



Thermal Physiology in Marine Fish

Jeff Smiley, M.S.

Mark Drawbridge, M.S.

Temperature is one of the most important environmental parameters exerting an influence on fish. Because fish are cold-blooded they cannot actively thermoregulate and therefore must move to areas with favorable water temperatures for which they are adapted (thermal induced behavior). The thermal ranges of fish vary by species and life stage, with some being limited (stenothermal) and some accommodating a wide range of temperatures (eurythermal). Through evolutionary processes fish have adapted to natural conditions and are able to survive varying degrees of temperature change. These adaptations are defined as resistance adaptation, acclimation, summation, and compensation. The thermal niche that fish inhabit is then defined by behavioral preference, lethal limits, physiological or metabolic optima, or by behavioral performance optima. Understanding the thermal preference and limits of all species currently being reared at Hubbs-SeaWorld Research Institute (HSWRI) is the first step in reducing stress and increasing healthy productive stocks.

Thermal physiology experiments are being performed in the thermal exposure system (TES; Figure 1). This system consists of fifteen 300 l cone tanks divided into three separate experimental groups. Each group has its own specific temperature controlled sump which can maintain temperatures ranging from 10 to 35 °C. Experiments will encompass single day acute trials to long term rearing experiments (8 weeks). For the acute trials twenty five fish will be placed into each tank and allowed three days of acclimation. After three days the fish will be subjected to rapid thermal shifts in order to identify their critical thermal max and minimums. For the rearing trials fish will be placed in the system and acclimated to their experimental rearing temperature at 1 °C per day. All fish will be fed to satiation and all feed weights will be recorded. A bath weight of all fish in each tank will be taken at the beginning and every 2 weeks thereafter. At least 5 different temperatures will be investigated for rearing trials.



This project seeks to accomplish the following objectives: 1) conduct sequential studies on the thermal limits of the juvenile fish being reared at HSWRI; 2) investigate the influence of acclimation temperature on the acute thermal response; 3) investigate the effect rearing temperature has on growth by calculating food conversion rates and specific growth rates; and 4) disseminate these results to project leaders and prepare manuscripts for publication.