# HSWRI Aquaculture Program Research Report
# **** December 2015 - January 2016 ****

## How Do Hatchery-Reared Yellowtail Stack up to Wild Ones?

HSWRI is collaborating with NOAA's Southwest Fisheries Science Center and the University of San Diego (USD) on a comparative study between aquaculture-reared California yellowtail (*Seriola dorsalis*) and juvenile yellowtail collected from the wild. This work aims to examine the growth rate, food conversion efficiency, metabolic rate, critical swimming speed, and muscle morphology of aquaculture-reared yellowtail in comparison to wild caught individuals in order to inform best rearing practices. Previous collaborative work with NOAA and USD has shown that wild caught individuals are typically more fit than their aquaculture-reared counterparts (likely associated with having to avoid predators and track down agile prey in the wild) and that aquaculture-reared yellowtail that are exposed to more active swimming regimes in specialized tanks have increased fitness and growth rates. The first component of this project is to determine if such fitness and growth advantages are retained once fish are no longer exposed to a constant swimming regime (i.e., wild fish brought into captivity). If fitness is retained, this would indicate that continuous swimming during early development has lasting effects on fish fitness and growth.

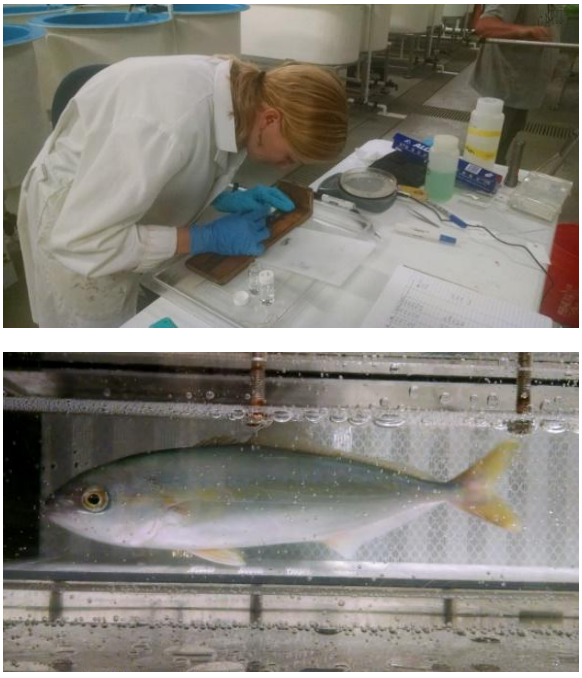

**Figure 1.** USD graduate student, Laura Schwebel, takes muscle samples of juvenile California yellowtail (top). Juvenile California yellowtail in the respirometer being tested for initial metabolic rate and critical swimming speed (bottom).

The logical extension of this concept and second component of this project will be to provide a swimming stimulus (i.e., constant current through specially-designed fish raceways) to juvenile fish in an aquaculture setting to increase their fitness and help promote more natural muscle development and growth in captivity. Initial data collection to look at fitness retention began in October of 2015 when juvenile wild-caught and aquaculture-reared fish were weighed

and starting fitness and health parameters were quantified. Muscle samples were taken to assess fiber diameter and the red to white muscle ratio. In addition, a subsample of each group was put through fitness testing in a swim tunnel respirometer to assess critical swimming speed and metabolic rate. These fish are currently in a grow-out phase, after which their fitness will be tested again, and final measurements will be taken to assess growth and food conversion rates. Assuming fitness is retained during grow-out, next summer we plan to expose juvenile yellowtail to varying forced swimming regimes to examine their long term effects on yellowtail growth and fitness.

## What's On Tap for 2016 at Our Mission Bay Laboratory? Here's a Sampler.

The start of the New Year is always exciting as we start to implement plans that have been in discussion for several months. At our Mission Bay Laboratory we have been busy readying new systems to support larger-scale, more efficient larval rearing of yellowtail and halibut. These systems will be tested in 2016. First, following a pilot test of a self-cleaning larval rearing tank in 2015, we have moved to Version 2.0 with some significant improvements. Among these were the addition of an upright tank wall-cleaning component and improved center screen attachment equipment, as well as a reduction in overall internal surface area through trimming of stainless steel cleaning components. Subsequent testing of the functionality and efficiency of self-cleaning culture tanks will be compared against traditional tank designs using multiple marine finfish species. Funding from the USC Sea Grant was used to acquire four more tanks, including two that will be outfitted with self-cleaning mechanisms and two without to serve as controls (Figure 2). This brings the total number of tanks to five, with one of the self-cleaning tanks being installed in Carlsbad for testing by hatchery personal at that location.

**Figure 2. –** New larval production facility with self-cleaning rearing tanks and halibut raceways.

In addition to the newly installed larviculture systems, we have renovated 26 square meters of laboratory space that will be re-purposed for production of live feeds to support larval rearing (Figure 3). Once complete in early 2016, the production component of this project will be capable of growing more than two times the current quantity of rotifers (*Brachionus plicatilis*) and Artemia (*Artemia fransiscana*). This equates to 2 billion and 450 million live prey animals per day, respectively. These two organisms are the critical "first feeds" for all of our marine finfish species. This expanded capacity will translate into a two-fold increase in larval fish output potential from our rearing center. Moreover, because of the system's custom design, greater levels of biosecurity and production efficiency will be achieved.

The result will be cleaner and less-expensive production of live feeds. Finally, a 15 square meter room adjacent to the main live feeds production room will allow for extensive scientific trials to be completed aimed at improving the nutritive quality and efficiency of live feed organisms.

**Figure 3.** Newly constructed live feeds room for rotifers and *Artemia*.

Lastly, as an integral component to HSWRI's efforts towards stock enhancement, in combination with the self-cleaning culture tank project, a series of four shallow raceways are being installed within the biosecure larviculture facility. These systems will be purposed for the pilot-scale production of California halibut (Figure 2).

## A Look Back

Did you know that we have been producing these newsletters every other month since November of 2002? Yikes – how time flies! Back then we were collaborating with Dr. Shunsuke Koshio at the University of Kagoshima, Japan on fish nutrition. Two of his graduate students, Satoshi and Michiko spent about a month each in Carlsbad working on a feeding trial to examine the effects of vitamin C on performance of white seabass. Research Scientist Dave Jirsa was working to develop bioassay techniques in order to better understand the causes of early larval mortality in white seabass. HSWRI Growout Facility Coordinator Gabe Buhr was busy collecting data on feed consumption and growth of white seabass at growout facilities as well as in hatchery raceways. Dr. Mark Adkison, working in Ron Hedrick's Laboratory at UC Davis, was developing an ELISA (enzyme linked immunosorbent assay) to detect viral nervous necrosis virus (VNNV) in white seabass blood sera. HSWRI/SDSU Field Manager, Mike Shane, had just returned from Catalina Island where he implanted two cultured seabass with acoustic transmitters at the Catalina Seabass Fund growout facility managed by Posh Gardiner. The primary objective of this research was to understand patterns of movement and habitat use in cultured fish. The gillnet program finished its 2002 sampling and Mike reported that it was another excellent year for tag returns - more than 130 were retrieved.

**Figure 4**. Juvenile bocaccio being sampled for growth in the laboratory.

At our Mission Bay Laboratory, HSWRI researcher Paula Sylvia was coordinating a project to set up cold water breeding systems to evaluate the culture potential of various depleted rockfish species in California. In addition to research on rockfishes, three adult lingcod were donated from a local fishermen and a small number of cabezon larvae survived after hatching from an egg mass that was collected by SDSU's scientific collector, Constance Gramlich. Graduate students were busy in the field and in the lab. Jeff Smiley of University of San Diego (USD) was continuing to examine the effects of supersaturation on the health of juvenile white seabass. Lisa Louie of USD was studying behavioral differences between wild and hatchery-reared California halibut. Scott Aalbers of California State University Fullerton was developing a thesis project to use white seabass sound production to help identify spawning areas for this species.

The diversity of aquaculture research continues at HSWRI and its relevance towards conservation and food security has never been more paramount!

## 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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- H & M Landing
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- Poseidon Water
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- Western Regional Aquaculture Center (WRAC)

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