



Thermal Preference 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.

The thermal preference assessments are performed in a horizontal thermal gradient measuring 4.5 m long, 0.4 m wide, and 0.4 m tall. A thermal range of 10 °C is maintained by heating seawater on one side while cooling seawater on the other. Twenty fish are placed in the system the night before experimentation and allowed 16 hours to acclimate at their current rearing temperature. The next morning the thermal gradient is initiated and fish location is recorded every hour from overhead cameras (Figure 1). These images are then analyzed and cross correlated with temperature in the gradient to identify a preference temperature. Three different age groups will be investigated along with multiple acclimation temperature to identify acute preference response.



Figure 1. Overhead camera view of the horizontal thermal gradient with 110 dph white seabass exposed to a thermal regime from 20 to 30°C (left to right respectively).

This project seeks to accomplish the following objectives: 1) conduct sequential studies on the thermal preferences and limits of larval and juvenile stages of four species currently being reared at HSWRI; 2) investigate the influence of acclimation temperature on the acute response of preference; 3) involve one or more students in these studies; and 4) expand these results to our thermal exposure system when a more comprehensive study will take place to identify long term survival, growth and overall fish health.