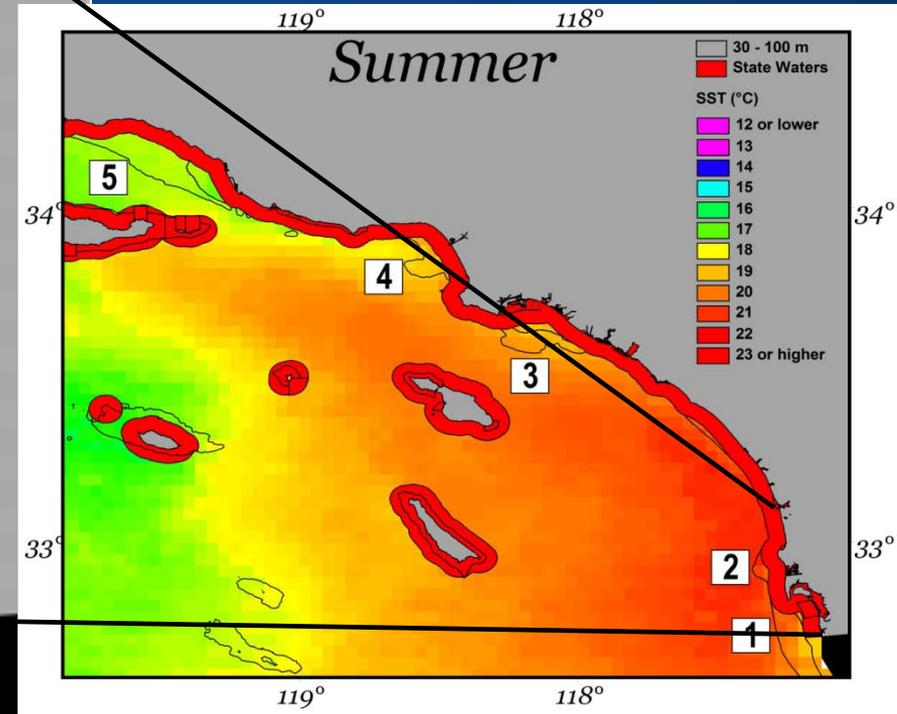
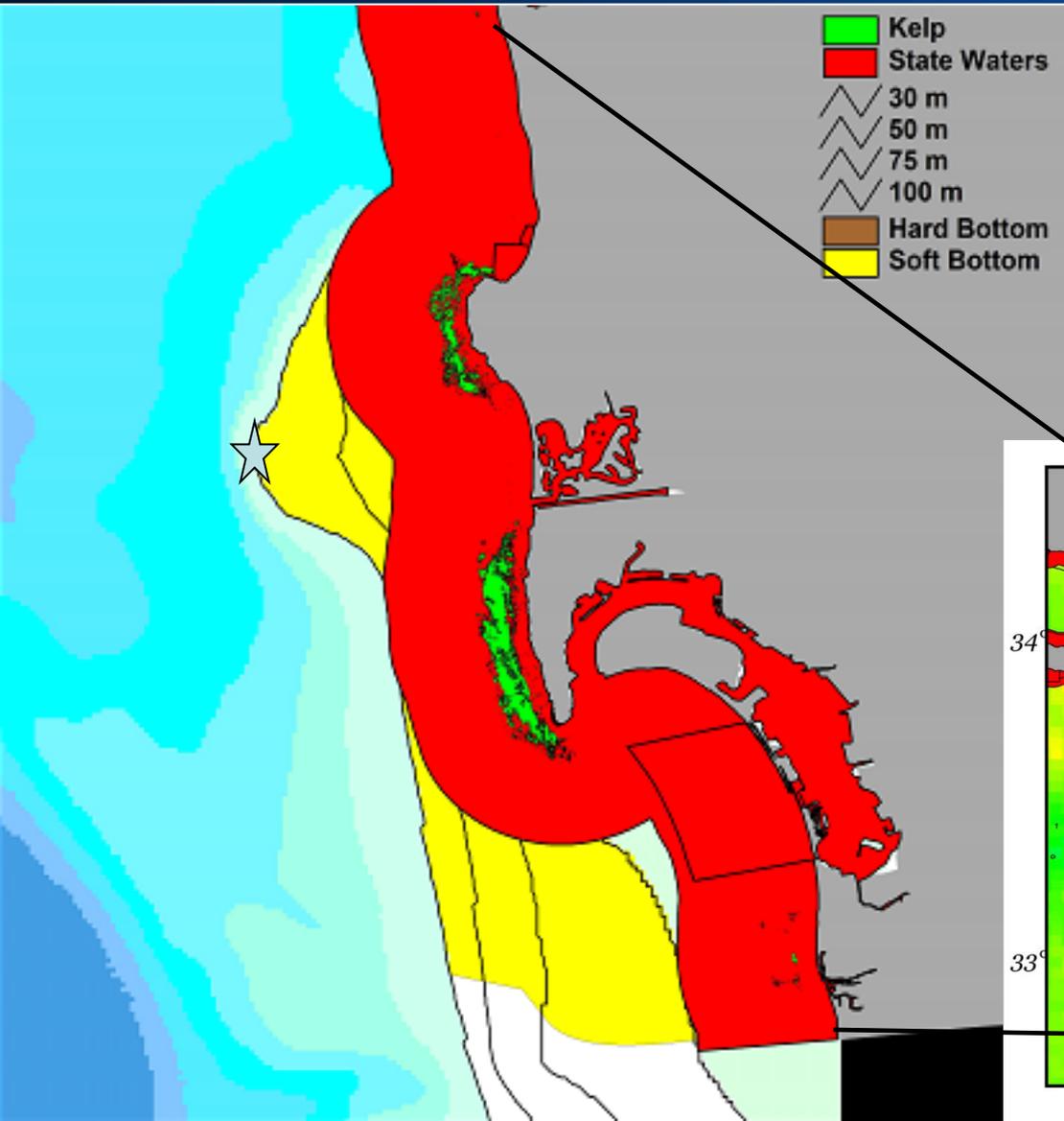
- Need
 - Greater than 100 feet and less than 350 feet deep
 - Clean water with consistent current
- Southern California area offers a nearly ideal climate
 - Consistent (i.e., predictable) water temperature
 - Infrequent extreme weather and wave conditions
- Avoid user and habitat conflicts
 - Outside 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

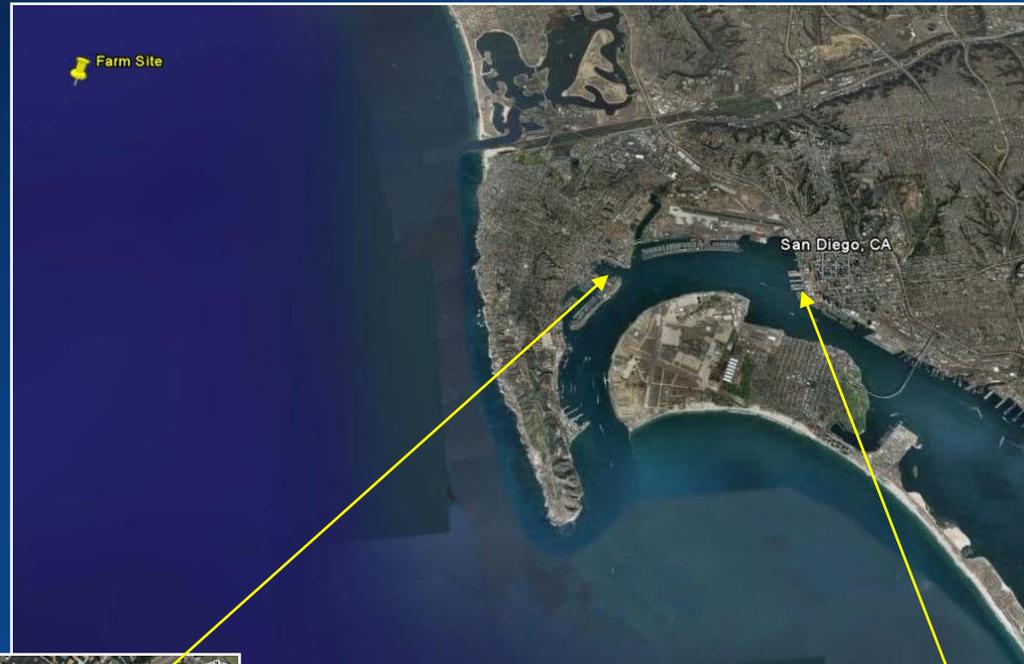


Image NASA
Image © 2008 DigitalGlobe





Species to be Permitted

Striped Bass



White Seabass



California Yellowtail



California Halibut



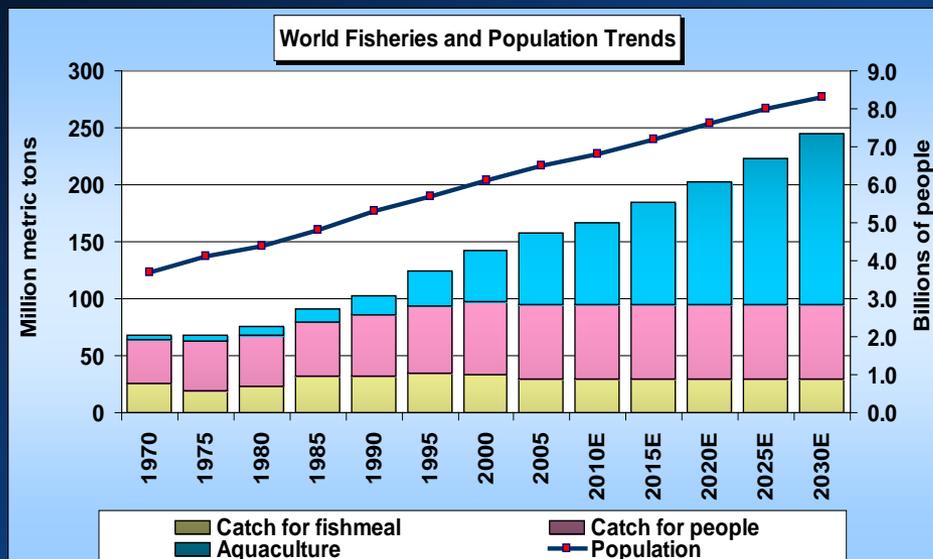


Identified Concerns

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

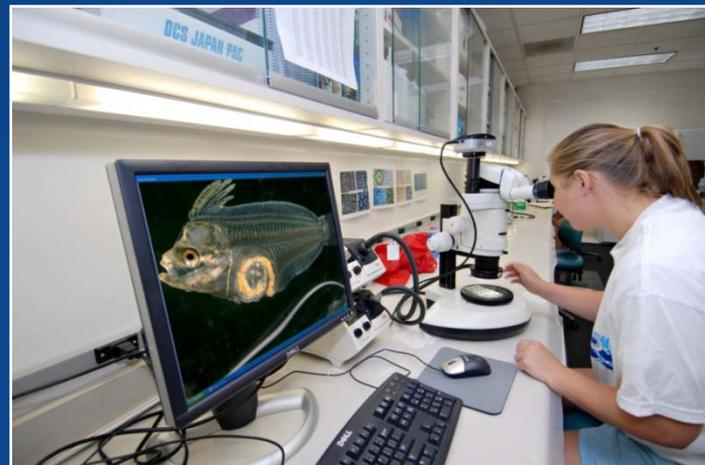


Concern 1. Using Wild Fish to Feed Farmed Fish



Courtesy: Jingjie Cho, NOAA Aquaculture

Fish meal harvest is sustainable, but fixed

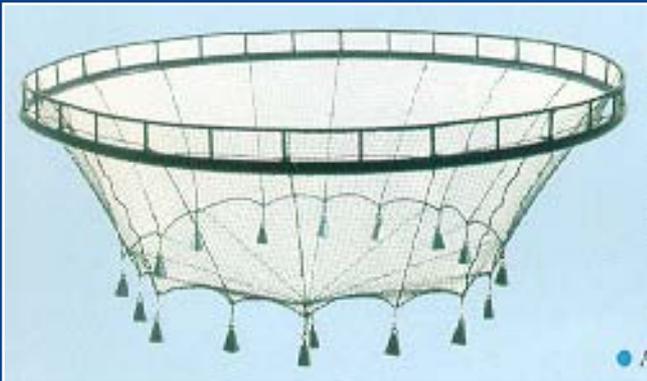


- Species specific diets
- Life stage specific
- Micronutrients
- Alternative proteins
- Live feeds
- Microencapsulated diets

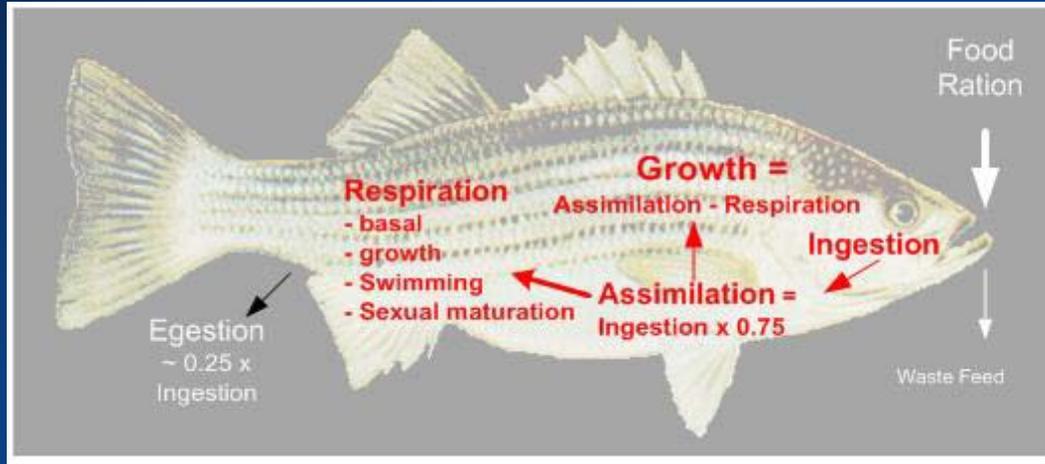


Concern 2. Impacts of Escapes on Wild Stocks

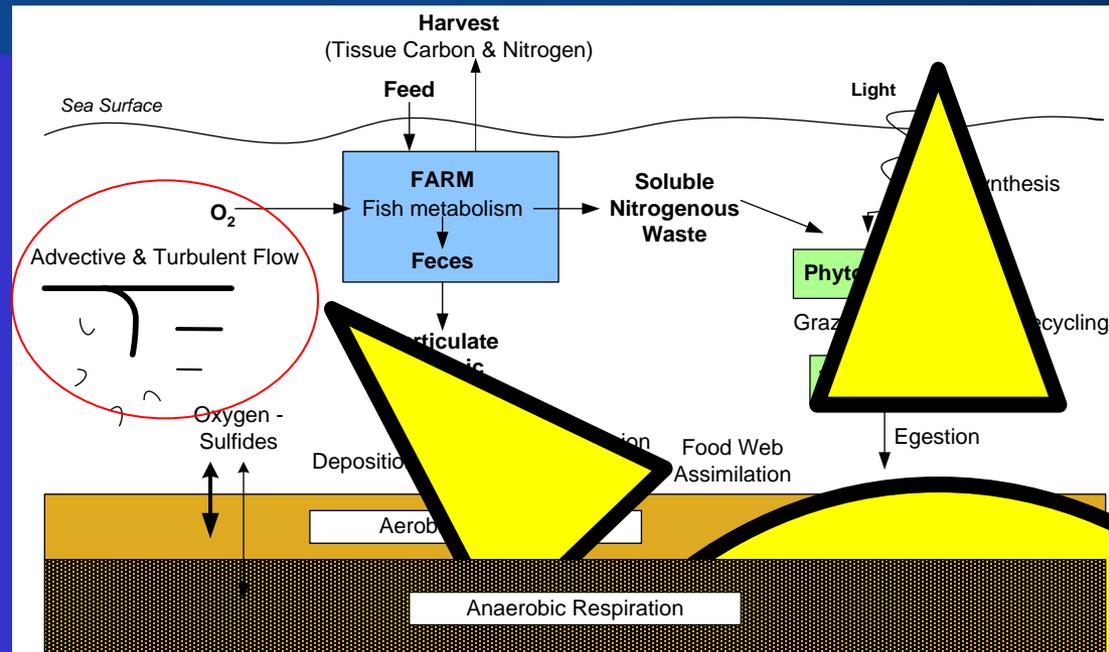
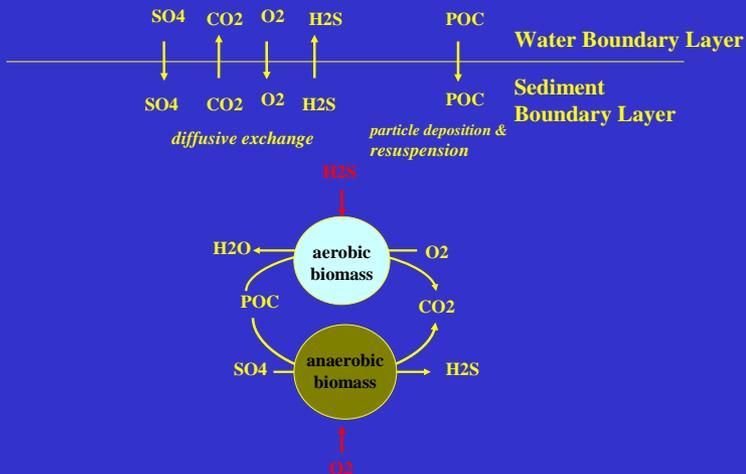
- Grow local species to avoid introducing new species or parasites
- Use “wild” genotypic fish until escapement is demonstrated to be non-problematic
- Systems are well-designed to prevent escapement and have been tested around the world



Concern 3. Polluting the Bottom and Algal Blooms



Benthic Dynamics





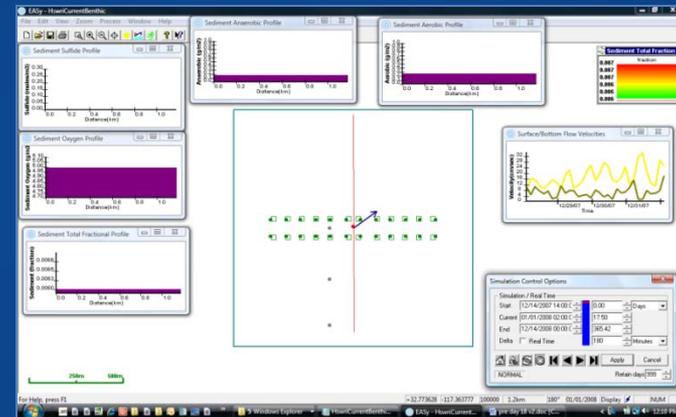
Concern 3.

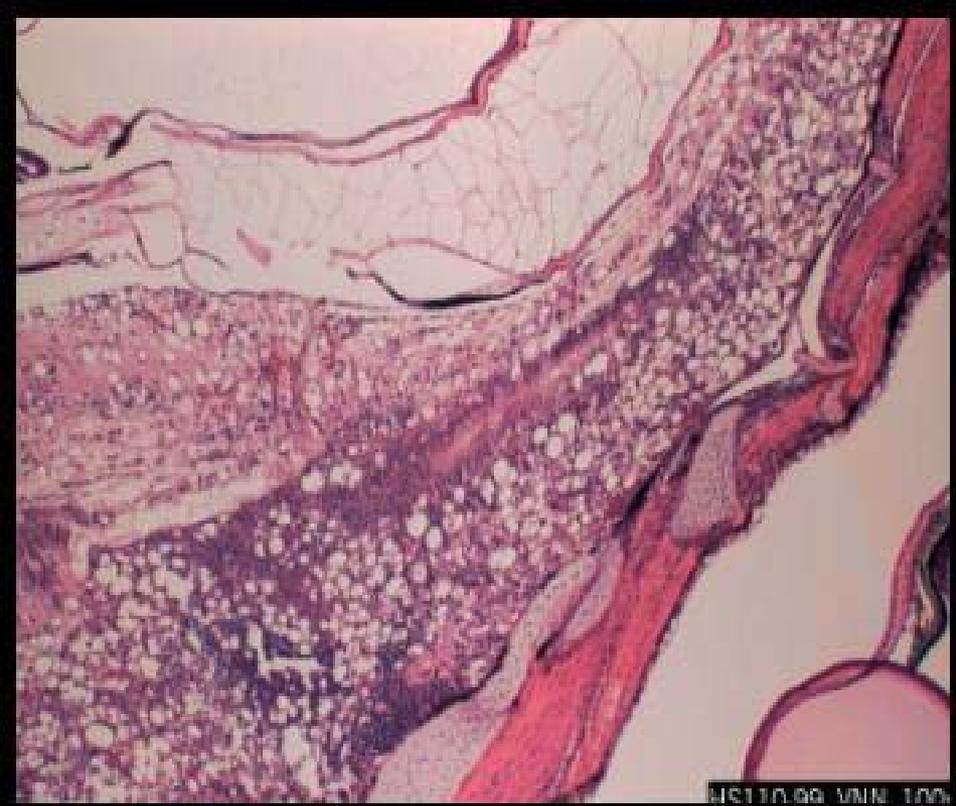
Polluting the Bottom and Algal Blooms

Bottom Sediment and Water Column Simulations

Results:

1. Depth and current combine to disperse carbon to very low levels
2. Peak TOC within footprint is 0.0062g C/g sediment (~1%) above ambient
3. [N] never exceeds 2 mg/m³ which is below the threshold for phytoplankton growth and downstream dilution diminishes nutrients
4. Based on observations of existing farms, these results are either correct or overstated
5. Eutrophication will not result from the farm and will not stimulate algal blooms
6. The HSWRI demonstration site far exceeds any standards utilized in any jurisdiction worldwide





Concern 4. Potential Spread of Disease

Disease Research

- Diagnostic tools
- Biosecurity protocols
- Health management
- Treatment protocols
- Evaluate wild populations



Best Management Practices Prevent Disease

1. Use lower stocking densities
2. Increase cage spacing
3. Optimize water quality



Concern 5. Competition with Commercial Fishermen



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

Swordfish \$1,477

All Others \$1,060

Thornyhead \$500



Sea Urchin \$503



Spot Prawn \$648



Spiny Lobster \$2,881



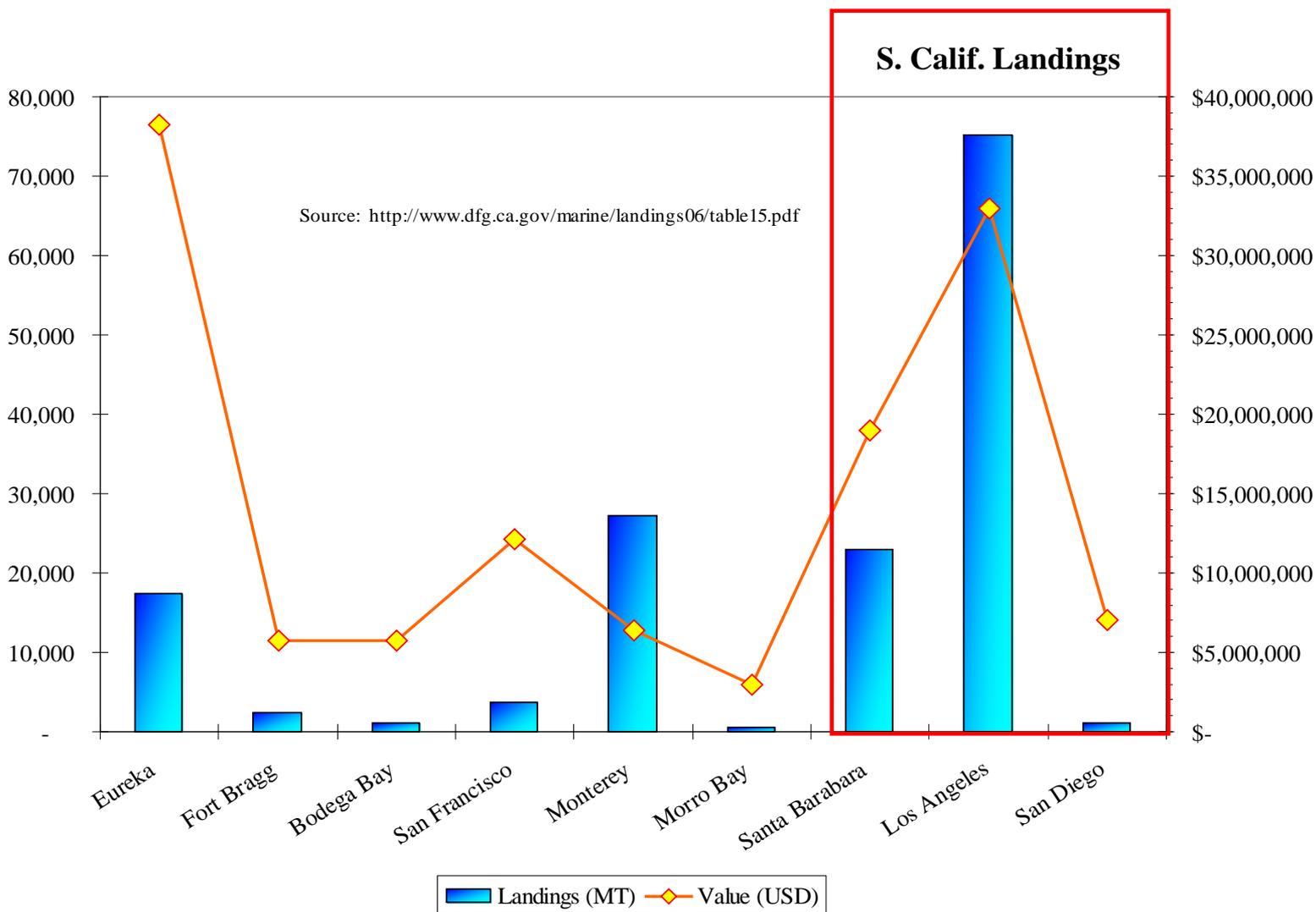
Total harvest = \$7 million



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

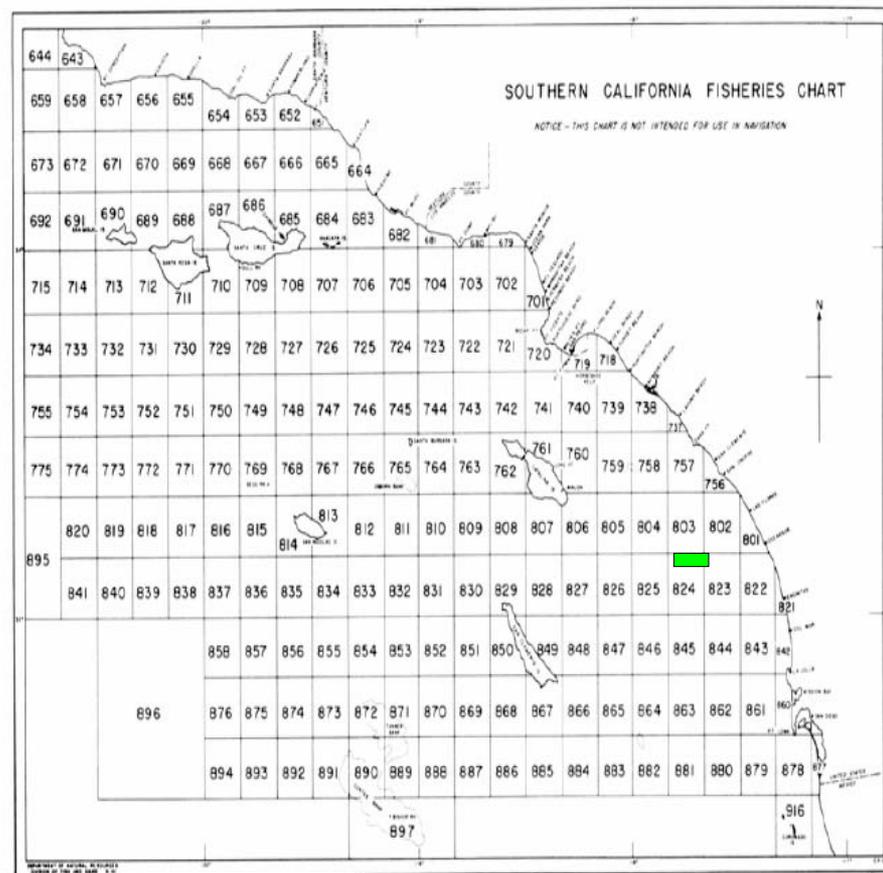


FIGURE 36. Chart showing Fish and Game block areas.



Next Steps

- Federal permits
 - Army Corps of Engineers
 - Section 10 permit
 - NEPA Review (*still awaiting public scoping process*)
 - Environmental Protection Agency NPDES
- State reviews
 - Dept. of Fish & Game aquaculture registration
 - Coastal Commission consistency certification

Visit www.hswri.org/offshore for more information



Summary Observations

- Economic Effects
 - Proposed project would increase existing landed value by more than 300%
 - 100K MT operation would add \$300 million to landings
 - Boost ailing commercial fishing and processing economy
- Environmental Impacts
 - Cages will likely provide increased habitat for wild fish
 - Predicted negligible impacts to water column and benthic habitats
- Policy Implications
 - Provide net conservation benefits to ocean management
 - Sets template for development of larger industry
 - Begins to delineate rate limiting factors to a larger industry



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.).



“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



Questions?



“We must learn to farm the sea as we farm the land.”

Jacques Cousteau Conservationist

“California is a world leader in agriculture, why can’t we be a world leader in aquaculture?”

Dr. Devin Bartley, CA Aquaculture Coordinator

“As wild fish stocks decline, it is important to be able to have more aquaculture.”

Honorable Gary Locke, Secretary of Commerce

HABITAT COMMITTEE REPORT ON PROPOSED OFFSHORE AQUACULTURE
DEMONSTRATION PROJECT

The Habitat Committee (HC) heard presentations from Mr. Don Kent of Hubb/Sea World on the proposed offshore aquaculture demonstration project, and Mr. James Ferro of the Ocean Conservancy on the cumulative impacts of aquaculture as well as impacts from inadequately regulated aquaculture projects. The HC discussed whether or not it would be appropriate to have national standards for marine aquaculture, and was pleased to learn that NOAA is considering developing such standards. An opportunity for further comments on the specific Hubbs/Sea World proposal will occur once the National Environmental Protection Act process is underway.

PFMC
09/13/09



Agenda Item B.3.d
Supplemental Public Comment PowerPoint
September 2009

The Future of U.S. Marine Aquaculture on the Pacific Coast

Pacific Fishery Management Council
September 13, 2009

James Ferro
Policy Analyst, Aquaculture Program
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The Future of U.S. Marine Aquaculture on the Pacific Coast

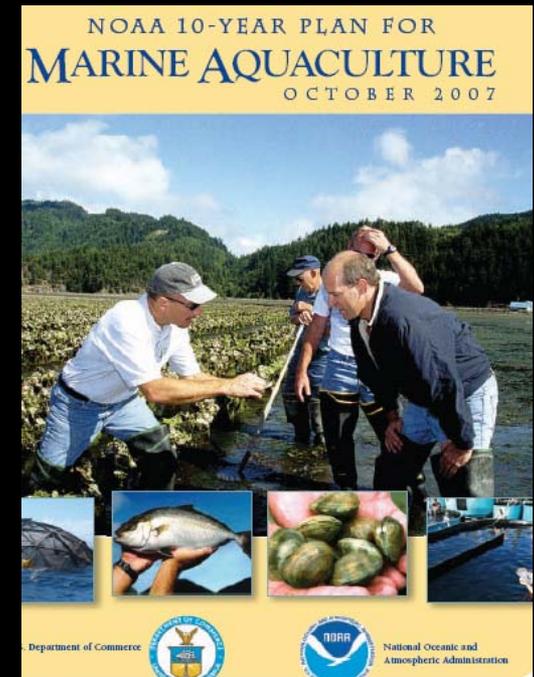


1. The Need
2. The political landscape
3. Environmental/social impacts
4. National framework
5. Role for Councils



Sustainable Seafood

- 80% wild fisheries overexploited or fully exploited
- Fish farming is growing worldwide
- US imports 84%- half is farmed
- \$9.9 billion “seafood deficit”
- 10.5 billion lbs. imported
- NOAA aims to increase domestic marine aquaculture 3X by 2025





Seafood Imports in 2008 = 10.5 billion lbs.

- 30 farms at Hubbs-SeaWorld production
+
• 100 farms at Kona Blue production
=
• Less than 3% of US seafood imports



Or....



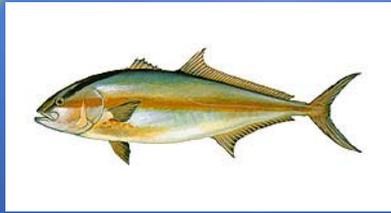
Seafood Imports in 2008 = 10.5 billion lbs.

- 1,600 farms @ Hubbs-SeaWorld production
- +
- 13,000 farms at Kona Blue production
- =
- 100% of US seafood imports

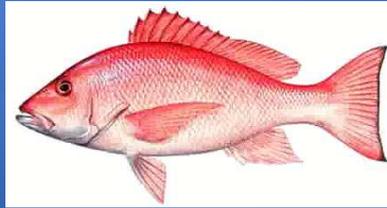


Where are all of these farms going to go?

U.S. Marine Aquaculture is On-The-Rise



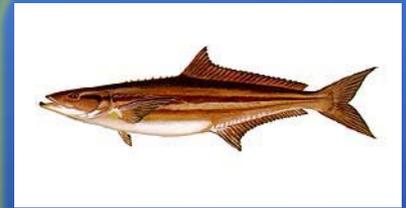
**Amberjack
(Hawaii)**



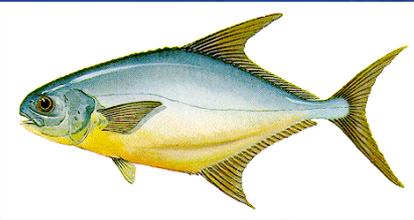
Red Snapper



Red Drum



**Cobia
(Puerto Rico)**



Florida Pompano



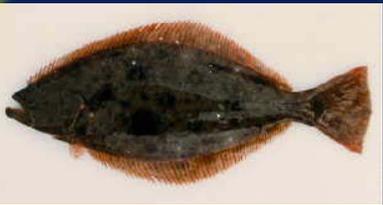
**Atlantic Salmon
(Maine, Washington)**



Summer Flounder



Mutton Snapper



**Halibut
(New Hampshire)**



**Pacific Threadfin
(Hawaii)**



Atlantic Cod



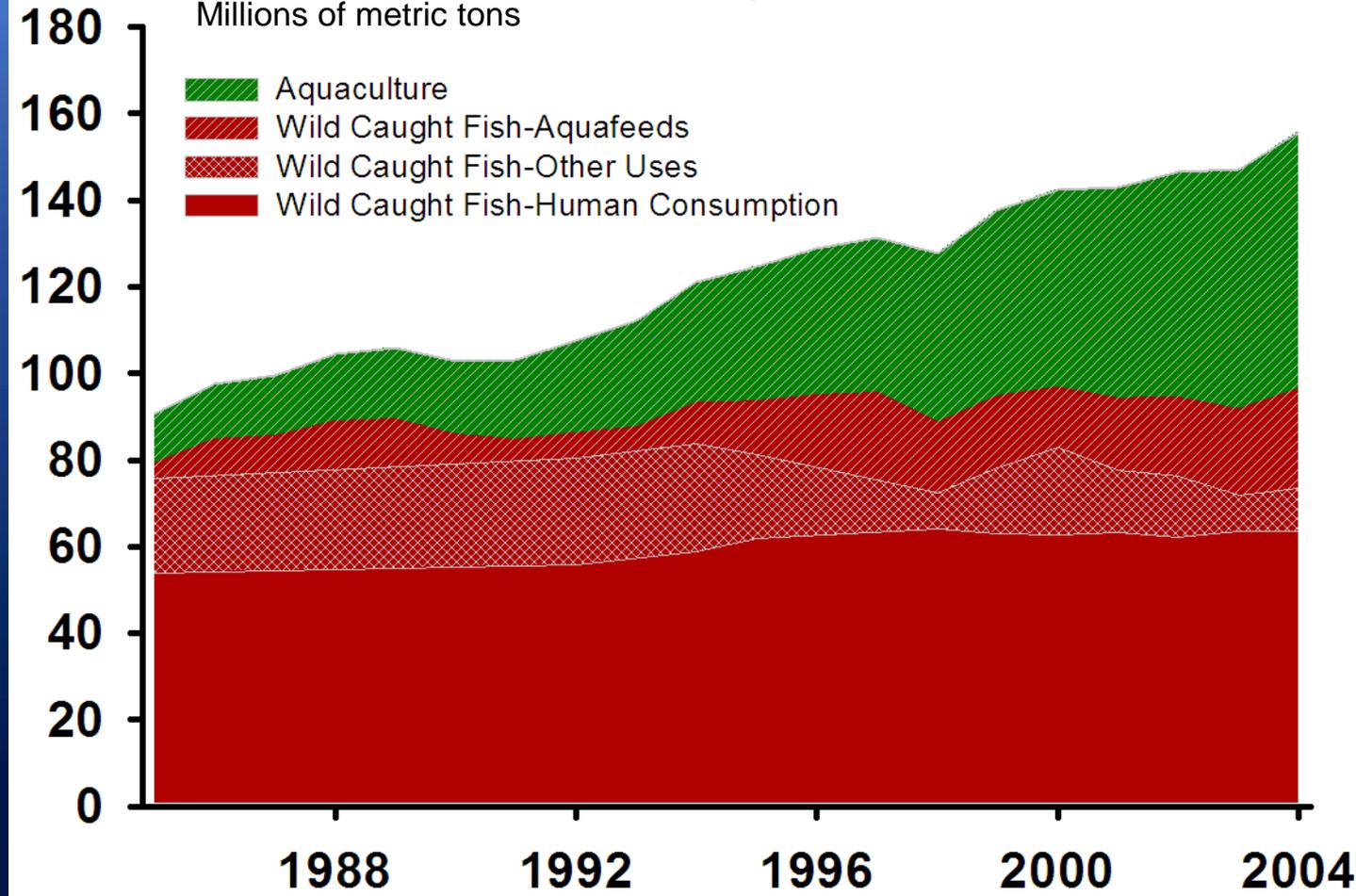
**Haddock
(New Hampshire)**

Aquaculture is Growing - Fisheries are Not

Global Fisheries and Aquaculture Production

Millions of metric tons

- Aquaculture
- Wild Caught Fish-Aquafeeds
- Wild Caught Fish-Other Uses
- Wild Caught Fish-Human Consumption



Aquaculture

Wild: Aqua feeds

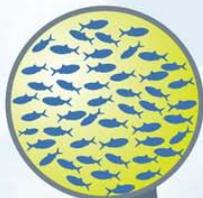
Wild: Other Uses

Wild: Human Food

Environmental Impacts of Open-Ocean Aquaculture

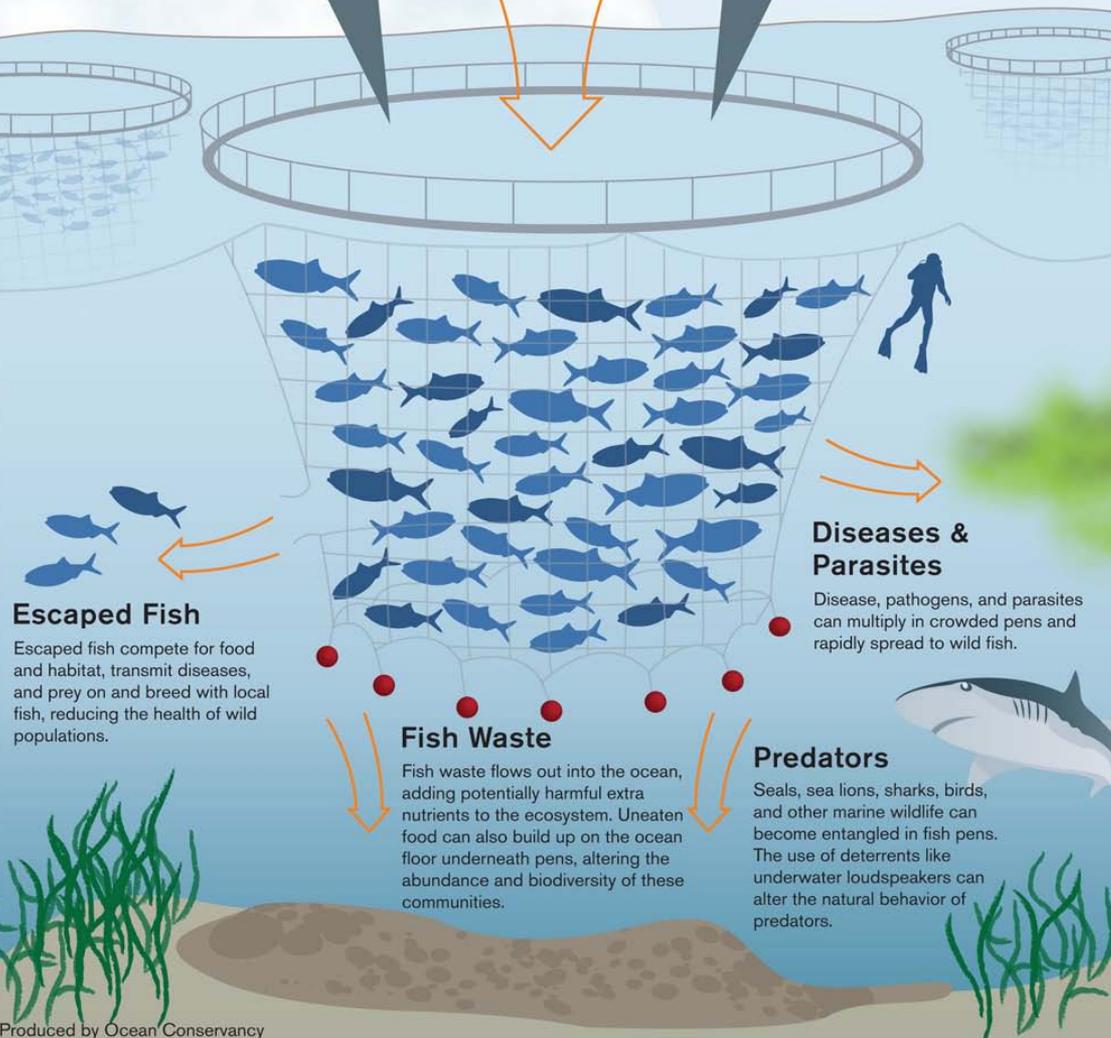
Fish Meal & Fish Oil

Using wild-caught fish to feed farmed fish puts additional pressure on these populations and can impact other wildlife that depends on them for food.



Drugs & Chemicals

When used, antibiotics, parasiticides, and other chemicals flow out of pens and can affect wild fish as well as the broader marine ecosystem.

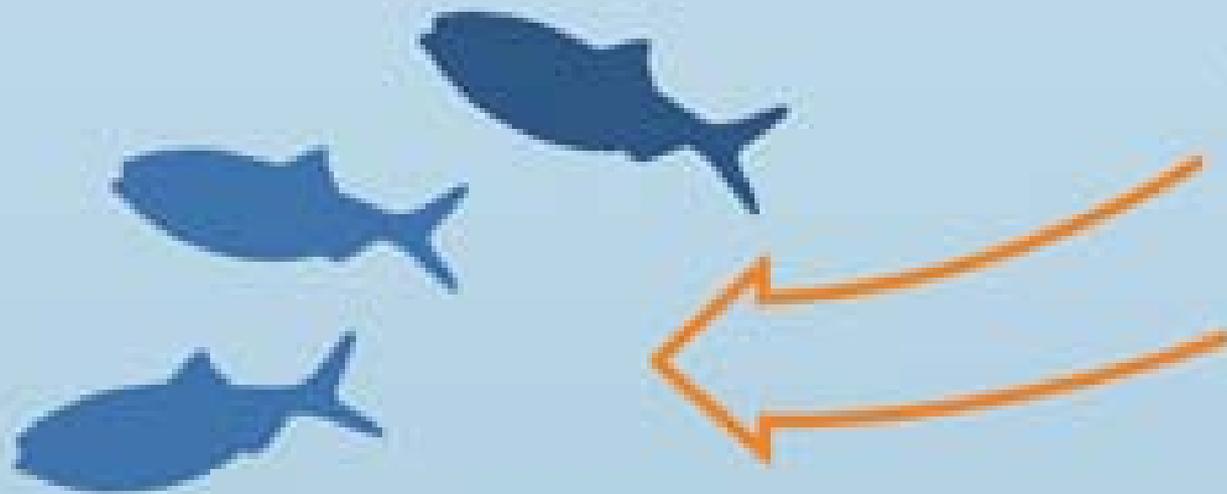


97% of Fish Oil by 2010
(IFFO 2007)

10.2 Million Farmed Salmon Escaped between 2000-2006
(Kavanagh et al 2007)

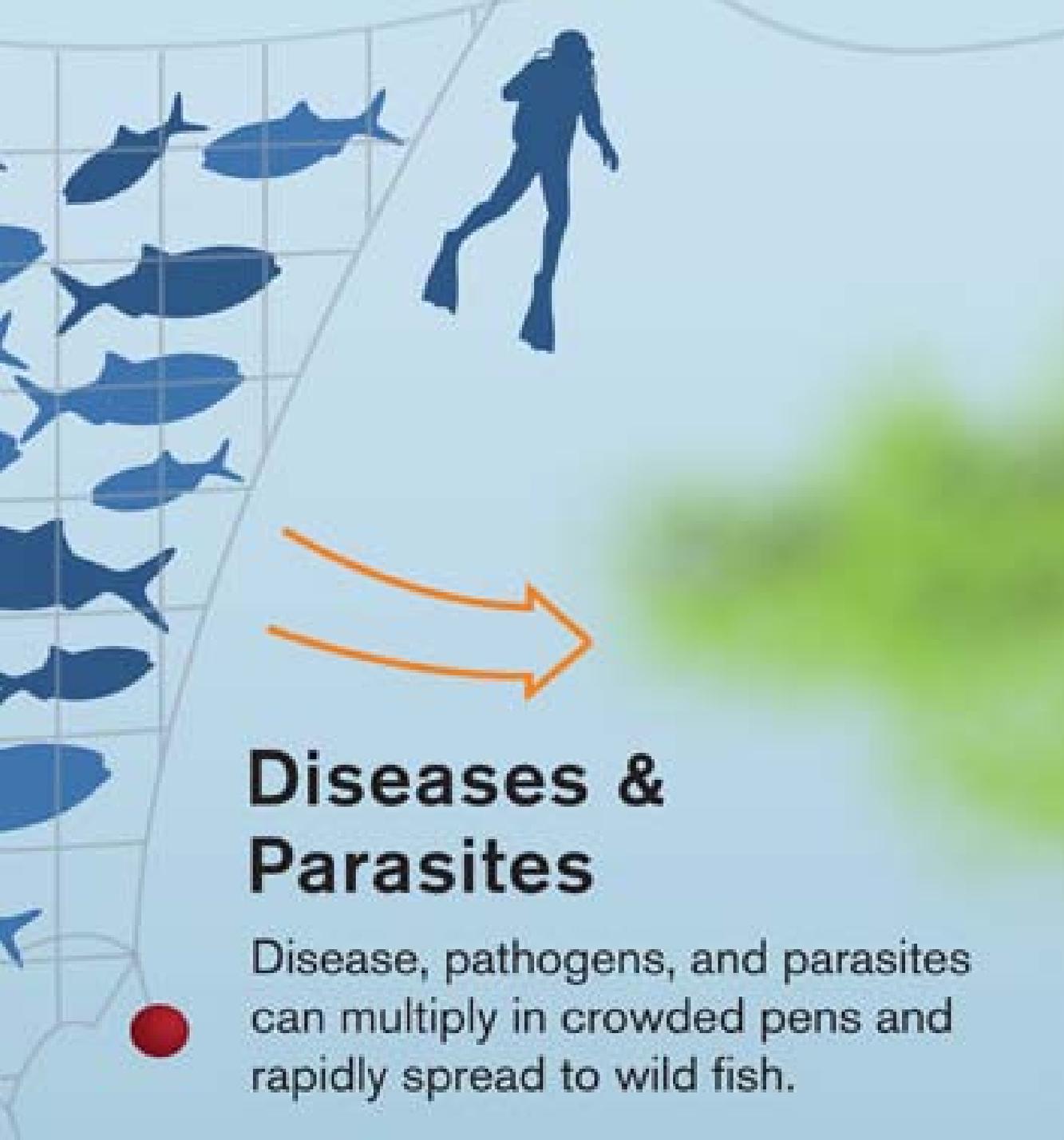
50% Decline in Survival per Generation
(Ford and Myers 2008)

\$5 B US Industry = N from 17 M people
(Goldburg & Naylor 2005)



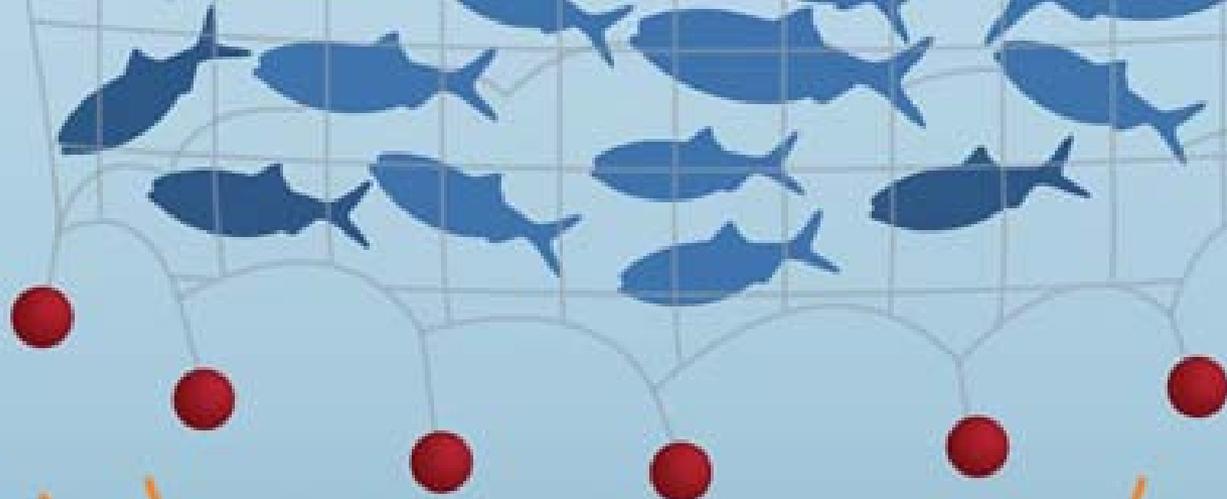
Escaped Fish

Escaped fish compete for food and habitat, transmit diseases, and prey on and breed with local fish, reducing the health of wild populations.



Diseases & Parasites

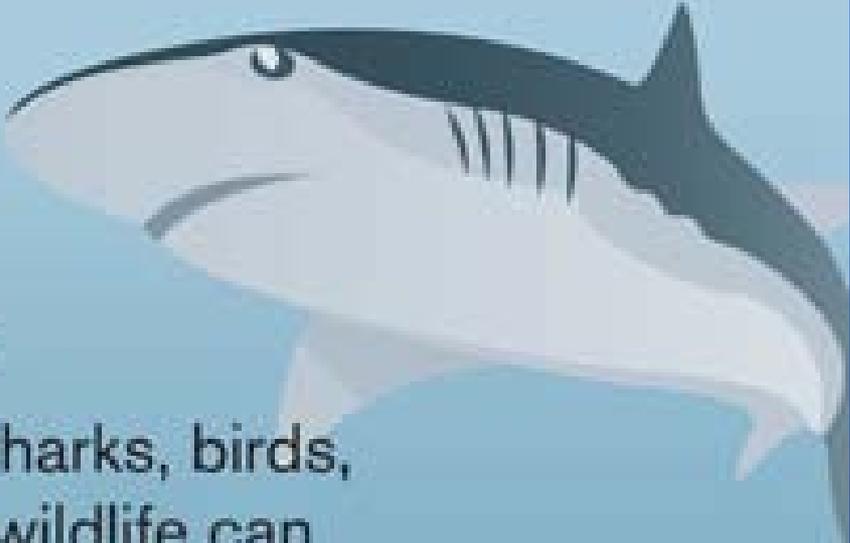
Disease, pathogens, and parasites can multiply in crowded pens and rapidly spread to wild fish.



Fish Waste

Fish waste flows out into the ocean, adding potentially harmful extra nutrients to the ecosystem. Uneaten food can also build up on the ocean floor underneath pens, altering the abundance and biodiversity of these communities.





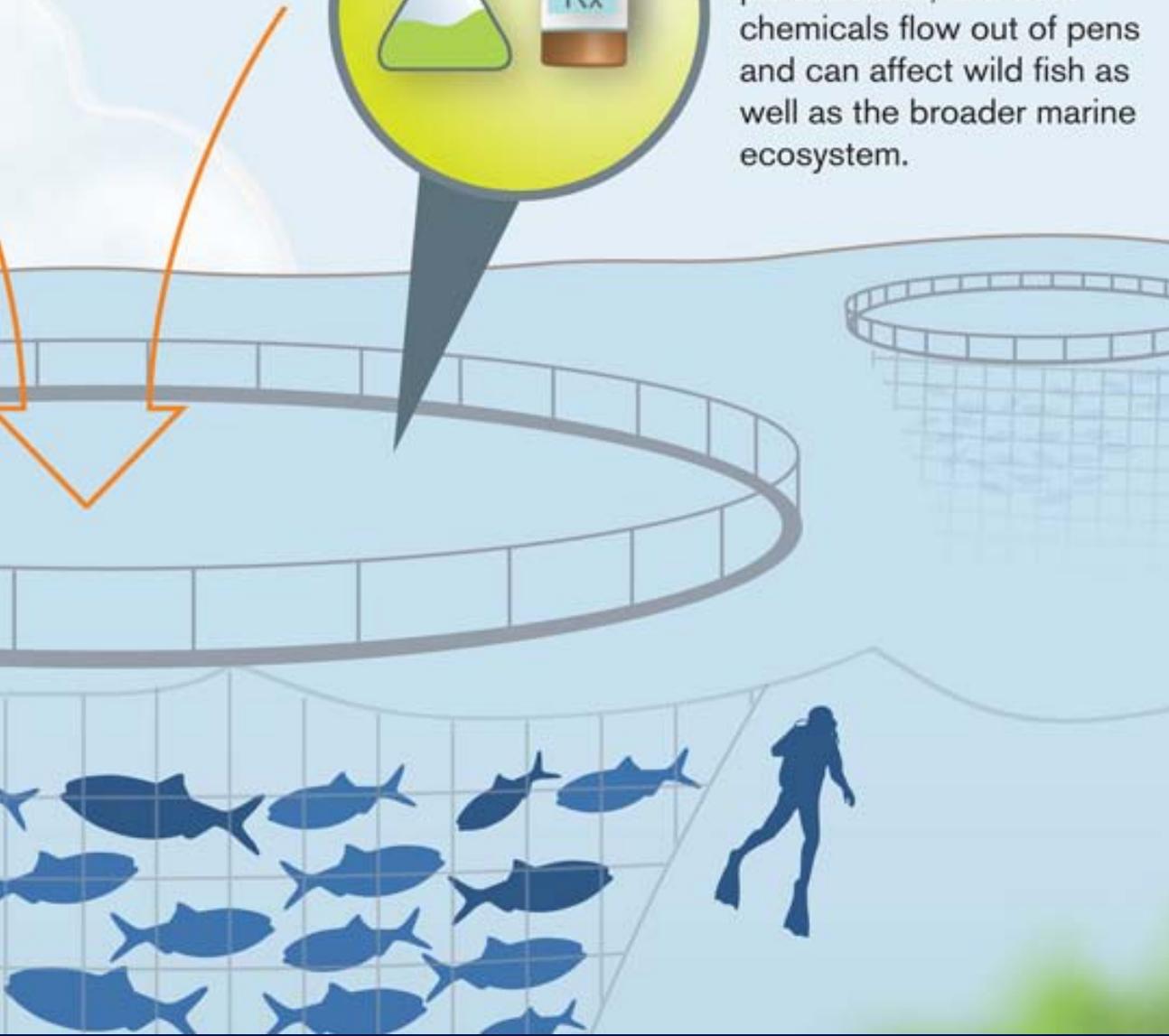
Predators

Seals, sea lions, sharks, birds, and other marine wildlife can become entangled in fish pens. The use of deterrents like underwater loudspeakers can alter the natural behavior of predators.



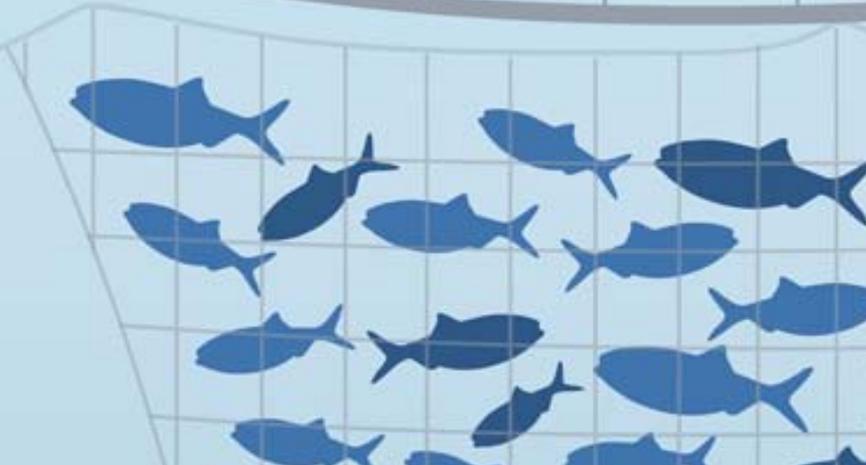
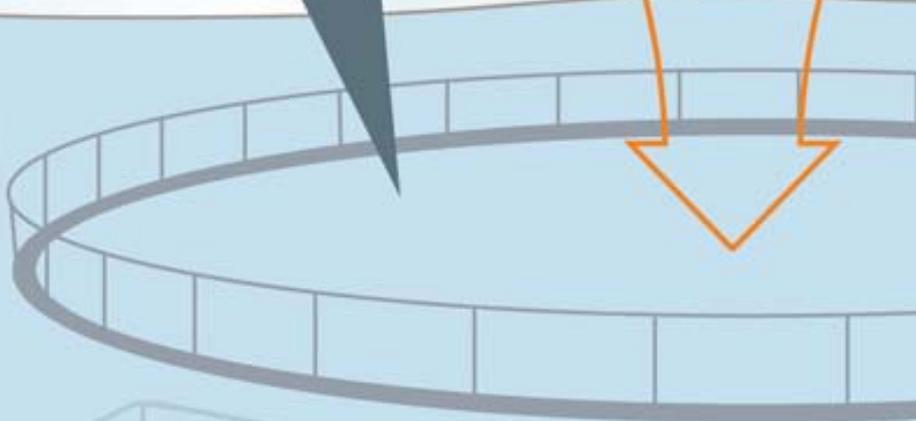
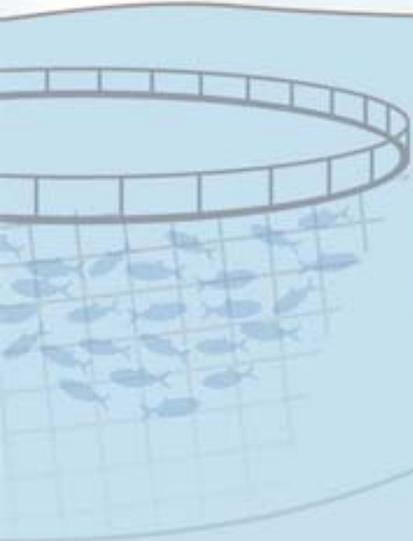
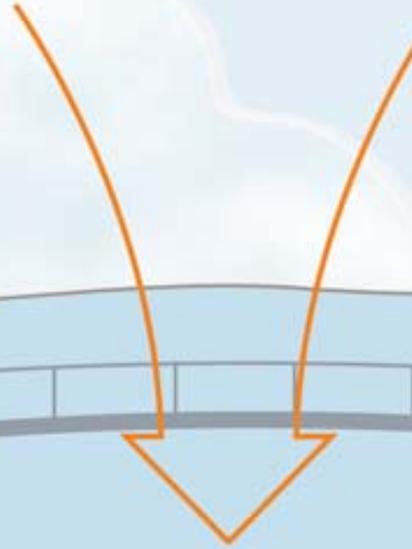
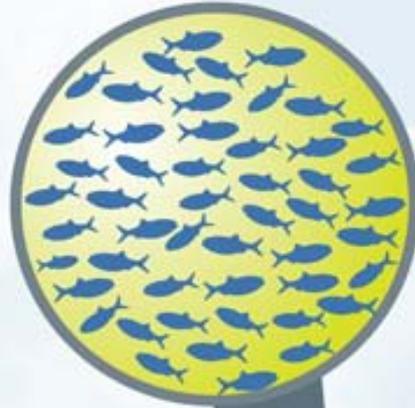
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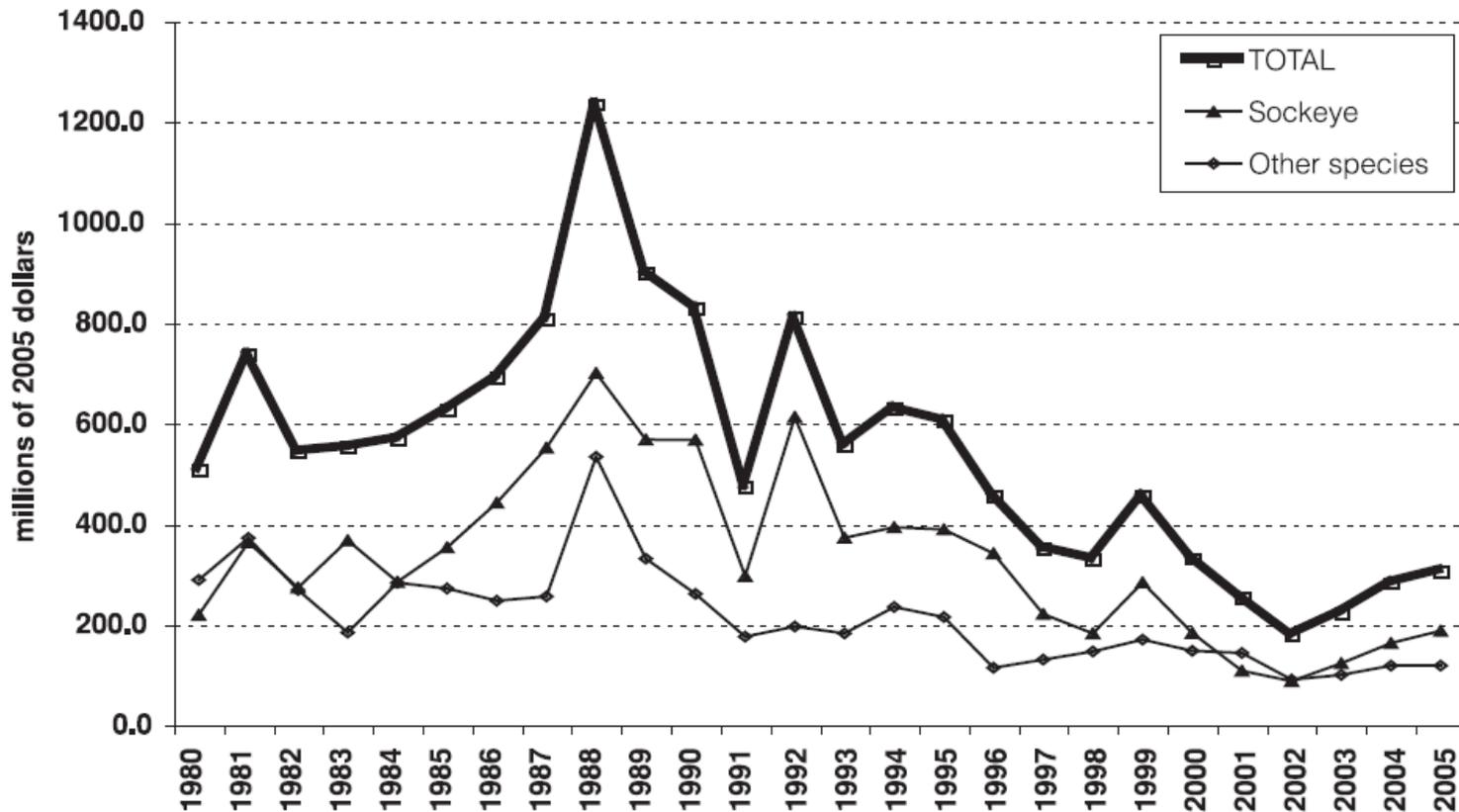


Socio-economic impacts to fishermen

Alaska Salmon ex-vessel prices (1980-2005)

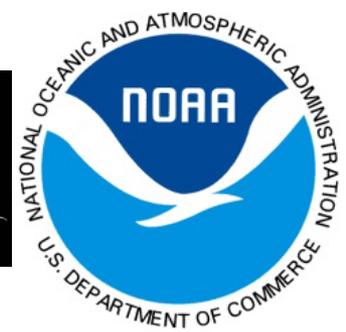
Figure 2

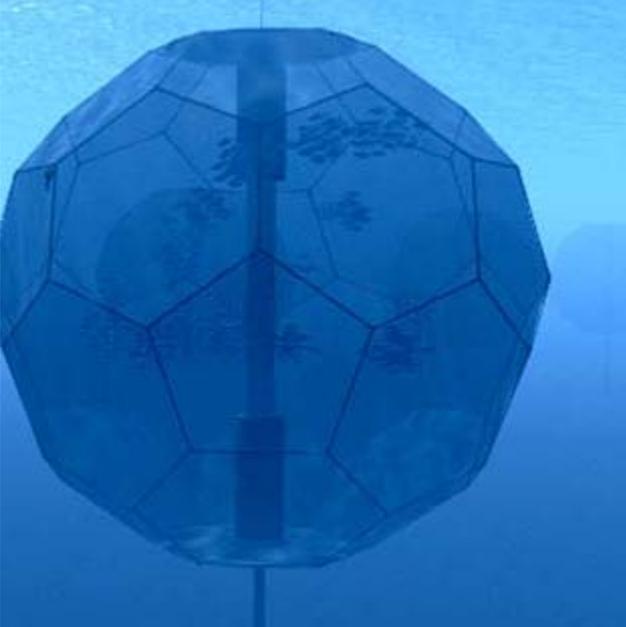
Real Ex-Vessel Value of Alaska Salmon Catches, 1980-2005



Source: CFEC Alaska Salmon Summary Data 1980-2005. Adjusted for inflation based on Anchorage CPI.

The Bigger Picture: We Need a Vision

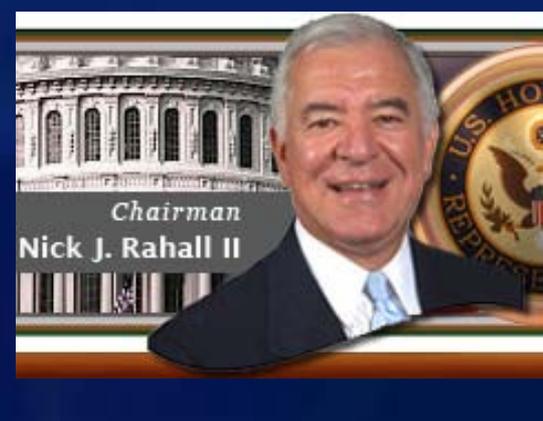
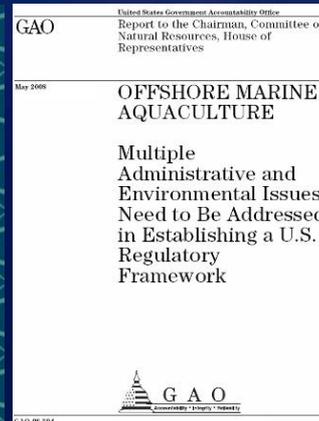
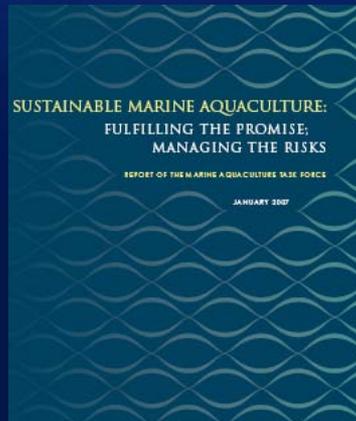
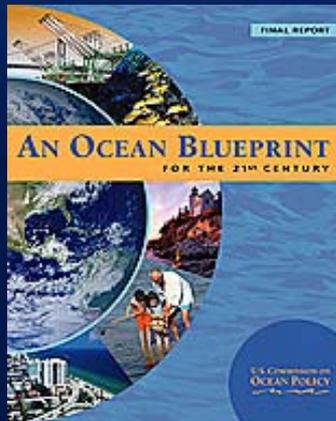
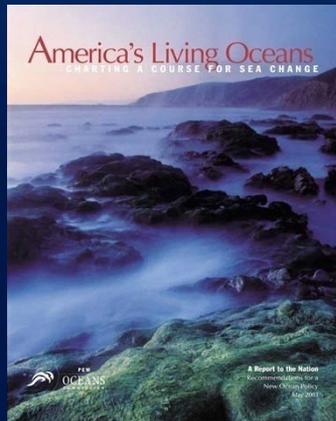


| Gulf of Mexico | Hubbs-SeaWorld | Hawaii |
|--|---|--|
| <p>Secretary of Commerce approved the Gulf Council's Aquaculture FMP this month to expand offshore aquaculture in Gulf of Mexico</p> | <p>Hubbs argues farm will "demonstrate both economic success and environmental compatibility" and "promises immediate commercial viability"</p> |  |

U.S. needs national standards for open ocean aquaculture BEFORE regulatory experimentation

The Call for a National Framework

- Plan is needed *BEFORE* industry expansion
 - Pew Oceans Commission
 - U.S. Commission on Ocean Policy
 - Marine Aquaculture Task Force
 - Government Accountability Office
 - House Natural Resources Committee



Pacific Fishery Management Council and the National Dialogue



- Fishery Management Councils must participate in shaping their role under NOAA's new federal regulatory framework.
 - Councils should insist that no commercial aquaculture facility be permitted without the express approval of the fishery management council with jurisdiction.
 - Any aquaculture development should be for species not likely to compete with sustainably managed U.S. fisheries.
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Thank you...

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