

## **DRAMATIC ACCELERATION OF SALMONID GROWTH RATES**

### **USING GENETIC MANIPULATION:**

### **WHY DON'T WILD FISH GROW THIS FAST?**

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### **EXTENDED ABSTRACT ONLY - DO NOT CITE**

#### **Introduction**

Through genetic manipulation, it is possible to dramatically alter the patterns of growth for both Atlantic (*Salmo salar*) and coho salmon (*Oncorhynchus kisutch*). Using this procedure, manipulated fish can be up to 37 times the size of control fish after one year, and can achieve sexual maturity in half the time (Devlin et al. 1994, 1995a) and have a higher feeding rate (Abrahams & Sutterlin 1999, Devlin et al. 1999). From an ecological perspective, such a manipulation may potentially be advantageous since the rapid growth would reduce the time period these fish would be susceptible to predators, as well as allowing them to more rapidly exploit larger food items within their environment (Werner & Gilliam 1984). Here we address the question of why wild salmon do not possess this apparently beneficial characteristic. Two distinct possibilities exist. Either this genetic manipulation has allowed the production of fish superior to the wild-type, or the ability to grow more rapidly is not selectively beneficial. For our research, we believe that there is no obvious selective impediment that would prevent wild fish from altering their hormone levels over time to achieve this accelerated growth. Indeed, for

juvenile salmon there may be circumstances where high growth rates are disadvantageous (Bull et al. 1996). We therefore assume that the energetic requirements necessary to sustain this growth, or correlated characters such as disruptions in pituitary function (Mori & Devlin 1998), acromegaly (Devlin et al. 1995b, Ostefeld et al. 1998), swimming performance (Farrell et al., 1997) and antipredator behaviour (Abrahams & Sutterlin 1999), will limit the ability of transgenic fish to survive in the wild.

Here, we test the hypothesis that accelerated growth rates of transgenic fish is a function of an artificial hatchery environment, and that with a more natural feeding regime their growth advantage relative to wild-type fish should diminish.

## **Methods**

Sixty transgenic and sixty wild-type fish were used for this experiment. All fish were of approximately equal size at the beginning of the experiment and every individual was identified for the duration of these experiments with an internal PIT tag. For these experiments, these 120 fish were divided between four tanks, with each tank containing a group of 15 transgenic and 15 wild-type fish. All tanks received a feeding ration that was equivalent to 1% of their total body weight per day. Two tanks received this ration via two feedings per day. The other two tanks received that same total amount of food over a four week period, but according to a negative binomial distribution. As a consequence, this feeding regime was unpredictable, including extended periods of food deprivation, with periodic large feedings. Every four weeks, all fish were removed from their tank, identified, and weighed. This experiment continued for 16 weeks.

## **Results and Discussion**

The influence of this temporal manipulation of feeding regime had no measurable effect upon the wild-type fish, but did alter the pattern of growth of the transgenic fish. Surprisingly, average growth rates of transgenic fish were not affected by this manipulation. Instead, providing food in an unpredictable fashion generated two modal groups of transgenic fish. The upper mode had a growth rate greater than transgenic fish on a uniform diet. The lower mode had a growth rate less than that of wild-type fish.

It is possible that dominance interactions between transgenic and control fish at a time when food is available in large quantities may be partially responsible for this result.

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