Appendix VI.

OPINION PAPER:

Transmission Experiments in the Field: Ethics, the Law, the Science

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"Wildlife disease practitioners determine transmissibility in the field through observational studies, not field manipulations. The most valid contribution of field studies is to provide detailed observations over time; specifically for coral lesions by describing them in very precise detail, determining by the use of specific and discriminating characteristics whether the lesions are the same or different among affected individual colonies and by recording the movements of the lesion border …noting either expansion or contraction."

There are three major factors that argue <u>*against*</u> conducting field activities, presumed to be valid transfection or transmission experiments *in situ,* in a quest to determine whether a diseased coral has an infective agent associated with visible lesions.

The first is an ethical issue. This practice is not condoned in human or veterinary medicine and is in direct opposition to the philosophy of conservation medicine, 'to do no harm'. There is a fundamental ethical question related to propagating disease in a 'wild' population, either within or between populations. When this manipulation is carried out, it in essence establishes another focus or node of infection, if the lesion is infectious. For example, no veterinarian would think of putting an oyster with *Perkinsus* into a 'healthy'oyster bed nor place a sick deer or bird with their herd/flock in the wild to see if members of the herd/flock got sick. A good scientific test of infectivity requires a valid statistical design requiring multiple 'nodes of infection' thus deliberately spreading the disease in an uncontrolled environment. The biologist/scientist unwittingly becomes a vector, a totally unacceptable situation.

The second factor is of a legal nature. Taking into consideration the status of coral reefs, and the fact that several species are already listed as threatened, either under the ESA or the IUCN's Red List, the transfection manipulation described presents a significant risk of further endangering the reef. This can be interpreted as a deliberate natural resource damaging action, and for Acroporids, a violation of the Endangered Species Act within U.S. jurisdiction. The IUCN (International Union for the Conservation of Nature and Natural Resources)/ The World Conservation Union has guidelines on practices related to management and wildlife conservation issues. None directly address coral or disease transmission in the wild, however the IUCN Position Statement on Translocation of Living Organisms (http://www.iucn.org/themes/ssc/publications/policy/transe.htm) points out that any movement of organisms (which includes their microbiota) needs to be screened for

disease and those with disease should not be moved. They further describe penalties that may be assessed: "Deliberate introductions without a permit as well as negligence resulting in the escape or introduction of species harmful to the environment should be considered criminal offences and punished accordingly. The author of a deliberate introduction without a permit or the person responsible for an introduction by negligence should be legally liable for the damage incurred and should in particular bear the costs of eradication measures and of habitat restoration where required."

The third factor is scientific considerations. The experimental design is fundamentally flawed when conducting a transmission manipulation within the same location/population where the disease is observed. This violates the principle of using cohorts in infectious disease studies. There are a number of confounding variables that make any results obtained from this type of study inconclusive and invalid. These include the fact that it is not known:

1) if the test subjects are already infected and not yet presenting with gross disease signs;

2) if disease signs appear in the test group whether they are the result of an infectious agent as opposed to a toxin or leachate; and

3) if disease signs appear in the test group whether they are caused by cell signaling molecules, chemical compounds released from dying tissue or proteases that propagate death (necrosis) from dying tissue.

In other words, the field studies will not conclusively determine whether an infective agent is present or not. Further, a valid statistical design would require exposing at least 9 individuals from a naïve population to determine infectivity----further deliberately spreading disease.

Ethical, legal and scientifically sound deliberate disease exposure studies should be conducted under containment regimes. A laboratory controlled population that consistently has presented with no signs of disease (naïve population) should be used as the test subject for exposure to diseased tissue. To meet criteria of evidence, the agent (infectious, chemical or toxin) should be isolated and characterized and then used to expose the naïve population to determine if the agent does elicit the same disease signs as observed in the field.