

## Phylogenetic relationships of two possible invading cnidarians from Ulithi Atoll, Federated States of Micronesia- March 2012

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Two cindarians (a scleractinian coral in the genus *Montipora* and a corallimorph in the genus *Rhodactis*) were sequenced using the mitochondrial gene cytochrome oxidase 1 (CO1). These two cnidarians were described to us by the communities of Ulithi as 'invasive' and in the case of the corallimorph as possibly causing problems of toxicity. A similar (and possibly identical) corallimorph has been documented as being highly invasive on Palmyra Atoll. We investigated the distributions of these two organisms in July 2012 at several locations on Ulithi Atoll, and took samples for genetic analyses. Preliminary DNA work showed that the hard coral is an unidentified species of *Montipora*, potentially a new species, and the Corallimorph is in the genus *Rhodactis* with a DNA sequence identical to a species (species name not determined) found in Okinawa, Japan. These organisms are important to understand and document, as their behavior and distribution may represent innovative adaptation in the face of rapid ecological change, a potential threat to reef ecology and biodiversity, and a potential threat to bio security and food security in the region.

Samples of the Corallimorph (soft coral) were from MogMog, where its toxicity had been suspected by the local Chief, and the *Montipora* was collected from MogMog, Asor, Falalop, and Yew (turtle islands). We sequenced CO1, which is a mitochondrial gene that is commonly used for barcoding species. The advantage is that thousands of species have been sequenced for this gene, so there is an extensive database. The disadvantage is that it is not highly variable so variability between sites (at the population level) will likely not be resolved.

There are two phylogenetic trees below from the two organisms we sequenced. The first is a tree for the Corallimorph (Genus *Rhodactis*, Order Corallimorpharia, Class Anthozoa, Phylum Cnidaria). Our sequences from MOGMOG are called COR\_MOG 1 and 2. They are 100% identical to a *Rhodactis* sequenced from Okinawa and published by Fukami et al (Fukami, H., C. A. Chen, A. F. Budd, A. Collins, C. Wallace, Y.-Y. Chuang, C. Chen, C.-F. Dai, K. Iwao, C. Sheppard and N. Knowlton. 2008. Mitochondrial and nuclear genes suggest that stony corals are monophyletic but most families of stony corals are not. PLoS One 3:e3222.doi:10.1371/journal.pone.0003222). It is possible for our individuals not to be genetically identical to the sample from Japan (and this would be shown by sequencing more variable molecular markers), but based on the CO1 sequence, it is clear that our species and the one from Japan are the same species. We can't tell if this means that the invader came from Japan (eg. did a Japanese ship come close to

Mog Mog?), or if, more simply, the species is widespread and occurs in Japan and Micronesia.

The second tree below is of the scleractinian *Montipora* coral (Genus *Montipora*, Order Scleractinia, Class Anthozoa, Phylum Cnidaria): Our samples are labeled MON\_MOG, ASO, FAL or YEW depending on where they were collected. All our samples are identical to each other (they are on the same vertical line, their vertical position does not mean anything in particular, just the order of input). CO1 was not variable enough to distinguish the localities (eg. separate populations), or maybe it is the same clone, at this stage we cannot say. Here again the sequencing of more variable molecular markers could potentially distinguish different scenarios. If you read all the labels you will see that the tree is a bit messy, with different species names clustering together. This is because identifying corals can be complicated and some species included in the GenBank database were misidentified (not a rare occurrence). Nevertheless we can say two things for sure: It IS a *Montipora*, and it is not a species that has been sequenced before. This means that it could potentially be a unique, endemic species, or at least an un-described species. Not all species of *Montiporas* have been sequenced, but the ones on this tree are the closest matches available, so clearly nothing matches exactly with our samples.

A. Tree of the corallimorph *Rhodactis* sp.:



