



# *When Control is Constrained to Containment*

## *Undaria pinnatifida in the Channel Islands, CA*

Sean Hastings

NOAA Channel Islands National Marine Sanctuary

# Asian Kelp, Wakame

Scientific Name: *Undaria pinnatifida*



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# Asian Kelp, Wakame

Scientific Name: *Undaria pinnatifida*



*Native range*

# Asian Kelp, Wakame

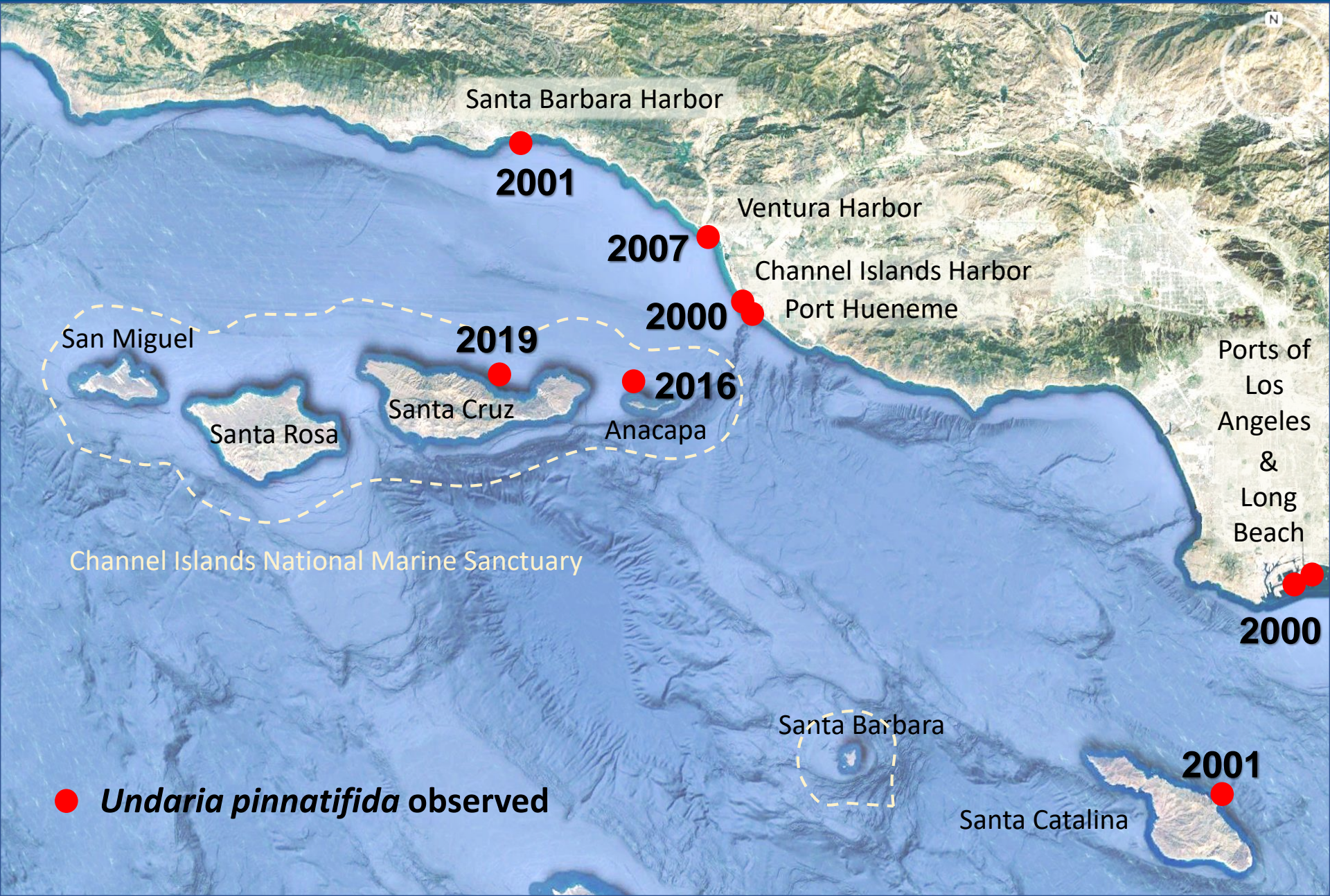
Scientific Name: *Undaria pinnatifida*



*Invasive range: So. America, Australia, New Zealand & California*



# Distribution of *Undaria* and year of discovery



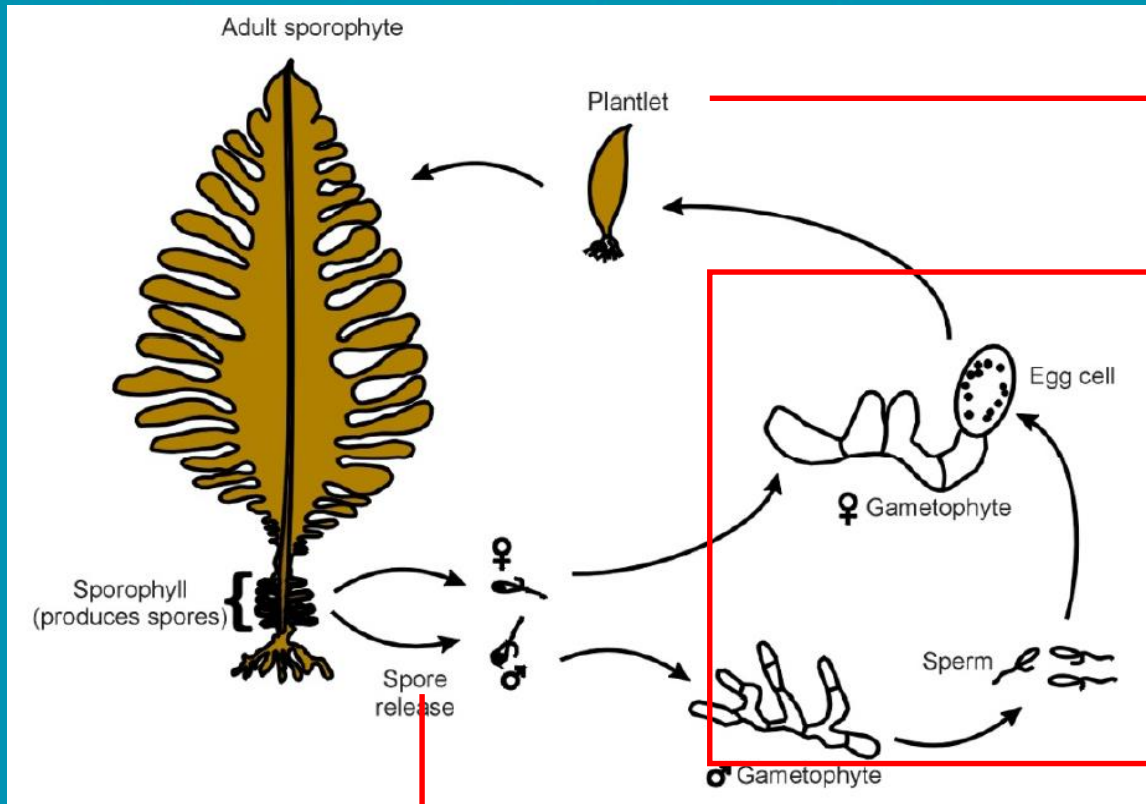


# Why should we care?



- Grows quickly and forms dense patches that can over-grow and displace natives, e.g. giant kelp
- Threatens native ecosystems, i.e., the food web that relies on native giant kelp

# Life history & reproduction of *Undaria*



- Growth triggered by drop in water temperature

- Microscopic gametophytes can lay dormant for up to 3 years

- Up to 700 million spores released per plant
- Swim up to 6 hours in water column before settling on hard substrate (e.g., rocks, plastic, metal, concrete, metal, rubber, other organisms)



# Seasonality of *Undaria*

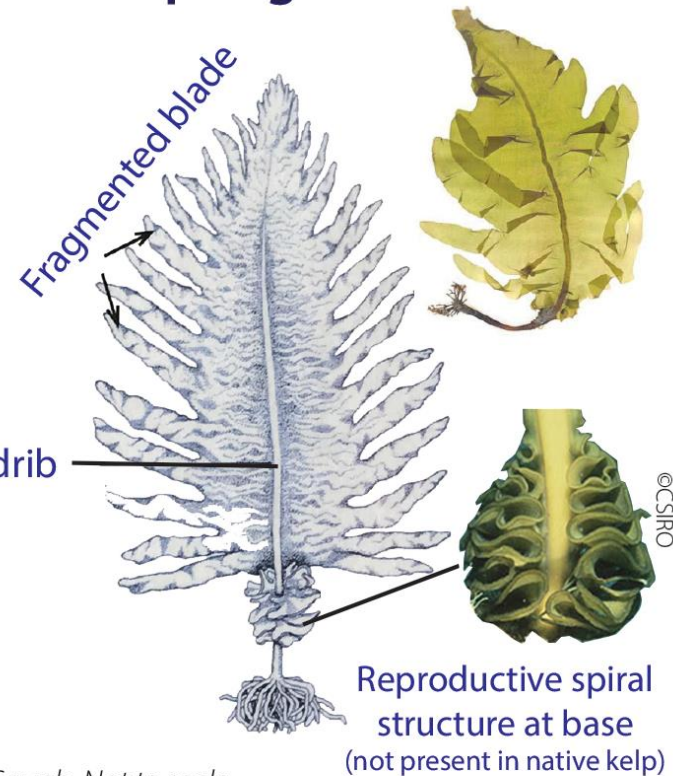


**Juvenile (<6")** → **Adult (1-10')**

**Winter-Spring**



**Spring-Summer**



Drawings by Rob Gough. Not to scale.

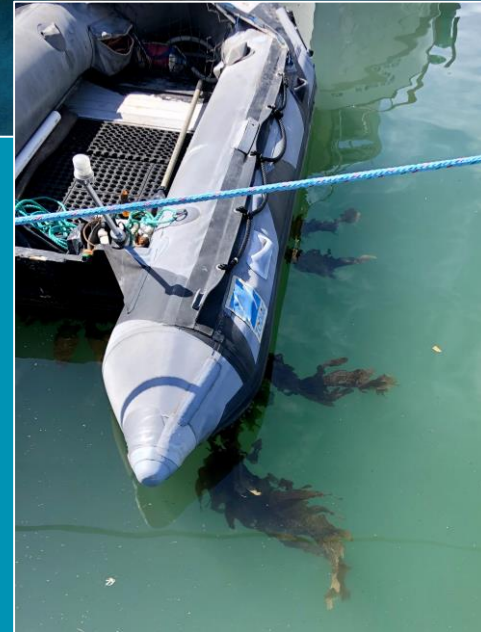
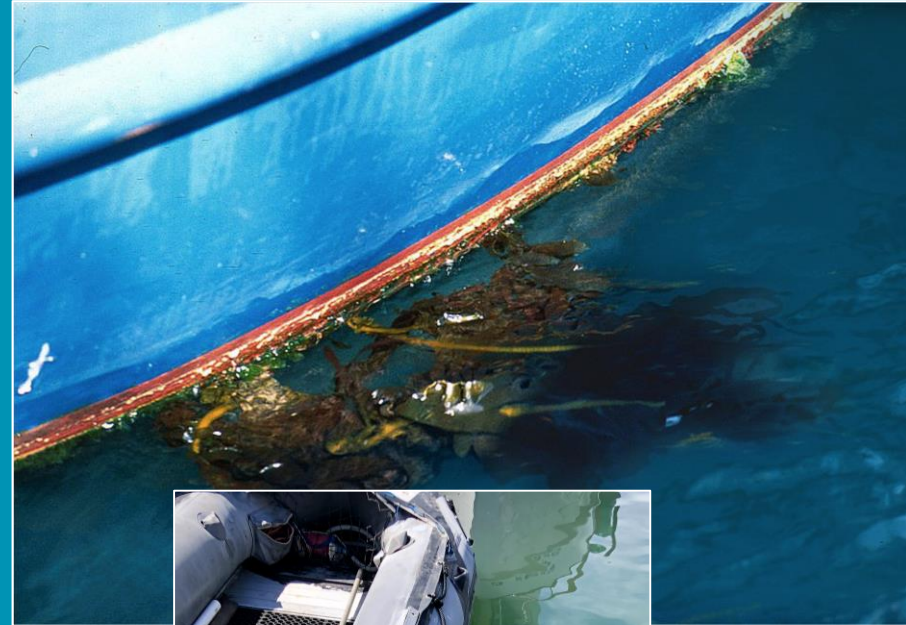
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# Harbors are invasion “hotspots”

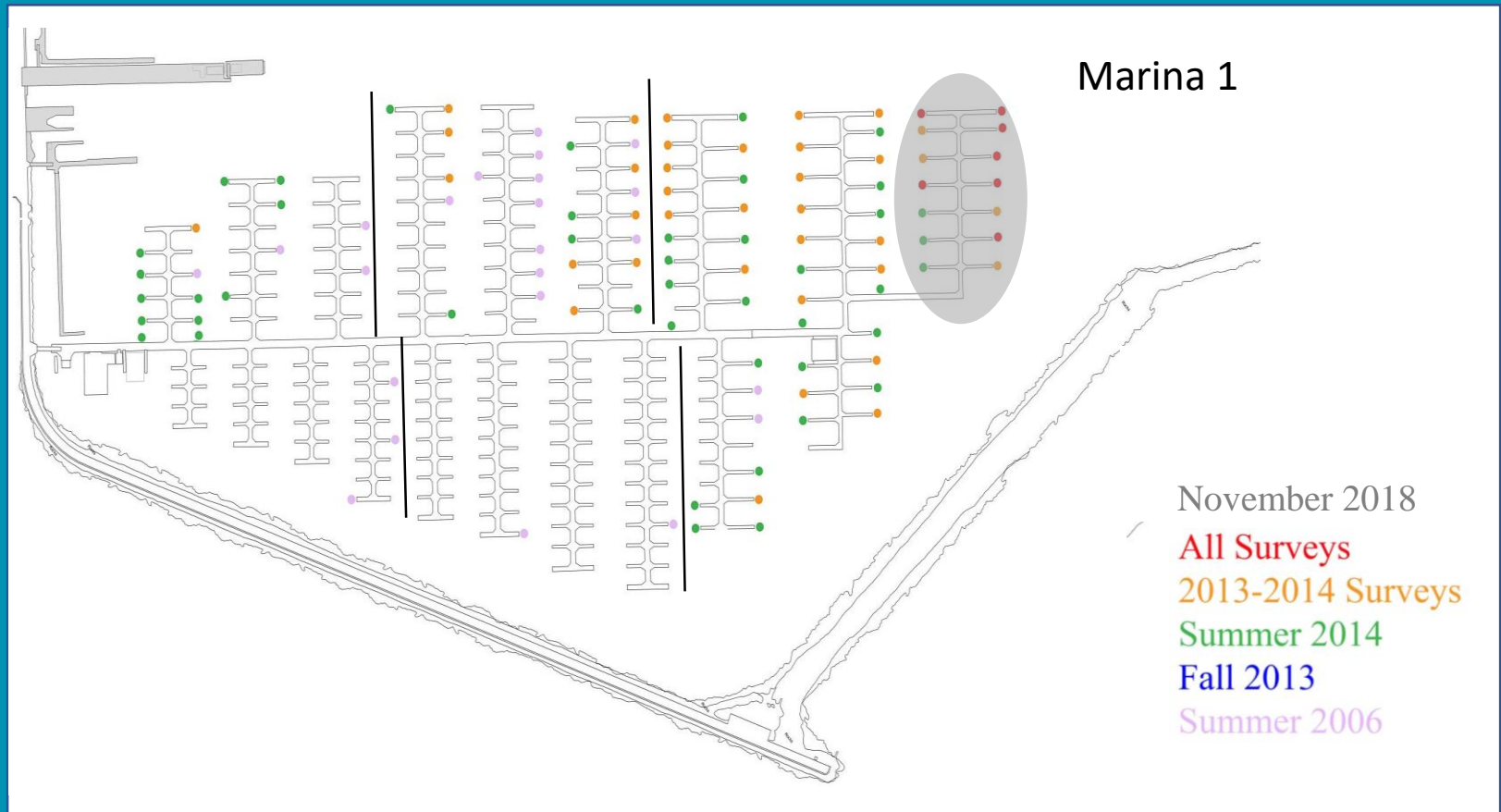




# Boats as vectors for *Undaria*



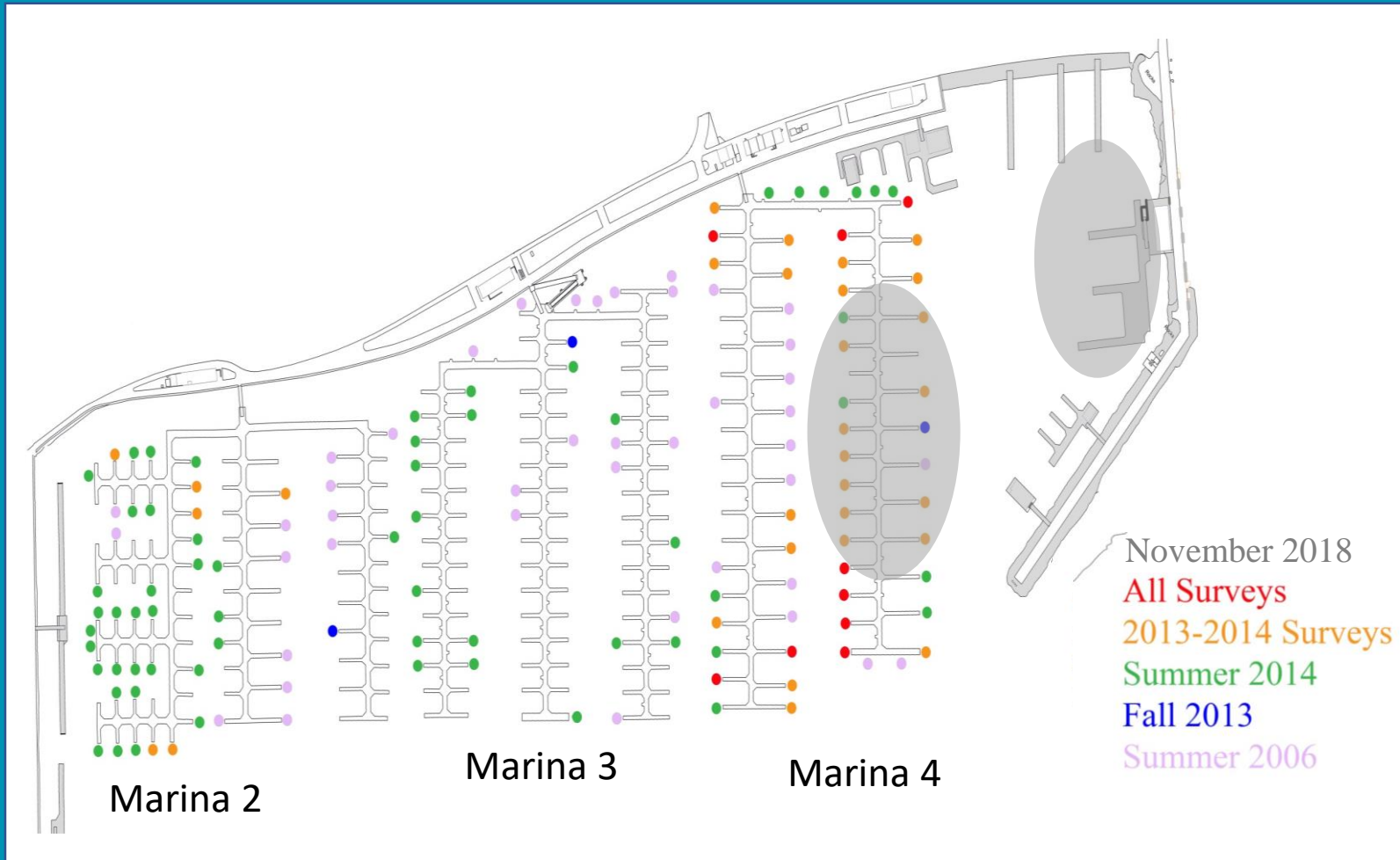
# Distribution in Santa Barbara Harbor



Source: Carolyn Culver, California Sea Grant



# Distribution in Santa Barbara Harbor



Source:Carolynn Culver, California Sea Grant

# Controlling the spread of *Undaria*



## 1) Monitoring

### Citizen Scientists

### ROV surveys

#### IDENTIFICATION GUIDE

#### Invasive Seaweeds



Help scientists and managers by identifying, photographing and reporting sightings of TWO invasive marine seaweeds in California waters. The species look different and are found at different times of the year depending on their age. Refer to the photographs for identification tips, size and seasonality.

If sighted, take a close-up photograph and record which species it was, how many you observed, and relevant additional information\*

SITE NAME \_\_\_\_\_ DATE \_\_\_\_\_

GPS COORDINATES \_\_\_\_\_

SPECIES <small>(DEVIL WEED OR ASIAN KELP)</small>	NUMBER OBSERVED	ADDITIONAL INFORMATION*	
			<input checked="" type="checkbox"/>

\*Additional information: depth, substrate (e.g. slip, trap, boat hull, buoy)



Visit <https://www.seagrasswatch.org/> for more information and to download the app.



#### DEVIL WEED *Sargassum horneri*



LOW-LYING FERN-LIKE BRANCHES



BUSHY, FLUFFY BRANCHES



OVAL FLOATS & TEARDROP STRUCTURES

#### ASIAN KELP *Undaria pinnatifida*



WIDE FLAT BLADE, SINGLE MID-RIB



NOTICEABLE SINGLE, MID-RIB



SPIRAL STRUCTURE NEAR BOTTOM

← JUVENILE  
← ADULT

DO NOT DISTURB OR REMOVE INVASIVES UNDERWATER, THEY CAN BE EASILY SPREAD!

PHOTOS: JESSIE ALSTATT, DAN RICHARDS, CAROLYN CULVER, LINDSAY MARKS  
DESIGN TEAM: JACLYN MANDOWISE, CAROLYN CULVER, LINDSAY MARKS





# Controlling the spread of *Undaria*



1) Monitoring

2) Research

*Genetic sequencing*



# Controlling the spread of *Undaria*



- 1) Monitoring
- 2) Research
- 3) Outreach

## Preventing the Spread of the Invasive Alga *Undaria pinnatifida* in the Santa Barbara Channel Region: Management Options and Case Studies

Roxanne Diaz<sup>1</sup>, Sean Hastings<sup>2</sup>, Aubrie Fowler<sup>2</sup>, and Lindsay Marks<sup>2</sup>



Wakame (*Undaria pinnatifida*)

## ATTENTION BOATERS AND DIVERS

Help protect kelp beds and reefs from invasive seaweeds!

LOOK FOR and REPORT sightings\* of two non-native seaweeds in California

**BROWN WEED**  
*Sargassum horneri*



**WAKAME**  
*Undaria pinnatifida*



PREVENT the SPREAD of invasives from harbors and other infested sites\*



### BOATERS

- Clean your hull before leaving harbor
- Remove seaweed fragments from anchor, lines, and boat deck before moving to new locations



### DIVERS

- Plan to dive uninfested sites first\*
- Remove seaweed fragments from yourself, your gear, and boat deck before moving to new locations
- DO NOT DISTURB OR REMOVE INVASIVES UNDERWATER. THEY CAN BE EASILY SPREAD!**

For more information, visit [www.noaa.gov/seaweed](http://www.noaa.gov/seaweed) or [www.undaria.org](http://www.undaria.org)



Wakame



Alga

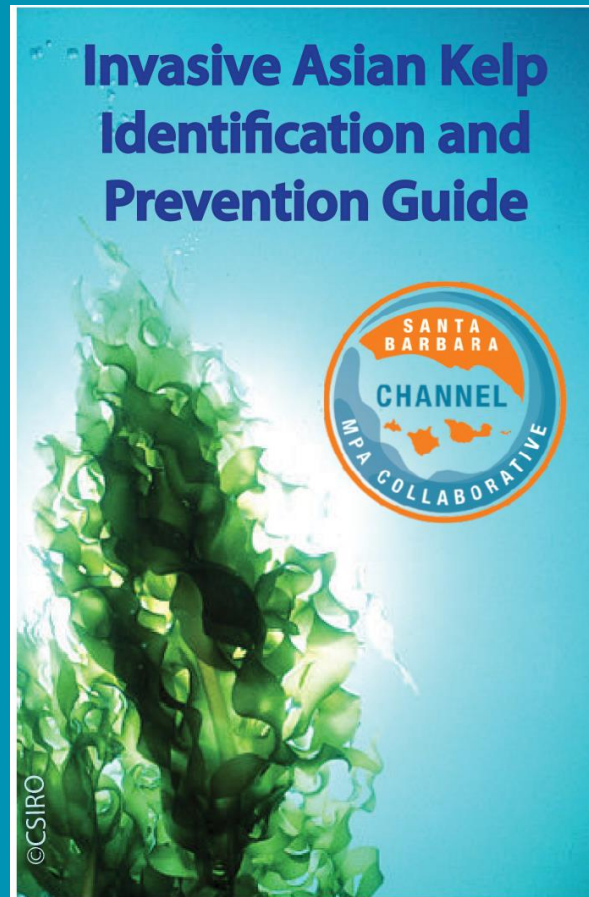
PHOTOS: TOM BOYD, LINDSAY MARKS, CAROLYN FOWLER  
DESIGN TEAM: JACQUELYN MANDOLAK, CAROLYN FOWLER, LINDSAY MARKS



# Controlling the spread of *Undaria*



- 1) Monitoring
- 2) Research
- 3) Outreach



## ATTENTION BOATERS AND DIVERS

Help protect kelp beds and reefs from invasive seaweeds!

LOOK FOR and REPORT sightings\* of two non-native seaweeds in California

**DEVIL WEED**  
*Sargassum horneri*



**ASIAN KELP**  
*Undaria pinnatifida*



**PREVENT** the **SPREAD** of invasives from harbors and other infested sites\*



**Harbors**

**Clean your hull** regularly and check for invasives before leaving the harbor

**Remove seaweed** from hull, slip, and gear, contain in a sealed bag for disposal on land



**Reefs**

**Plan to visit uninfested sites first\***

**Contain seaweed fragments** from yourself, your gear, and boat deck before moving to new locations

**DO NOT DISTURB OR REMOVE INVASIVES ON UNDERWATER REEFS, THEY CAN BE EASILY SPREAD!**

\* LEARN HOW TO IDENTIFY INVASIVE SEASWEEDS, VIEW MAP OF INFESTED SITES, AND REPORT SIGHTINGS AT

[MarineInvasives.org](http://MarineInvasives.org)



Website



App

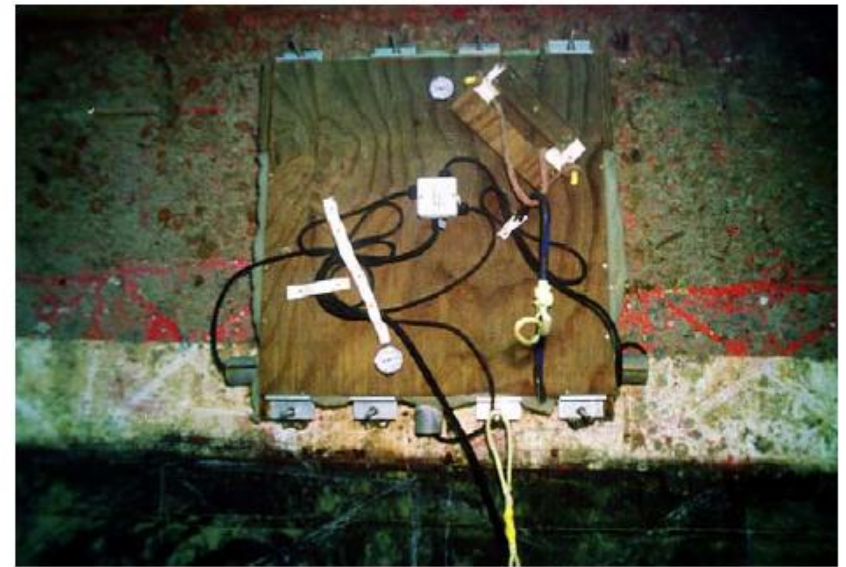
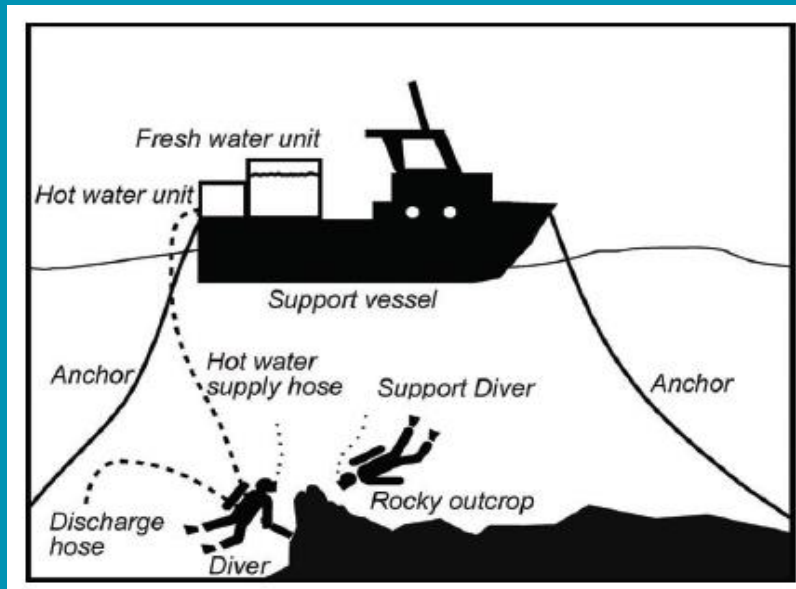
PHOTOS: TOM BOYD, LINDSAY MAIRIS, CAROLYN CLEVER  
DESIGN TEAM: JAGDYN MANDOSKE, CAROLYN CLEVER, LINDSAY MARKS

# Management Controls



- 1) Monitoring
- 2) Research
- 3) Outreach
- 4) Control

## *Removal and heat treatment*



Plywood box with elements used to heat a boat hull infested with *Undaria* (targeting microscopic gametophytes)



# Management Controls



- 1) Monitoring
- 2) Research
- 3) Outreach
- 4) **Control**

## Ultraviolet Light treatment

