

...Algae Dominated

**Non-indigenous species as
threats to coral reefs**



Hawai'i Coral Reef Initiative



Mike Hamnett, Director

Management Committee

Lu Eldredge, Bishop Museum/Pacific Science Association

Jo-Ann Leong, Hawai'i Institute of Marine Biology, UH

Celia Smith, Botany, University of Hawai'i

Bill Devick, Division of Aquatic Resources (DAR)

Frances Oishi, DAR

Bob Nishimoto, DAR

Kevin Foster, US Fish and Wildlife Service

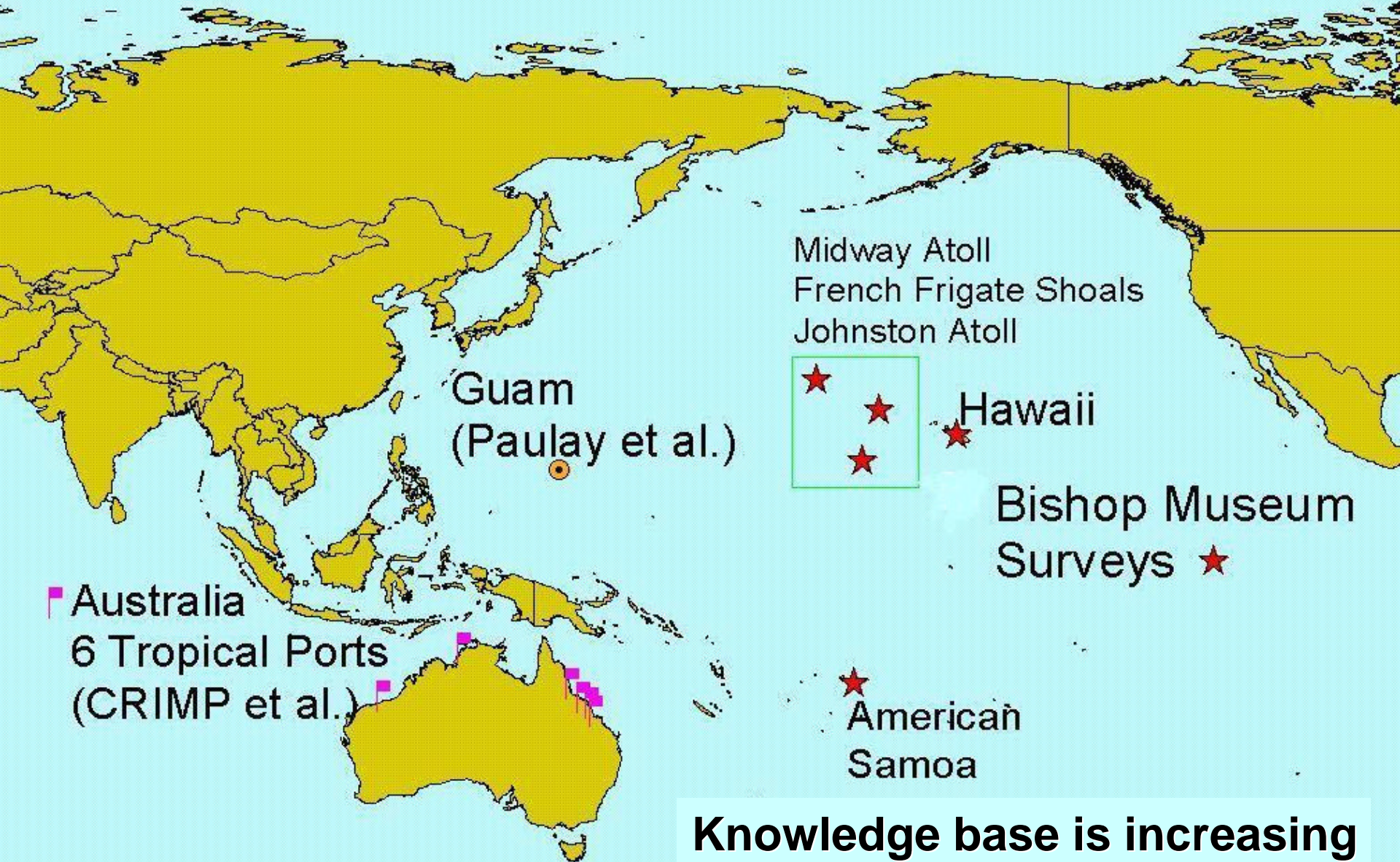


University of
Hawai'i
M Ā N O A



COASTAL
OCEAN
PROGRAM

Marine NIS Surveys - Tropical Pacific



**Knowledge base is increasing
– in select areas**

MARINE ALIEN SPECIES SURVEYS – TROPICAL PACIFIC

Region	Total Nonindigenous	Total Species	% Nonindigenous
<u>Hawaii</u>			
• O'ahu			
➤ Pearl Harbor	95	419	23.0
➤ S & W Shores	100	585	17.0
➤ Waikiki	52	749	6.9
➤ Kuapa Pond	58	317	18.0
• Midway	4	444	1.5
• Kaho'olawe	3	298	1.0
• French Frigate Shoals	2	622 ¹	0.3
<u>Johnston Atoll</u>	10	668	1.5
<u>Guam</u>			
• Apra Harbor	46	682 ²	6.7
• Islandwide	80	4,635	1.7
<u>Australia</u>			
• 12 Ports (Queensland)	30	-----	-----
• Hay Point Port	12	506	2.4
• Mourilyan Harbour	4	401	1.0
• Abbot Point	5	593	0.8
• Lucinda Port	11	480	2.3

1 Marine Invertebrates Only

2-Sponges, Echinoderms and Ascidians Only

TRANSPORT MECHANISMS FOR MARINE NONINDIGENOUS SPECIES: MARINE INVERTEBRATES

Mechanism	Species	% Established
Hull Fouling	212	90
Solid Ballast	21	90
Ballast Water	18	89
Intentional Release: Fishery	18	28
Parasites on Nonindigenous Species	8	88
Associated with Commercial Oysters (Unintentional)	7	100
Aquarium Release	3	67

ANS* in Hawai'i: who, when, where and how?

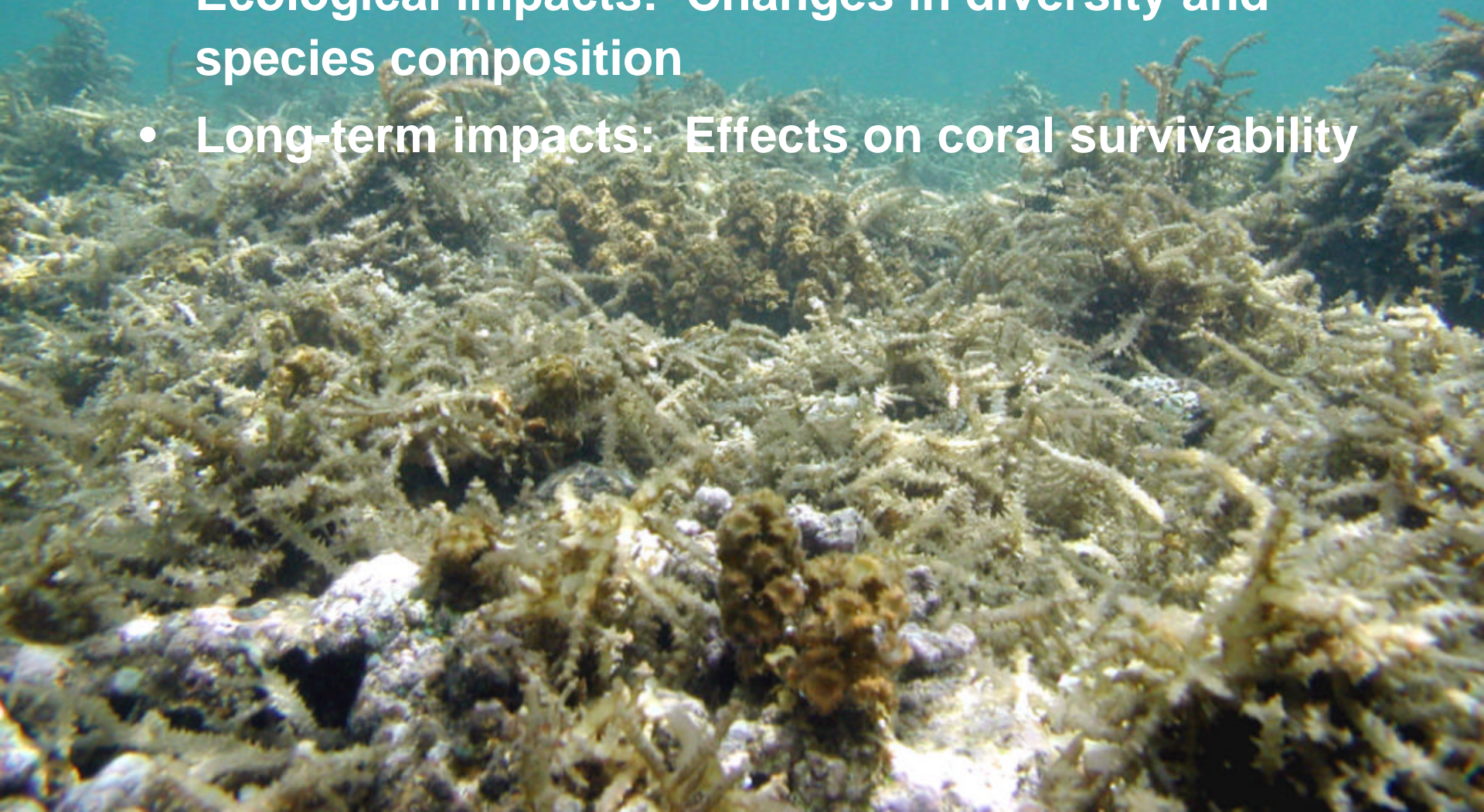


Species	Year	Origin	Vector
<i>Acanthophora spicifera</i>	1950	Guam	Hull Fouling - Accidental
<i>Hypnea musciformis</i>	1974	Florida	Aquaculture - Intentional
<i>Gracilaria salicornia</i>	1971	?, Native to W Pacific, Indian Ocean, Australasia	Aquaculture - Intentional
<i>Kappaphycus sp.</i>	1974	Philippines	Aquaculture - Intentional
<i>Avrainvillea amadelpa</i>	1981	Native to W Pacific	Unknown

* Alien nuisance seaweeds

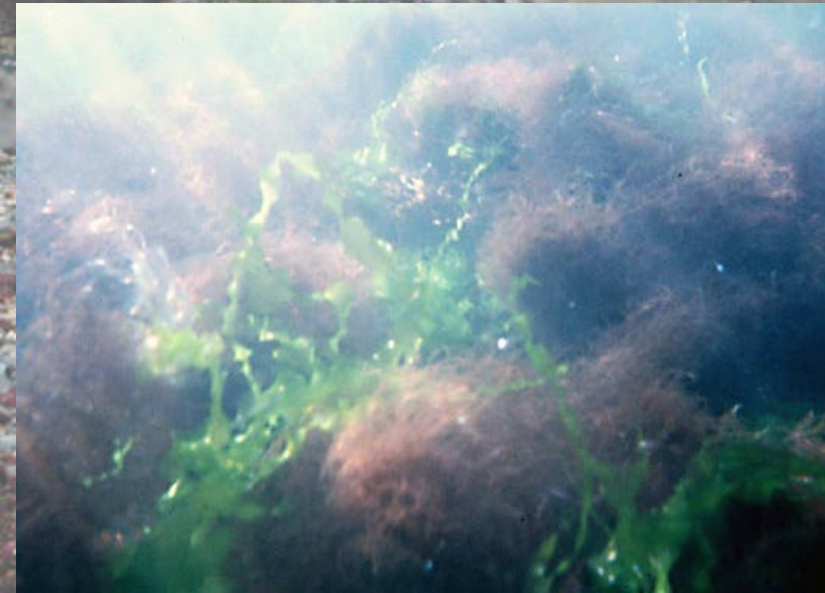
Quantifiable impacts on reefs

- Economic impacts
- Ecological impacts: Changes in diversity and species composition
- Long-term impacts: Effects on coral survivability



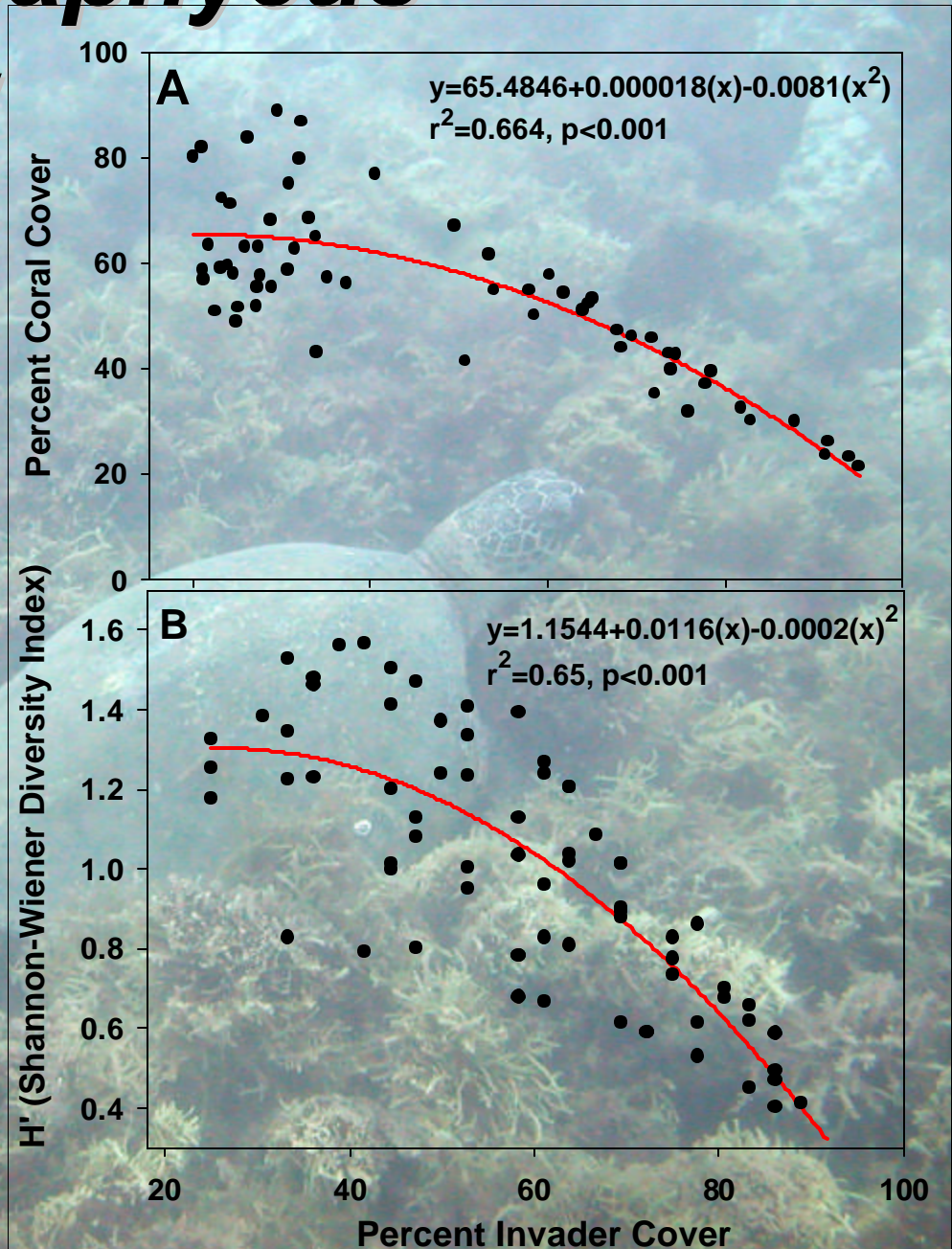
Impacts of *Hypnea musciformis* on Maui

- 20,000 lbs of algae wash up on Kihei beaches / week
- >\$100,000 / yr to clean beaches
- Economic study – algal biomass in north Kihei cost more than \$20 million / yr
 - Loss in rental income, decrease in property values & clean-up
- Ecological impacts - smothering and overgrowth

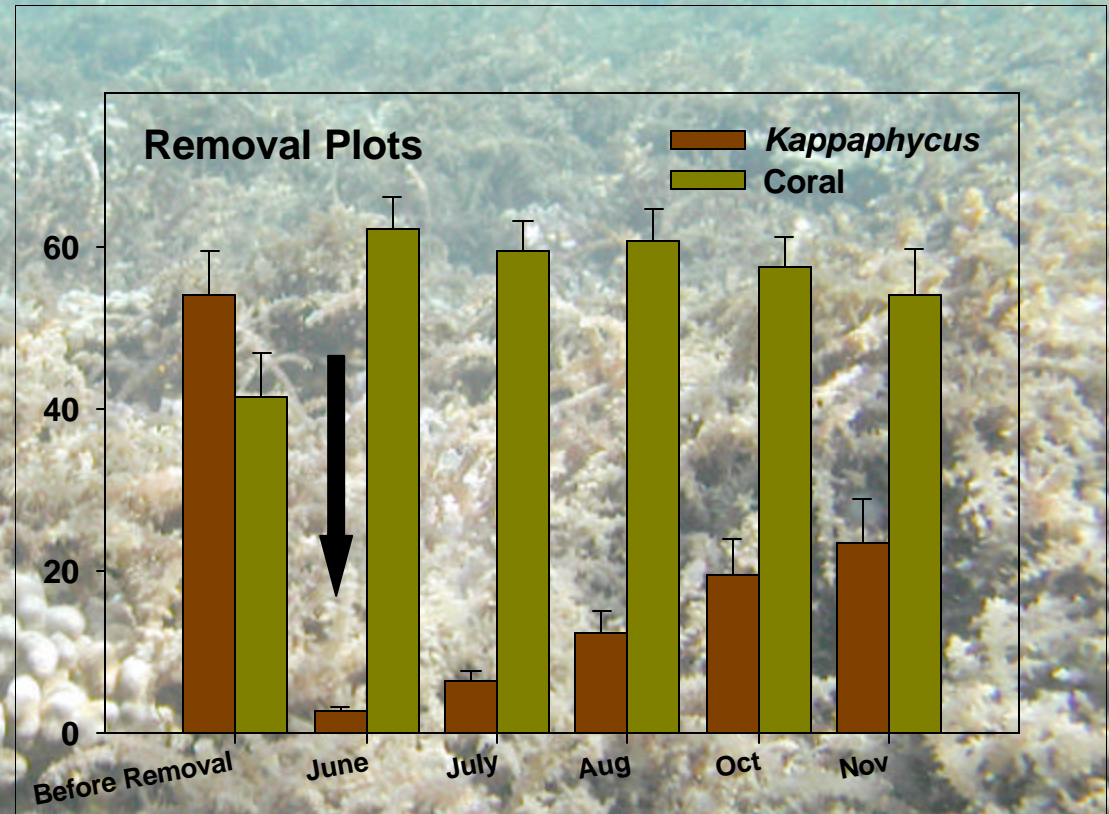
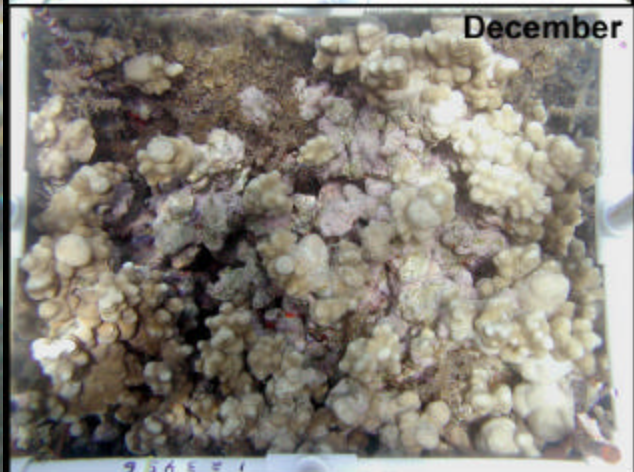
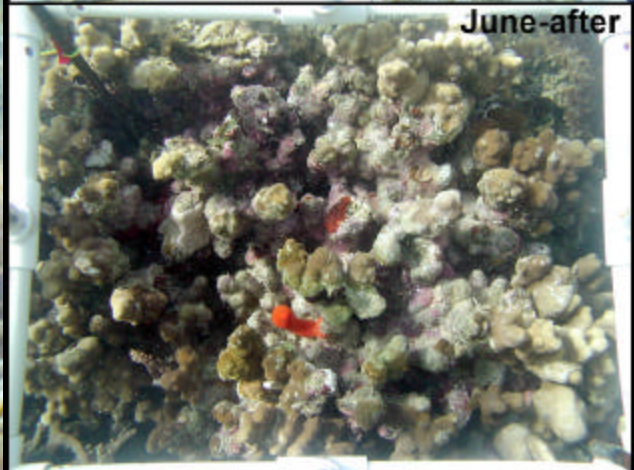
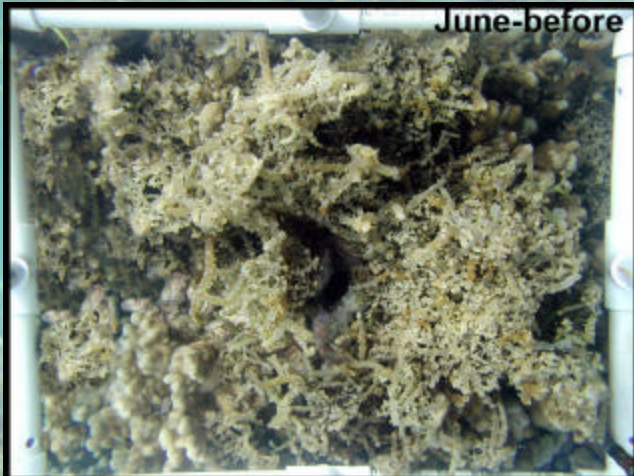


Impacts of *Kappaphycus* in Kane'ohē Bay

- *Kappaphycus* abundance is significantly correlated with lowered diversity & coral cover
- N=72 plots

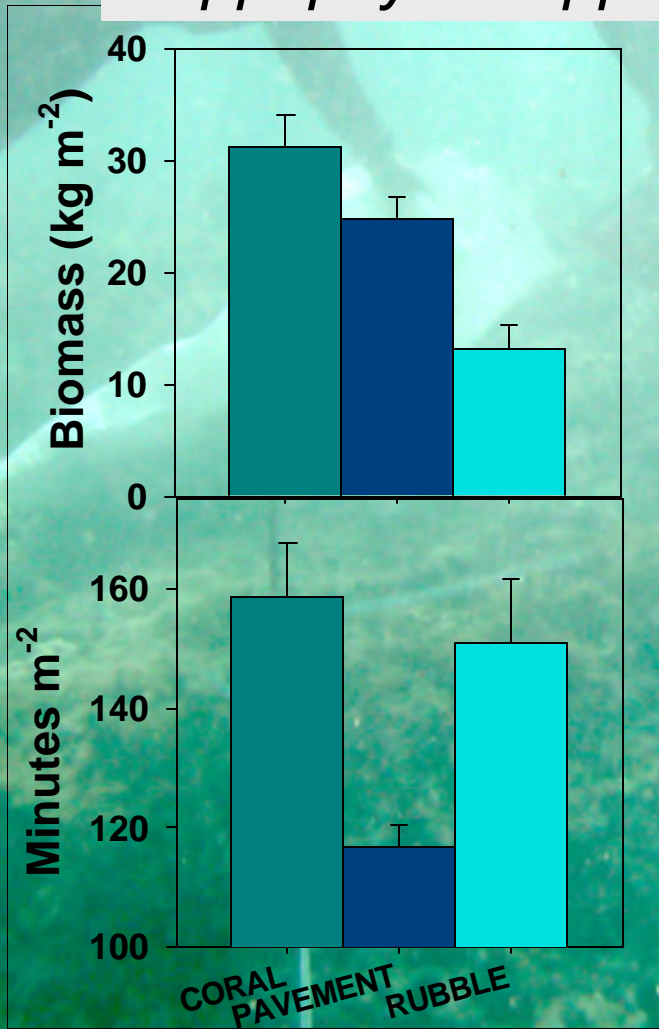


Kappaphycus Removal

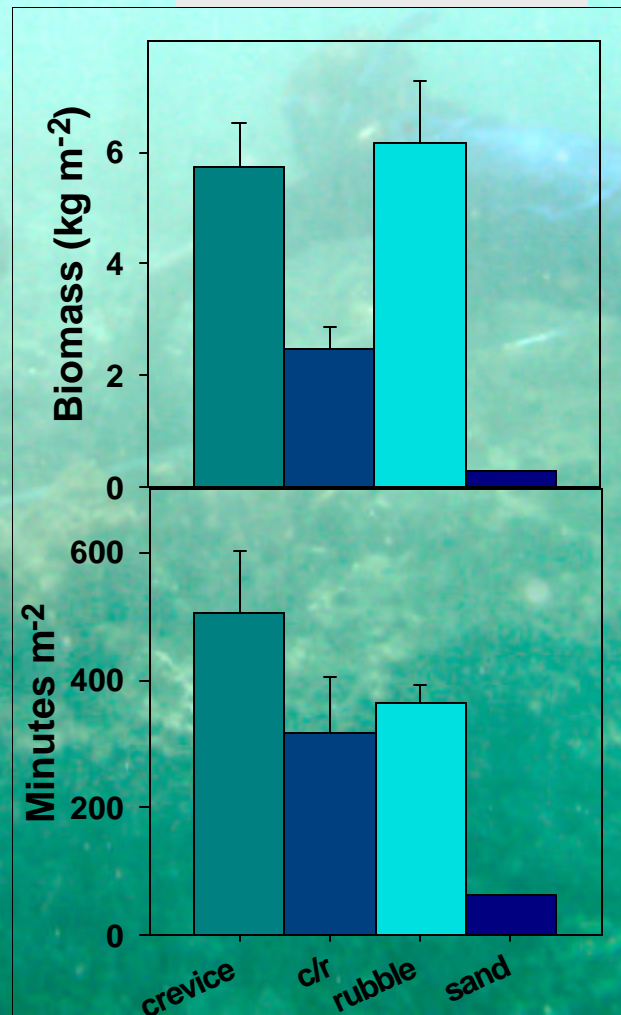


Manual Removal

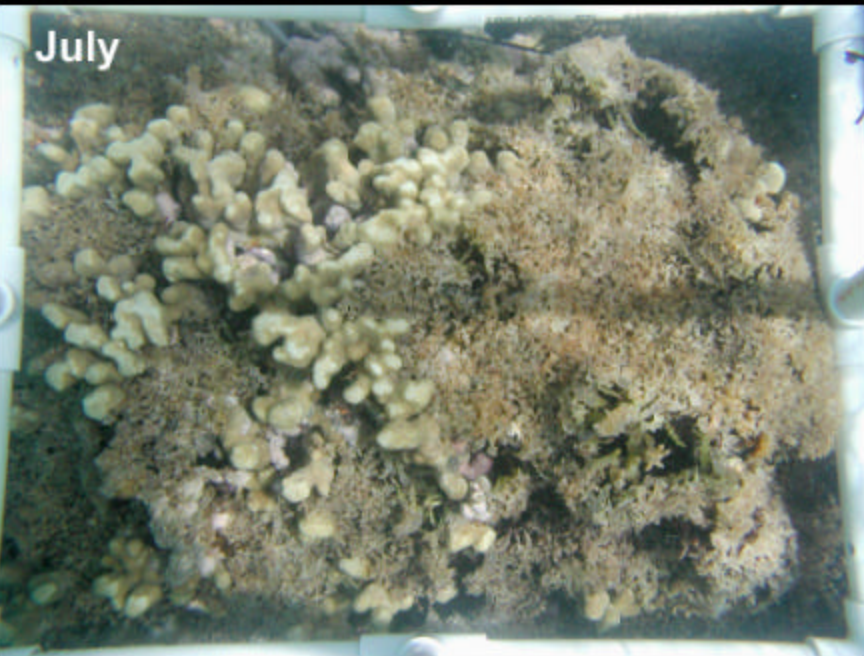
Kappaphycus spp.



G. salicornia



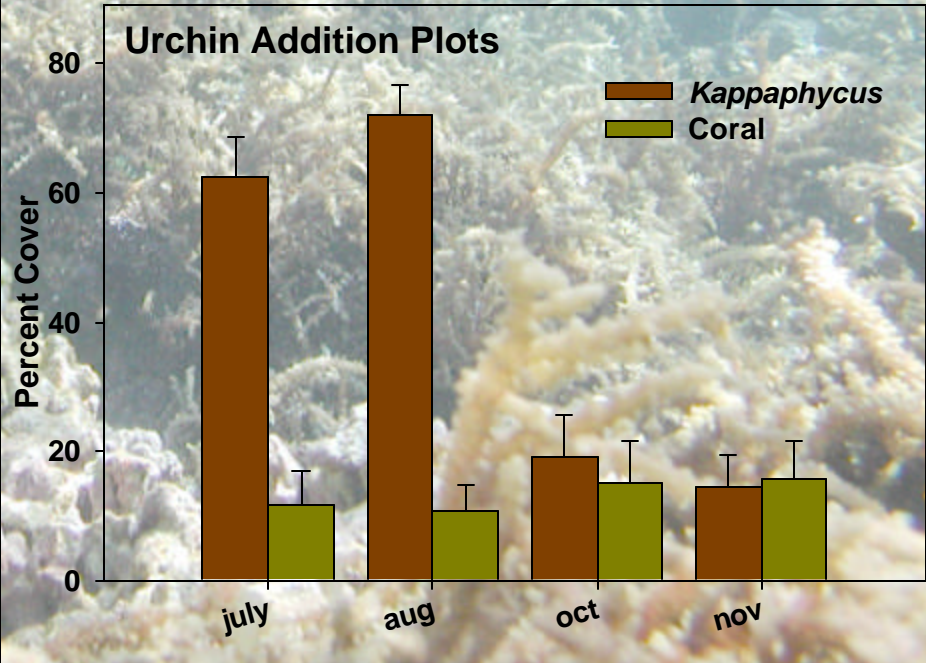
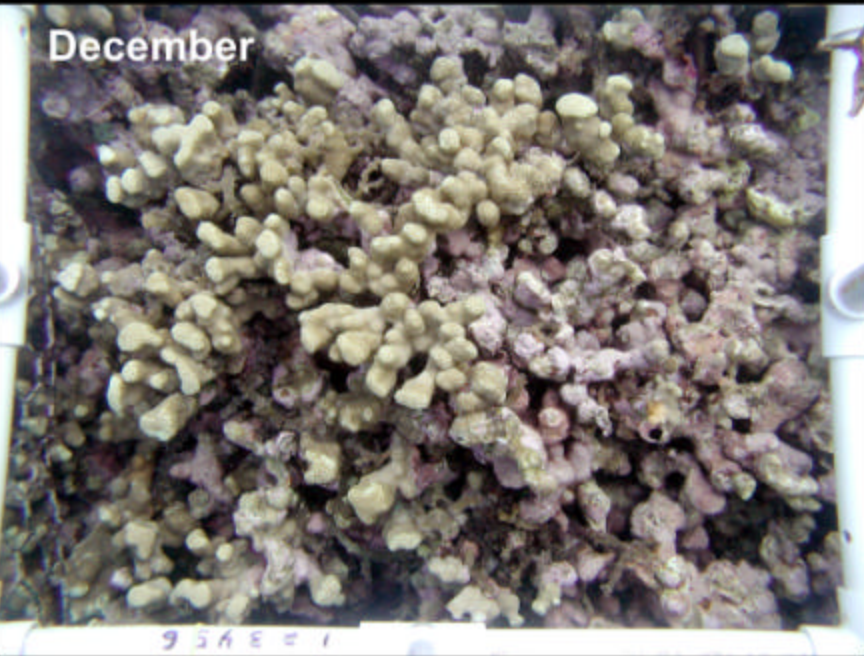
July



Adding Urchins



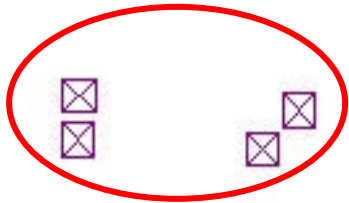
December



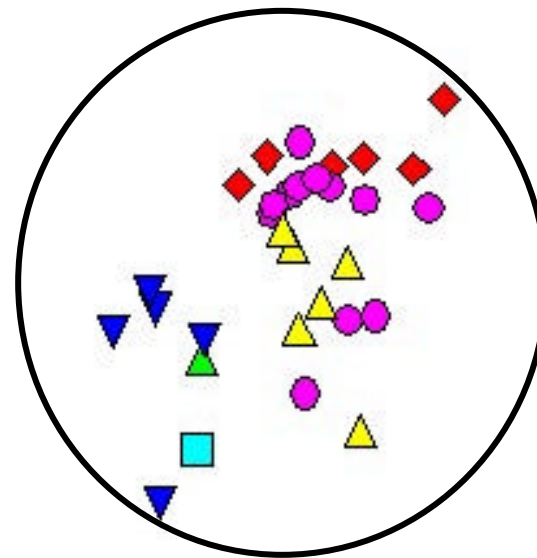
Impacts of *Gracilaria salicornia* in Waikiki

MDS Plot: Changes in Community Structure on Waikiki's Reefs

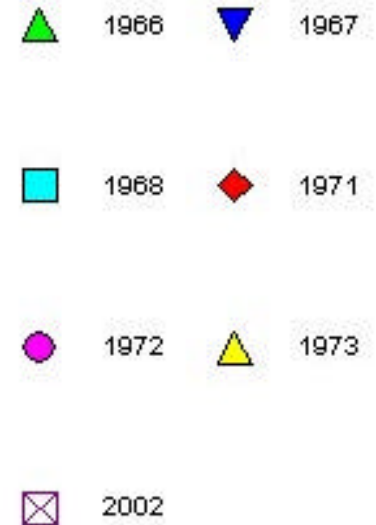
Stress: 0.09



Less than 20 species
Dominated by 2 alien algae



Over 60 species
No single species dominated



Community and Volunteer Training

Waikiki Alien Algae Clean-Up Event

August 24, 2002

Waikiki Alien Algae Clean-Up Event

September 21, 2002

Waikiki Alien Algae Clean-Up Event

November 16, 2002



- Gracilaria salicornia* was introduced to Waikiki in 1974 for aquaculture.
- Tons of *G. salicornia* wash up on Waikiki's beaches after south swells.
- This exotic pest outcompetes native species and overgrows living coral.



What We Are Doing:

- On September 21, 2002 over 90 volunteers removed 6,500 lbs. of the alien alga *Gracilaria salicornia* in less than 5 hours from the reef fronting Waikiki.
- On November 16th, 2002 volunteers and researchers will make another concerted effort to reduce the impacts of this invasive species on Hawaii's reefs.
- The goals of these multi-agency events are to determine the resources and manpower needed to control invasive, alien algae in Hawaii.



This event is fueled by:



- Alien algae clean-up events
 - 3 in Waikiki
 - 2 Events in Kane'ohe
- Informational booth with brochures and algal displays
- Organized in conjunction with:



- Multi-agency partnership formed with the goal of reducing impact of alien algae in Hawai'i

Invertebrate species



Carijoa (=Telesto) riisei

on 100 ft Waikiki Wreck;
threatens precious corals

Gelliodes fibrosa



Chthamalus proteus

Pennaria disticha at Tern Is.

in Northwestern
Hawaiian islands

BISHOP MUSEUM

Home | Natural Sciences | Hawaii Biological Survey | Invertebrate Zoology | Marine Invertebrate Checklist

Checklist Marine Invertebrates of the Hawaiian Islands

L.G. Eldredge and R.C. DeFelice
Hawaii Biological Survey, Bishop Museum, Honolulu, Hawaii

This compilation was initiated in the mid-1960s as a 3x5 card file in an attempt to keep track of the marine biota of the Hawaiian Islands. The information has been used, in part, to assemble the "How many species are there in Hawaii?" series which appears in the Records of the Hawaii Biological Survey annually and the "Reef and Shore Fauna" series. Periodicals, books, and reports beginning as early as the late 1700s have been reviewed, as has been Zoological Record.

The Invertebrate Checklist can be viewed in a static outline form arranged in phylogenetic order grouped by major taxonomic level, or it can be searched by phylum, class, order, family, species, biogeographic status (i.e., native or introduced), general habitat, and location. In search mode, the literature references which report the species in the Hawaiian Islands are listed. References are not shown in the outline view. Follow the "outline" link to view a summary table of major invertebrate taxa found in the Hawaiian Islands.

The list is still considered to be preliminary, and comments and suggestions for additions and revisions are encouraged. The Checklist will be updated periodically. Special thanks go to the Charles H. and Margaret B. Edmondson Trust for partial support to develop this website. Please contact L. G. Eldredge [psa@bishopmuseum.org] with your comments.

Search the checklist
Run simple query on taxa, status, location, and habitat.

Browse the checklist
View Checklist in outline form by major taxonomic group.

For example:

- Phylum Echinodermata
- SubPhylum Eleutherozoa
- Class Ophiuroidea
- Order Phryngophiurida
- Family Asteroschematidae
 - Asteroschema* Oersted and Luetken, 1856
 - Asteroschema ajax* Clark, 1949
 - Asteroschema caudatum* (Lyman, 1879)
 - etc.....

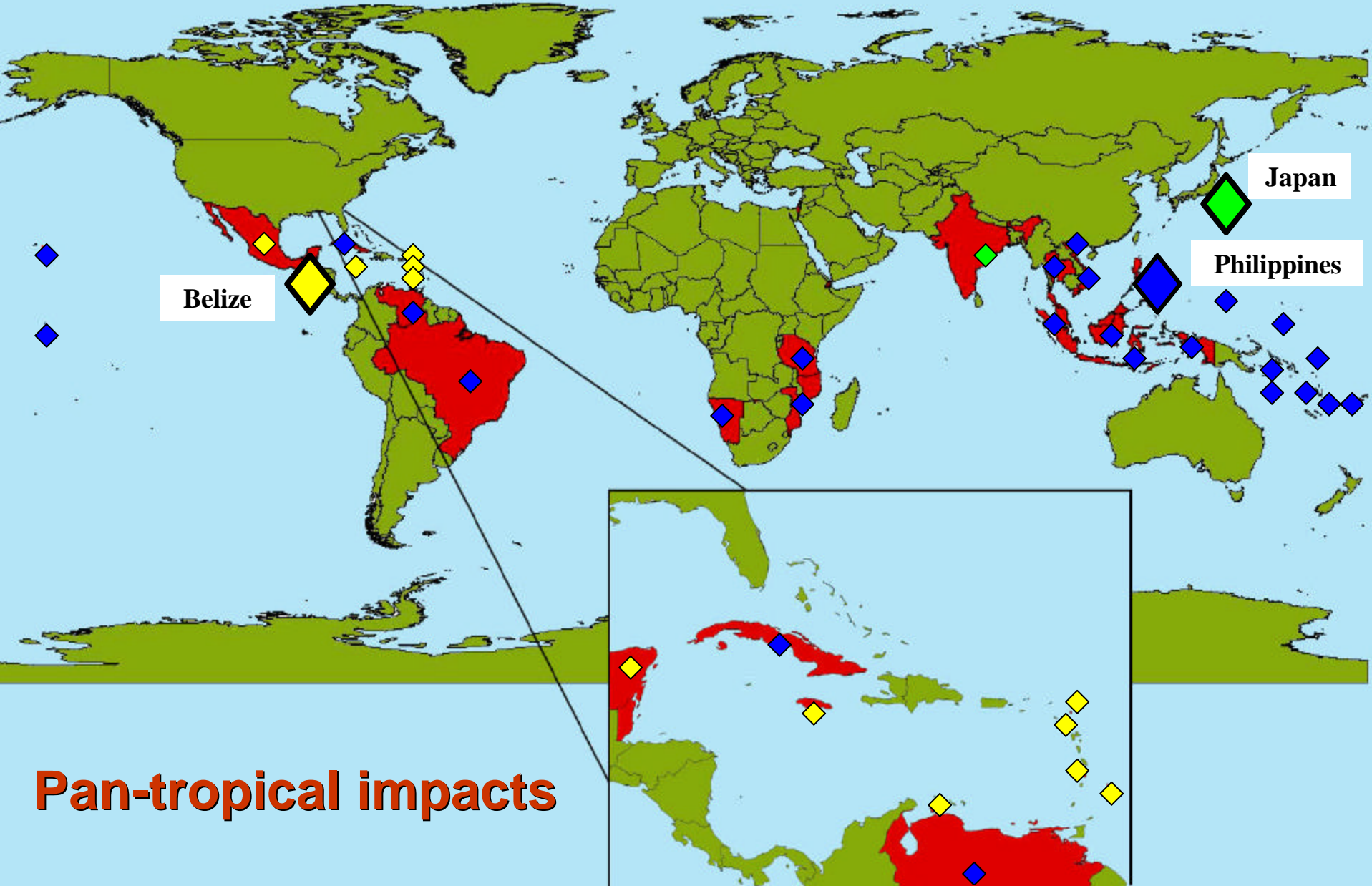
Threat of coral diseases



Acropora tumor

Photo by T. Work

Global Sites of Introduction: *Kappaphycus*



Belize

Japan

Philippines

Pan-tropical impacts