



COAST Internship: Vessel Biofouling Management

California State Lands Commission
Marine Invasive Species Program
Marine Environmental Protection Division

Julisa Portugal | August 13, 2019
Sacramento, CA

California State
Lands Commission



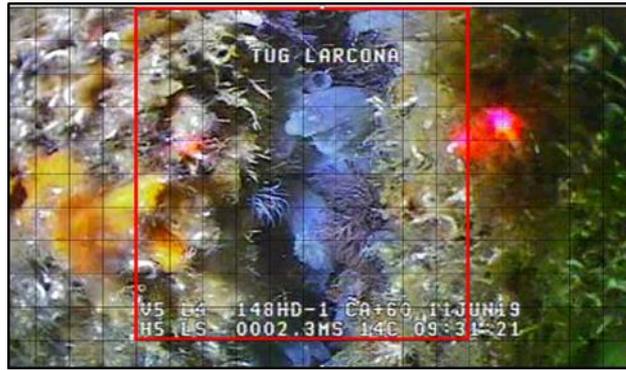
My Background

- 2019 Summer Intern through CSU COAST
- Graduate Student at Cal State Los Angeles
- Master's in Environmental Science
- B.S. degree in Biology with a concentration in Molecular Cell from Cal State San Marcos
- Previous Internships: Aquarist Intern for Santa Monica Aquarium and Research Assistant at Madrona Marsh in Torrance, CA
- Hobbies include eating tacos, going to the beach, and going to Disneyland



Agenda

- I. Introduction
- II. Projects (3)
- III. Conclusions
- IV. My Experience
- V. Acknowledgements



Nonindigenous Species (NIS)

- NIS pose a great threat because they can
 - Impact biodiversity
 - Out-compete native species for natural resources
 - Affect human health by being a vector for foreign diseases
 - Genes are altered through interbreeding with native species
- Preventative planning is currently the most cost-effective and efficient method for nonindigenous species control.



Biofouling

- ❖ Biofouling is defined as organisms that attach to underwater or wetted surfaces.
- ❖ Once attached to a surface, these individuals are transported via vessels to different part of the world.
- ❖ They can be introduced in a variety of ways, including:
 - Being knocked or scraped off
 - Released during vessel in water cleaning
 - Released as larvae or through spawning
 - If mobile, they can literally jump ship
- ❖ Currently, biofouling contributes to 55.5%-69.2% of currently established nonindigenous species in coastal waters globally.



Article 4.8 Biofouling Management Regulations

- Marine Invasive Species Program (MISP) is administered by the California State Lands Commission aims to prevent the introduction of Nonindigenous Species within California waters.
- Vessels are required to maintain a **Biofouling Management Plan (BFMP)** that is:
 - vessel specific
 - lists management strategies for niche areas
 - includes an antifouling coatings profile with the effective coating lifespan
- Vessels are also required to maintain a vessel specific **Biofouling Record Book (BFRB)** with up to date records of management actions taken.
- Aligns with the financial incentive to minimize biofouling because of its impact on drag, fuel consumption, and overall operational efficiency.

Project 1: Quantifying Biofouling Extent



Wheeler Reef Expansion Project: Background

- S. C. Edison is working on mitigation mandated by the California Coastal Commission.
- Mitigation project involves a 150 acres expansion extending from San Clemente Pier to Dana Point.
- To minimize the introduction of NIS, we conducted a two-phase risk assessment on the project vessels



PC: San Clemente Times

- Phase 1: A review of each vessel's recent history and maintenance practices to determine NIS introduction risk. If we determine it a high risk, vessels were surveyed underwater.



- Phase 2: Vessels with more than 10% cover of multispecies assemblages would have to be cleaned prior to transporting materials.

ROV Inspections

- After phase one we surveyed five vessels (A-E).
- An ROV also known as “Green FLASH” (Flying Around Ship Hulls) was used to conduct the survey.
- Each video was analyzed and four images per vessel were taken at pseudo-randomly chosen time stamps.
- A grid was laid over each image. A red 10X10 frame was placed over the grid using power point.
- For each image, an evaluation of the different growth forms and the number of layers (complexity level) within each of the 100 cells of the 10X10 frame was recorded on an Excel spreadsheet.



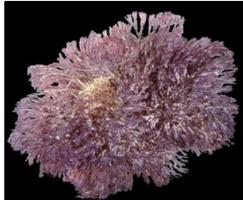
Growth Forms



Solitary upright – *Mytilus galloprovincialis*, Mediterranean mussel



Solitary flat – *Hydroides elegans*, tubeworm



Colonial upright - *Bugula neritina*, branching bryozoan



Colonial flat - *Watersipora subtorquata*, encrusting bryozoan

Terminology

Solitary - One organism that functions on its own without the necessity of clones.

Colonial - More than one interconnected clone or individuals that comes together to form one functioning organism.

Upright - Species facing outward from the vessel surface and being slightly attached to a surface.

Flat - Species being completely attached to or encrusting on the vessel surface.

Complexity Levels

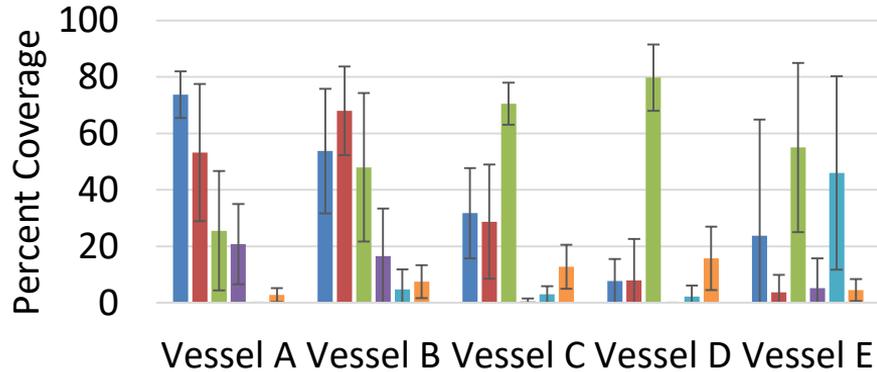
In terms of complexity levels, it ranged from 0 to 3.

- **0** - represents a hull bottom that was visible with no obvious species
- **1** – represents a single layer of species
- **2** - two represents one to two layers with two species
- **3** - represents three or more layers with at least three species.

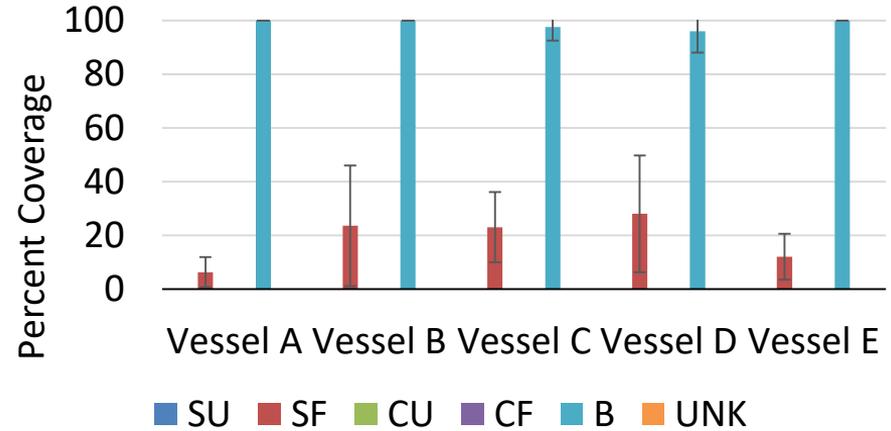


Growth Form Results

Pre-Cleaning Growth Form

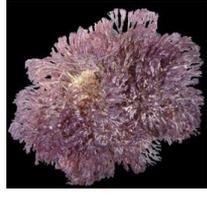


Post Cleaning Growth Form

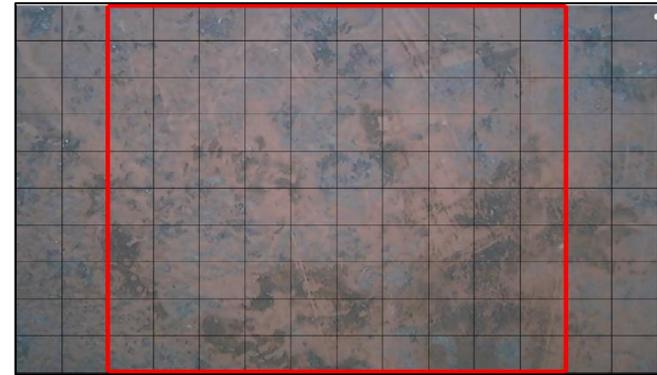
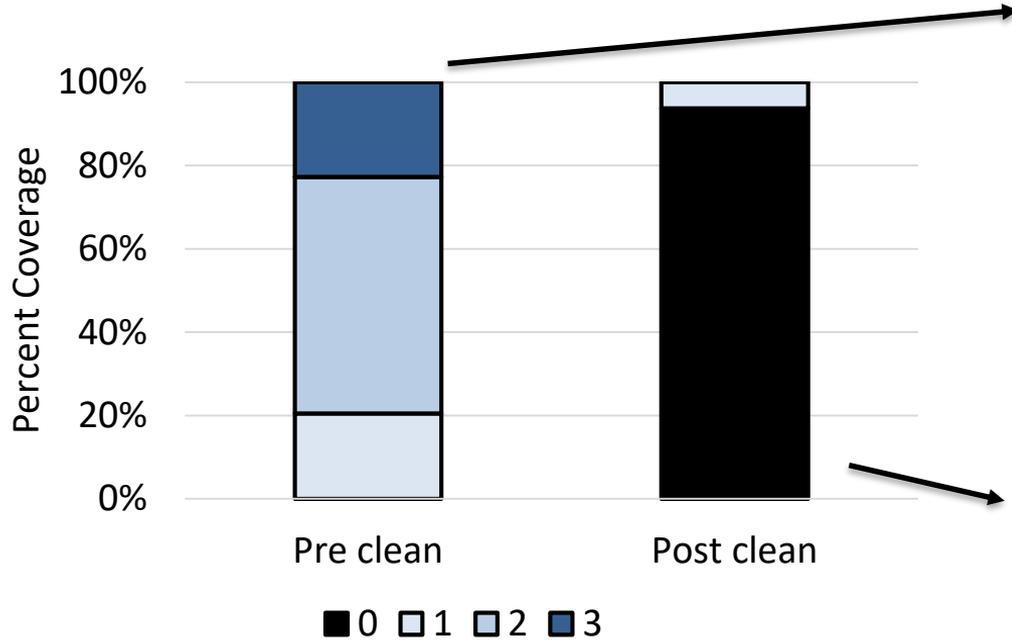


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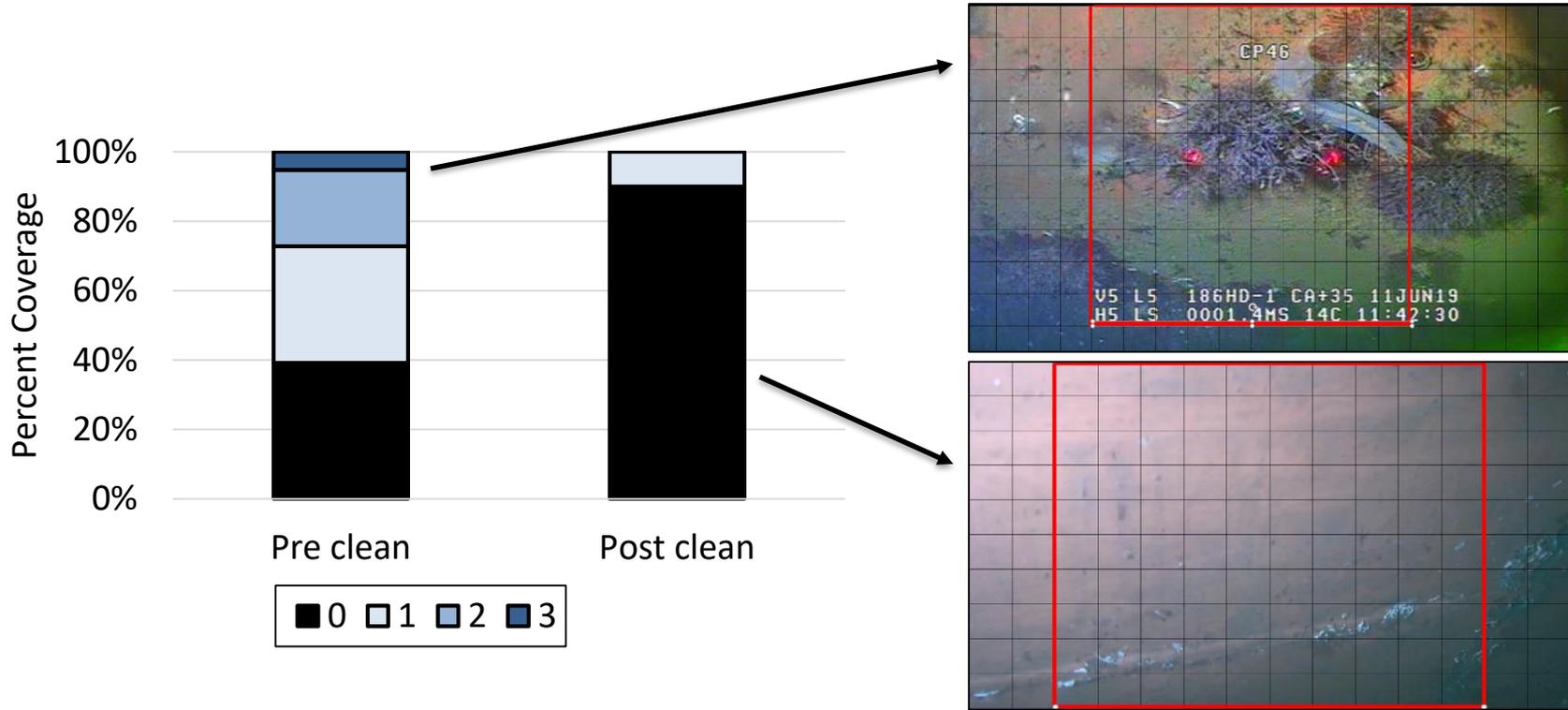


Complexity Level- Vessel A Results



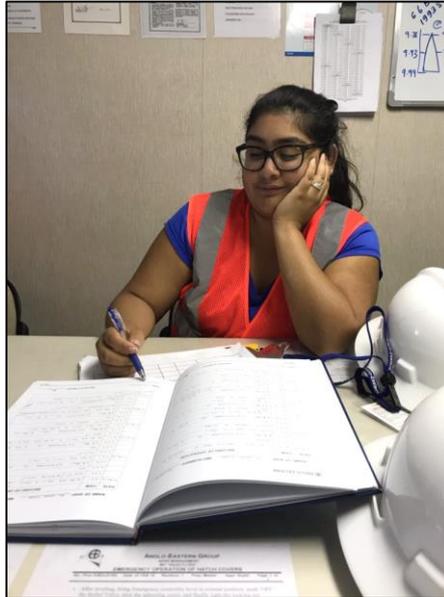
* ~ 80% cover of multispecies assemblages prior to cleaning

Complexity Level – Vessel E Results



* ~ 30% cover of multispecies assemblages prior to cleaning

Project 2: Vessel Inspections



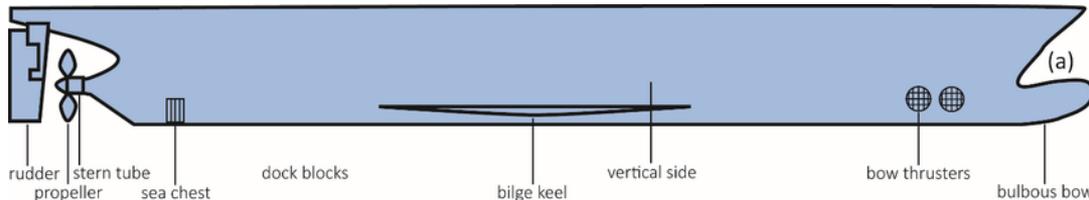
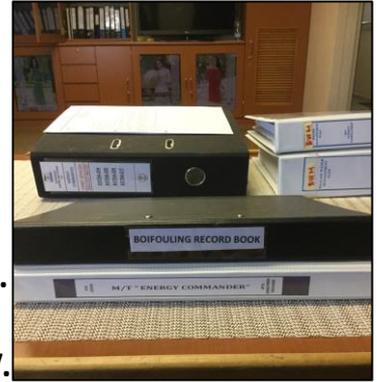
Background

- Purpose of this project was to board vessels that were subject to California's biofouling regulations and review their BFMP and BFRB.
- Looking at the specific descriptions of preventative maintenance and log entries of biofouling actions
- Allows regulators an in depth understanding of how these regulations are being implemented.



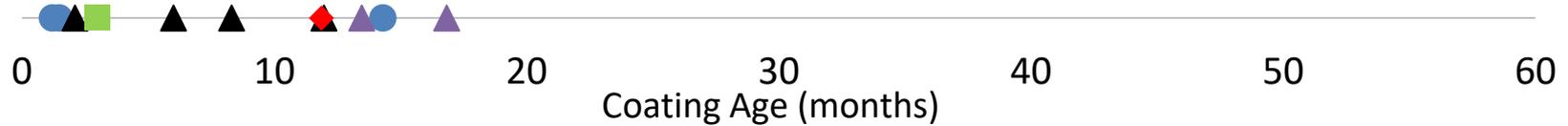
Data Collection

- **Duration of Project:** Approximately 6 weeks
- **Sample Size:** 11 vessels, were inspected with a Safety Specialist.
- **Location:** Various berths within the Ports of Long Beach/ Los Angeles.
- Management plan and record book were requested from vessel crew.
- Antifouling coating specifics, operating profile, and list of maintenance description for specific niche areas were required in the management plan.
- Record books were inspected for up to date entries for niche area management actions taken.



Antifouling Coating Results

● CONTAINER ▲ AUTO ◆ PASSENGER ▲ BULK ■ TANKER

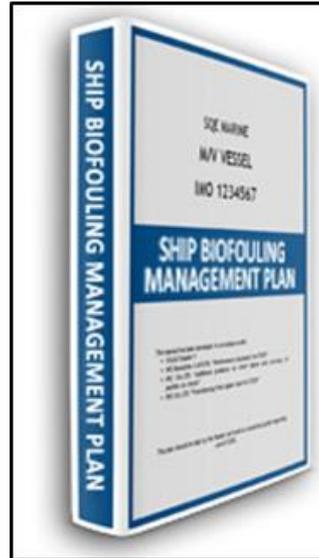


Antifouling Coating Summary Table (%) Reported by vessels	
Manufacturer	100
Model	100
Location	100
DFT (μm)	82
Expected Lifespan	73
60 Day Grace Period Issued	27

Niche Area Description Results

Niche Area	Description Present in BFMP (%)	Log entries in BFRB (%)	Most Common Description in BFMP
Sea Chest	100	64	Area is inspected at each dry dock and cleaned, as necessary. (64%)
S.C. grating	100	18	Inspect and clean at dry dock.(64%)
Thruster	100	9	Area is inspected at each dry dock and cleaned, as necessary.(55%)
Thruster grating	100	0	Area is inspected at each dry dock and cleaned, as necessary.(45%)
OOWSS	100	0	Placement of blocks to be moved at each dry dock. (100%)
Rudder	100	9	Area is inspected at each dry dock and cleaned, as necessary.(45%)
Propeller and Shaft	100	36	Area is inspected at each dry dock and cleaned, as necessary.(45%)
Stabilizers (*)	18	0	Clean every 2-3 years. (50%)

Project 3: Enforcement Trends

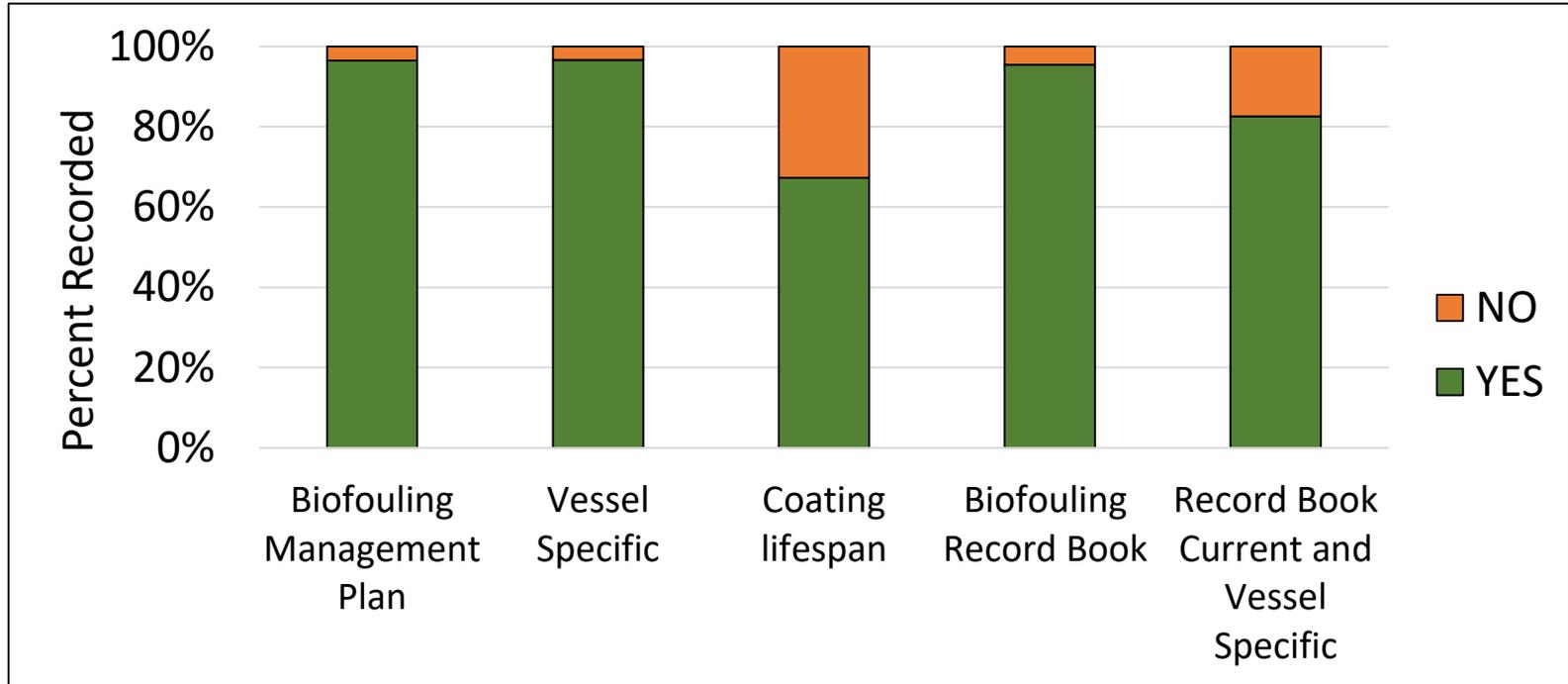


Background

- ❖ This project is based on examining biofouling inspections that were conducted by Commission Marine Safety Specialists from August 2018 to July 2019.
- ❖ Note any trends throughout the year can point out enforcement effectiveness.
- ❖ Compare the broad range of biofouling inspections with the inspections I conducted.
- ❖ Inspections from August 2018 – April 2019 manually entered onto an excel spreadsheet. Inspections from April 2019 to July 2019 were retrieved from the MISP database and compiled onto an excel spreadsheet that contained the previous inspections.

Results

Duration: August 2018- July 2019
Sample size: 497 vessels

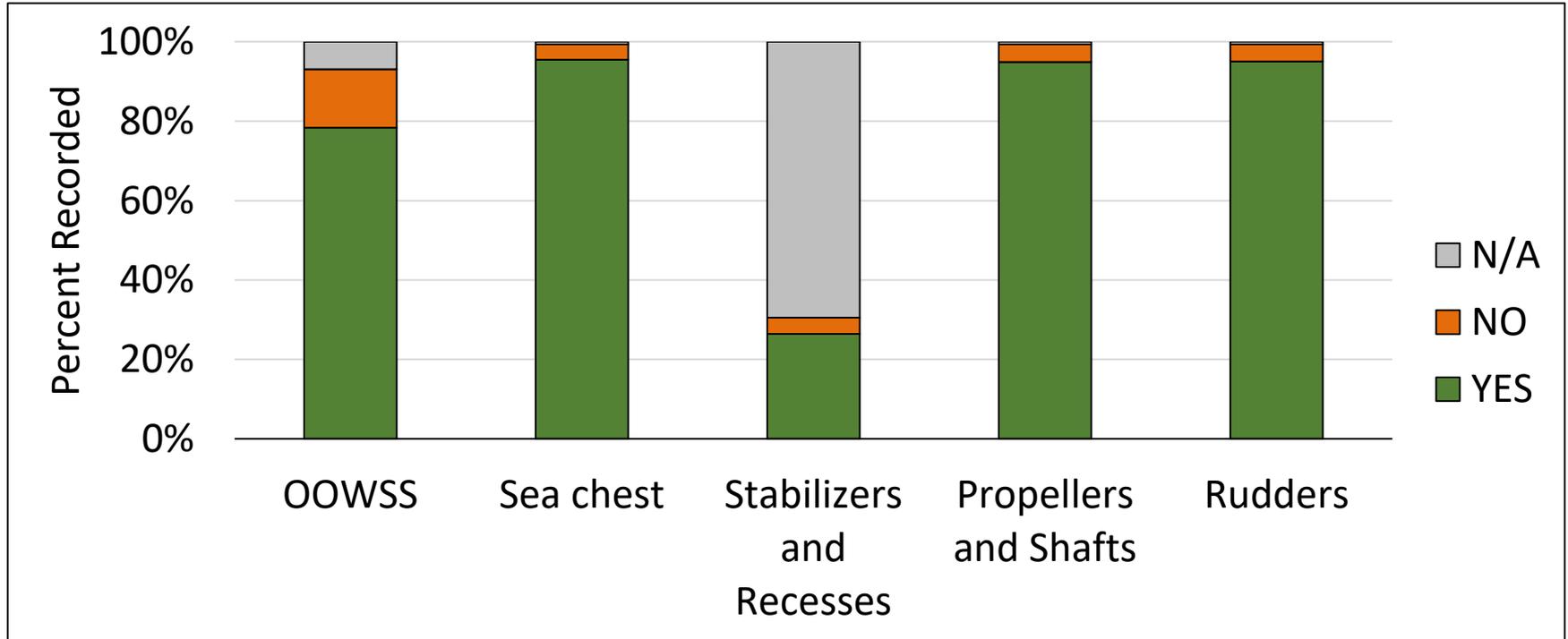


* More than 60% of vessels had required record keeping components.

Results

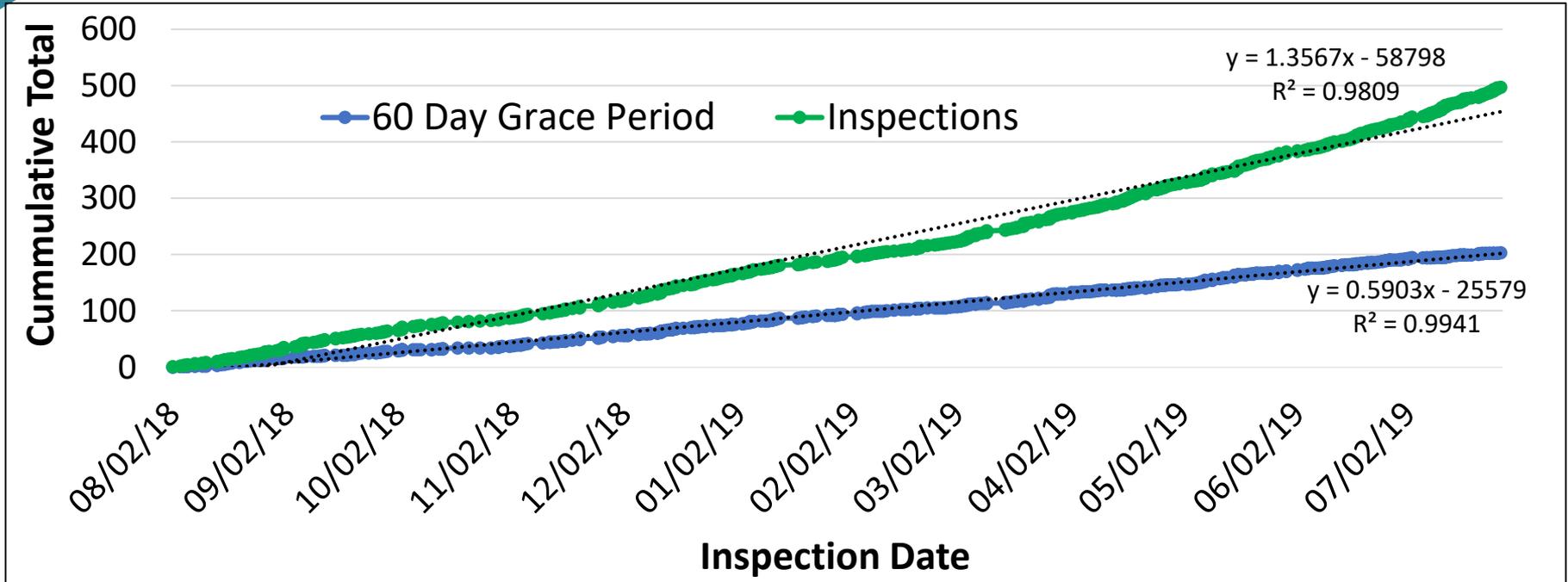
Duration: August 2018- July 2019

Sample size: 497 vessels



*Aside from stabilizers and recesses, more than 70% of vessels listed descriptions of managing these niche areas.

Results



* Rate between sixty-day grace period issued and total inspections is decoupling. The rate of sixty-day grace periods issued is less than half of the rate of inspections.

Conclusions: Take Away

- The Wheeler Reef Expansion project commenced on July 18th, 2019. All vessels transporting construction materials have successfully passed the risk assessments.
- Every vessel had a biofouling management plan and record book on board. In addition, every niche area that was required to have a preventative management description did indeed have one.
- Effective communication among all parties directly reflects decrease in deficiencies noted and 60-day grace periods issued.



PC: Orange County Register



My Amazing Experience

- Projects were unique, challenging, and very rewarding
- Relationships built with MISP team and SLC staff
- Experience with boarding vessels and interactions with vessel crew
- Enhanced understanding of environmental regulations



Acknowledgements



A special thank you to everyone I interacted and worked with on the MISP team, safety specialists, and MEPD!





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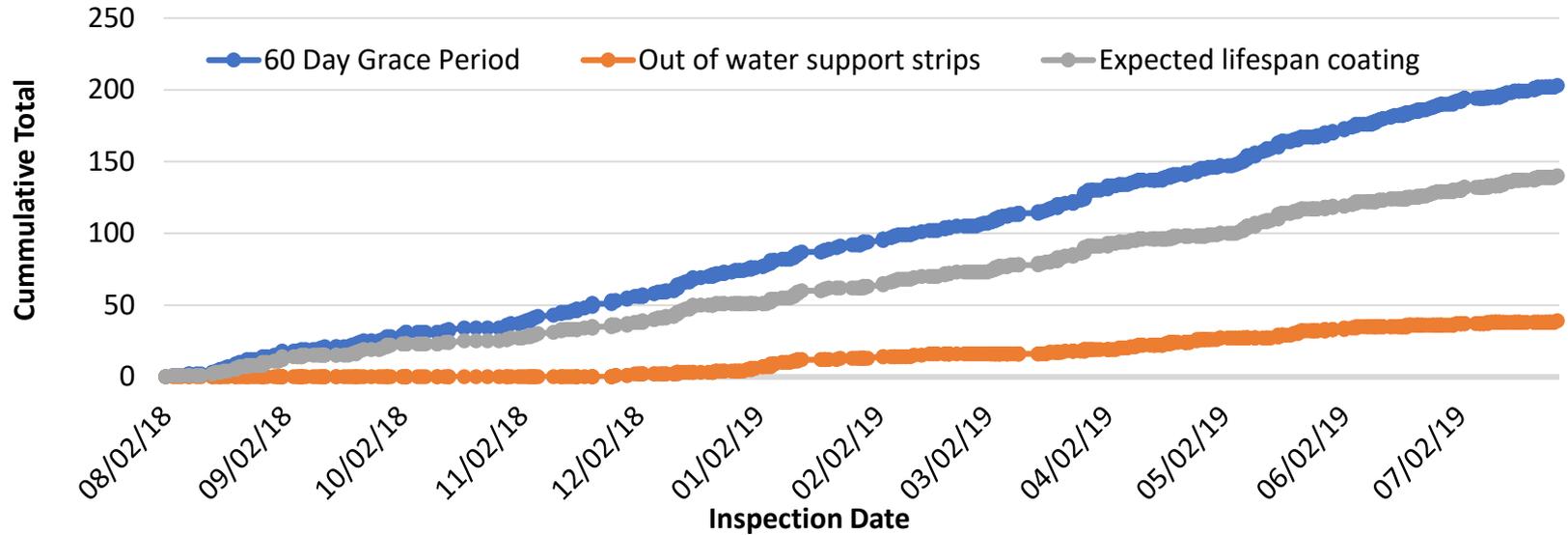
THANK YOU & QUESTIONS

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Results



* The primary cause for grace periods is vessels missing antifouling coating lifespans.