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ACTIVITY UPDATE from the

Sustainable Aquaculture Program

Program Manager's Message

New Name and Program Changes…

Michael Rust – Mike.rust@noaa.gov

We have a new name! The Applied Marine Bioscience Group is now the Sustainable Aquaculture Program. The new name better reflects the nature of the majority of our work. In addition we have made a number of transfers to improve the efficiency and focus of our research. Our Kodiak, Alaska office was closed at the end of the Summer 2007 and Kermit Reppond transferred to the Manchester Research Station in Washington. In addition, Eric Kroeger and Matt Cook have been transferred from the Montlake facility to Manchester. These changes should allow our Manchester program to tackle projects at a larger scale than in previous years. We are currently gearing up for an expanded lingcod –research season which we will report on in the future. Over the next year we will also be re-examining our research focus to better serve the needs of our agency and stakeholders.

Broodstock Development

Closing the Life Cycle on Pacific Cod in Captivity

Ken Massee and Tom Wade –Ken.Massee@noaa.gov

Pacific cod is almost absent from Puget Sound, but it once supported a commercial fisheries as well as a large recreational fishery. Recent tagging and genetic data for Pacific cod in Puget Sound appears to indicate that the Puget Sound population is different from northern Pacific cod populations.

In the winter of 2007, several three- and four–year- old F1 Pacific cod *(Gadus macrocephalus)* from Puget Sound raised and held at our Manchester Research Station produced viable offspring, completing the Pacific cod life cycle in captivity for the first time in the US. This technology opens the door to studies that may lead to restoring depleted Pacific cod in Puget Sound using conservation hatcheries. The ability to keep Pacific cod in captivity through its whole life cycle also makes this species a promising candidate to use in the study of impacts of global climate change and ocean acidification on marine fish over several generations.

Using Ultrasound to Determine Maturation Status in Adult Sablefish

Eric Kroeger, Tom Wade, and Ken Massee – eric.kroeger@noaa.gov

Sablefish (*Anoplopoma fimbria*) are a high value commercial species found off the U.S. Pacific coast and Alaska. The high value combined with declining wild catches has raised interest in farming sablefish. Female sablefish rarely mature or spawn naturally in captivity. Researchers have found that GnRH (gonadotropin-releasing hormone) injections or implants are needed to induce final maturation and ovulation. Typically, timing of hormone delivery is based on oocyte size. An oocyte diameter of 1.1mm is the minimum size, in our lab, at which hormone treatment has been successfully administered. Measuring oocytes is achieved by cannulating the ovary and taking a suction biopsy. However, cannulating is invasive, may result in tissue damage, infection, and the associated stress could disrupt the natural progression to ovulation. Ultrasound offers a less invasive technique to determine maturation in sablefish and guide the timing of GnRH implants.

We are using ultrasound to track the development of the ovaries and testes over time to determine maturity status of each fish. This is accomplished by PIT tagging the fish and sampling every 2 months with ultrasound. Images of the gonad at each sampling period are compared. Measurement of the gonad can be done using the ultrasound unit itself, or image analysis software. Both males and females that are progressing toward spawning will show an increasing gonadal cross section (Figure 1). Measurement of this cross section, or some related index, has the same application as the gonadal somatic index without the need to sacrifice the fish. Future studies will include optimizing the time to implant GnRH based solely on gonad cross-section images. Determining the sex of unripe sablefish based on morphology is also difficult; however it is possible to determine sex using ultrasound.

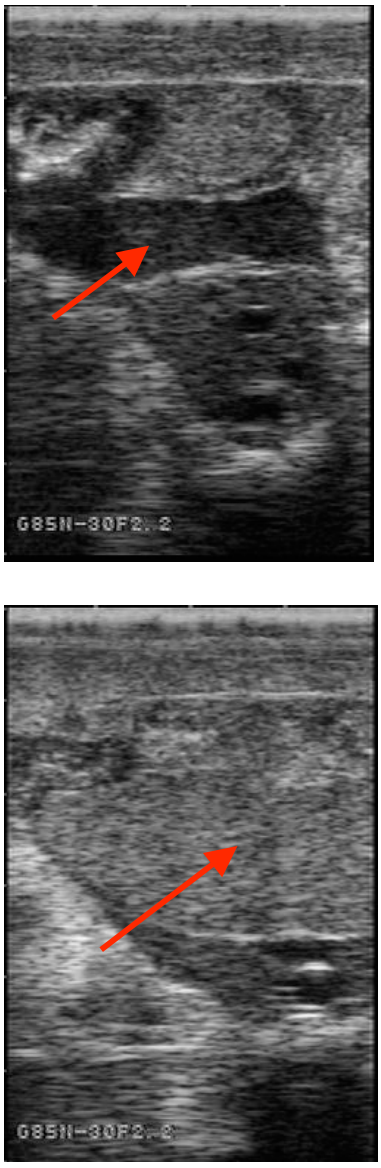

Figure 1. Top: Immature ovary. Bottom: Maturing ovary

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Fish Feeds and Nutrition

New Feed Lab Gets Cooking

Pete Nicklasen and Harold Barnett – Pete.Nicklasen@noaa.gov

The former clownfish lab at the Montlake facility has a new life as a pilot lab for producing larval and grow-out fish feeds and feedstuffs. A key new piece of equipment is a steam-heated double-drum dryer shown below. This dryer has a very short contact time with feed formulations, which allows exact control of drying and minimum heat damage to protein and oil in experimental fish feeds. Planned improvements will expand the number of processes to manufacture feeds for support of aquaculture research.

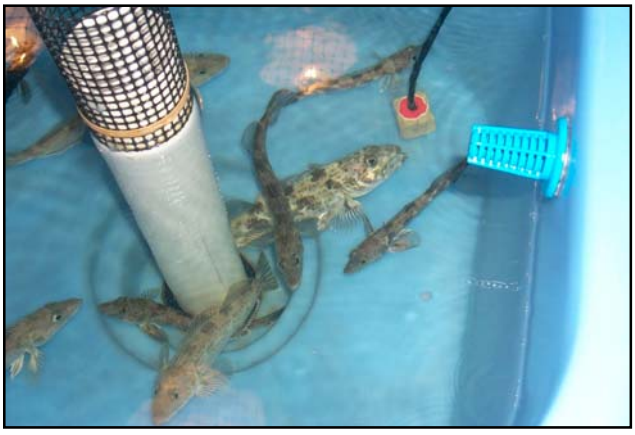
Drying high protein salmon concentrate on double drum dryer

Finished dried fish protein for use in fish feeds

Developing Sustainable Feeds for Lingcod Grow-out Utilizing Alaska Fisheries Byproducts

Adelaide C.E. Rhodes, Michael B. Rust, Thomas L. Scott - Mike.rust@noaa.gov

We recently completed a fishmeal protein replacement study. This research was conducted in collaboration with the USDA-ARS, the University of Idaho and the University of Alaska to develop and evaluate the digestibility and nutritional value of novel protein ingredients made from Alaska fisheries byproducts. The diets contained the following byproduct percentages: (Diet 1: 40% Pollock Viscera Meal, Diet 2: 40% Salmon Liver meal, Diet 3: 40% Organic Whitefish Diet 4: 40% KFC – Whitefish Diet 5: 50% anchovy meal (control diet). Juvenile lingcod, *Ophiodon elongatus* (about



one year old) were chosen for the experiment because they are a potential target for aquaculture development in the Pacific Northwest. Incorporating fish protein meal ingredients, derived from byproducts of seafood processing, instead of conventional fishmeal ingredients in grow out diets for lingcod, may produce growth performance and feed efficiency equal to or better than standard diets made from industrial fishmeal. Byproducts produced by the University of Alaska, were analyzed for proteins, lipids, ash, and amino acid content prior to being made into test diets. From these analyses four protein replacement diets were formulated to be 57% protein, 17% lipid, and 12% ash (dw/dw) Using three replicate tanks per dietary treatment the fish were fed to satiation and weighed every two weeks to determine if there was a difference in growth and feed efficiency ratios. The whitefish meals (Diets 3 and 4) were the least palatable to the fish, resulting in lower growth and feed efficiency ratios (Figure 3). The pollock viscera meal (Diet 1) and the salmon liver meal (Diet 2) were not significantly different from the control diet containing anchovy meal.

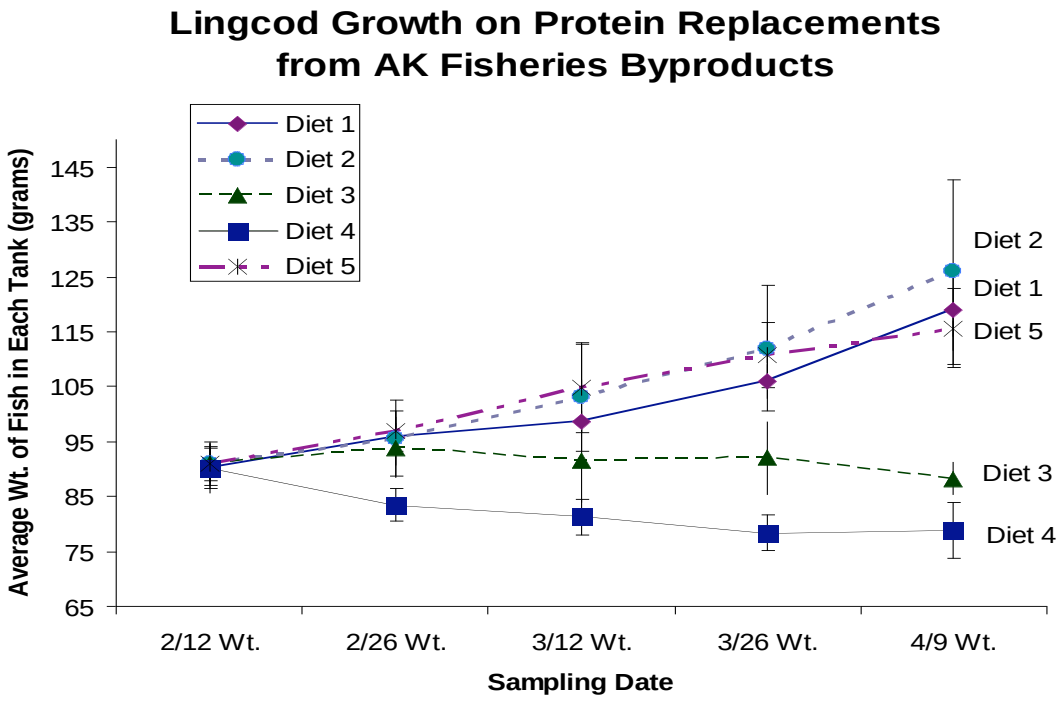


Figure 3. Growth, over time, for protein replacement diets.
Error bars represent standard error.