USF&WS releasing SeaReady™ treated Atlantic salmon into Penobscot River in May, 2003.

Marical Applies its Science to New Species and a New Application

Dr. Tim Linley inspecting SeaReady™ treated chinook salmon at Medvejie hatchery.

By Dave Scarratt

Portland, Maine. Several months ago, in an article on MariCal's SuperSmolt® technology, I alluded to work the company was doing in Alaska to improve Pacific salmon stock enhancement (Hatchery International, May/June 2004). To re-cap, MariCal has produced an effective method for pre-adaptating juvenile salmon to seawater prior to their transfer from the hatchery. Until now, they have largely focused on Atlantic salmon, but clearly the technology has potential for adaptation to other anadromous species. I recently caught up with the folks at MariCal, and learned that much has transpired since I last wrote about them.

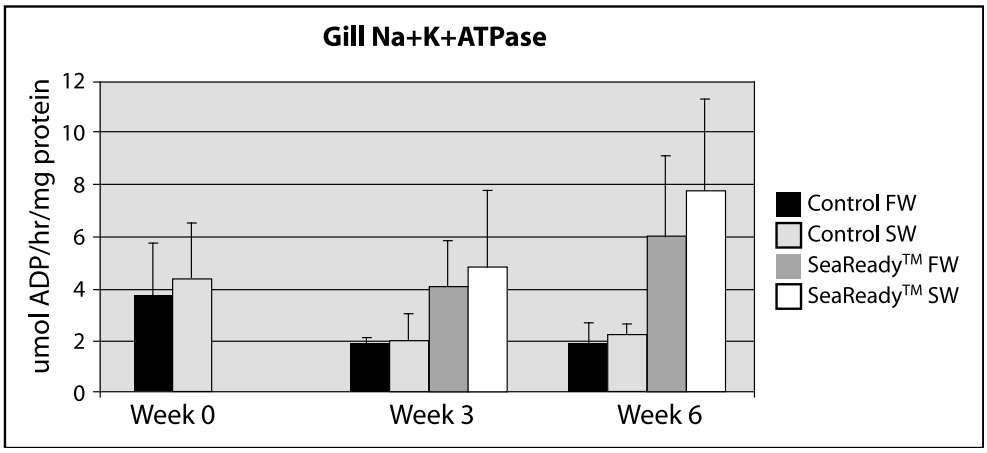
Dr. Tim Linley, MariCal's Senior Research Scientist who has been in charge of the Alaskan project was not slow to explain their obvious interest in seeing if their methods would have the same positive effect on hatchery-raised salmon that are released into the wild as they do on farm-raised salmon. The experiments were designed to determine whether their ocean survival could be improved by pre-adapting Pacific salmon prior to release and the number of adult returns increased. As with farmed salmon, Linley believes that proper acclimation to seawater is critical to survival and growth of salmon in the ocean, and MariCal's research is focused on making sure that hatchery-raised smolt are completely ready to make this transition.

To test the technology under real conditions, MariCal has been working with private enhancement organizations in Alaska, and in Maine with the U.S. Fish & Wildlife Service (FWS) and the National Marine Fisheries Service (NMFS). To date, they have treated and released over 1.5 million hatchery-raised salmon in multiple trials using what MariCal calls the SeaReady™ process (more on the difference between SuperSmolt® and SeaReady™ later).

Linley showed me the initial results from two of these trials. In a trial conducted on chinook salmon at the Medvejie Hatchery in Sitka, Alaska (Figure 1), operated by the Northern Southeast Regional Aquaculture Association, 295,000 SeaReady-treated fish, and 810,000 non-treated controls were transferred into seawater netpens in the fall of 2003 and held over winter. Although ocean returns for these fish will not begin until 2006, Linley is encouraged by the physiological changes in the treated chinook prior to transfer, and their growth and survival over winter. "The treated chinook at Medvejie had higher gill NA^+K^+ATPase levels than the controls (Figure 2), which is something seen consistently in SuperSmolt-treated, farm-raised Atlantic salmon. Since the SeaReady treated fish are pre-acclimated to seawater they likely have a much greater chance of surviving marine transfer than their non-treated counterparts."

Linley also shared some results from an on-going trial with Atlantic salmon from the FWS Green Lake National Hatchery in Maine, that were released into a tributary of the Penobscot River in 2003 and 2004, some 75 miles from the ocean (Figure 3). According to Linley, the SeaReady-treated fish consistently showed improved hypo-osmoregulatory ability. "This improved ability to osmoregulate in seawater likely contributed to doubling the number of one sea-winter SeaReady-treated adults that returned in 2004, compared to the untreated control group". In fact, the trial data show that the SeaReady-treated fish yielded the highest number of returning one sea-winter adults of the eight groups of fish marked and released at different locations in 2003. "The real test will be in 2005 when the majority of the adults should return as two sea-winter fish," said Linley, "but so far, so good".

The obvious question is why are they calling this process "SeaReady™", instead of referring to it as SuperSmolt®, a product the company has



Comparison of gill Na+K+ATPase activity (Mean + S.D.) displayed by SeaReady™ treated and untreated chinook salmon. After 6 weeks, SeaReady-treated fish showed 3-4 fold elevations in Na+K+ATPase in both freshwater (FW) and seawater (SW).

obviously invested considerable resources in promoting? Harry Nelson, MariCal's Marketing Manager told me that while the basic components of SeaReady are identical to that of SuperSmolt (calcium, magnesium and sodium salts as well as a common amino acid) the application of the SeaReady process is actually quite different. The intent is to optimize for key parameters such as those for imprinting and rapid transition through estuaries for hatchery-raised fish after their release into the wild. These are different from those needed for commercial strains of salmon that are farmed in ocean net pens. "We felt it was important to differentiate the two processes by using distinctive names," said Nelson

MariCal believes that its SeaReady process will offer a number of opportunities to organizations trying to restore and enhance salmon populations. The obvious one, of course, is the potential to increase ocean survival and increase the number of returning adults. One of the more intriguing applications, however, may be the possibility of reducing the ecological interactions between hatchery and wild salmon. For example, by using the SeaReady process to advance (or delay) smoltification, hatchery stocks could be temporally separated from wild salmon smolts during the critical period of downstream migration and their entry into the ocean. A second possibility involves the use of the SeaRead process to transfer hatchery-raised stocks that are produced primarily for harvest, to marine sites located away from estuaries and rivers where wild populations are found.

In summary, MariCal is working hard to apply its understanding of the smoltification process and the SeaReady technology to improve the survival and growth of hatchery-raised coho smolt in their early ocean environment and increase the number of returning adult salmon. The early results from Maine are encouraging, according to Linley who anticipates that that two sea-winter returns of Atlantic salmon in Maine, and adult coho from SeaReady-treated smolt released into Resurrection Bay near Seward, Alaska last summer, will begin showing up in the summer of 2005. "All of us at MariCal – and our partners – are eager to see next year's return data," said Linley.

On a different, but clearly related topic. Harry Nelson, Marketing Manager at Maricals's head office in Maine, also told me that the company was now beginning a joint research and development project with Dyer Aqua L.L.C. dba Maritech/Proaquatix, a science-based marine aquaculture company, in Sebastian, Florida. The work will be focused in two areas. The first is to develop methods of raising and maintaining species of marine ornamental fish in just slightly brackish water, and the second will investigate methods of increasing the growth rates of warm water marine food fish species by combining Maritech's commercial aquaculture expertise with MariCal's expertise in fish salinity regulation and growth.

Hatchery International will keep you appraised as we learn of progress.

HATCHERY

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The final chapters cover the problems of getting started in the business, the Law (Australian Rules… but a good guide to things that likely will (or should) be needed in any country) and the Management and Administration of an aquaculture business.

Australia is a sub-continent with a climate that ranges from tropical to cold-temperate. The number of fish and invertebrate species that live there and that are amenable to cultivation is enormous. Some eighty pages are given over to listing and describing these species and their current state of maturity as candidates for aquaculture. This alone is valuable information for people wishing to diversify their businesses by considering Australian species. Besides the Index and bibliography, there is a brief glossary of terms used throughout the book. The book is well illustrated with photos and diagrams.

But who is GWQEHN? Throughout the book, on almost every page, is a rather delightful, small line-drawing of a mermaid with a short highlighted aphorism summing up the points raised in the previous section of text. Her name (Gwen) comes from the initial letters of the five principles that support successful aquaculture: Genetics, Water Quality, Environment, Husbandry and Nutrition. A touch of whimsy, perhaps, but GWQEHN says: Read this book.

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