

HSWRI Aquaculture Program Research Report

*** August & September 2011 ***



Streamlining Live Feeds Production

In 2011, the Institute's aquaculture research team has put much effort into improving and streamlining systems and protocols that supply live feeds for rearing trials with California yellowtail (*Seriola lalandi*), white seabass (*Atractoscion nobilis*), California halibut (*Paralichthys californicus*) and yellowfin tuna (*Thunnus albacares*). New brine shrimp (*Artemia franciscana*) harvesting methods have been employed that save both time and money and result in a cleaner finished product. *Artemia* are purchased in bulk as dry cysts (resistant eggs), which need well-aerated seawater in order to hatch. Newly hatched *Artemia*, called nauplii, are an ideal primary or secondary feed for most larval fish, but they need to be physically separated from their eggshells. If separation is not done properly, larval fish will ingest these shells and can suffer from problems, such as bacterial infections of the gut or intestinal blockage. Traditionally, separation is facilitated by treating the cysts with a strong mixture of chlorine and sodium hydroxide in a process called "decapsulation". This treatment thins the cyst shell and allows it to float to the surface where it can be removed with relative ease. Unfortunately, decapsulation requires noxious and expensive chemicals and it is time consuming. Recent advances in *Artemia* technology, however, have yielded a new method and associated product called SEPArt (INVE Technologies, Dendermonde, Belgium). The SEPArt cysts are treated with a non-toxic magnetic coating (Figure 1a), and once hatched, the *Artemia*/shell mixture is passed through a tube containing magnets. The magnets capture the empty cysts, but live *Artemia* pass through and can be collected in a net (Figure 1b). The result is a clean, separated feed that requires less labor to prepare and fewer chemicals (i.e. more eco-friendly).

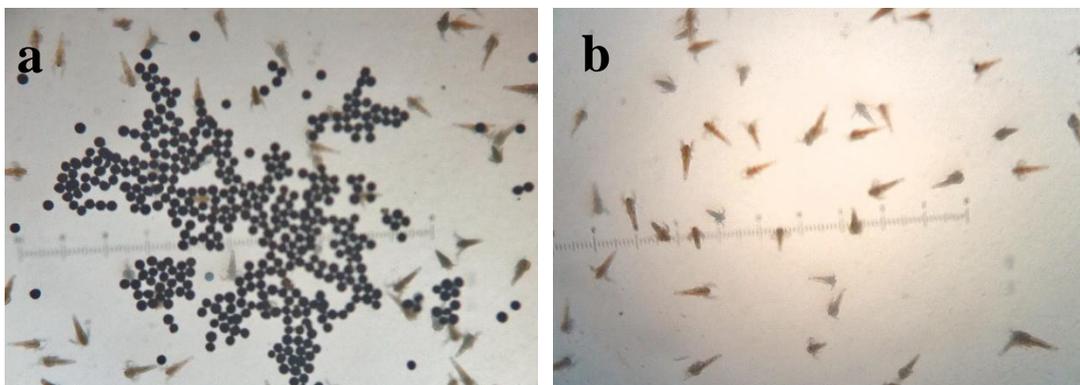


Figure 1. a) INVE Technologies SEPArt. Pre-separation *Artemia* and cyst (egg) shell mixture prior to being passed through the tube containing magnets (left); dark spheres are empty cysts that have been treated with the magnetic coating. b) *Artemia* free from their shells after separation are safe for larval fish to eat (right).

Larval fish with very small mouths (e.g. yellowtail) are fed microscopic aquatic animals called rotifers (*Brachionus plicatilis*) until they are large enough to eat *Artemia*. A common practice is to “enrich” mass numbers of rotifers with nutrients (vitamins, amino acids, protein) essential for healthy larval development. This process is done by feeding specially formulated enrichment products to rotifers. Once enriched, these rotifers are stored in cold water and fed incrementally to larval fish over a 24-hour period. Cold temperatures are used to slow the rotifers’ metabolism, so that they retain their high nutritional value. The traditional cold-storage method involves putting the rotifers into an ice chest or cooler with aeration, oxygenation, and ice. Although somewhat effective, this often leads to temperature and quality variations that can result in conditions that kill a portion of the rotifers. Since larval fish do not eat dead rotifers, this can be a significant problem for reliable larval fish production. Currently, the team is developing a digitally-controlled cold-storage unit that will eliminate temperature variations and consistently yield higher quality rotifers for larval fish to eat. A working prototype is expected for November 2011.

White Seabass Broodstock Collection Continues

The white seabass broodstock collection efforts continued in 2011. The primary focus was again centered offshore at Catalina Island. Catalina Island attracts large schools of spawning fish during the spring and summer, and the location of the netpens in Catalina Harbor is convenient for holding captured fish during the spawning season (Figure 2, top). With generous assistance from Jock Albright again this year, a total of 21 fish were collected during July and August. These fish, ranging from 61 to 107cm in length, were held at Catalina until they could be transported to the Carlsbad hatchery. The sportfishing vessel *Outer Limits* was utilized to transport the fish in late August. Once the fish arrived at Oceanside Harbor, they were loaded onto the Institute’s transport truck and driven to Carlsbad. While in transit, fish were treated with a mild formalin bath to kill any external parasites they may have been carrying. Upon arrival, the fish were dipped in a five-minute freshwater bath to further treat for marine parasites and then transferred to the 4.6m diameter by 2.4m deep fiberglass quarantine holding tank supplied with ozonated, recirculated seawater. Once the 45-day quarantine period ends in mid-October, the fish will be measured (Figure 2, bottom), weighed, sexed, fin-clipped for genetic analysis, and introduced to the spawning tanks within the main hatchery building.



Figure 2. View of the Catalina Island net pens (top) and a new white seabass brood fish getting measured (bottom).

Some effort was also spent fishing in local waters at Oceanside Harbor and the kelp beds around La Jolla, which yielded another 27 seabass. The local-caught fish are currently being held in a small pre-quarantine staging system, consisting of a 3.7m diameter by 0.9m deep fiberglass tank supplied with ozonated, recirculated seawater. The local efforts will continue through October, and at the end of the collection season, the fish will be treated and quarantined before being processed and introduced to the spawning tanks.

European Graduate Student Conducts Otolith Research

During the past five months, Fabrice Boucher, a French student in the Joint European Marine Environment and Resources Master's program worked at HSWRI under the supervision of Research Scientist Mike Shane. Fabrice assisted with various aspects of the Aquaculture program, including studying malformations in cultured fish (see Issue 51 article "Quality Control Considerations in the Culture of Marine Finfish") and scanning white seabass (*Atractoscion nobilis*) heads for coded wire tags (CWT; e.g. Issue 52 article "Hatchery Fish Recaptured from Central California"). He even took a brief trip to the net pens at Catalina Island to check CWT retention rates and assess the health of cultured fish prior to their release.

For his Master's thesis research, Fabrice worked on white seabass otoliths (ear bones). The objectives of his research were to 1) evaluate differences in otolith metrics (morphology, mass, and size) between captive broodstock and wild adult fish, 2) determine if formation of different otolith growth zones (similar to tree rings) was temperature-dependent, and 3) compare bodily growth of captive and wild fish. He examined 67 sectioned sagittal otoliths from fish aged 4-25 years that had been held for 1-15 years in one of five temperature-controlled broodstock tanks at the Carlsbad hatchery. Significant results from his study showed that otolith length, width, height, and mass in captive fish were greater when compared with similarly sized wild fish. The formation of the different growth zones at the margin of the otoliths appeared to be temperature (and, therefore, seasonally) related, with only opaque bands observed when temperatures were below 14.5°C; most otolith margins were translucent when water temperatures exceeded 15°C. Finally, the growth of captive females was slower than their wild conspecifics, but differences between captive and wild males were not apparent. While he wished he could have stayed in San Diego longer, Fabrice had to return to Europe in late September to present his research to the faculty of his program.



Figure 3. Joint European Marine Environment and Resources graduate student, Fabrice Boucher.

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. This information was contributed by HSWRI staff and compiled by Aquaculture and Fisheries Research Coordinator Dr. Kristen Gruenthal under the direction of Senior Research Scientist and Aquaculture Program Director Mark Drawbridge.

The aquaculture research program has been active for more than 30 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 Dr. Kristen Gruenthal at kgruenthal@hswri.org.

Aquaculture research at HSWRI is currently supported by these major contributors:

- Cabrillo Power/NRG
- California Sea Grant
- Chevron Corporation
- City of Carlsbad Agriculture Conversion Mitigation Fee Grants Program
- Cruise Industry Charitable Foundation
- Darden Restaurants Foundation
- Indian River Lagoon National Estuary Program
- NOAA Fisheries
- NOAA's Saltonstall-Kennedy Program
- San Diego County Fish and Wildlife Advisory Commission
- Santa Monica Seafood
- SeaWorld Parks and Entertainment
- SeaWorld San Diego
- The California Department of Fish and Game'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)



Hubbs-SeaWorld Research Institute is a 501(c)(3) non-profit charity. If you would like to become a financial supporter of the Institute's aquaculture research, please contact Karen Terra at (619) 226-3870. You can also make an online donation by clicking here: [Donate Now](#).

For more information on the Institute visit www.hswri.org or become a fan at www.facebook.com/hswri.