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### Invasive Algae Survey in Private Fish Pond behind Paiko Lagoon

On April 5th, 2011, the DAR Aquatic Invasive Species Team surveyed a private fish pond located directly behind Paiko Lagoon/ State Bird Sanctuary. The AIS Team was contacted by a caretaker of a residence on the pond who was concerned of an invasive algal outbreak. The team responded by recording the presence, abundance and locations of invasive and some native algae with GPS points and taking biological samples to be identified by UH Phycologist Alison Sherwood.

The private fish pond is connected to the Paiko Lagoon by a single makaha that was rehabilitated by private landowners surrounding the pond, in order to increase water flow and circulation. Therefore, much of what is found in the lagoon is easily transported to the private fish pond through the makaha. The salinity of the lagoon may differ from the private fish pond due to the fish ponds inland location and proximity to a freshwater spring. The invasive algae found and identified in the fish pond were *Gracilaria salicornia* (Photo 1) and *Acanthophora spicifera* (Photos 2 and 3). The native algae or sea-grass found and identified in the fish pond was *Rupia maritima* (Photo 4). *Rupia maritima* tends to favor more brackish environments. There were several different kinds of green cyanobacteria that were not identified, although they may be native blooms. Specimens of these cyanobacteria can be seen in Photo 1, imbedded in the *G. salicornia*, and in Photo 2, interlocking the *A. spicifera*.

Paiko Lagoon was surveyed more thoroughly in 2009 by the AIS team, and the presence of the 3 invasive algae (*Gracilaria salicornia*, *Acanthophora spicifera*, and *Avrainvillea amadelpha*) were documented and mapped. The AIS team does not record the species and abundance of native algae, although it can be assumed that *Padina spp.* and *Spyridia filamentosa* were present as these are some of dominant natives in Maunaloa Bay that can withstand deep mud found in lagoons and fish ponds. A large population of *Cassiopea andromeda* (Upside-down Jellyfish) was also noted, although these populations can fluctuate with the seasons.

Maunaloa Bay was entirely surveyed in 2007 and most of the algae present in Paiko Lagoon and the private fish pond were thoroughly mapped throughout the whole bay. It is likely that these invasive algae were transported through the makaha of both the lagoon and fish pond, or that vice versa, the pond and lagoon were seeded historically with at least *Gracilaria salicornia* for the purpose of aquaculture, and that this population in turn seeded the bay. However, *Acanthophora spicifera* and *Avrainvillea amadelpha* have never been used for aquaculture, and their prevalence throughout the bay suggests that this overall invasion has moved inland to the lagoon and pond over the years.

Division of Aquatic Resources recommends that in the event of locally organized community algae removal event, volunteers would **remove** the invasive *Gracilaria salicornia* and *Acanthophora spicifera*, but **leave** the native sea grass, *Rupia maritima*. The method of removal that DAR recommends is using hand-held fish scoop nets (preferably mesh or with the smallest holes possible) and scooping the algae into a bag or kayak with a tarp in order to transport to a nearby compost pile (Photo 5). The goal is to leave the algae as intact as possible and to avoid fragmentation. *Gracilaria salicornia* reproduces by fragmentation which means each little piece that breaks off can start another possible clump or colony. Therefore, a compost pile on site is also recommended in order to minimize spread via transportation, for instance if some algae were to fly out of the bed of a truck. Another way to remove mass quantities of algae would be to get many people with a similar mesh seine type of net to surround large tumbleweed piles of algae in the pond. This can then be pulled to the shore and carried to the compost pile. *Acanthophora spicifera* is hard to fragment and can therefore be handled more casually, although the two are usually intertwined. For composting, many farmers have had good results by letting the rain wash down the salt in the pile and then letting pile decompose (Photo 6). The algae matter will greatly reduce in size and become dried out. This can be added to soil as an additive. Some farmers also add the fresh limu directly to their plots, but it is advisable to wash down the pile with freshwater in order to minimize the salinity level.

It may be possible to receive some guidance and/or samples of native limu for transplantation by certain people in the aquaculture community. In terms of stocking the pond with fish or invertebrates, the landowners would need to apply for the appropriate aquaculture permits from DAR/DLNR and possibly additional agencies. Great caution would have to be taken in order to not release anything invasive out of the makaha since it is not an enclosed system. The DAR recommendation is that only **native limu** such as *Gracilaria parvispora* (ogo), *Ulva fasciata* (limu palahalaha), or possibly *Ulva prolifera* (limu 'ele 'ele) be transplanted. It is not certain that this inland, brackish environment would be conducive to successful growth and experts should be consulted. For information, DAR recommends their native limu contact: **Wally Ito (808) 222-2550** and their aquaculture contact (for fish): **Dave Cohen (808) 393-1093**. The DAR recommendation is that also only **native fish** be stocked, (if the correct permits are obtained and the makaha is regulated), such as striped mullet (ama'ama) and milkfish (awa). It **would not be beneficial** to stock the pond with tilapia, as they are considered invasive, and the fish pond is not enclosed to the surrounding waters.

Photos of algae samples collected and identified by Alison Sherwood, Phycologist, UH on 4-5-2011

Invasive



Photo 1: *Gracilaria salicornia* (Gorilla Ogo) mixed with unknown green algae or cyanobacteria.

Invasive



Photo 2: *Acanthophora spicifera* (Prickly Seaweed) mixed with unknown green algae or cyanobacteria. Thin, stringy morphology or growth.

Invasive



Photo 3: *Acanthophora spicifera* (Prickly Seaweed) more bushy morphology or growth.

Native



Photo 4: *Rupia maritima* (Native Freshwater Plant/ Sea Grass).

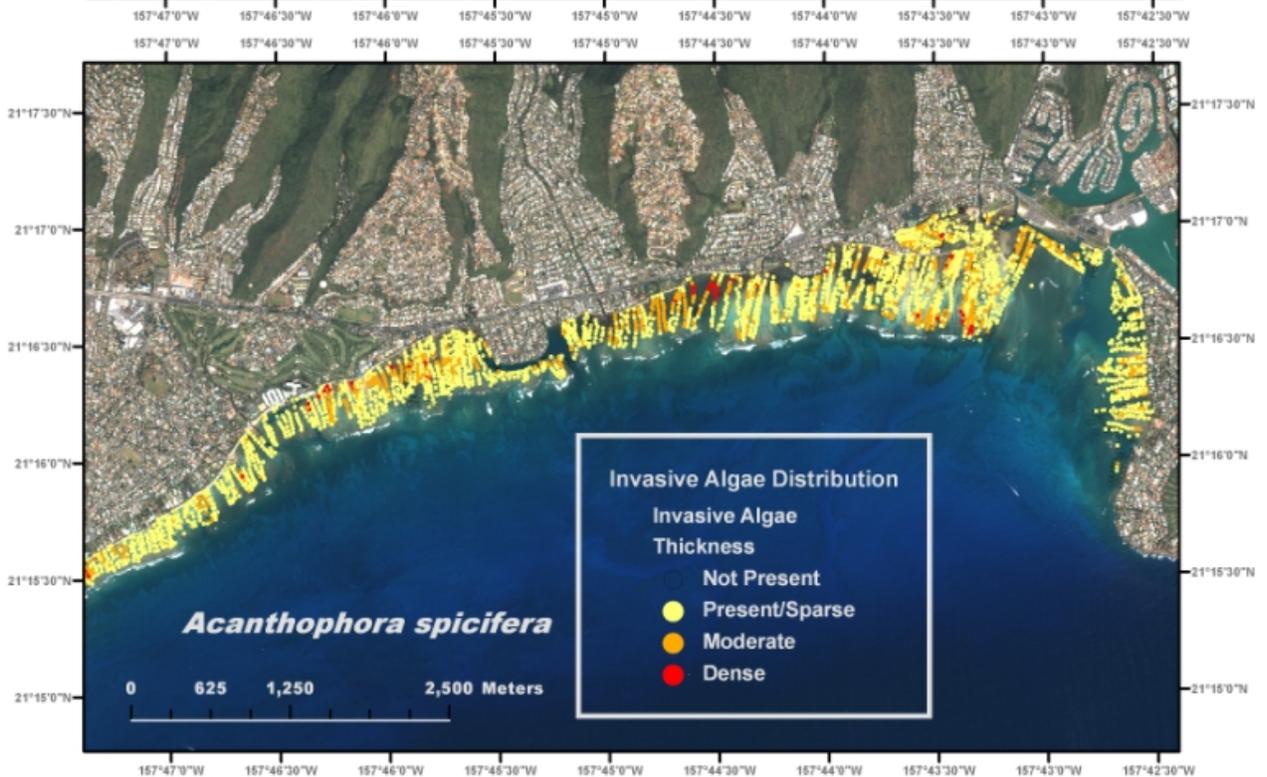
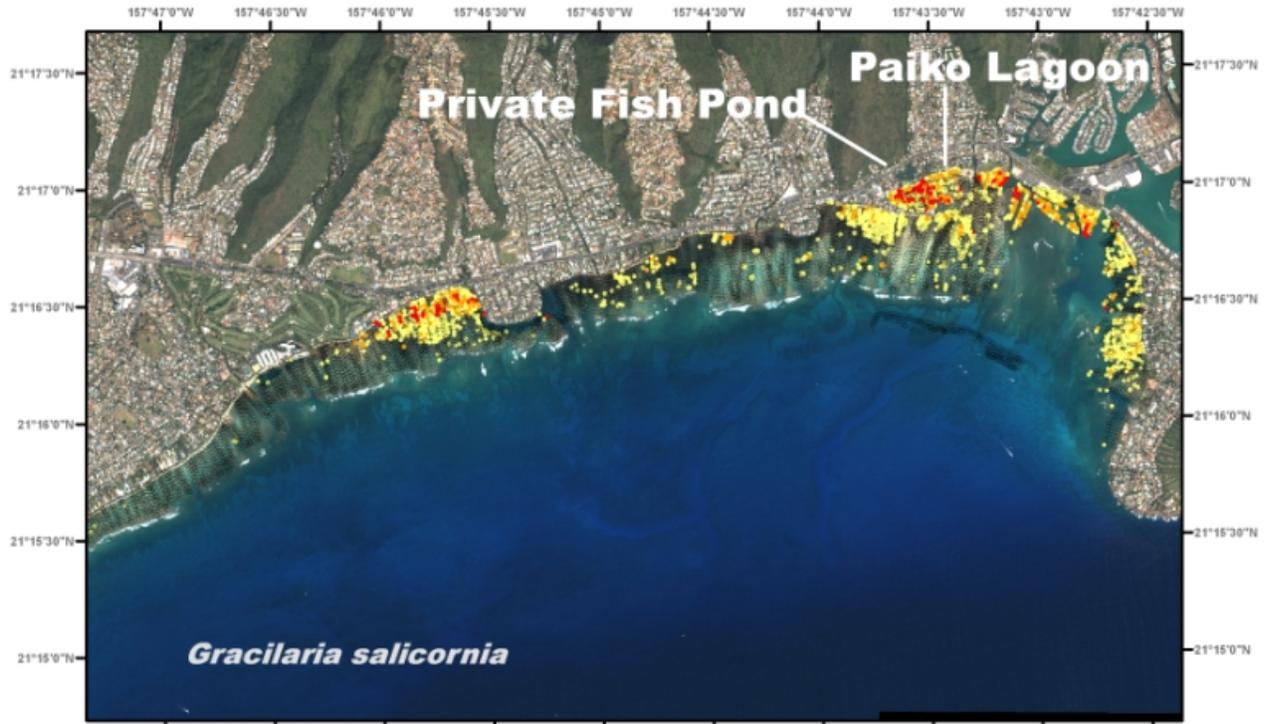


Photo 5: Removing *Gracilaria salicornia* with small-mesh scoop nets.

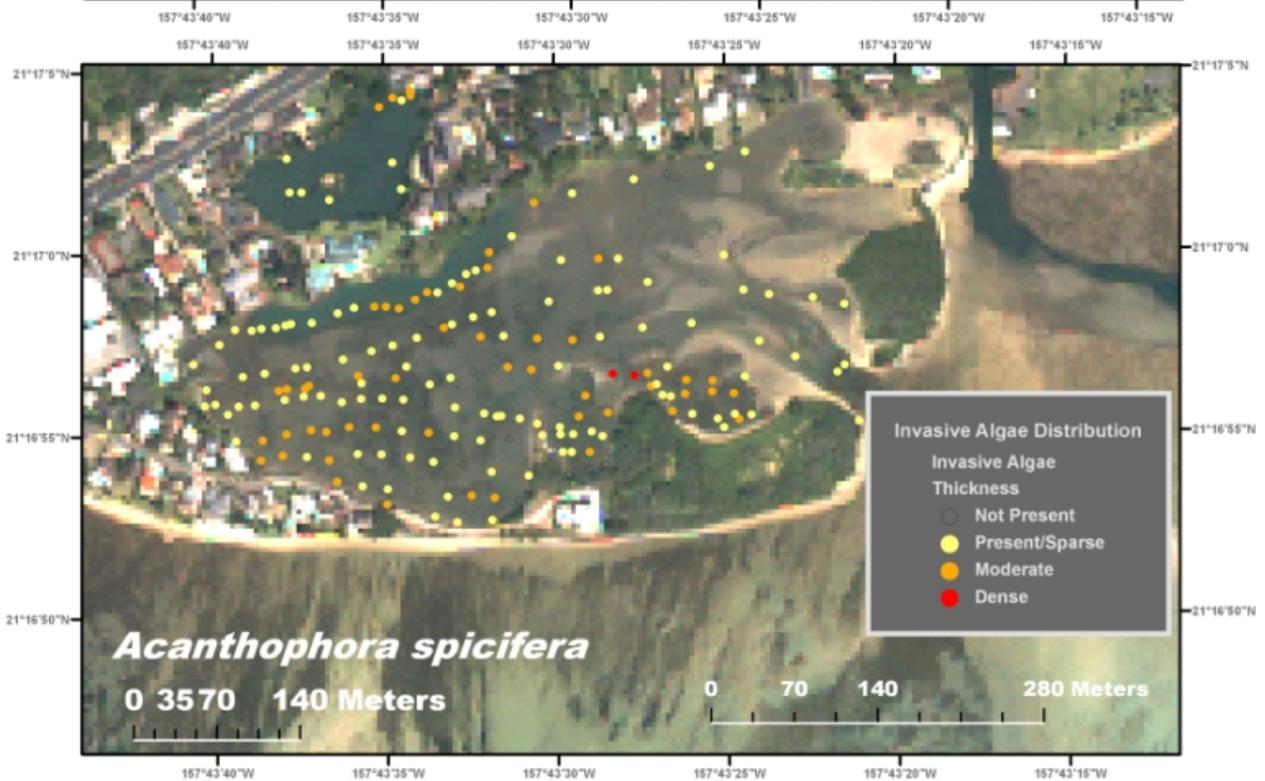
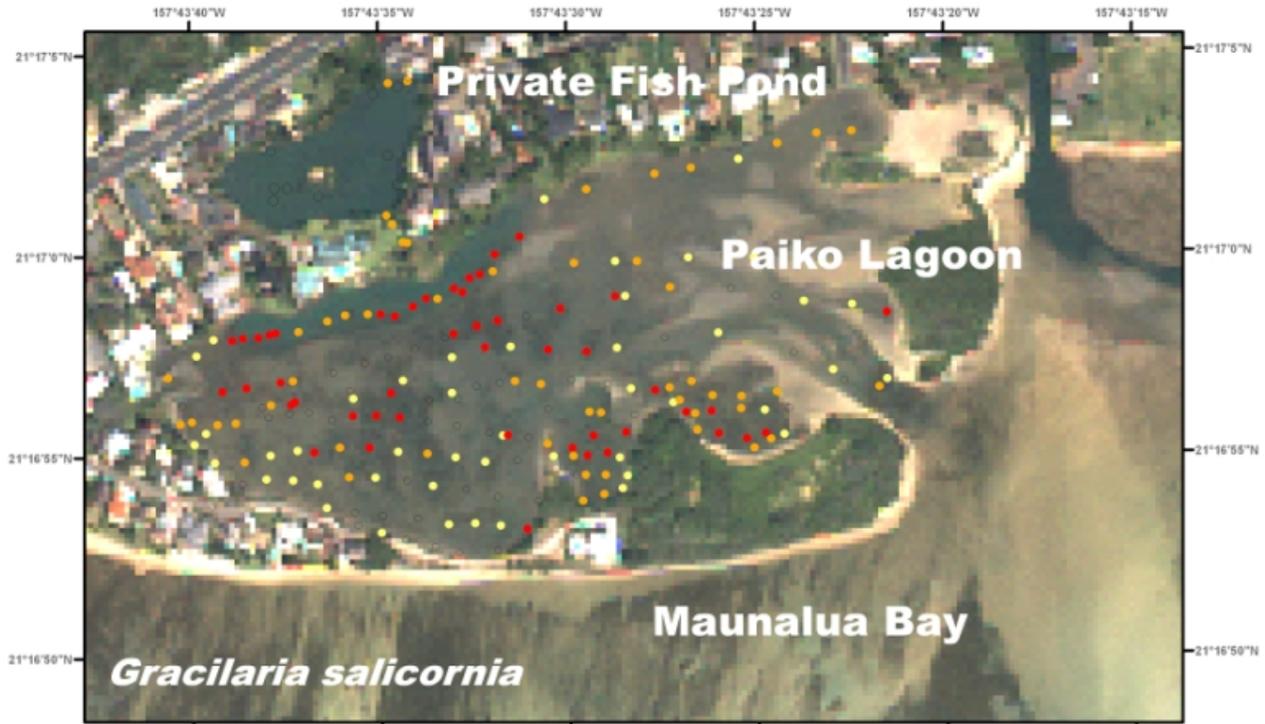


Photo 6: Compost pile of *Gracilaria salicornia* and *Acanthophora spicifera* left in open for rain to wash salt off.

# Maunalua Bay *G. salicornia*/ *A. spicifera* 2006-2010



# Paiko Lagoon *G. salicornia*/ *A. spicifera* 2006-2010



# Private Paiko Fish Pond: *G. salicornia*/ *A. spicifera* 2011

