Monitoring and Detection of *Caulerpa taxifolia* in Florida

Florida Department of Agriculture and Consumer Services
Division of Aquaculture

Caulerpa taxifolia

- **Marine macroalage from South Pacific, coastal Australia, also native to Caribbean**
- **Used as an aquarium plant in Europe and North America**
- **Aquarium plant was likely source of infestation in Mediterranean**
- **In the Mediterranean, *Caulerpa* (Med clone) overgrows other plants, altering the ecosystem**
- **Introduction detected at Carlsbad CA in 2001, DNA indicates Med clone origin**

Invasive Characteristics

- **Grows fast on different substrates**
- **Reproduces by vegetative fragmentation**
- **Tolerates variable temperature and salinity regimes**
- **Lacks predators, produces toxin that discourages grazing by sea urchins**

Monitoring Program

- **Must be supported on a low budget**
- **Must provide a cost-effective survey of areas of highest risk**
- **Must have capability to detect invasive *C. taxifolia* and distinguish it from native *Caulerpa* species**

Monitoring Program

- **Learn from California**
- **Surveys by divers very expensive**
- **Dive club volunteers offer alternative survey capacity**
- **Identification by DNA analysis of samples**

C. taxifolia (Med.clone vs. native)

Caulerpa taxifolia is present in the Florida Keys.

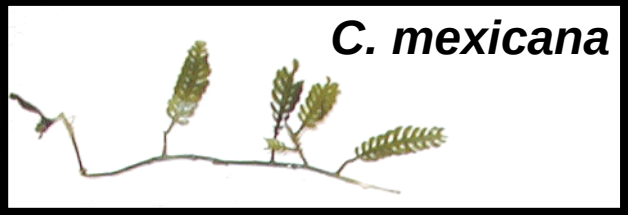
Is it distinguishable from the Mediterranean clone?

How do the appearance of other Caulerpa species in Florida compare to the Mediterranean clone?

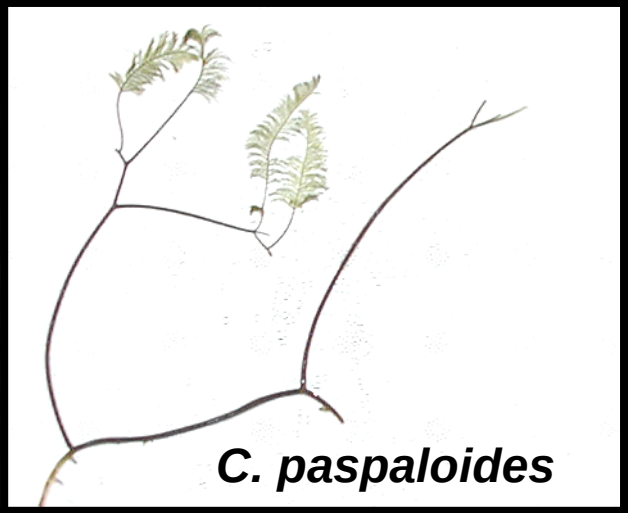
C. taxifolia (Florida Keys)

C. taxifolia (Carlsbad, CA)

Caulerpa species of Florida



C. mexicana



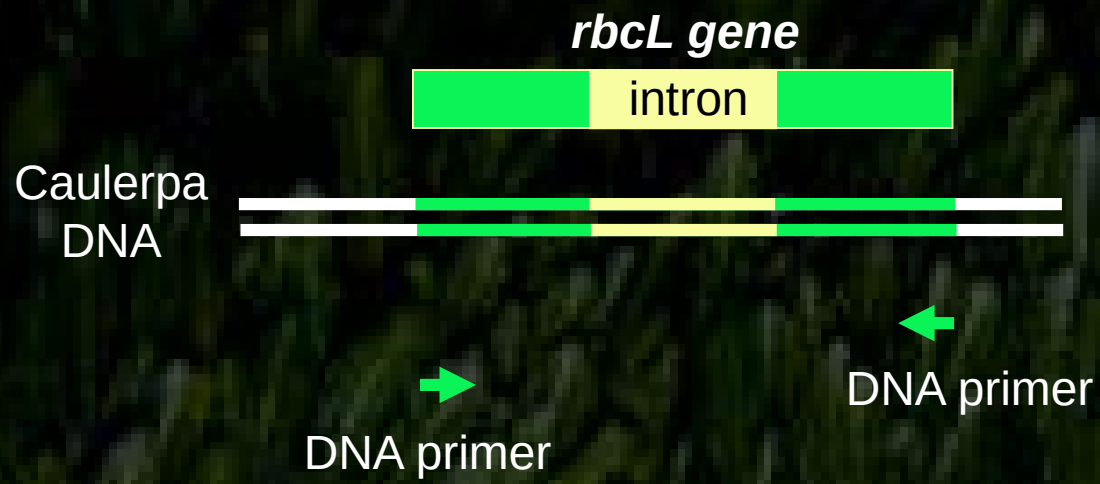
C. paspaloides

C. mexicana var. lixor

C. taxifolia (Florida Keys)

C. taxifolia (Carlsbad, CA)

PCR reaction



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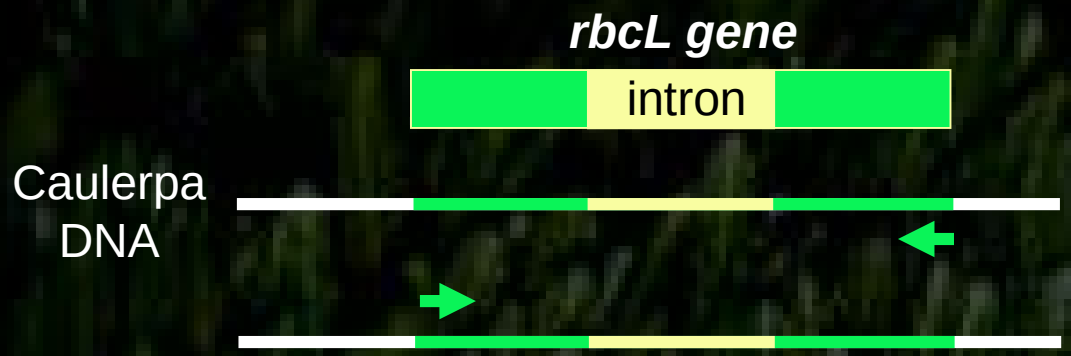
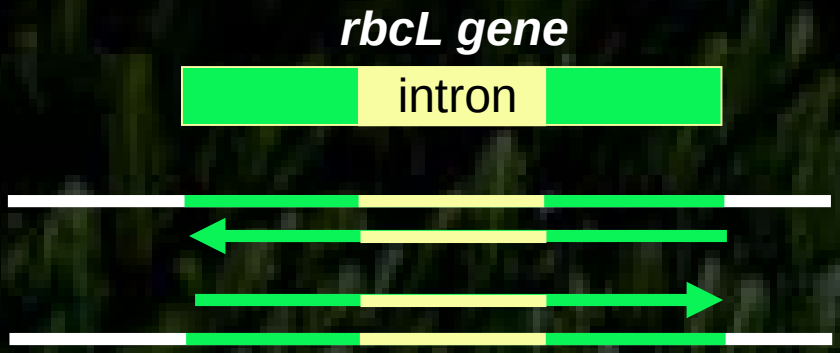


Separate DNA strands, allow primers to bind DNA

PCR reaction



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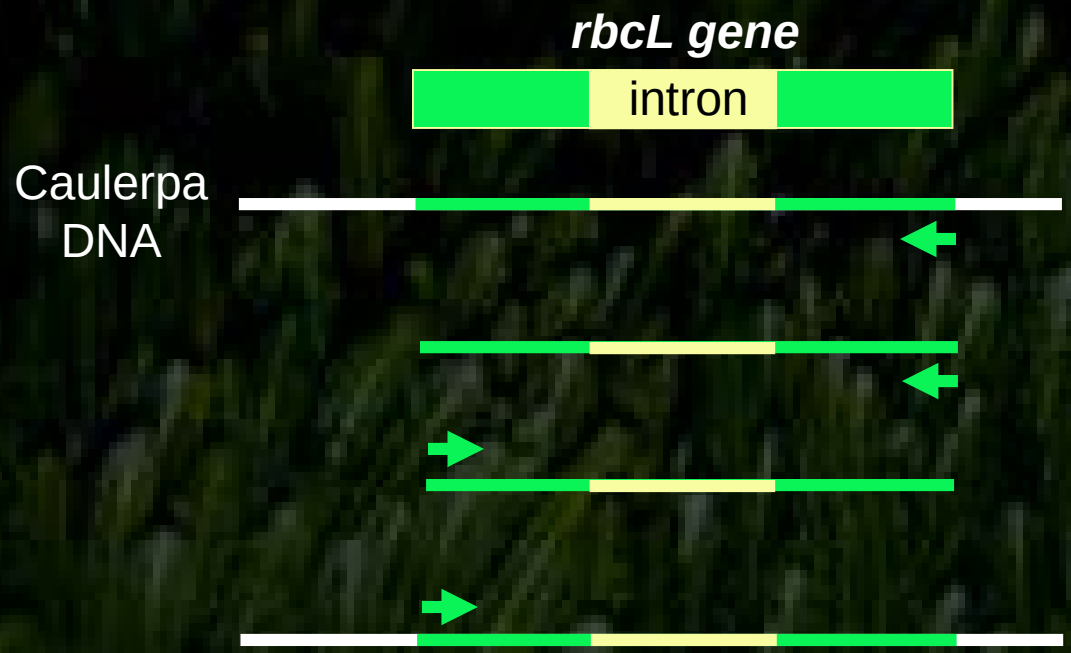

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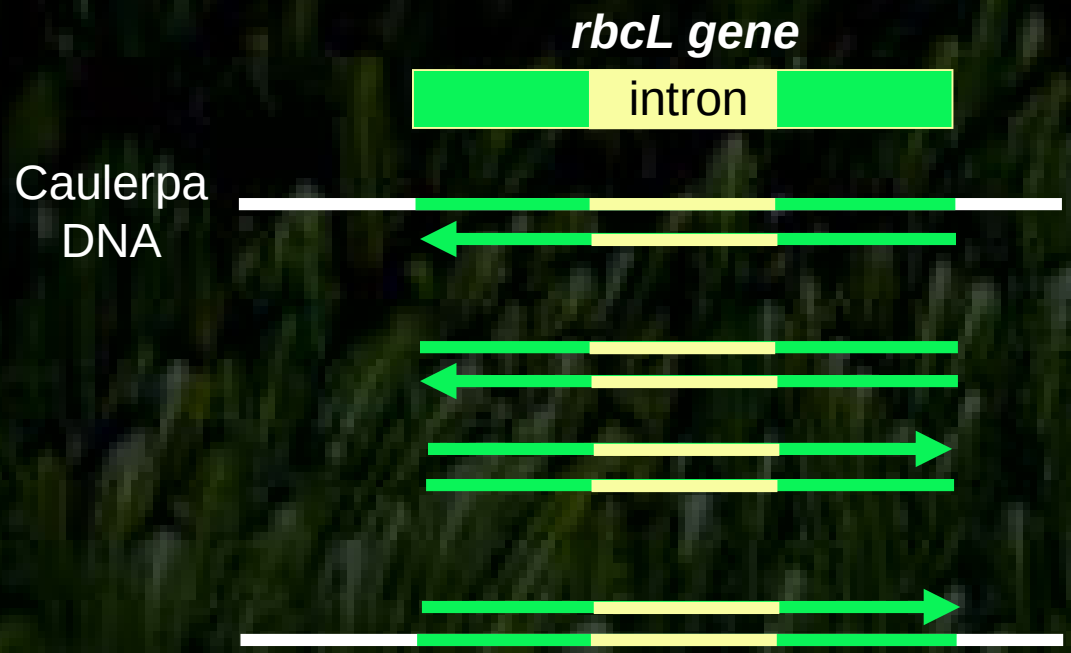
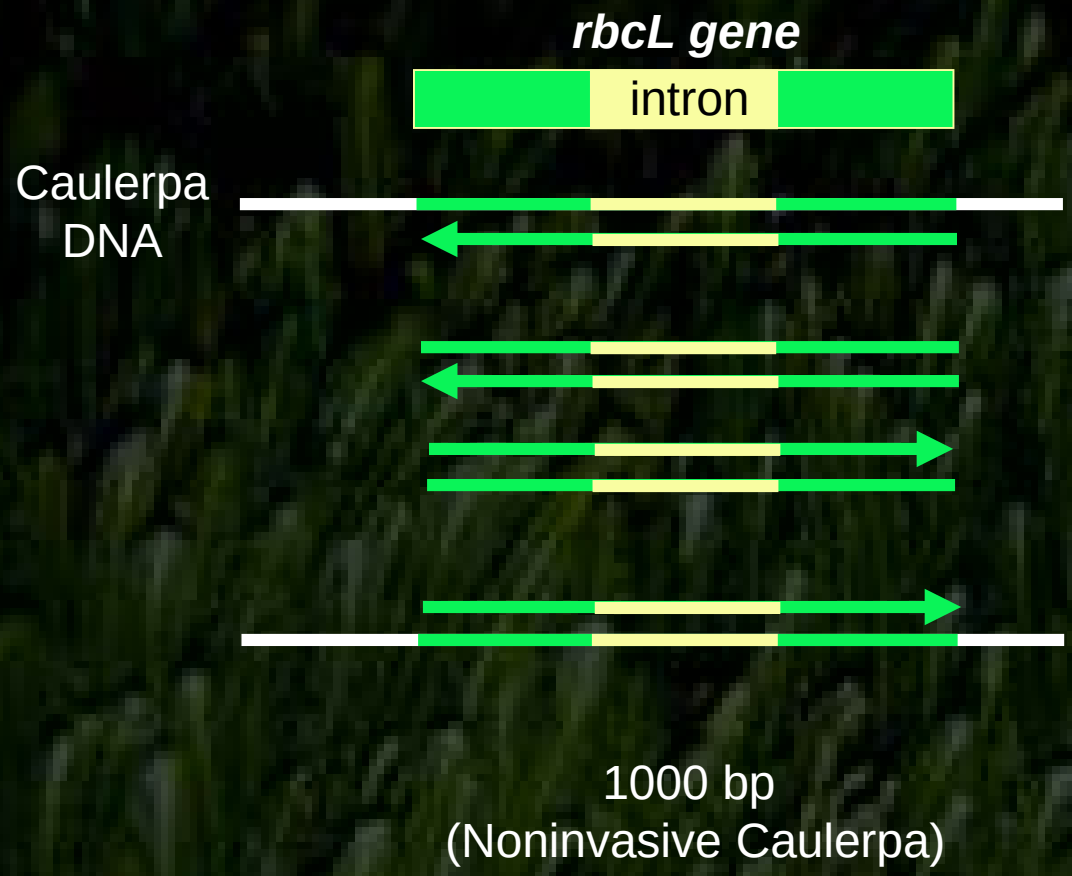
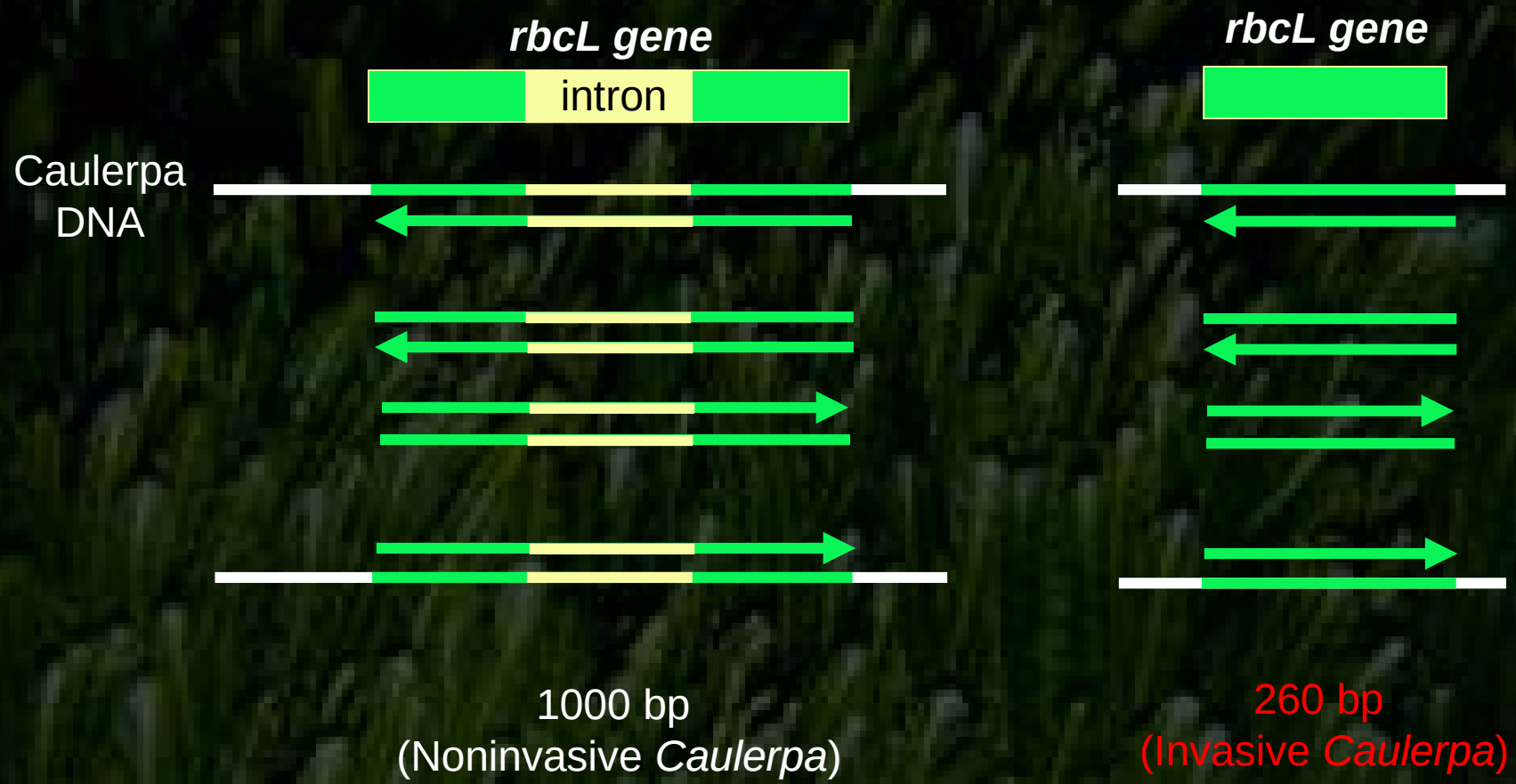


Synthesize new DNA

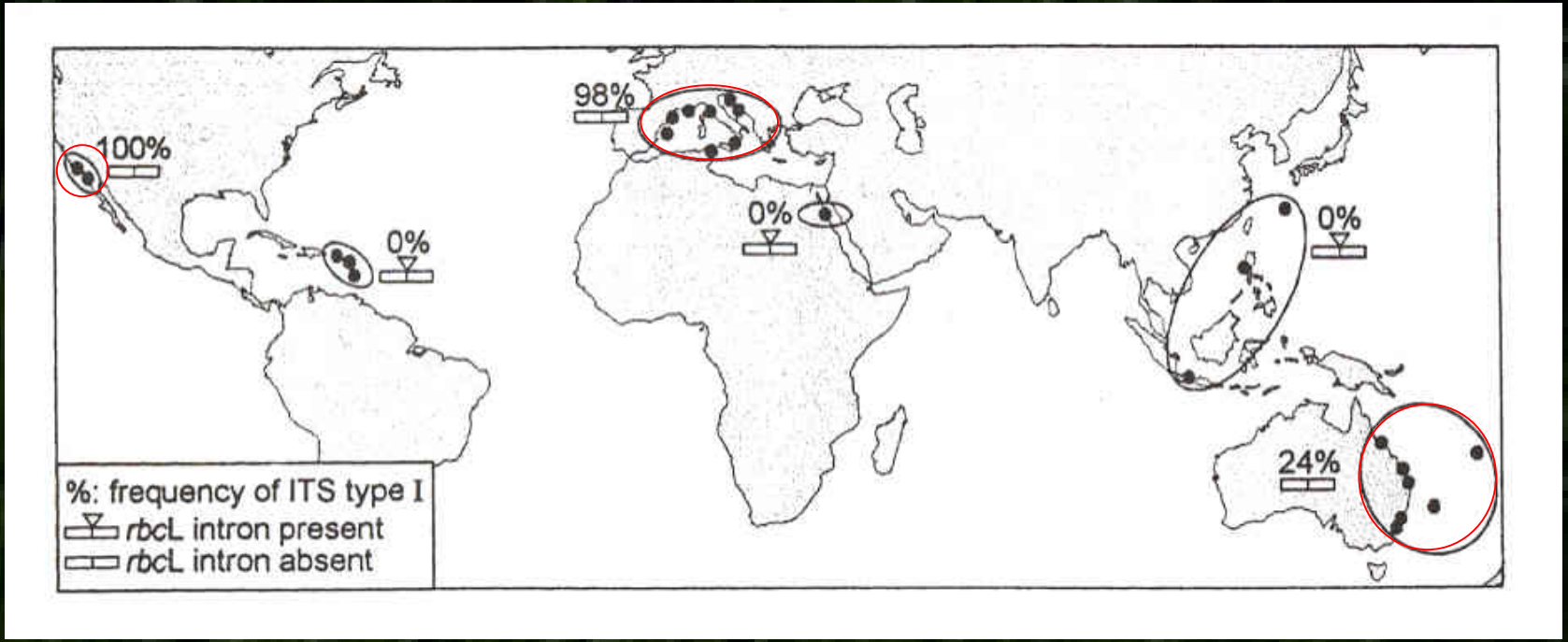
PCR reaction



PCR reaction



PCR results suggest Australian origin of invasive *Caulerpa taxifolia*

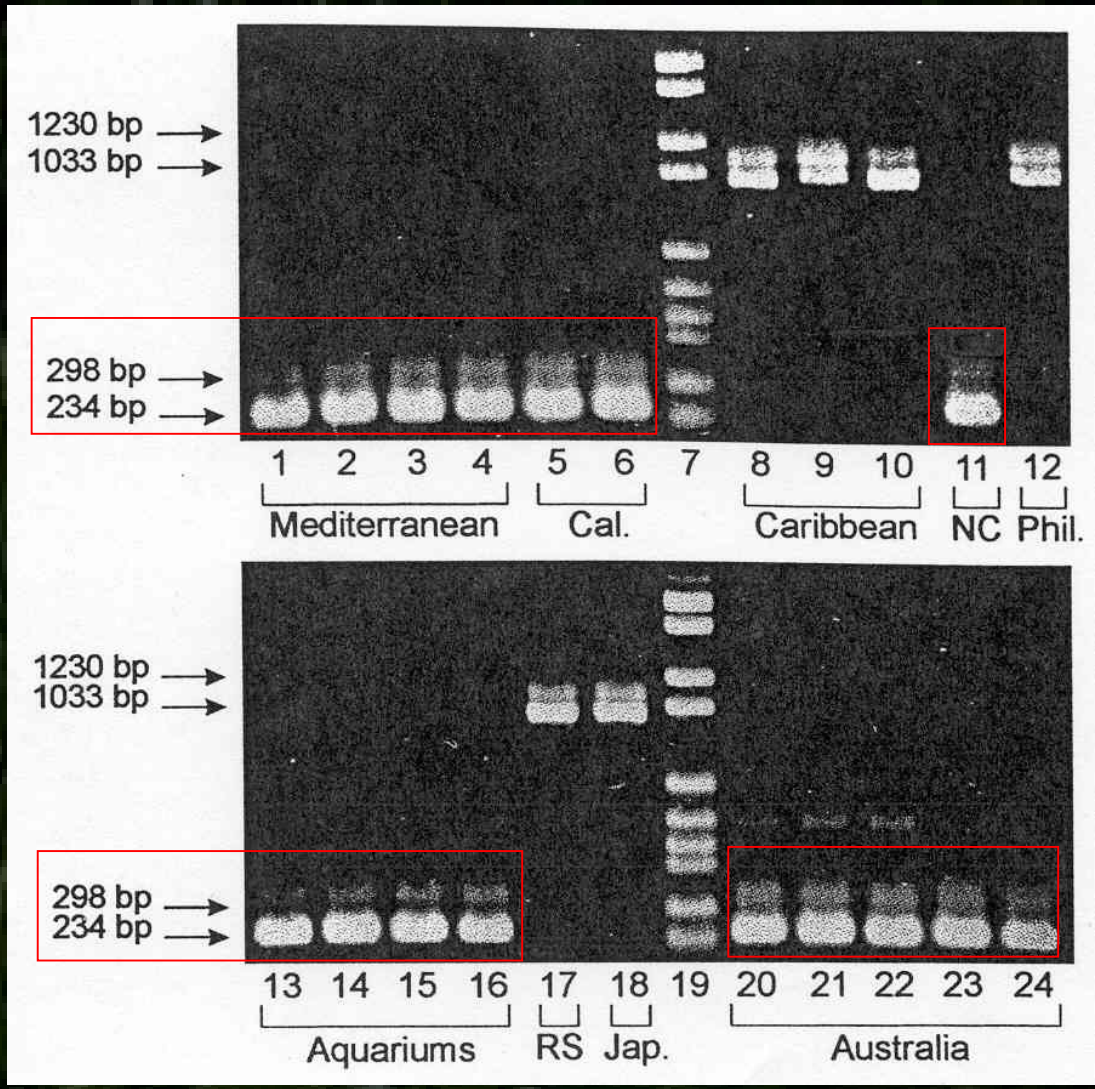


Fama et al, 2002, J. Evol.Biol

PCR Assay

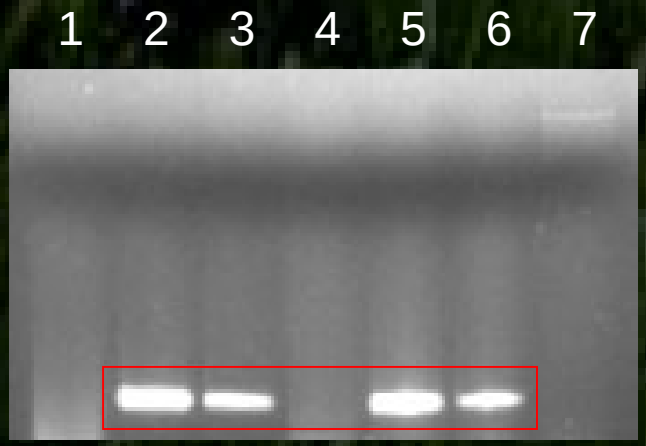
A DNA fragment of ~260 bp is diagnostic for the Mediterranean clone (and also Californian, South Pacific, and aquarium samples)

DNA fragment of ~1000 bp is diagnostic for the noninvasive *Caulerpa*.



Fama et al, 2002, J. Evol.Biol

PCR results with native Florida *Caulerpa* species

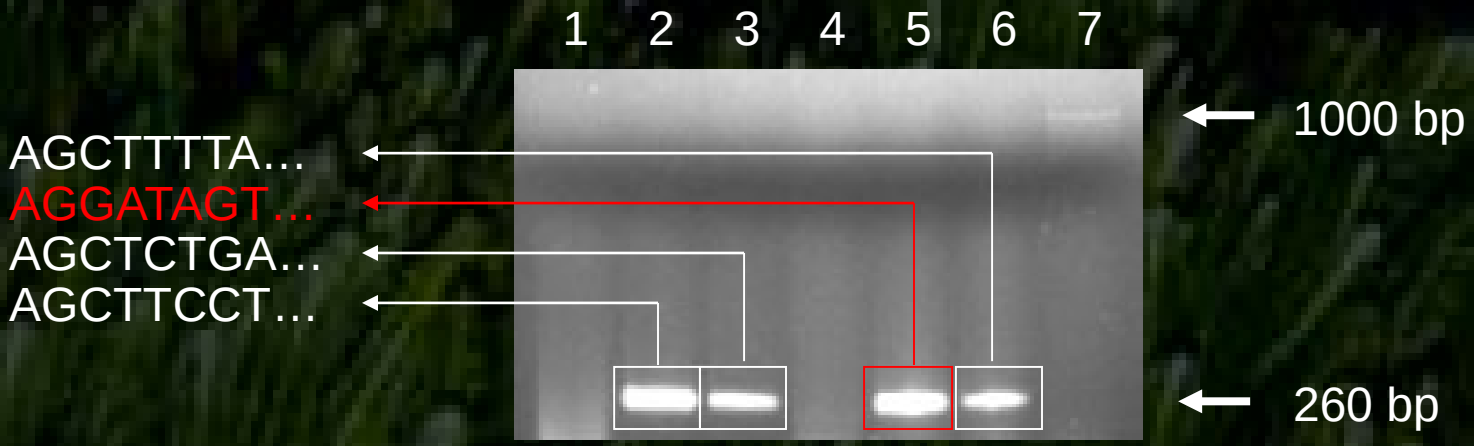


1 No DNA
2 *Caulerpa prolifera*
3 *Caulerpa paspaloides*
4 *Caulerpa taxifolia* (Florida Keys)
5 *Caulerpa taxifolia* (Med clone)
6 *Caulerpa mexicana*
7 *Caulerpa mexicana var. lixor*

PCR testing alone is not sufficient to identify *Caulerpa taxifolia* Med clone

PCR results will need to be interpreted with the associated morphological appearance of sample.

DNA Sequence analysis may be required to distinguish *Caulerpa* species



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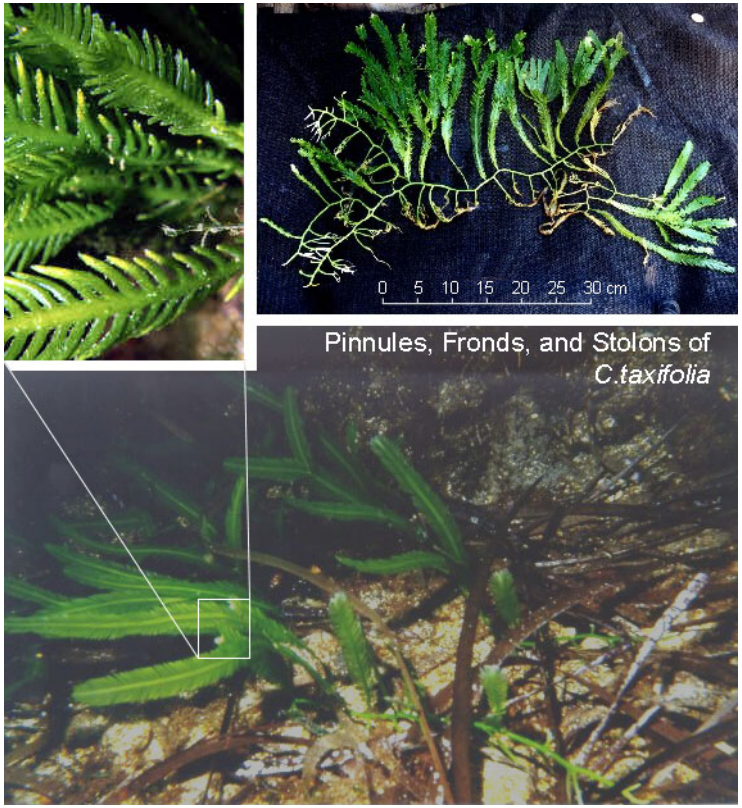


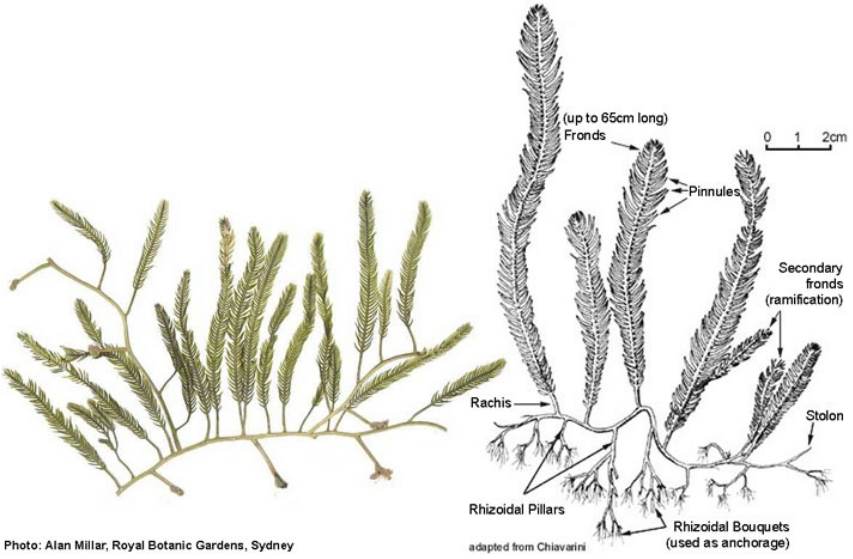
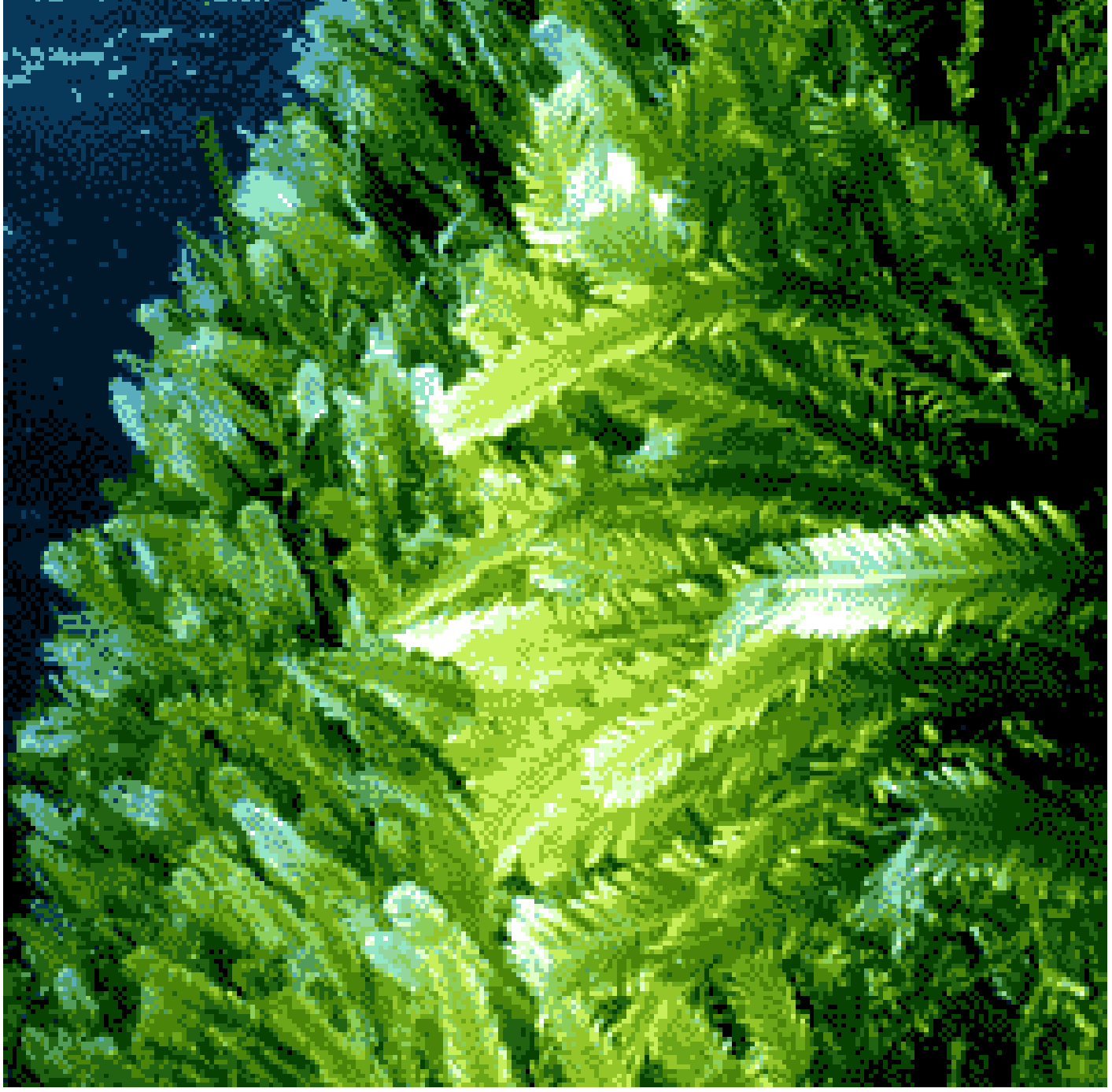
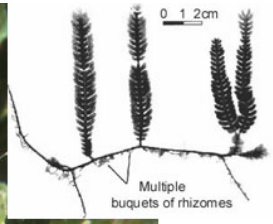
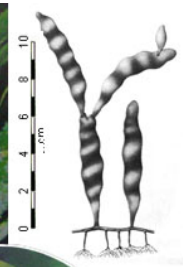


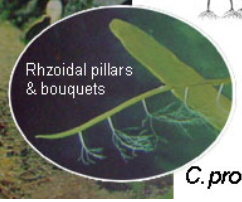
Photo: Alan Millar, Royal Botanic Gardens, Sydney





C.mexicana





C.prolifera