Field Manual for Investigating Coral Disease Outbreaks

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PREFACE

Coral reefs throughout their circumtropical range are declining at an accelerating rate. Recent predictions indicate that 20% of the world's reefs have been degraded, another 24% are under imminent risk of collapse, and if current estimates hold, by 2030, 26% of the world's reefs will be lost (Wilkinson 2004). Recent changes to these ecosystems have included losses of apex predators, reductions of important herbivorous fishes and invertebrates, and precipitous declines in living coral cover, with many reefs now dominated by macroalgae. Causes have been described in broad sweeping terms: global climate change, over-fishing and destructive fishing, land-based sources of pollution, sedimentation, hurricanes, mass bleaching events and disease. Recognition that corals can succumb to disease was first reported in the early 1970's. Then it was a unique observation, with relatively few isolated reports until the mid 1990's. Today disease has spread to over 150 species of coral, reported from 65 countries throughout all of the world's tropical oceans (WCMC Global Coral Disease Database). While disease continues to increase in frequency and distribution throughout the world, definitive causes of coral diseases have remained elusive for the most part, with reef managers not sufficiently armed to combat it.

Wobeser (1994) writes, *"Disease management is a tactical battle in which one uses intelligence gathered about the disease to identify the most vulnerable point at which to attack"*. Understanding the disease process and how it relates to ecology are the necessary steps when attempting to determine causation. The rationale, however, for studying coral disease is often challenged as an esoteric pursuit that *'you can't do anything about anyway'*. This myopic point of view undermines the 'intelligence gathering' efforts. But it is this 'intelligence' that makes it possible to assess the nature and significance of the disease, and in turn identify management strategies (*'points at which to attack'*) to restrict or curb the occurrence or effects of the disease.

There is a recognized need, first put forth in the CDHC National Research Plan (Woodley et al. 2003), articulated by resource managers, and highlighted in several Local Action Strategy plans, to establish local response capabilities to investigate coral disease outbreaks. Establishing regional Outbreak Investigation Response Teams addresses this need by providing a network of well trained responders that can be mobilized on short notice to carry out formal investigations into unusual occurrences of coral disease or mortality.

This document was created through the collaborative effort of members of the CDHC to provide standardized protocols and procedures for field investigations of coral disease outbreaks. The authors also gained insight and inspiration from other field manuals published for wildlife (Friend 2006; Friend and Franson 1999) and marine mammals (Geraci and Lounsbury 1993). The framework for responses is set up such that it is consistent with practices of veterinary and wildlife disease experts to enable communication with and gain support from these disciplines. Field operations provide a

critical link in disease diagnostics. Consistent and efficient sampling and data collection are crucial to effective laboratory analyses and ultimately to the diagnosis of a disease. This manual is intended to serve as an operational guide to coordinate effective, informative responses by outbreak response teams to unusual incidents of coral disease or mortalities. As such, there are chapters intended to assist in gathering quality information and maintaining specimen integrity, both of which are needed to develop a reliable diagnosis. We have provided a summary of ecological and environmental information that should be collected in the field during an outbreak response to assist in developing a diagnosis. Outlined, in general and in specifics, are collection techniques, preservation methods for different analyses, and shipping procedures. Universal precaution measures when dealing with diseases (i.e., work from clean to dirty areas), biological containment and disinfection regimes have also been highlighted. We have attempted to point out critical control points in each of the procedures or methodologies that must be adhered to minimize the risk of compromising the samples or biasing further analyses. Each investigation will, of course, have its own unique features, requiring that some flexibility be incorporated into the field operation. The initial steps in a Coral Disease Outbreak Investigation invariably occur in the field and thus a cohesive management scheme, including operational pre-planning, is critical to achieve success. To provide continuity, structure and consistency, the Incident Command Structure (ICS) was adopted as the standardized emergency management strategy for Coral Disease Outbreak Investigations, and adapted from that used by all other U.S. agencies operating under the National Interagency Management System (NIMS).

This manual was developed as an aid to provide context for outbreak investigations and to help train coral disease outbreak response teams so that coordinated response operations can be executed. Chapter 1 provides a rationale for the need to study coral disease and respond to disease outbreaks. Chapter 2 identifies elements critical in the advanced planning process and includes issues such as regulatory and permitting authorities, criteria for mounting a response, and logistical considerations. Chapter 3 is dedicated to describing ICS structure, the functional roles and responsibilities of response team members, and its operation as it has been adapted to Coral Disease Outbreak Investigations. Chapter 4 focuses on the methodologies for collecting field data, samples and preservation techniques to preserve sample integrity suitable for laboratory analyses. Since coral disease field investigations by their very nature requires underwater operations. Chapter 5 addresses safety precautions on the boat, by response divers and during field laboratory operations.

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