

EFFECTS OF TEMPERATURE AND SALINITY ON THE
EGGS AND EARLY LARVAE OF THE OMAKA, CARANX
MATE (PISCES: CARANGIDAE) IN HAWAII

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ABSTRACT

Omaka (Caranx mate) eggs obtained from the plankton of Kaneohe Bay, Oahu, and incubated in the laboratory between temperatures of 17.2 and 30.1°C and salinities between 20 and 40 ‰ showed the following processes to be inversely proportional to temperature: incubation times, durations of the yolk sac stage, times to functional eye and jaw development, and times to the attainment of maximum length during the yolk sac stage. Effects of temperature on incubation time and time to 95% yolk sac absorption were fitted by a power function. Unfed omaka larvae attained the largest size at 25°C. Larvae reared at low salinities had larger yolk sacs and body lengths. Salinity had very little effect on the time to functional eye and jaw development. Eyes and jaws of larvae were functional by the end of the yolk sac stage at all the temperature and salinity levels tested.

Data on hatching success and larval survival at the end of the yolk sac stage between temperatures of 17.3 and 33.1°C and salinities between 10 and 42 ‰ showed that hatching success was generally high between temperatures of approximately 22 and 31°C, and larval survival was generally high between temperatures of approximately 23 and 30°C. Hatching success and larval survival were poor at salinity extremes. Low temperatures in combination with low salinities and high temperatures in combination with high salinities were particularly detrimental to omaka larvae. The frequency of morphological abnormalities increased at both extremes of the temperature

and salinity ranges, and was high in all salinities at the highest test temperature (33.1°C). During the warmer months of the spawning season, omaka larvae were better able to tolerate warm temperatures, but less able to tolerate low temperatures.

A bioassay of the upper lethal temperatures of various ages of unfed omaka larvae acclimated to 23.8°C and abruptly transferred to ten test temperatures between 23.8 and 41.5°C, suggested that the incipient T_{lm} for omaka larvae increased from 31.5°C for newly hatched larvae to 34.2°C for larvae near the end of the yolk sac stage. Following absorption of the yolk sac, incipient T_{lm} decreased to 32.0°C for 120-hour old larvae.

A comparison of laboratory and field data suggested that temperature extremes would have only a limited effect on omaka eggs and larvae during their normal spawning season in Kaneohe Bay. However, low temperatures possibly encountered by C. mate eggs and larvae early in their spawning season in the Bay, and elevated temperatures encountered in the vicinity of thermal plumes from electric generating stations elsewhere, could prove detrimental to the early stages of this species.