# HSWRI Aquaculture Program Research Report
# **** June & July 2014 ****

## Measures of Egg Quality in Marine Finfish and Factors That Affect Them

HSWRI and a network of collaborators recently initiated a three year project funded by USDA's Western Regional Aquaculture Center (WRAC) with the goal of identifying easy-to-use indicators of egg quality, as well as documenting factors that affect them. This research will be applied to three ecologically different and economically valuable marine fish species native to the U.S. West Coast: a coastal pelagic, the California yellowtail (*Seriola lalandi*; YT); a deep-sea whitefish, the sablefish (*Anoplopoma fimbria*; SF); and a benthic flatfish, the California halibut (*Paralichthys californicus*; CH). Sablefish research is being conducted at NOAA's Northwest Fisheries Science Center's (NWFSC) Manchester station in Washington. At HSWRI, CH and YT broodstocks have been spawning through the summer. Information from each spawn event is being collected including: egg viability, fecundity, egg and oil size, hatching rate, yolk sac length, and larval survival to first feeding. Collaborators at NWFSC and the University of Idaho are analyzing sub-samples of eggs for biochemical composition. Collaborators at NOAA's Southwest Fisheries Science Center in La Jolla are using genetic techniques to assign parents to each spawn event, so quality characteristics can be linked to parentage.

As part of this project we will explore how various supplements in broodstock diets can affect egg quality and early larval survival, toward the goal of optimizing broodstock diets. To accomplish this, adult YT will be partitioned into four pools of 12m$^3$ each allowing for two treatments with two replicates. The new broodstock maturation systems are currently under construction and slated to be completed this summer so they can be stocked with fish. Initially we will compare broodstock diets supplemented with arachidonic acid against diets that are not supplemented.

**Figure 1.** Construction of new broodstock nutrition research area.

Other supplements will be evaluated in subsequent trials. Broodstock feed intake and growth will be recorded routinely along with basic egg and larval quality parameters. California Sea Grant is providing outreach support for the project to communicate the results effectively to the commercial sector.

## Opportunities to Recycle Fish Trimmings from Commercial Processors in Southern California

As part of our ongoing research to help develop sustainable aquaculture practices, HSWRI has been working with partners at NOAA to evaluate opportunities to recycle fish trimmings into feeds for fish. Historically much of the trimmings have been disposed of at sea or in a landfill. We used commercial landings data from the California Department of Fish and Wildlife (DFW) to evaluate how much aquaculture feed could be made from fish trimmings supplied by processors in southern California. We analyzed data from 2011 with combined data for southern California coming from Santa Barbara, Los Angeles and San Diego Counties. The data were prepared for analyses by going through the following steps:

1. Combining all data from the three counties
2. Sorting by species and pooling similarlike fishes into common categories (e.g. multiple rockfish species into one)
3. Removing crustaceans and cartilaginous fishes from the dataset
4. Identifying and separating out baitfishes like anchovies, sardines and mackerel that would not be used as trimmings
5. Sorting by total biomass landed per year
6. Assigning percent contribution to the total biomass remaining in the dataset

**Figure 2.** Assortment of trimmings from a local processor.

A total of approximately 2.5K metric tons (MT) of bony fish was landed in southern California in 2011, excluding sardines (17.6K MT), anchovies (0.8K MT) and mackerel (1.3K MT). Of this total, the top 12 contributors accounted for 95% of the landed biomass (Table 1).

Using the total of 2.5K MT of bony fish biomass available exclusively to support trimmings-based aquafeeds and the results of our feeding trials, we modelled its potential

contribution to one or more commercial farms in southern California. Using assumptions that included a food conversion ratio (FCR) of 1.3, an average trim yield of 60%, and a trim inclusion level in the diet of 50% (we were successful as high as 82%), we find that annual fishery landings in southern California could support 35% of the feed needs for a typical 3,000 MT farm. If the trimings from the farmed fish are recycled in subsequent years, they would contribute another 60%, although you would not feed trimmings from harvested fish to farmed fish of the same species for biosecurity reasons.

**Table 1.** Fishery landings of select fishes in 2011 from southern California.

| Rank | Fish Species/Category | TOTAL (kg) | Relative Contribution (%) | Cumulative Contribution (%) |
|---|---|---|---|---|
| 1 | Sablefish | 330,176 | 25% | 25% |
| 2 | Thornyheads - all | 192,241 | 15% | 40% |
| 3 | Seabass, white | 187,353 | 14% | 54% |
| 4 | Bonito, Pacific | 110,459 | 8% | 62% |
| 5 | Tuna, bluefin | 107,376 | 8% | 71% |
| 6 | Halibut, California | 88,686 | 7% | 77% |
| 7 | Rockfish | 62,026 | 5% | 82% |
| 8 | Swordfish | 50,576 | 4% | 86% |
| 9 | Barracuda, California | 34,935 | 3% | 89% |
| 10 | Tuna, albacore | 30,922 | 2% | 91% |
| 11 | Sheephead, California | 30,510 | 2% | 93% |
| 12 | Hagfishes | 22,679 | 2% | 95% |
| | | 1,247,936 | | |

## White Seabass Broodstock get “Shuffled” for Stocking Program

HSWRI’s broodstock management program has evolved over the years as new information on breeding habits has been attained and more advanced biosecurity procedures and associated infrastructure have been implemented. Our management program for WSB now includes two 35$m^3$ pools dedicated to quarantine for newly collected wild fish. The water supply for these pools is sterilized and recirculated but not temperature controlled at this time. Additionally, we have an “extra” 44$m^3$ pool that is identical to the four primary breeding pools in volume and environmental control. This extra pool is currently being rotated into commission to allow maintenance on the other pools that have been in continuous service for 20 years. When all pools are back in service, this extra pool will be used to support the acclimation of new brood fish to temperatures aligned with the destination breeding pool for those fish.

This year we “processed” over 100 brood fish from three pools, representing approximately 50% of our captive inventory of brood fish. The fish weighed up to 25kg, which made the process that much more exciting! The processing involved culling older

fish from the population; obtaining current length and weight measurements; verifying the gender of those previously undetermined; translocating fish among pools for genetic mixing; and assessing fish condition.

**Figure 3.** HSWRI researchers in action: (left to right) corralling WSB brood fish using vinyl barriers and slings; determining fish sex via biopsy; performing necropsies to assess health status.

## Acknowledgements

This document reports on aquaculture research projects supported by numerous grants, contracts and private contributions. It also represents the hard work of many dedicated staff and volunteers throughout southern California, as well as collaborators around the country. This information was contributed by HSWRI staff and compiled by Senior Research Scientist and HSWRI Aquaculture Program Director Mark Drawbridge.

The aquaculture research program has been active for more than 35 years at HSWRI. The primary objective of this program is to evaluate the feasibility of culturing marine organisms to replenish ocean resources through stocking, and to supply consumers with a direct source of high quality seafood through aquatic farming. Please direct any questions to Mark Drawbridge at mdrawbridge@hswri.org.

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- Santa Monica Seafood
- SDG&E Environmental Champions
- SeaWorld Parks and Entertainment
- SeaWorld San Diego
- The California Department of Fish and Wildlife's Ocean Resources Enhancement and Hatchery Program
- The Catalina Seabass Fund
- The Fletcher Foundation
- The Shedd Family
- The U.S. Fish and Wildlife Service's Sport Fish Restoration Account
- United Soybean Board
- USDA National Institute of Food and Agriculture
- Western Regional Aquaculture Center (WRAC)

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