Eradication of *Caulerpa taxifolia* in the US Five Years After Discovery: Are We There Yet?

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Acknowledgements

- Southern California Caulerpa Action Team
- California Dept. of Fish and Game
- Merkel and Associates (Keith Merkel, Rachel Woodfield, Robert Mooney)
- Wailun Tan (USDA-ARS/ UC Davis)
What is *Caulerpa taxifolia*?

- Marine alga
- Native to tropics (Australian origen-but selected for cool-water tolerance)
- Bright green, with fern-like fronds
- Used in saltwater aquaria
Caulerpa taxifolia

Photo: Rachel Woodfield
Caulerpa taxifolia
Why is *C. taxifolia* a concern?

History in Mediterranean Sea:
- 1984: one small (1 m²) patch
- 2001: >100 sites; >15,000 hectares; five countries; >>>out of control!
- Habitat Changer
- Reduced biodiversity

*California/USA*- Threat to >800 km of shoreline
Santa Barbara Harbor
China Cove/Newport Beach
Emerald Cove - Laguna
Why is *C. taxifolia* invasive?

- Long survival out of water
- Not eaten by herbivores outside its native range
- Spreads by fragmentation
  - Very small pieces are viable
- Invasive
What is *C. taxifolia* invasive?

- Cold-tolerant (aquarium strain)
- Can form dense mats
- Can grow on any substrate
- Can grow rapidly
- Can grow over a wide range of depths
Caulerpa taxifolia in the US:

Agua Hedionda Lagoon
30 mile north of San Diego, CA
Discovered June 12, 2000

Huntington Harbour
Near Long Beach, CA
Discovered July, 2000
Caulerpa taxifolia in Agua Hedionda Lagoon
Caulerpa taxifolia in Agua Hedionda Lagoon
East Basin - Cumulative total June

2000 - April 2002
What has been done?

- Response team immediately formed: "SCCAT"
  - Southern California Caulerpa Action Team

**Steering Committee:**
CA-State Regional Water Board
CA Dept. of Fish and Game
US- NOAA Fisheries
USDA- Agricultural Research Service

- **Goals**
  - Eradication of existing infestations
  - Prevention of new infestations

- Action plan; Implementation
What has been done?

- Containment / treatment
- Intensive surveillance of waters known to be infested
- Mapping / record keeping
- Verification of Treatment Efficacy (sediment bioassays)
- Limited surveillance of other waters
Diagram depicting typical tarping of Caulerpa colonies for containment and treatment with chlorine.
PVC Containment and Treatment System for

Caulerpa taxifolia

Injection port for sodium hypochlorite
What has been done?

- Develop Criteria for Eradication
- Surveillance evaluation
- Outreach / education
- Stakeholder meetings
- Legislation
What is the current status?

- None found in Agua Hedionda Lagoon since September 2002
  - Surveillance ongoing
- None found in Huntington Harbour since November 2002
- Continue Surveillance
- Declare full eradication in fall of 2005 (?)
PVC Core sampler used for removal and transport of sediment from *C. taxifolia*-infested sites after treatment with chlorine.
Two types of *Caulerpa taxifolia* explants used to inoculate "control" (untreated) sediment cores to verify adequate grow-out conditions.
Control Cores 42 DAP
Eelgrass in Chlorine-Treated Cores - 76 DAP
Eelgrass Seedlings Emerged from Sediment Cores from Tarped and Treated C. taxifolia Colonies- 76 Days after Core Sampling
Agua Hedionda - *Caulerpa*
Lagoon Wide Infestations (m²)

No plants found
# Summary: Post-Discovery Actions:

- **JUNE 12, 2000-** DISCOVERED IN CARLSBAD, CALIFORNIA (CONFIRMED 3 DAYS LATER)
- **JUNE 29-** >>First Eradication Treatments
- **JULY 2000-** DISCOVERED IN HUNTINGTON HARBOUR >> Eradication underway after confirmation
- **JULY, 10, 11, 2001** ANS Sponsored conference on “Implementing a National Prevention Program”
- **SEPT. 24TH. 2001** State legislation signed to BAN C. taxifolia plus 8 other species in California
- **JAN. 2002** International Conference on Caulerpa taxifolia
- **2001, 2002** Efficacy Assessment, Containment, treatments of very small plants
- **September, 2004** No new plants found (last found: Sept/Nov 2002)
What Now?

✓ Continue surveillance
✓ Establish Criteria for

"Notification of Eradication"
Fall 2005?

✓ Communicate "End Game" to stakeholders

✓ Celebration: Grilled lobster smothered in garlic-roasted caulera!!
Optimal Conditions for Rapid Response

Pre-Invasion Planning!

Biological and Ecological Expertise

Eradication Expertise in Place

Knowledge of Site with Stakeholder Support

Adequate Funds-Fast!
Why Has the California Response been Successful?

- Scientific and Political "Awareness" in place two years before the first population was found
- Fortuitous detection (Knowledge... and LUCK!!)
- Essential components of Eradication program quickly assembled through agency consensus (1 to 2 weeks)
- Field team was already in place
- Political will rapidly followed scientific input
- Extremely dedicated people With a Clear Goal
- $1 million "raised" for first year of project (About $3.4 million since 2000)
- Full Eradication Will Cost ca. $5 MILLION
Potential Use of Acetic Acid for Eradication

7 Days Post-Treatment
30 min 2% Acetic Acid
Control
Preventing New Introductions of Invasive Marine Plants

- Improved Communication with Aquarium Industry & Hobbyists on "INVASIVE SPECIES"
- Use "Case Study" examples to explain costly impacts
- Promote environmental stewardship via media, clubs, associations: This must include plant communities as part of the ecosystem
- Research, identify and promote use of safe alternative plants
- Provide incentives to the retailers, e.g. recognition of responsible marketing, inventory and sales