SPAWNING DYNAMICS AND PARENTAL EFFECTS IN THE HAWAIIAN SCLERACTINIAN CORAL *MONTIPORA CAPITATA*

A DISSERTATION SUBMITTED TO THE GRADUATE DIVISION OF THE UNIVERSITY OF HAWAIʻI IN PARTIAL FULFILLMENT OF THE REQUIRMENTS FOR THE DEGREE OF

DOCTOR OF PHILOSOPHY

IN

OCEANOGRAPHY

AUGUST 2011

By

Jacqueline L. Padilla-Gamiño

Dissertation Committee:

Ruth D. Gates, Chairperson
Robert Bidigare
David Karl
Robert Kinzie
Craig Smith
Rhian Waller

ABSTRACT

Coral reefs are some of the most diverse and productive ecosystems on the planet and function as important spawning, breeding and feeding areas for many organisms in the tropical seas. The persistence of these ecosystems relies on spawning events with remarkable synchronicity during limited periods each year and the ability of coral holobionts (animal host and symbiotic community) to acclimatize and/or adapt to environmental change. The goal of this dissertation was to advance our understanding about the spatial and temporal variation in coral reproductive capability and parental effects in scleractinian corals. Specifically, this work explored for the first time (1) the spawning dynamics of a major reef building coral (broadcast spawner) from the central Pacific using a systematic sampling of the gametes in the field, (2) the ultrastructure of the egg-sperm bundle and (3) how the variability in parental environmental and physiological conditions (host and *Symbiodinium*) relates to the phenotype of gametes in a scleractinian coral. Spawning dynamics of *Montipora capitata* varied among years, months and lunar days. Synchrony and proportion of spawning colonies did not reflect differences in coral colony morphology or environment between sites. Major changes in spawned material occurred in different years, suggesting that reproductive output may have been controlled by changes in the coral's phenology and/or stress associated with larger temperature fluctuations. *M. capitata* is a coral with extraordinary phenotypic plasticity that can release a diverse array of gametes (depending on the parental environment) within a mass spawning event. Oocytes released by different parents were seeded with different *Symbiodinium* assemblages and had different biochemical traits, yielding taxonomic and phenotypic variability that may have profound implications for

the early development, settlement and survival of coral offspring. Further research is necessary to understand the causes of variability in spawning at different temporal scales and how spawning cues may interact and affect the reproductive physiology at the population, organism and polyp level. Understanding these relationships will help us to better predict the effects of climate change on the phenology and reproductive success of corals, which are critical for the resilience and persistence of coral reef ecosystems.