

# **SURVEYS OF NON-INDIGENOUS SPECIES IN THE COASTAL WATERS OF CALIFORNIA**

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# **Main Points**

- 1) Purpose of our program**
- 2) Most recent surveys and results**
- 3) Most invaded areas of the California Coast**
- 4) Most common vectors**
- 5) Accessing our data**

# **Purpose of Marine Invasive Species Program**

## **Ballast Water Act of 1999:**

**Directed DFG to Conduct Biological Surveys to Identify Non-indigenous Species (NIS)**

## **Main Questions:**

- 1) To what extent has the California coast been invaded?**
- 2) Which NIS have arrived in California via Ballast Water?**



# Marine Invasive Species Program

## To answer these questions:

- Initiated several baseline field surveys of ports and bays along CA Coast in 2000/2001.
- Submitted report to legislature detailing results in 2002.
- <http://www.dfg.ca.gov/ospr>

# More Legislation...

- 1) Removed sunset date
- 2) Expanded the scope of our study
- 3) Requires a Legislative report  
January 1<sup>st</sup> 2009 and updates  
every 3 years.



# **Four Categories of Taxa**

- 1) Non-indigenous: Introduced species**
- 2) Cryptogenic: Neither demonstrably native or introduced**
- 3) Unresolved: Not identified to species level**
- 4) Native**



# **Recent Surveys**

**1) Bays and Harbors Survey  
(2006)**

**2) Outer Coast Survey (2004  
& 2008)**

**3) SF Bay Survey (2005)**

# Bays and Harbors Survey

## Sampled Major Ports and Small Harbors





## BAYS AND HARBORS SAMPLING SITES



# Bays and Harbors Survey

- **Three Main Habitats**

**1) Rocky Epifaunal**

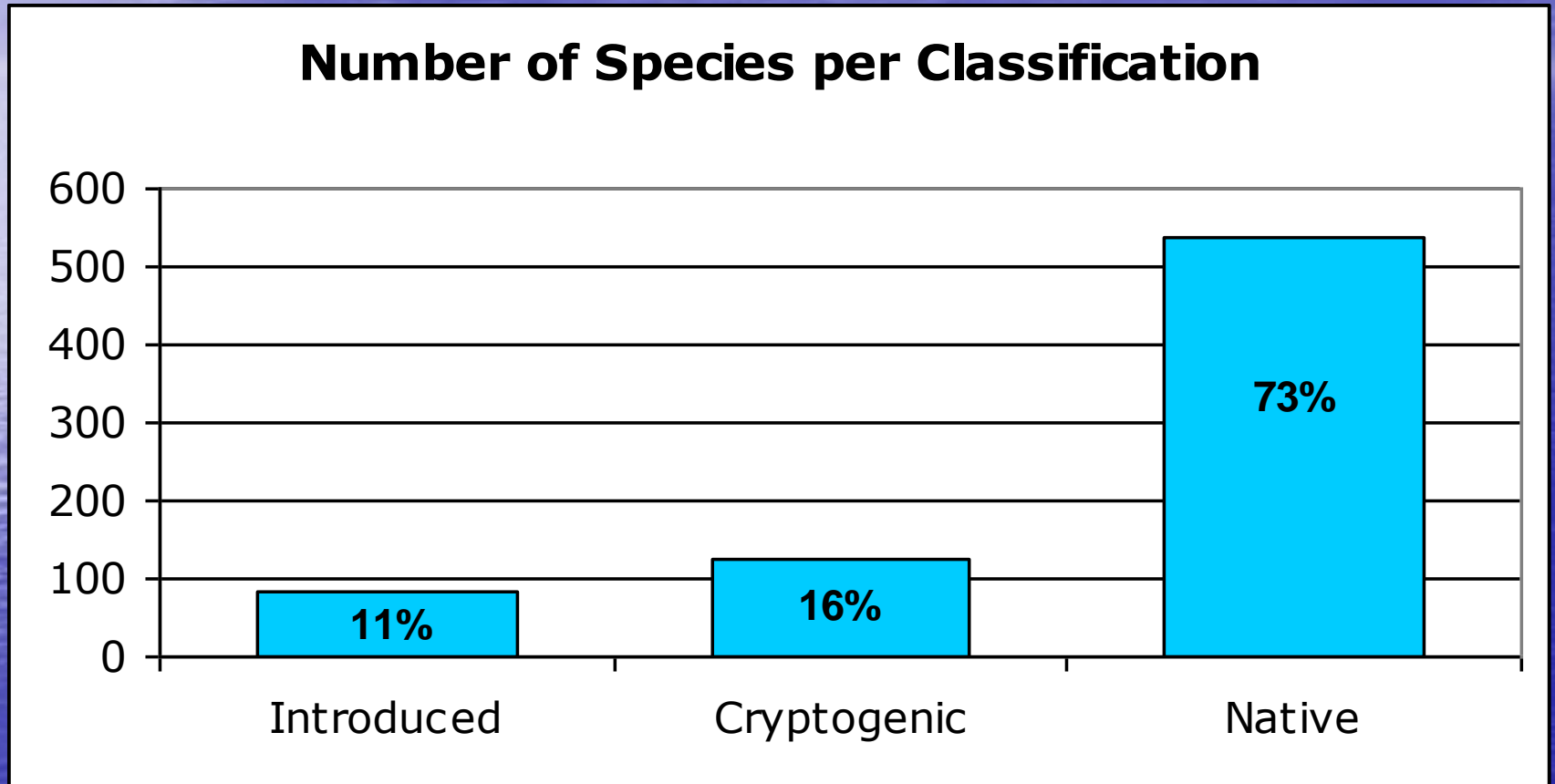
**2) Sandy Infaunal**

**3) Water Column**





# Bays and Harbors Survey



402 Unresolved Species: not identified to species level

# Bays and Harbors Survey

## Top Two Introduced Phyla:

1) Arthropods: 25 introduced species  
Most common: Crustacean



2) Chordates: 18 introduced species  
Most common: Tunicates





# Outer Coast Survey

- Design was adapted from Bays and Harbor survey
- 22 Sites Sampled
- Focused on:
  - Whole community structures
  - Areas around prominent coastal headlands
  - Areas impacted by ballast water
- Initial Sampling Completed in 2005. Follow-up Sampling was Completed in 2008



## OUTER COAST SAMPLING SITES





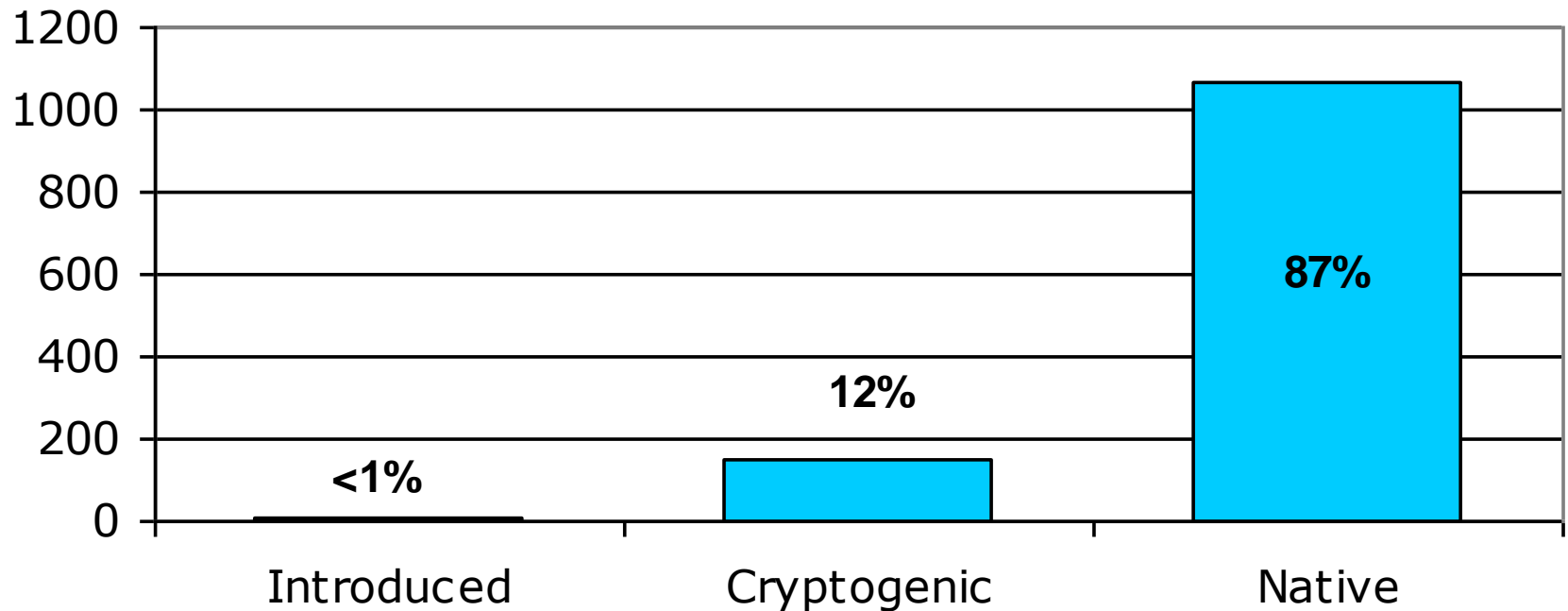
# Outer Coast Survey

- 4 Main Habitats
  - 1) Rocky Intertidal
  - 2) Sandy Intertidal
  - 3) Rocky Subtidal
  - 4) Sandy Subtidal



# Outer Coast Survey

**Number of Species per Classification**



650 Unresolved Species: not identified to species level

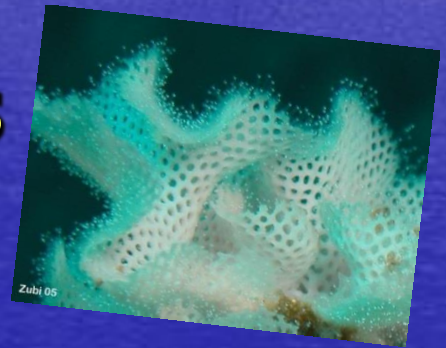


# Outer Coast Survey

## Top Two Introduced Phyla:

1) Ectoprocts:  
9 introduced species

2) Arthropods:  
7 introduced species



# San Francisco Bay Survey

- One of the most invaded ecosystems in the world?



- Field and laboratory studies complimented by literature and data reviews.



# **San Francisco Bay Survey**

## **4 Sub-regions:**

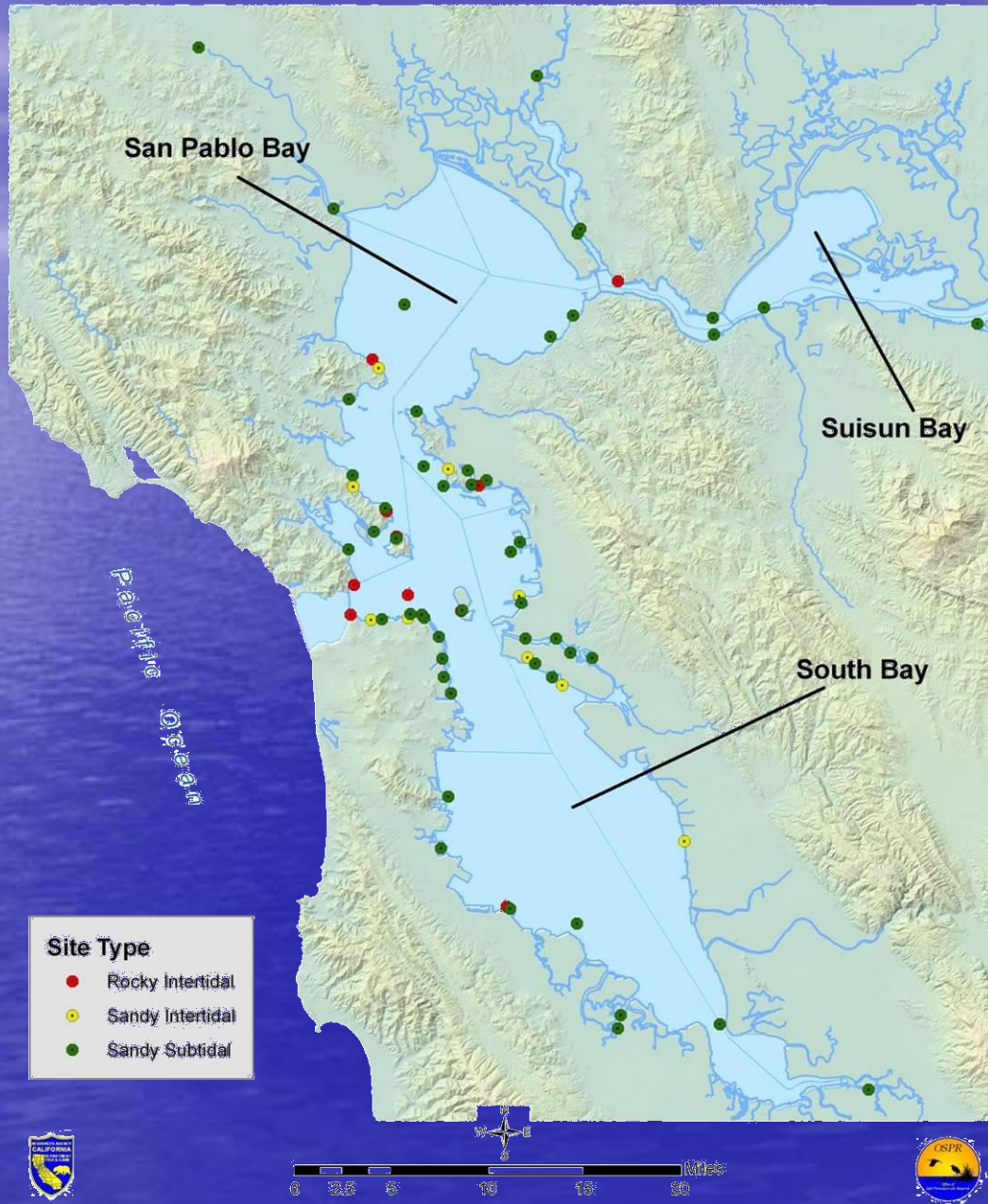
**1) Central Bay**

**2) San Pablo Bay**

**3) Suisun Bay**

**4) South Bay**

# San Francisco Bay Sampling Sites

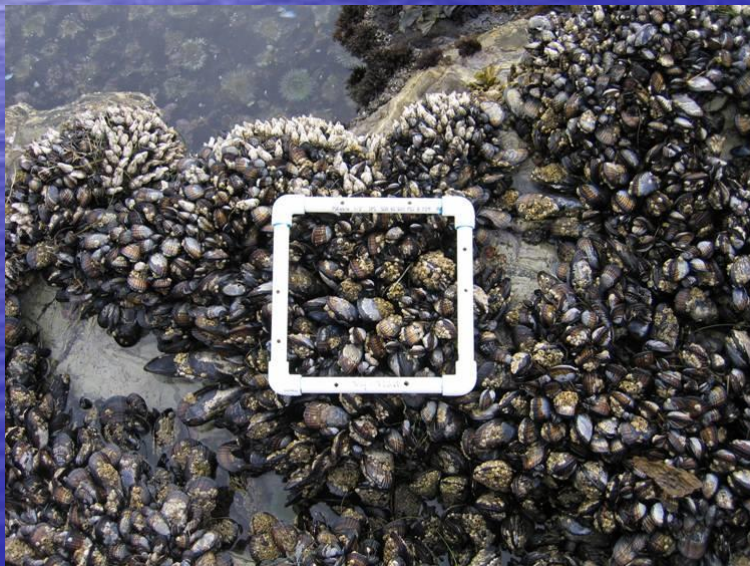




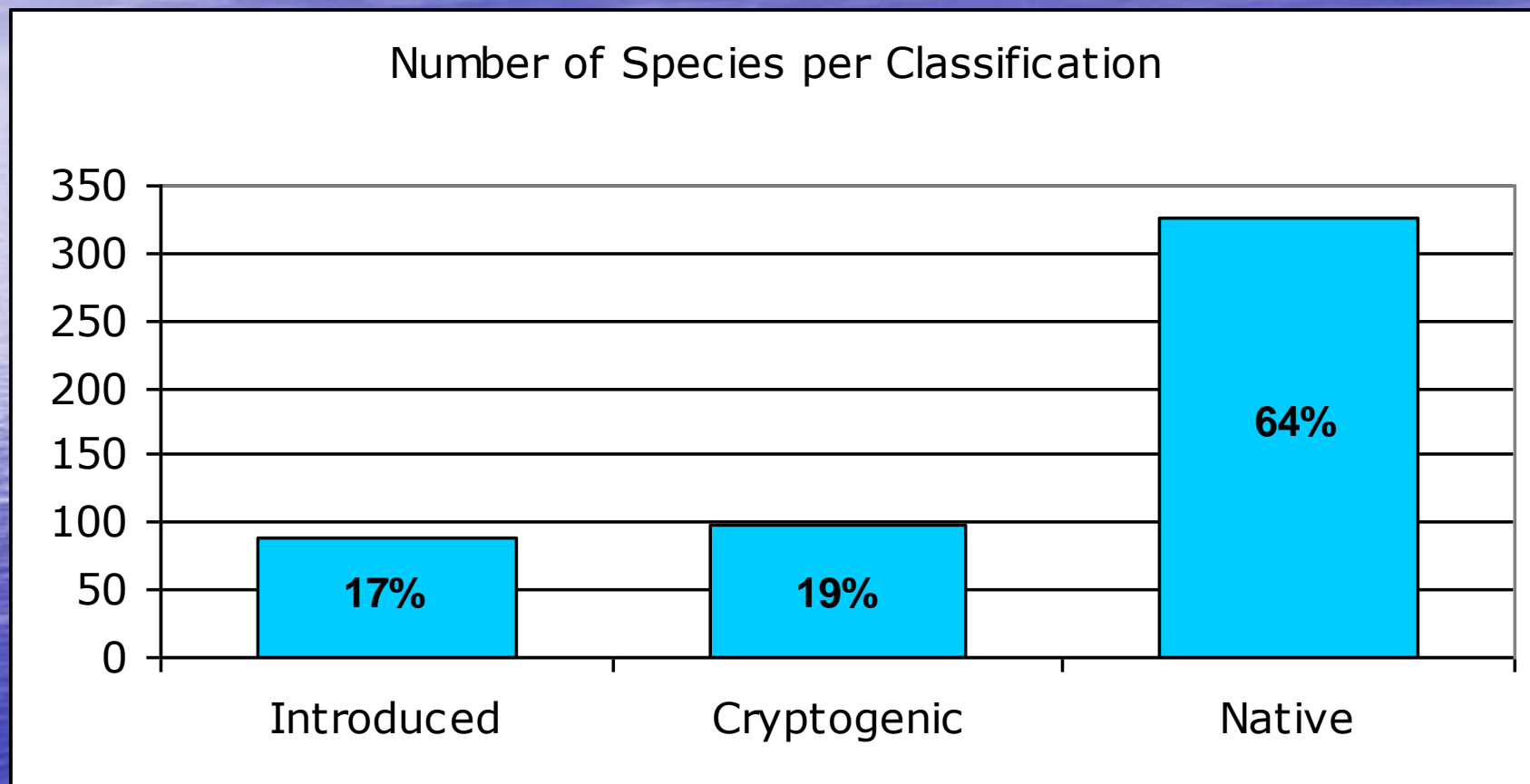
# San Francisco Bay Survey

## Three Main Habitats

- 1) Epifaunal Intertidal
- 2) Sandy Intertidal
- 3) Infaunal Subtidal



# San Francisco Bay Survey



307 Unresolved Species: not identified to species level



# San Francisco Bay Survey

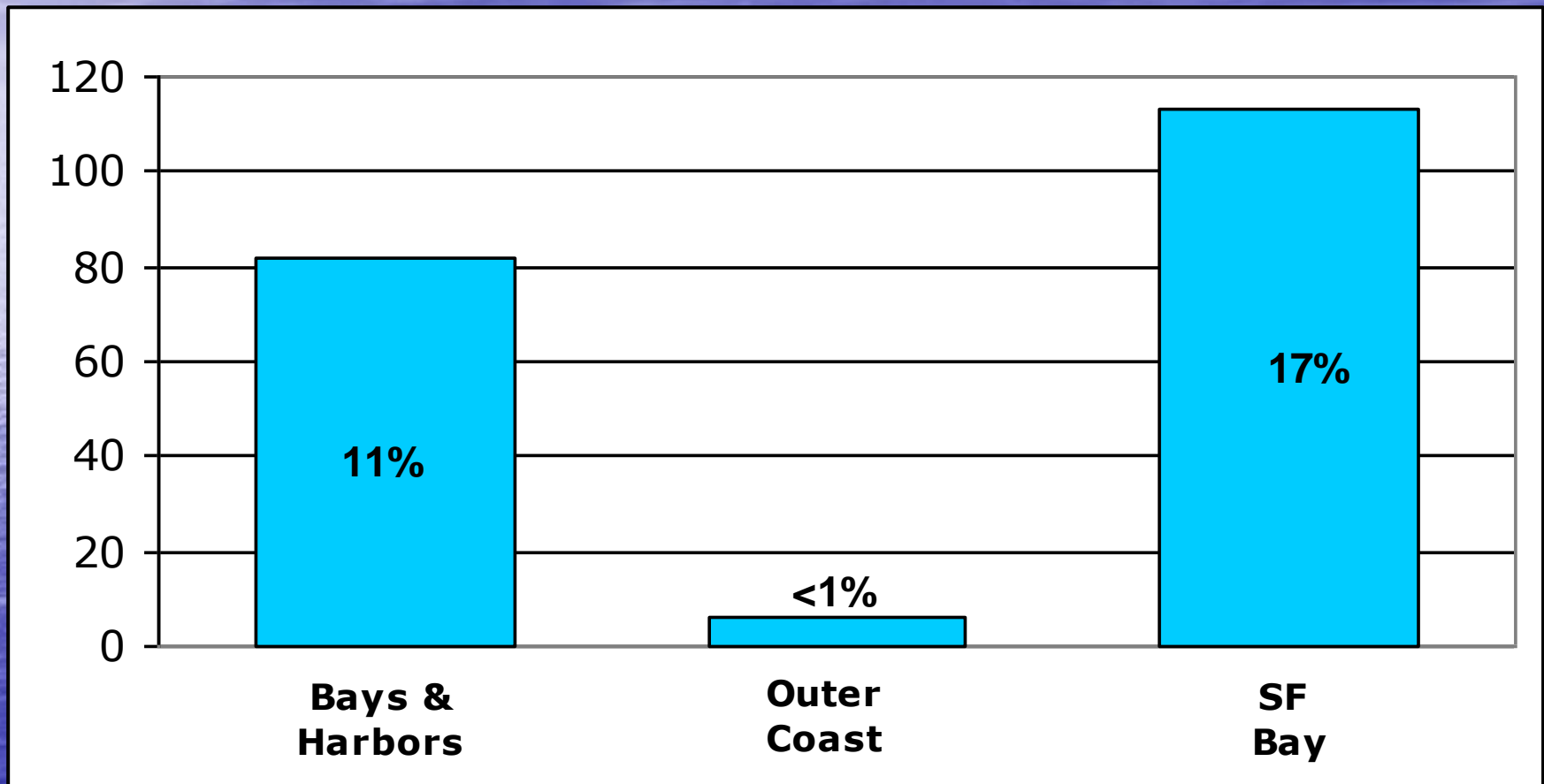
## Top Two Introduced Phyla:

1) Arthropods:  
37 introduced species

2) Chlorophyta:  
15 introduced species



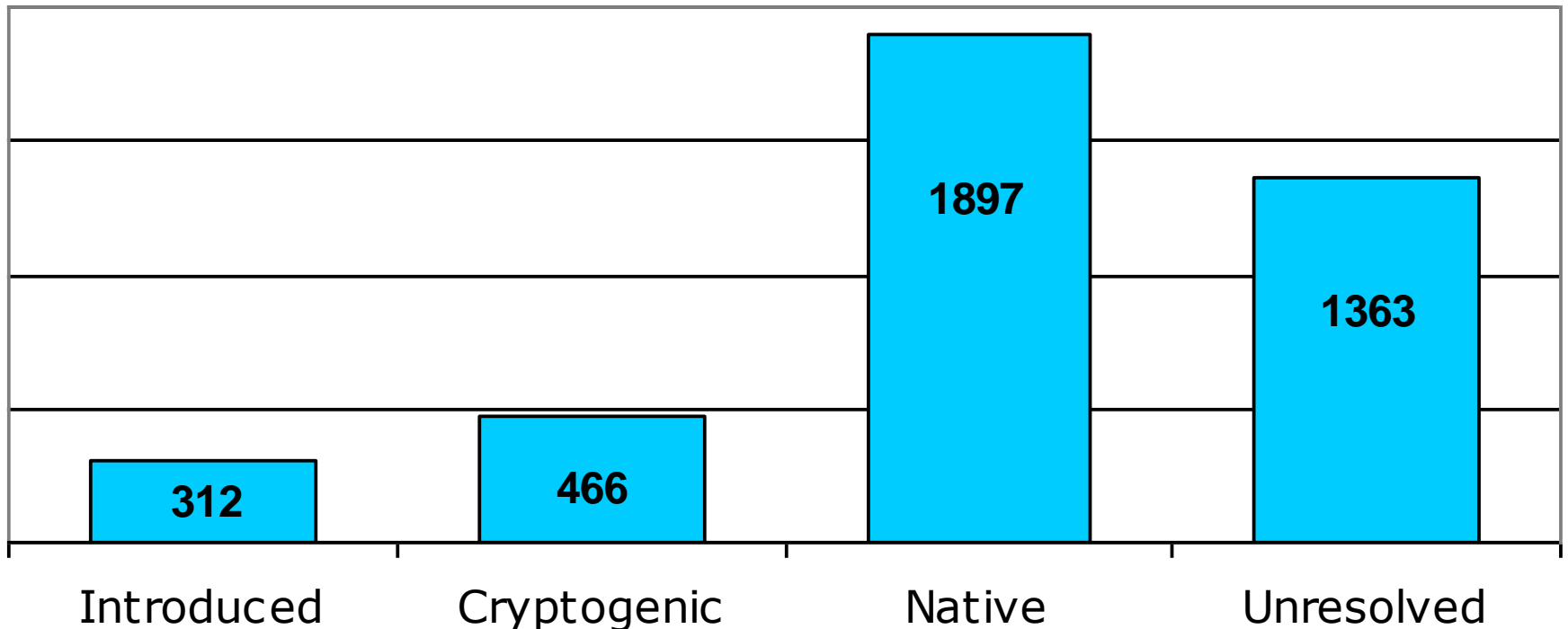
# Comparison of Surveys





# Statewide Results

Number of Species per Classification



# Vector Study

## What is a Vector?

**A means to transport aquatic invasive species from their region of origin to a non-native region**





# Vector Study

## Types of Vectors:

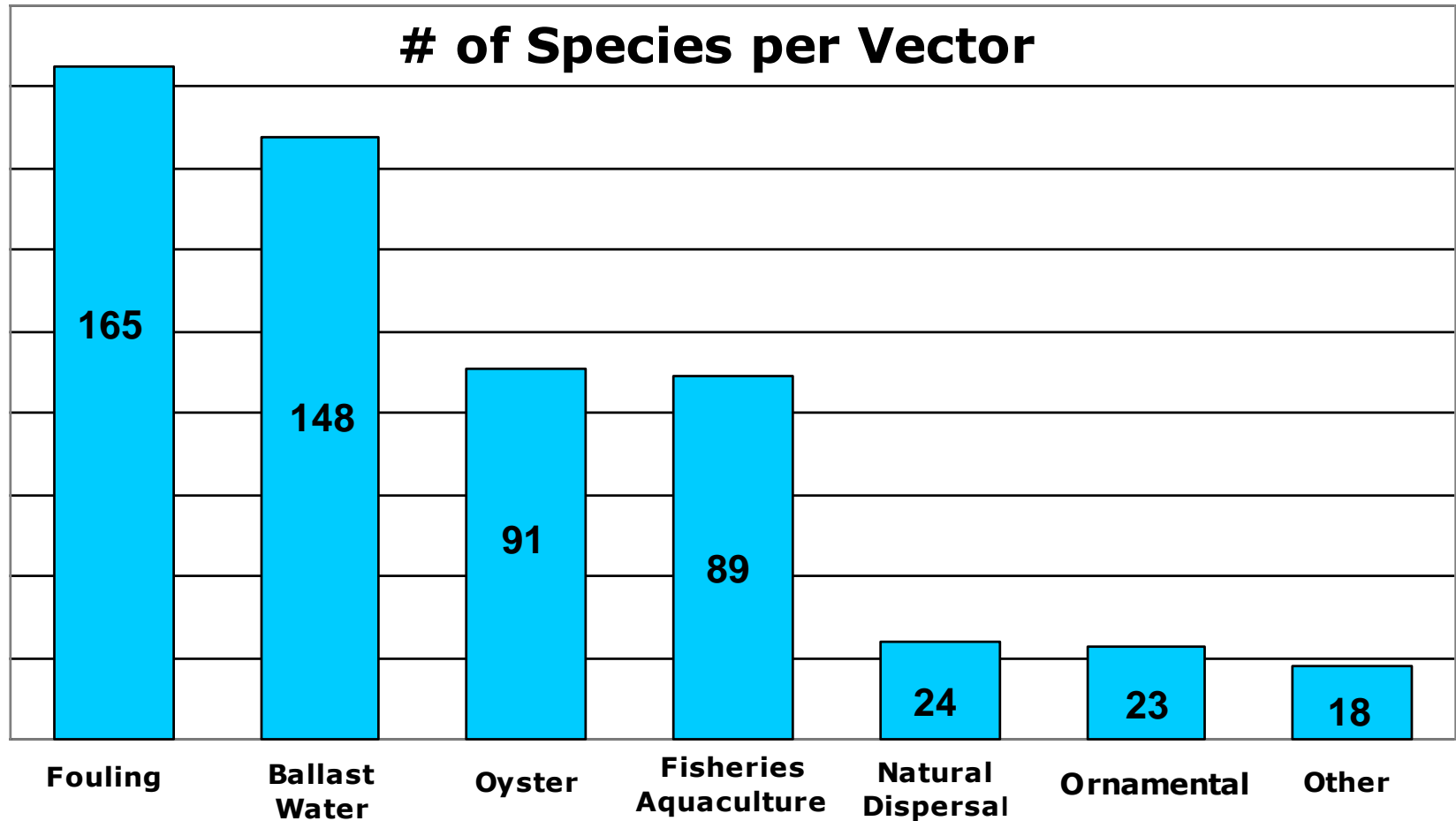


# **Vector Study**

- **Introduced species were assigned a probable vector**
- **Vectors were summed**
- **Statewide totals were calculated**
- **Many species were assigned multiple vectors**



# Vector Study



# **Upcoming Projects**

- 1) Legislative Report due January 2009**
- 2) Create a long-term monitoring plan**
  - Is the rate of new introductions increasing?**



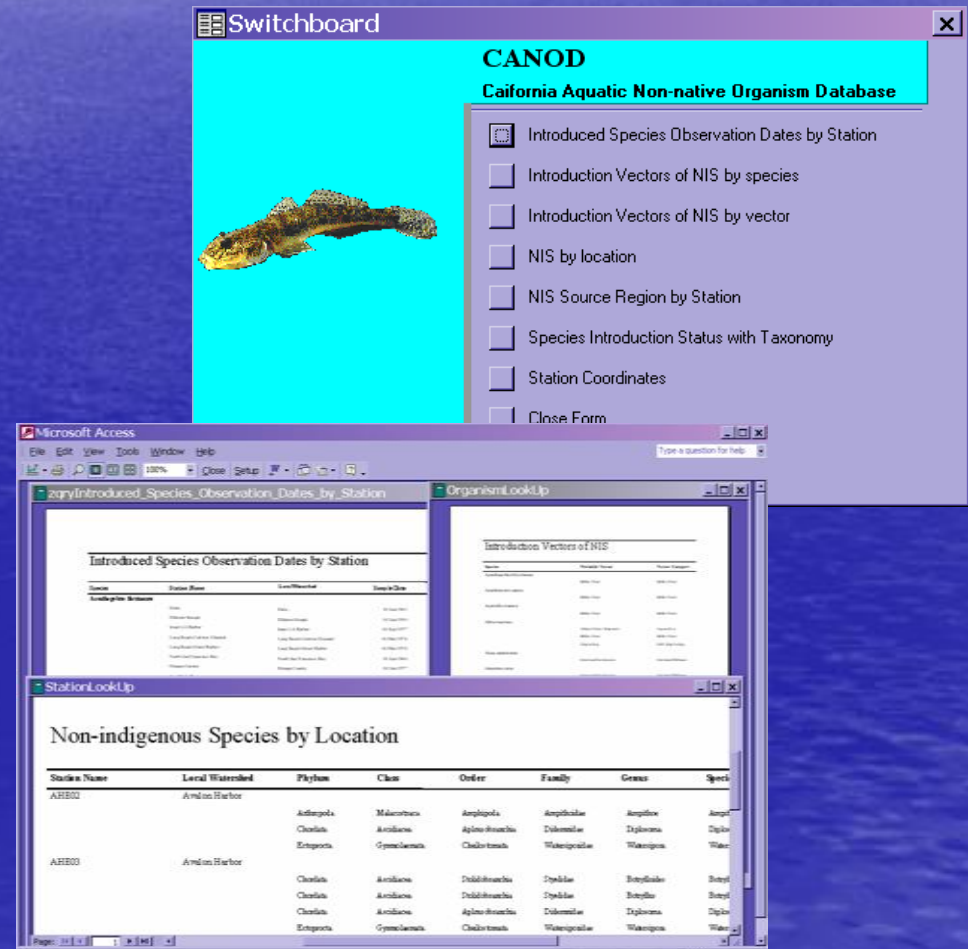
# Access to MISP Data

## California Aquatic Non-native Organism Database (CANOD)

### Includes:

- Name of species
- Location observed
- Date of introduction
- Vectors of introduction
- Native region

[WWW.DFG.CA.GOV/OSPR](http://WWW.DFG.CA.GOV/OSPR)  
Link to "Invasive Species"



# Summary

- 1) 312 introduced coastal aquatic species statewide;
- 2) Most invaded area of CA is SF Bay, while Outer Coast is the least invaded area;
- 3) Most common vector is fouling closely followed by ballast water;
- 4) Our database, CANOD, can be found at:

[WWW.DFG.CA.GOV/OSPR](http://WWW.DFG.CA.GOV/OSPR)  
Link to "Invasive Species"



# **QUESTIONS?**

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