

# Sturgeon Farming & the Long View

## Sterling Caviar visit (May 2015)



**White Sturgeon** (*Acipenser transmontanus*)

- White sturgeon aquaculture started with research at UC Davis in 1979; Prof. Sergei Doroshov is considered the Father of Sturgeon Aquaculture.
- Commercial farming of sturgeon began soon after, starting with a handful of farms in northern California in the early 1980's before spreading worldwide.
- Sterling Caviar represents the consolidation of multiple area facilities, including Stolt Seafarm at Wilton (started in 1983), Sierra Aquafarms at Elverta, which was a pioneer in water recirculating technology and started in 1985, and the Buena Vista coldwater facility near Ione CA.
- The first farm-raised caviar in the world came from here in 1993. Culinary acceptance has gradually grown to dominate the market, with chefs preferring the environmental sustainability and consistent quality of farm-grown product.
- Today, Sacramento is the caviar capital of America, with local farms accounting for approximately 80% of US supply.
- While it takes an estimated 20+ years for a female white sturgeon to mature in the wild, it takes about half that time on Sacramento area farms where their water remains warm year-round. Still, a crop that takes 8-10 years before harvest represents a substantial investment in capital and risk, unmatched in conventional agriculture.
- Initial broodstock originated from the Sacramento River and San Francisco Bay; requiring changes in Fish & Game Code, both to make the collection of breeders legal, and to clarify ownership of the progeny resulting from such captive spawns.
- Sterling produces nearly 12 tons of caviar and approximately 180 tons of sturgeon meat annually. Global supplies from farms have stepped up to replace wild harvests from the Caspian Sea, where a moratorium is in place to protect and allow recovery of wild sturgeon populations. Chinese caviar production is ramping up steeply, aiming to quadruple supply in the next decade.
- Caviar prices and preferences vary depending on color, texture, and flavor.
- Area sturgeon farms are a great example of water conservation, both through recirculation and by sharing their discharged waters. At the Elverta site, adjacent wetland habitat for endangered species (Natomas Basin Conservancy) is entirely dependent on Sterling; at this and other locations, neighboring farmers also re-use the water for crop and pasture irrigation.



Bobby Renschler – Production Manager, Sterling Caviar  
Photo: Jonathan MacKay

## Translating Success throughout California Aquaculture



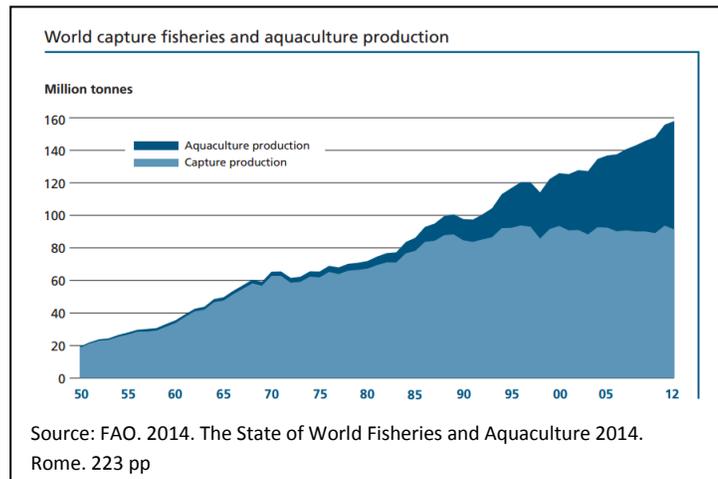
Shaoching Bishop – Managing Director at Sterling Caviar, hands out samples while Bobby Renchler describes the Italian made caviar tins.  
Photo: Miho Umezawa

Growing a crop like sturgeon caviar, which takes a decade to yield its harvest, requires commitment. Growing a successful industry based on such challenges takes committed collaboration – contributions from academic research and their funding institutions (like Sea Grant, USDA, and the University of CA), from cooperative regulators (who needed to adjust conventional thinking and create new rules for this new activity), and the long-term private investment of capital, labor, and patience – all came together to make California sturgeon aquaculture the success story it is today.

California has a similar opportunity to look ahead and meet the challenges of the next 30 years with a long-term view:

### Consider:

- With a world population topping 9.3 billion by 2050, more food will be needed in the next 35 years than was produced during the last 8000 years.
- A significant boost in the global middle-class (particularly Asia) over the next 35 years will translate into an even greater proportion of the seafood we now import being kept and purchased locally by producer countries.
- California has the spatial, climate, and waterfront resources to support a significantly expanded marine aquaculture industry, one that is not reliant on competing for precious freshwater resources.
- From the same amount of feed, farmers can produce: one pound of beef, two pounds of pork, four pounds of poultry, or **SIX** pounds of fish.  
Expanded aquaculture development in California makes resource and economic sense.
- With over 90% of US seafood being imported, much of it at great expense to the world's carbon footprint, increased local aquaculture production can lessen our greenhouse gas impact and contribute to the state's economy.



In response to these challenges, researchers from UCSB, using marine spatial planning tools, have identified suitable areas to expand marine aquaculture in the Southern California Bight. →

## PROJECT BRIEF:

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

Funded by: California Sea Grant

Project Team: Marine Science Institute and Bren School of Environmental Science, UC Santa Barbara and Biological Sciences Department, Cal Poly

## The Challenge

Demand for seafood in the United States and around the world continues to rise, driven by population growth and escalating per capita consumption. As a result, aquaculture is increasingly proposed as a potentially sustainable option to meet this demand. Given intense competition for space on land and in coastal bays and estuaries, many are looking to open water or offshore aquaculture as an innovative solution. Offshore aquaculture represents an opportunity to bring economic development to coastal communities, decrease our reliance on foreign imports and overharvested wild stocks, overcome potential downsides of other types of aquaculture, and ensure that high quality seafood products reach American consumers. However, offshore aquaculture is not without its own challenges, as aquaculture can interact with other ocean uses like wild fisheries and can result in negative environmental impacts such as nutrient enrichment and spread of disease.

## The Solution

Proactive, scientifically-informed marine spatial planning (MSP) for offshore aquaculture has the potential to minimize undesirable interactions and impacts, while maximizing the benefits provided by increased aquaculture production.

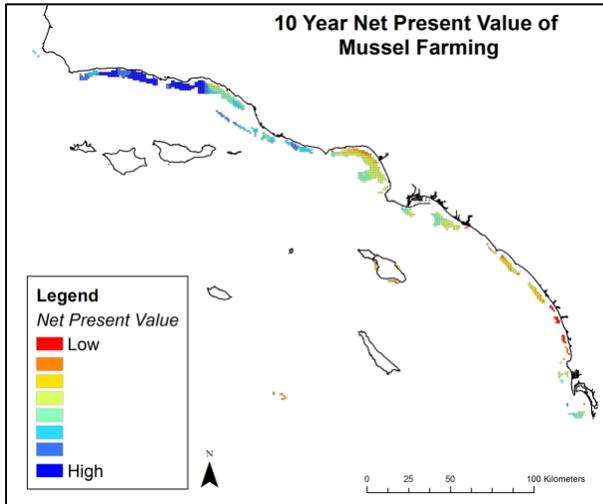
## Project Approach

We have developed a new quantitative spatial planning framework that informs offshore aquaculture siting by minimizing the economic and environmental tradeoffs between offshore aquaculture development and other existing and planned marine uses. We applied this framework to a case study of aquaculture development (for finfish, shellfish and seaweed culture) for the Southern California Bight.

## Key Results to Advance Open Ocean Aquaculture Development in California

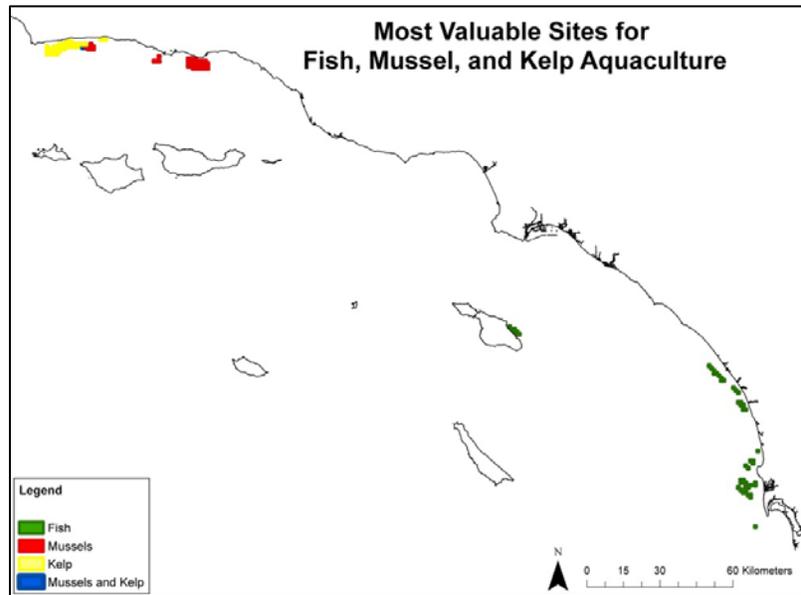
We began by determining which areas of the Southern California Bight are not suitable for aquaculture development due to environmental factors (such as hard bottom habitat), technological limitations (such as depth), or existing incompatible uses (such as marine protected areas or shipping lanes) and excluded these areas from our study area. This analysis revealed over 1000 locations within the Southern California Bight (at a resolution of 1 km<sup>2</sup>) where aquaculture could potentially be developed (figure, right).



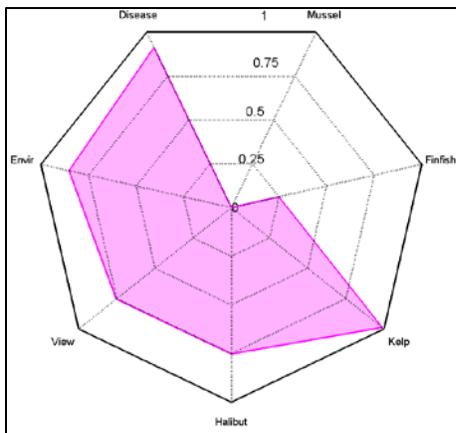


For each of the three aquaculture types (finfish, shellfish, kelp), we have developed production and cost models based on species that could feasibly be grown in southern California. Aquaculture yields (production) will be impacted by environmental conditions that vary over space (e.g. water temperature, currents, productivity, etc.), and economic costs of production will vary based on environmental conditions (e.g., wave height, depth) and geographic location (e.g., distance from port). By putting together a revenue model (based on production and prices) and a cost model, we are able to evaluate the value of each developable cell to the aquaculture industry, represented as a 10 year net present value (figure, left). When examining

the most valuable areas for each aquaculture type, we found that the best locations for kelp and mussels were clustered in the north, and the best areas for finfish were clustered in the south (figure, right). However it is important to note that these maps were made based on example species; the most suitable areas could change if different target species are evaluated.



We then examined tradeoffs between these three types of aquaculture and: 1) wild fish populations specifically California halibut, and the associated recreational and commercial fisheries, 2) environmental health, specifically the effects of nutrient enrichment on the seafloor (from finfish aquaculture, 3) viewshed quality given that offshore aquaculture



will interrupt the view from coastal locations, and 4) disease risk from aquaculture (both in terms of spread to other farms and to wild populations), focusing on the increased risk resulting from greater connectivity among farms. We then conducted a tradeoff analysis examining the millions of possible permutations of developing these feasible planning areas with the three aquaculture scenarios. For any possible spatial plan, we can examine how that plan performs for the seven objectives (figure, left) and determine where tradeoffs between these objectives can be minimized through spatial planning. Our analysis will identify a range of spatial plans that provide optimal outcomes when planning for aquaculture development in the context of multiple ocean uses.

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