EcoEléctrica

A better environment with natural gas

ENVIRONMENTAL PROTECTION AGENCY MEETING

REGION 2 HEADQUARTERS

NEW YORK, NY

DECEMBER 19, 2019

AGENDA

- **Greetings & Introductions 10:00-10:05 AM**

- **BMPP Regulatory Update 2015-2019**
  EcoElectrica 10:05-10:30
  - Five-year summary

- **BMPP Results 2015-2018**
  Reefscaping 10:30-11:00 AM
  - Benthic cover
  - Seagrasses (with UPRM)
  - Fishes

AGENDA (CONT.)

- **BMPP Results 2017-2019**
  UPR-M 11:00-11:30 AM

  - Water Quality (Continuous/Monthly)
  - Outfall Plume
  - Currents
  - Impingement
  - Entrainment
  - Conservation Projects (Maria Langa/Biobay/Mangroves)

- **BREAK 11:30-11:40 AM**

- **2015-2019 BMPP Closure/Proposal 2020-2025 BMPP**
  EcoElectrica 11:40 AM-12:00 noon

- **Meeting Closure**
  All attendees 12:00 noon

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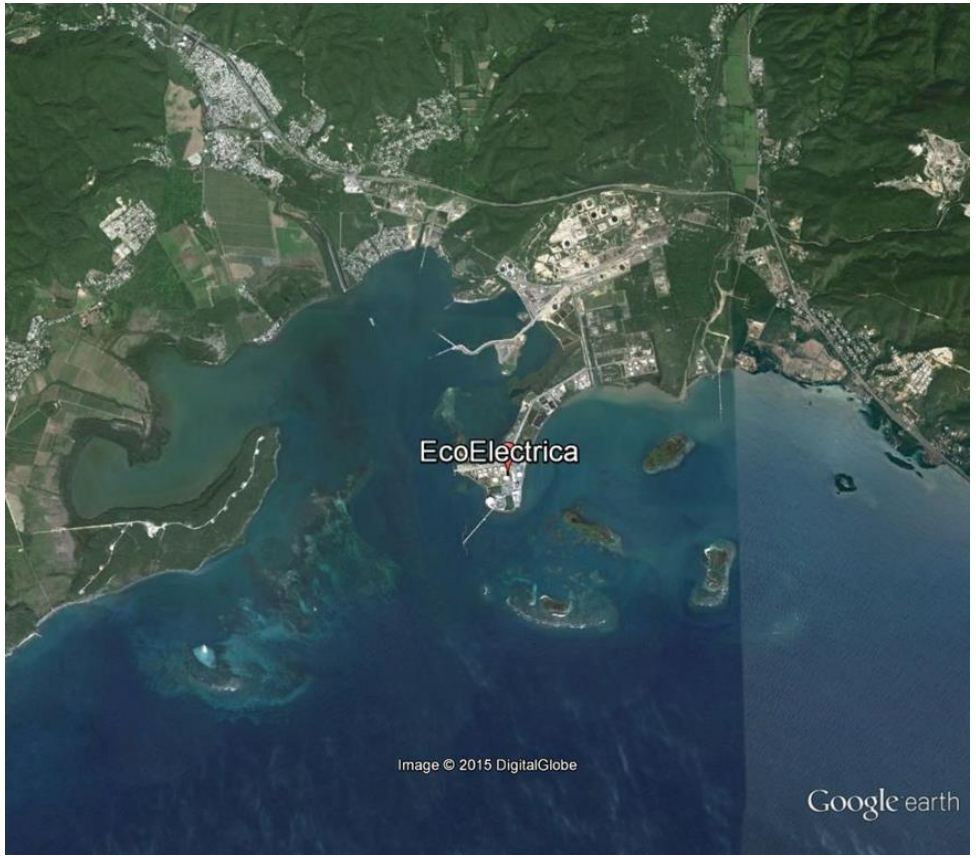
"Un mejor ambiente con gas natural"

Who are we?

EcoElectrica


EcoElectrica
Image © 2015 DigitalGlobe
Google earth

Who are we?

Cogeneration Plant

- 530 MW contracted capacity
- Natural gas/propane/fuel oil #2

Desalinization Plant

- 2 MM gallons processed/day
- Water Franchise

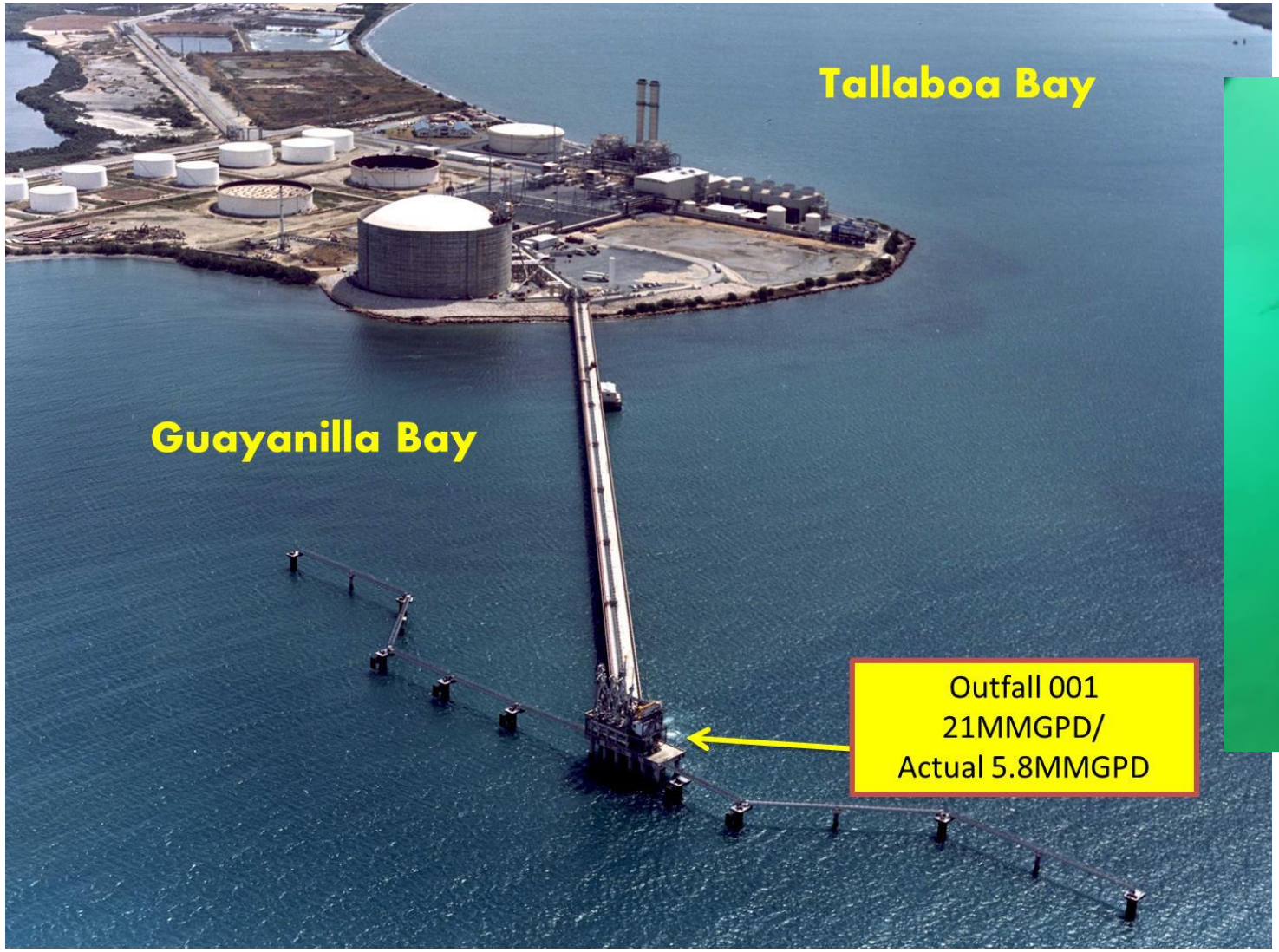
LNG Receiving Terminal

- 42 MM Gallon Storage tank
- Pier 1,800 linear ft
- Regasification 279 MM SCFD

EcoEléctrica produces approximately 17% of PR's electric energy.

Capacity to send out up to 186 MMSCFD natural gas to the neighboring PREPA Costa Sur Power Plant in addition to 93 MMSCFD consumed by the facility.

Environmental Context- Cooling Water Discharge



BMPP REGULATORY UPDATE
2015-2019

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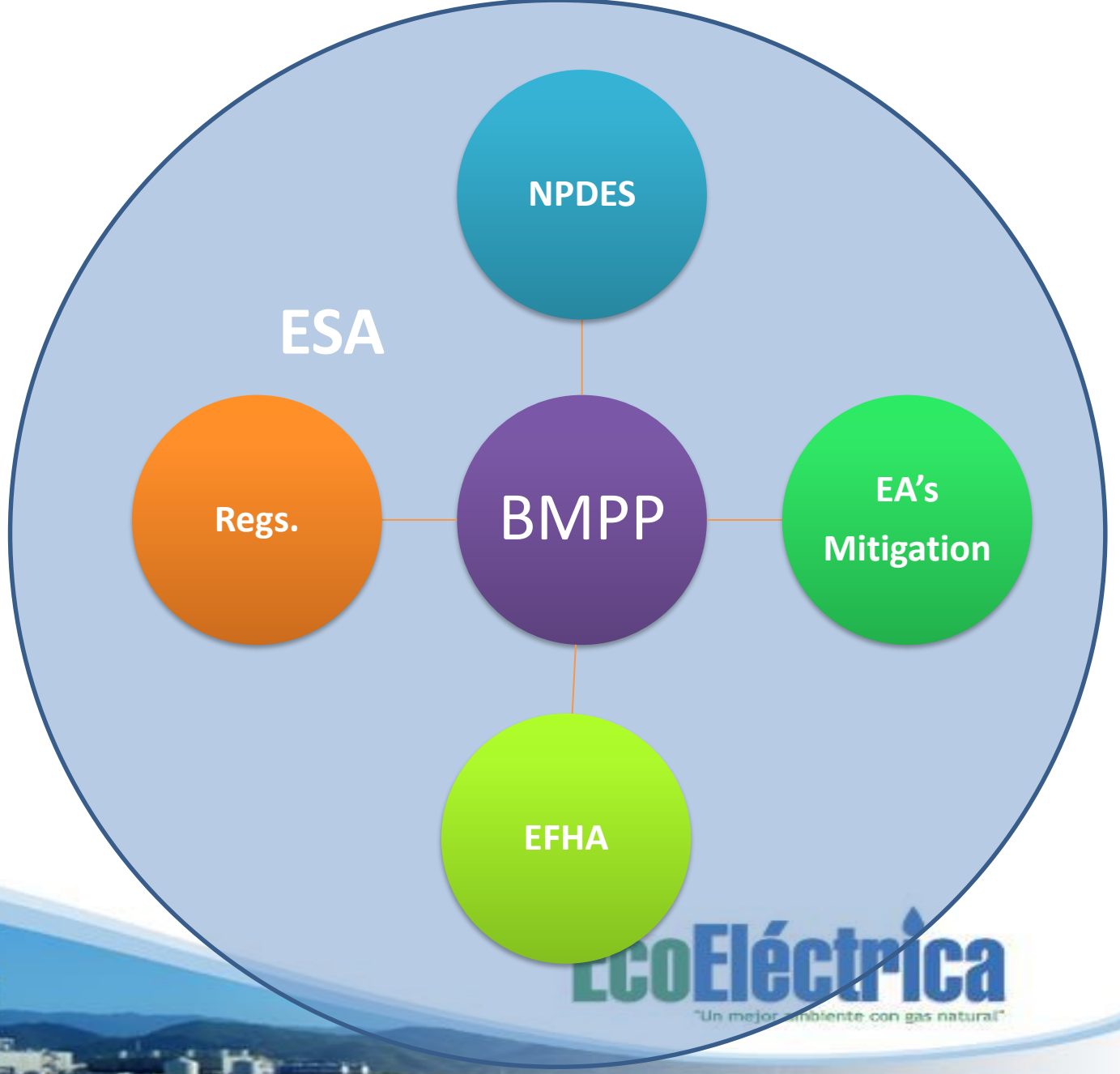
Background



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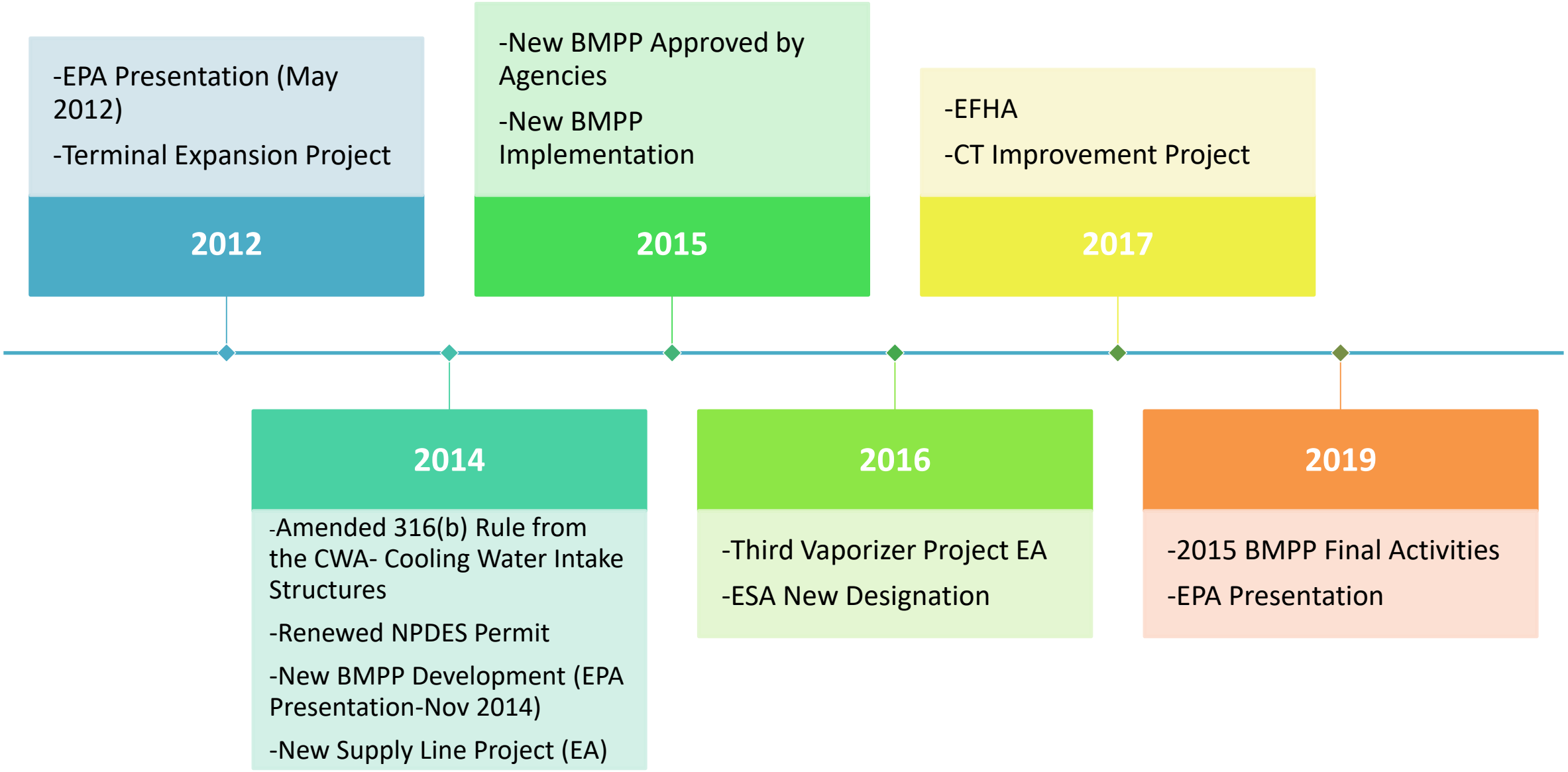
"Un mejor ambiente con gas natural"

Background (cont.)



Comments from EPA Meeting November 2014 BMPP 2015-2019

Study	Details
Coral Study	Coral large scale
	Cora small scale
ESA and Action area	Coral ESA
	Coral ESA additional site
Seagrass large scale	Seagrass large scale
	Motile macro invertebrates
	Seagrass Cover Mosaic
Seagrass small scale	Seagrass productivity
	Seagrass epiphytes
Fish Survey	Fish survey
	Passive acoustic
Water Quality Monitoring	Monthly
	Continuous
	Temperature Plume Distribution
Water Currents	One Event
Impingement	One Event
Entrainment	One Event

HJR OVERVIEW

- Benthic Cover
  - Corals
  - ESA
  - Other reefs

- Seagrasses
  - Cover & productivity

- Fishes
  - Surveys
  - Passive acoustic

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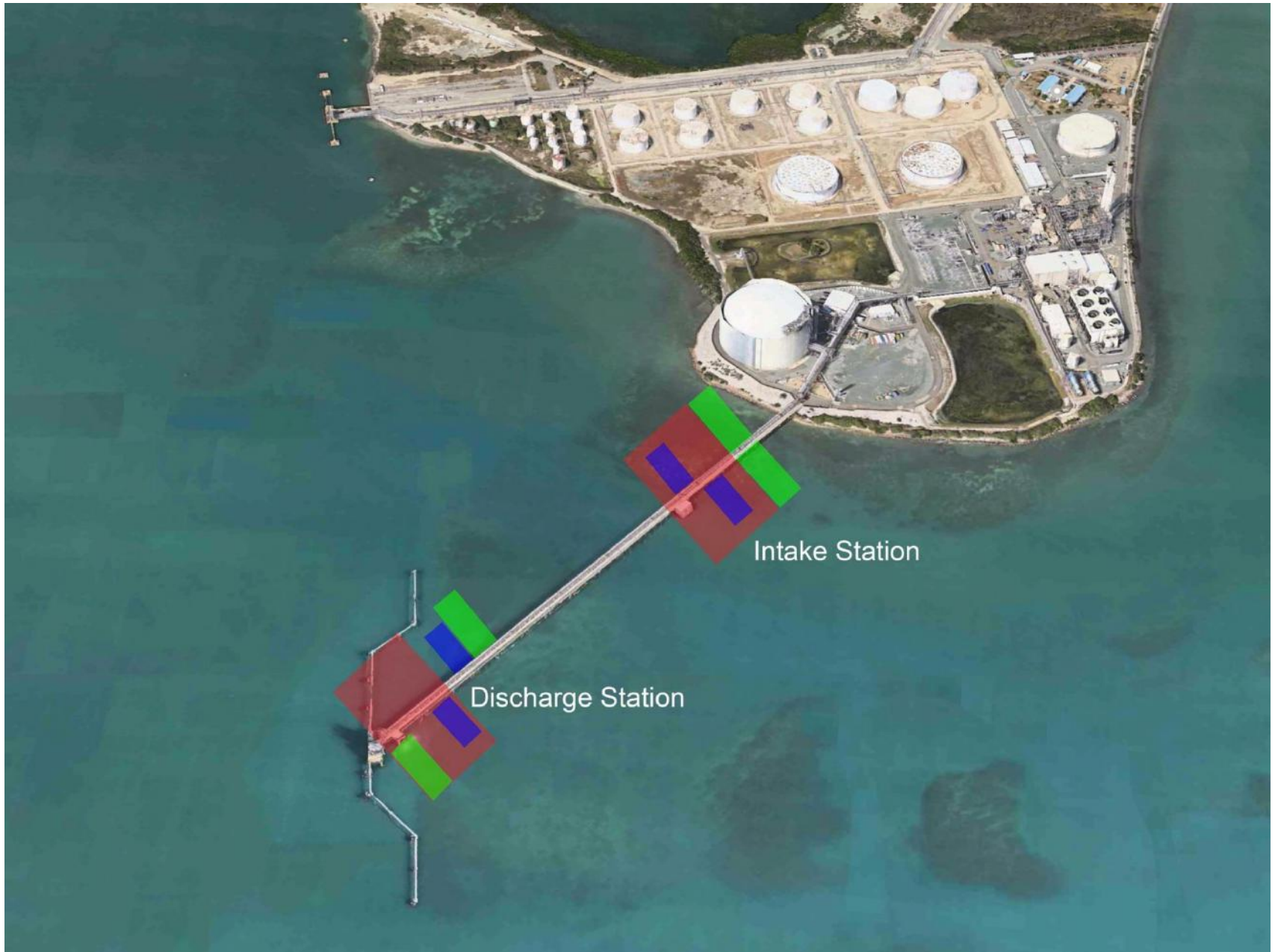
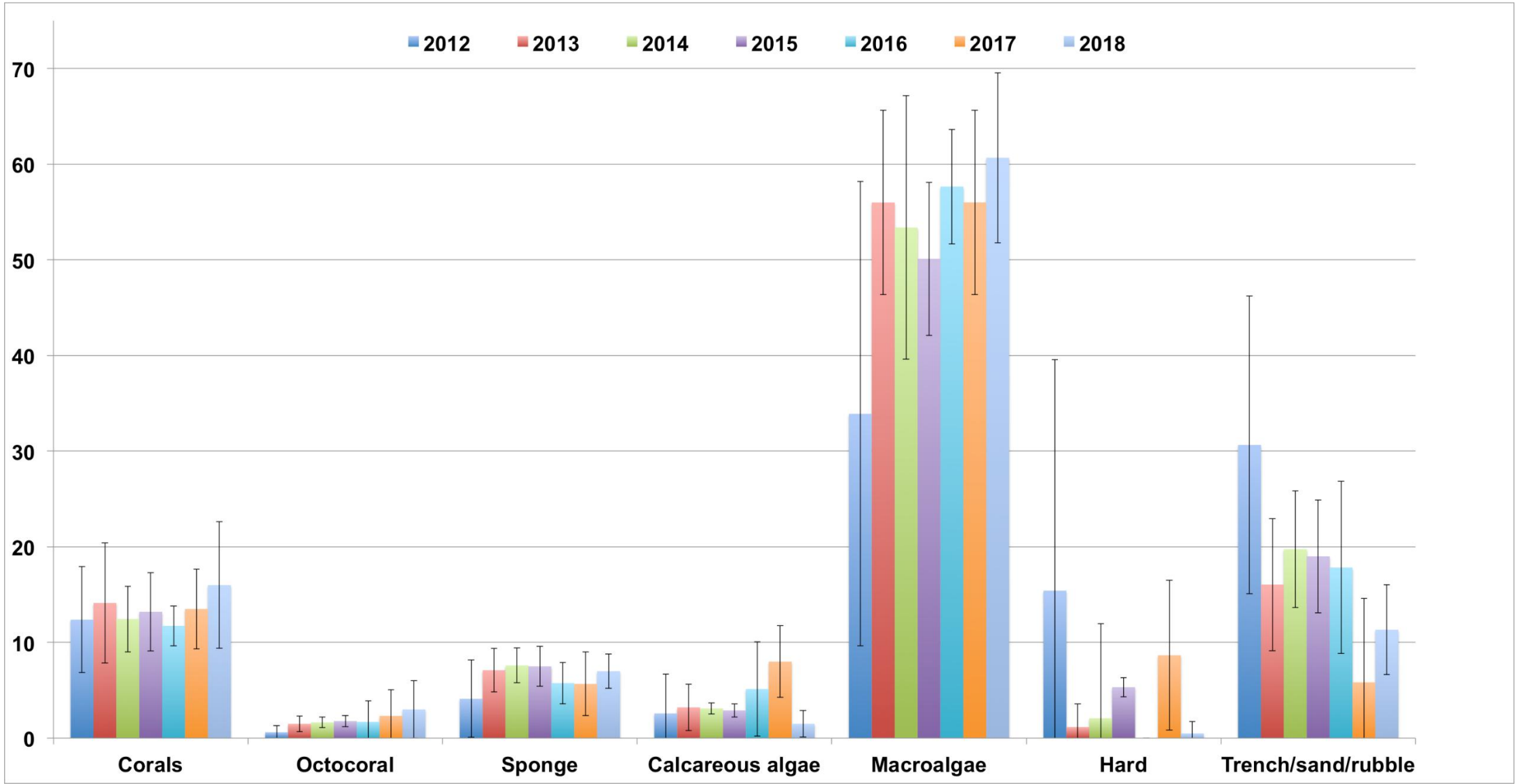
BENTHIC COVER

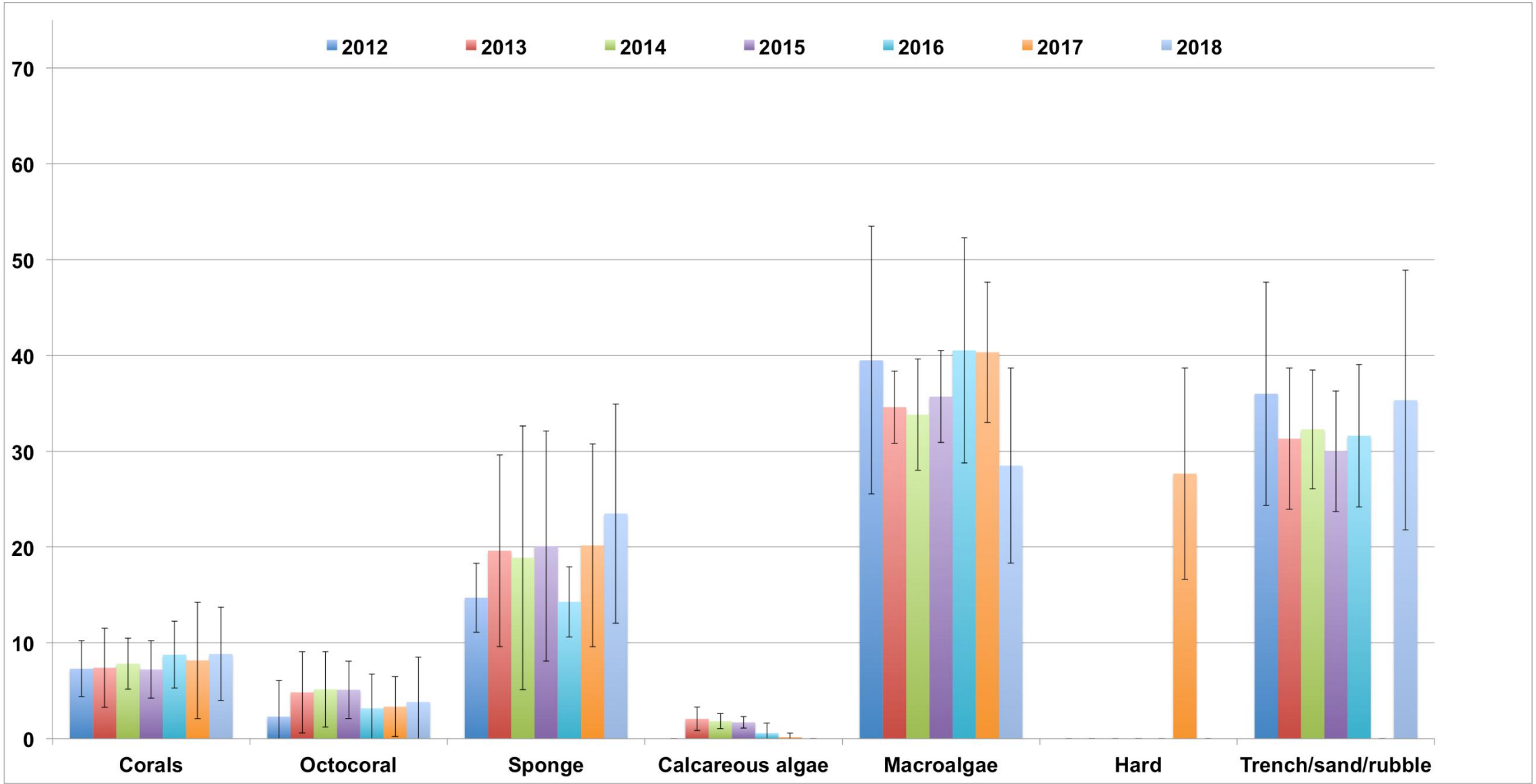
Monitoring Stations Location



Intake Station
Mean Linear Percent Cover



Discharge Station
Mean Linear Percent Cover



Benthic Cover Summary

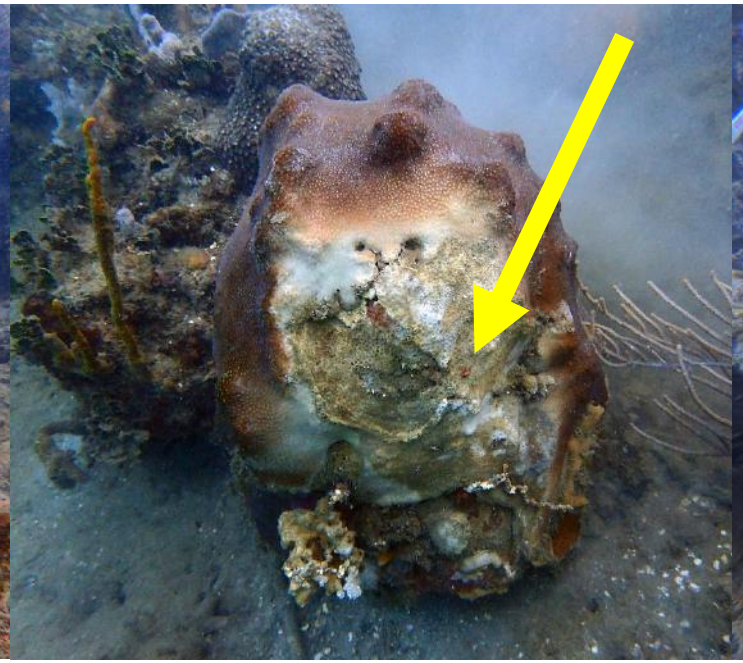
- Macroalgae is the dominant benthic organism at both stations
- Coral cover is 13.6% at the Intake Station (NCRMP-PR 9.3%)
- Coral Cover is 8.3% at the Discharge Station (NCRMP-PR-8.0%)
- No Significant differences since 2012

ESA Coral Species

- None of the 7 listed ESA coral colonies on the pilings.
- Pilling are mostly covered by sponges 74% (turf algae 15.2%, hydroids 4.4%, fire coral 4.4% and cyanobacteria 2%).
- One *Acropora palmata* colony lost after hurricane Maria.
- *Orbicella faveolata* colony dislodged from the substrate. This colony was recued and cemented back to the reef.
- Additional surveys identified 5 *Orbicella faveolata* colonies.

Orbicella faveolata colony dislodged from the substrate. Colony was recued and cemented back to the reef.

Prior to Hurricane Maria (2017)



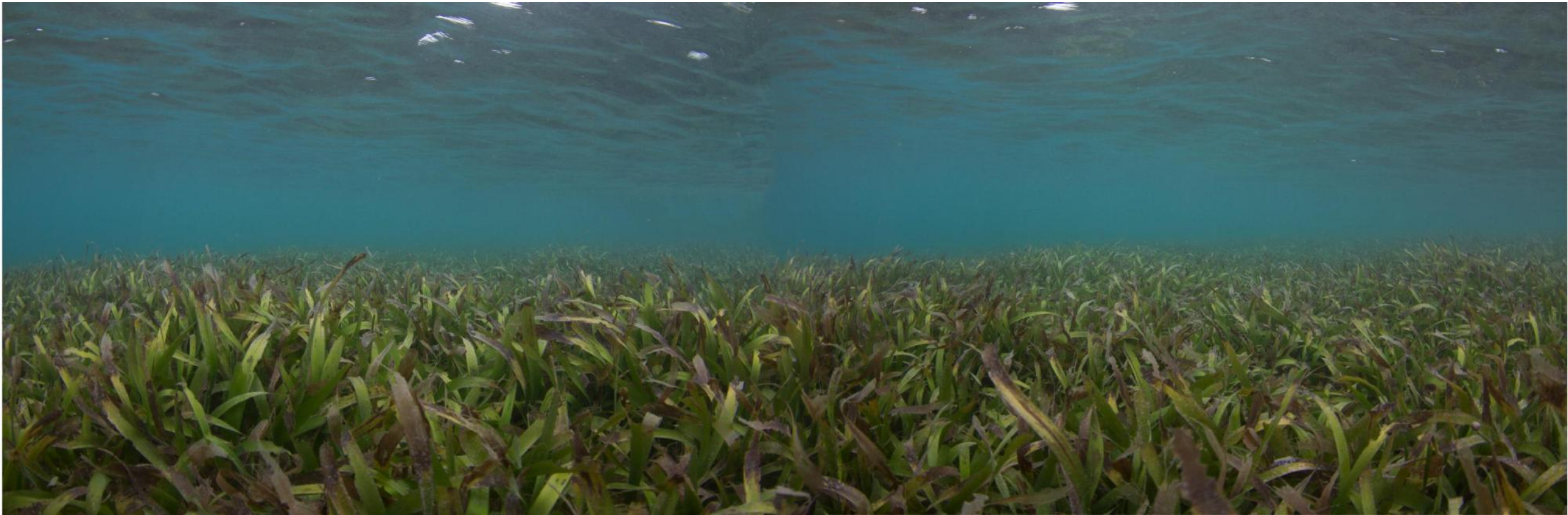
Hurricane Maria Impact

2019 (after restoration)

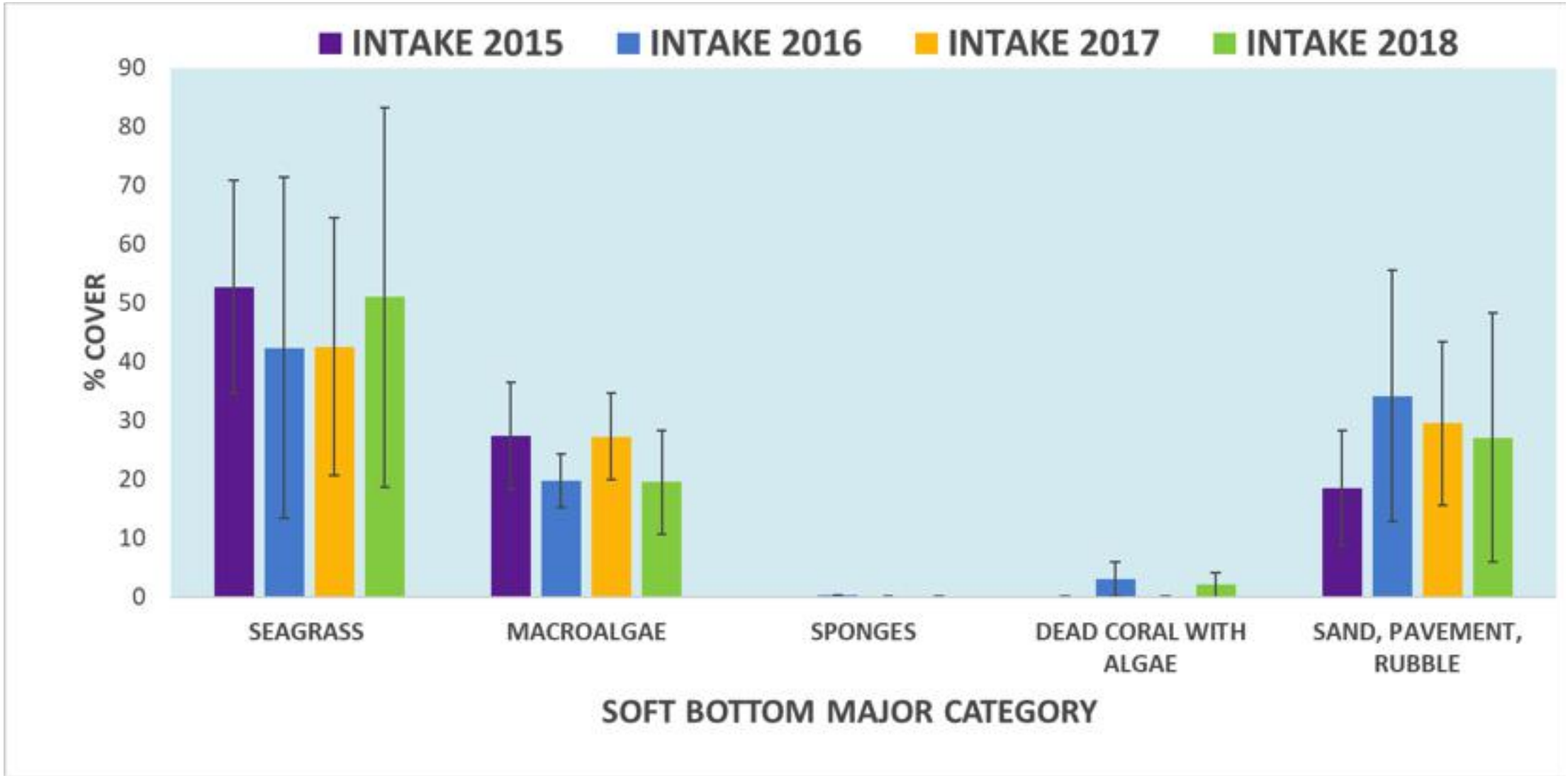
2019-Bleaching Event and Coral Disease

- Regional event including Puerto Rico and U.S. Virgin islands.
- Bleaching in coral colonies, anemones, octocorals and zoantids.
- Coral disease threats expected after bleaching events.
- New fatal coral disease Stony Coral Tissue Loss Disease (SCTLD).

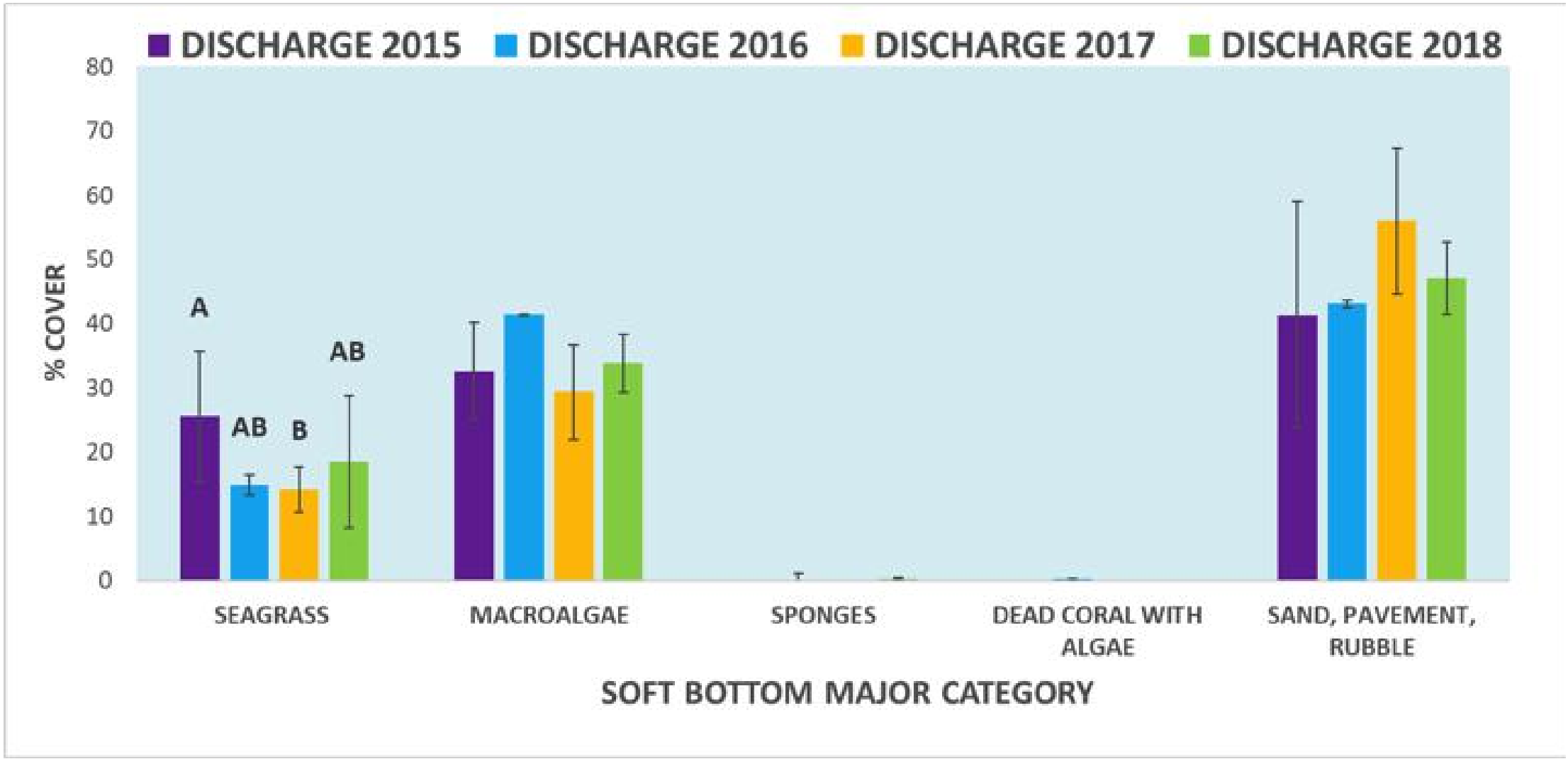
SEAGRASSES



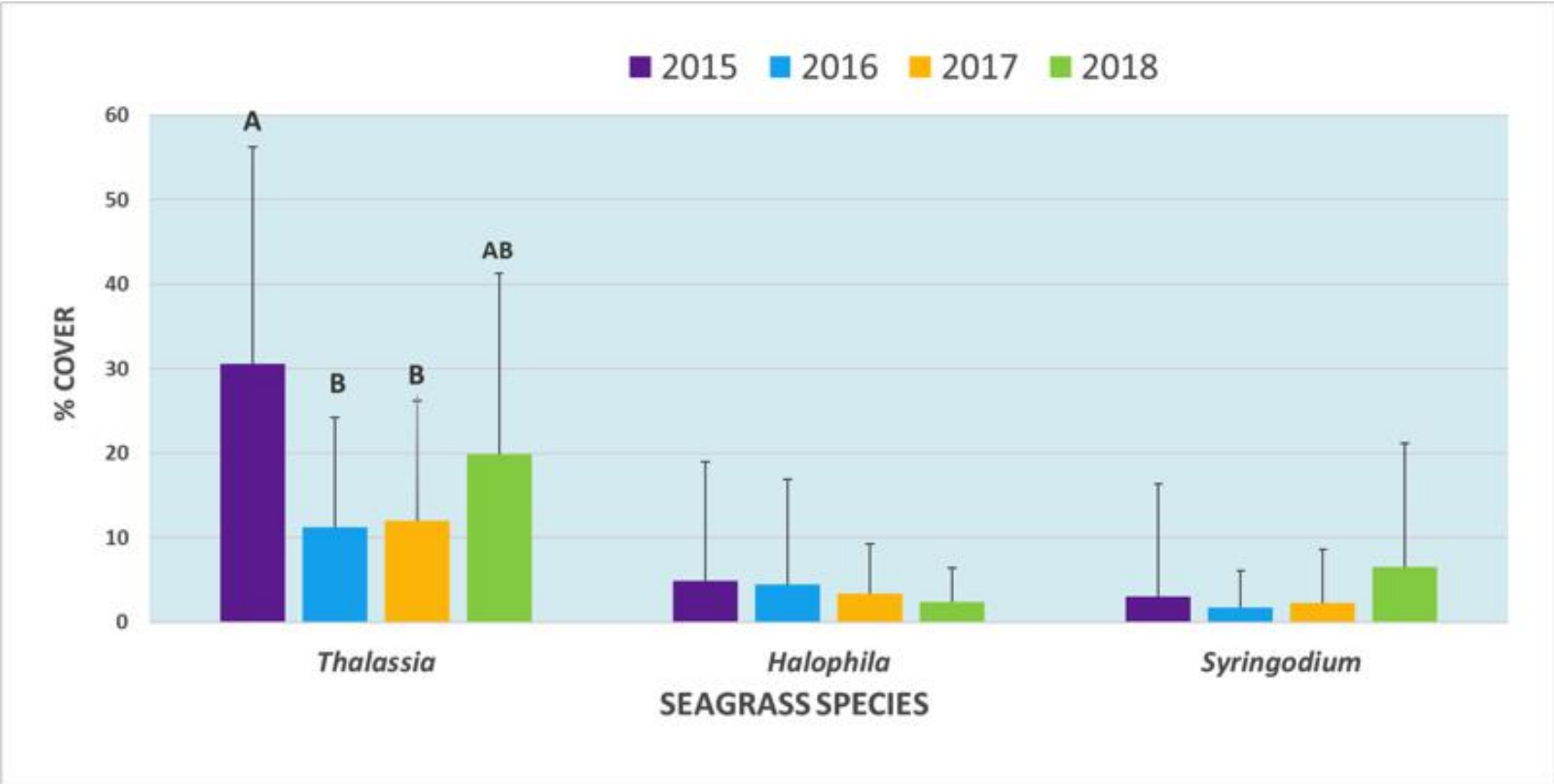
Seagrass Transect Monitoring at the Intake Station

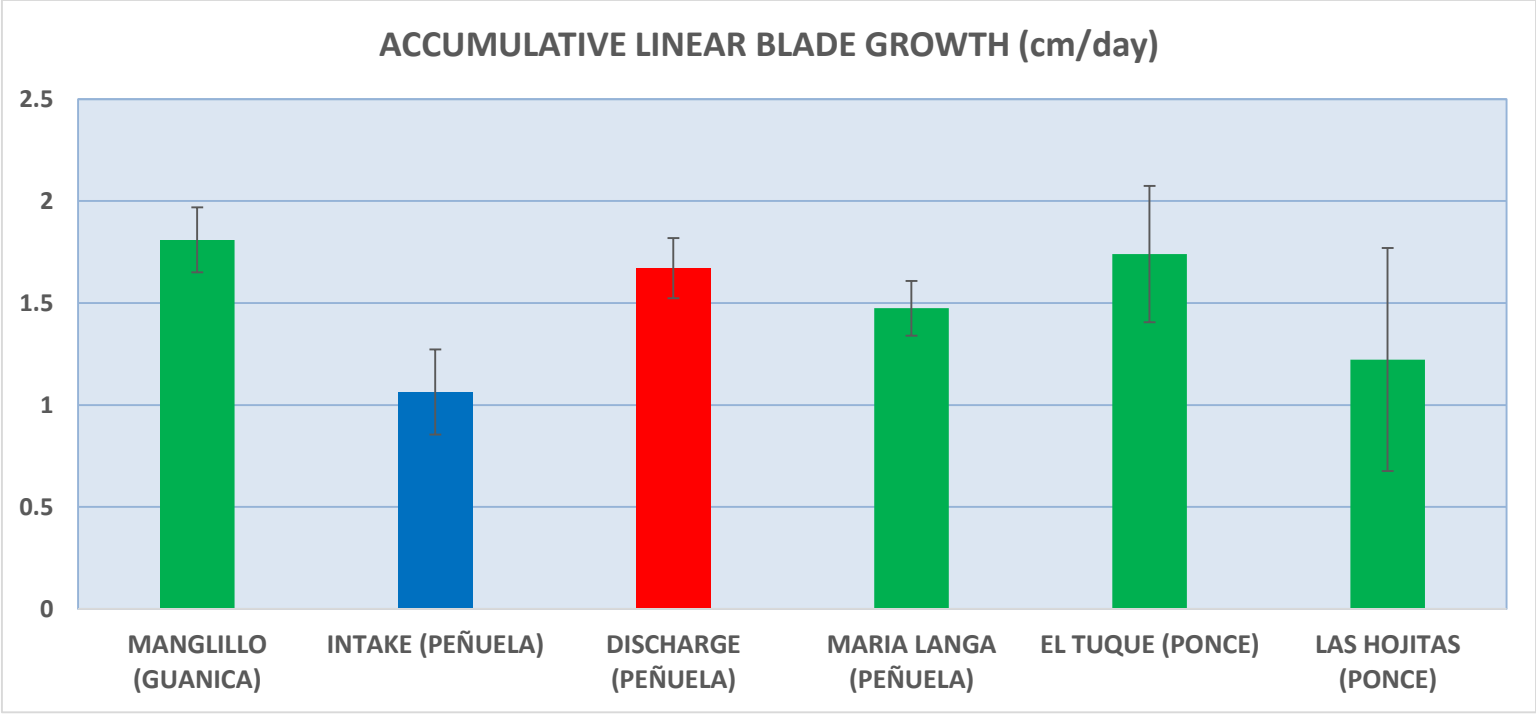


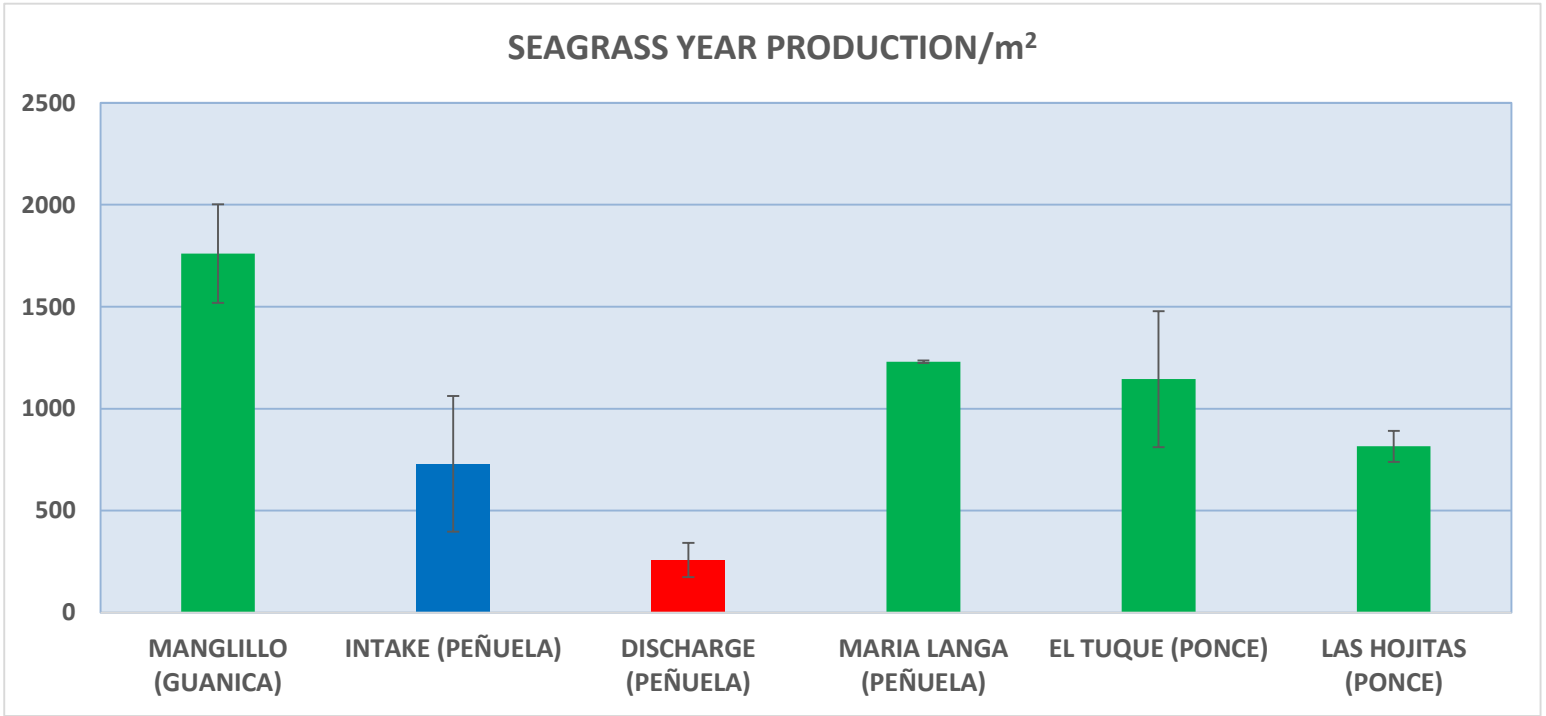
Seagrass Transect Monitoring at the Discharge Station

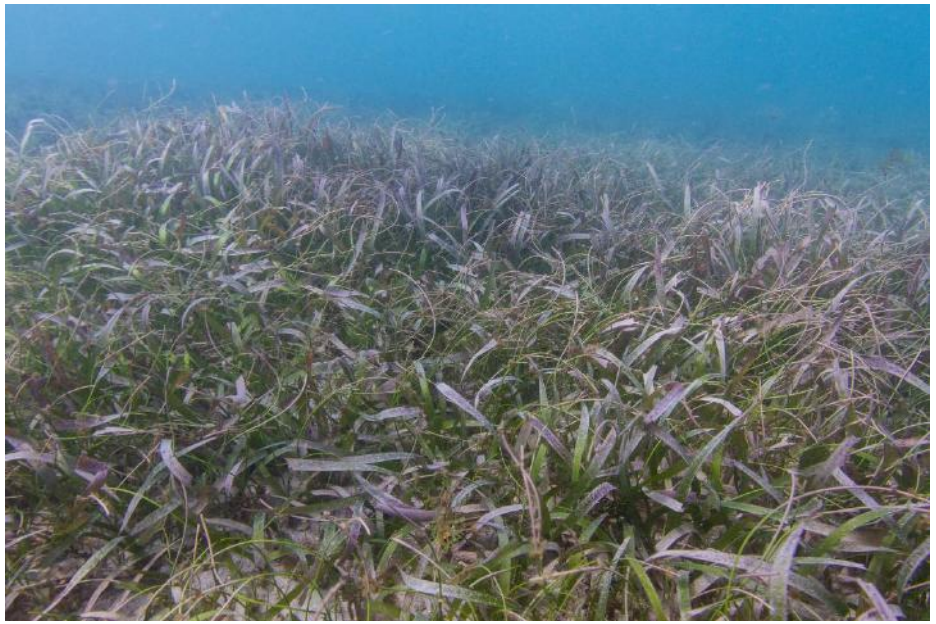


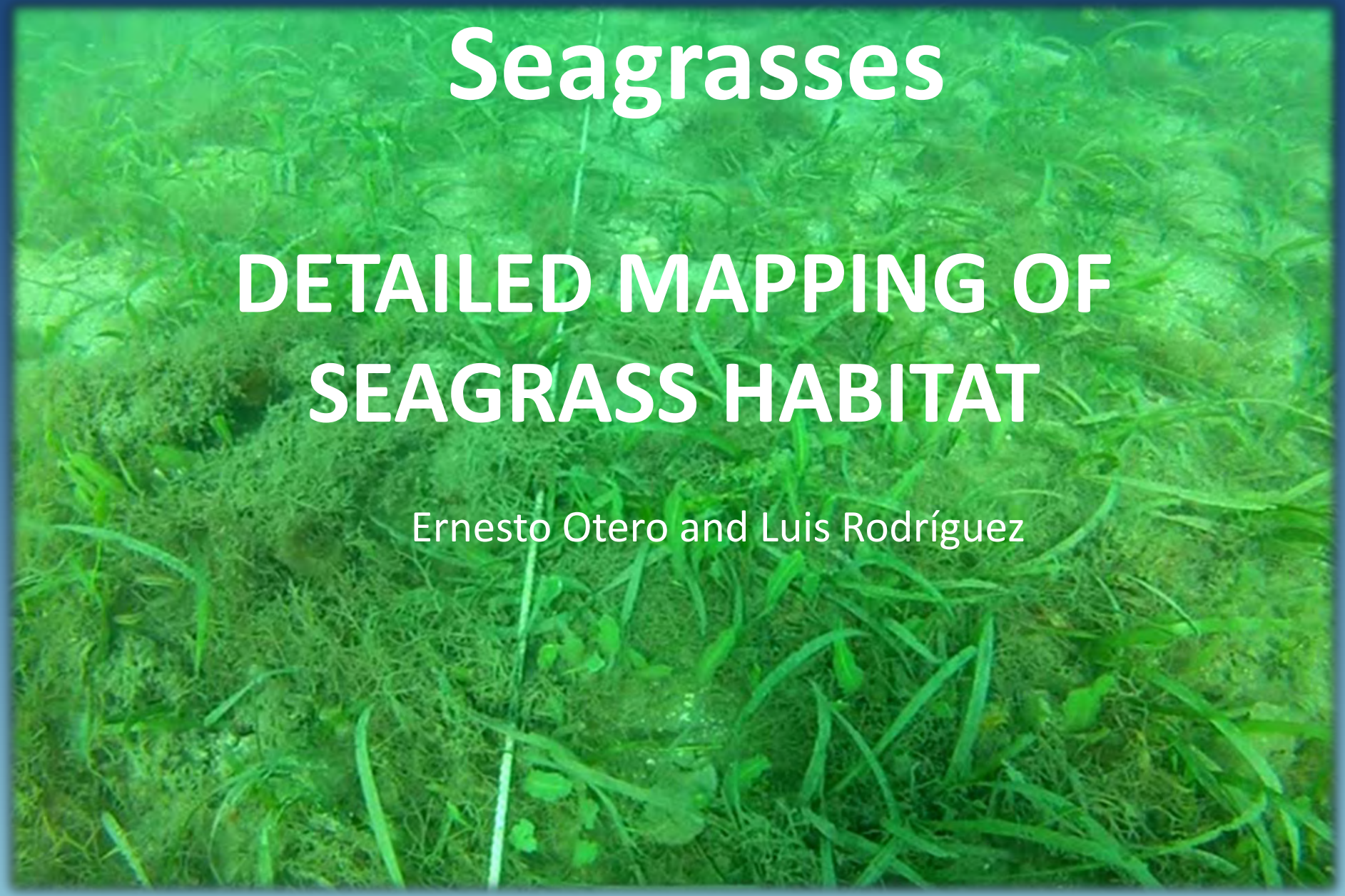
Seagrass Cover by Species at the Discharge Station




ACCUMULATIVE LINEAR BLADE GROWTH (cm/day)
2.5
2
1.5
1
0.5
0
MANGLILLO (GUANICA)
INTAKE (PEÑUELA)
DISCHARGE (PEÑUELA)
MARIA LANGA (PEÑUELA)
EL TUQUE (PONCE)
LAS HOJITAS (PONCE)


SEAGRASS YEAR PRODUCTION/m²
2500
2000
1500
1000
500
0
MANGLILLO (GUANICA)
INTAKE (PEÑUELA)
DISCHARGE (PEÑUELA)
MARIA LANGA (PEÑUELA)
EL TUQUE (PONCE)
LAS HOJITAS (PONCE)





Seagrasses

DETAILED MAPPING OF SEAGRASS HABITAT

Ernesto Otero and Luis Rodríguez

A

Thalassia testudinum

B

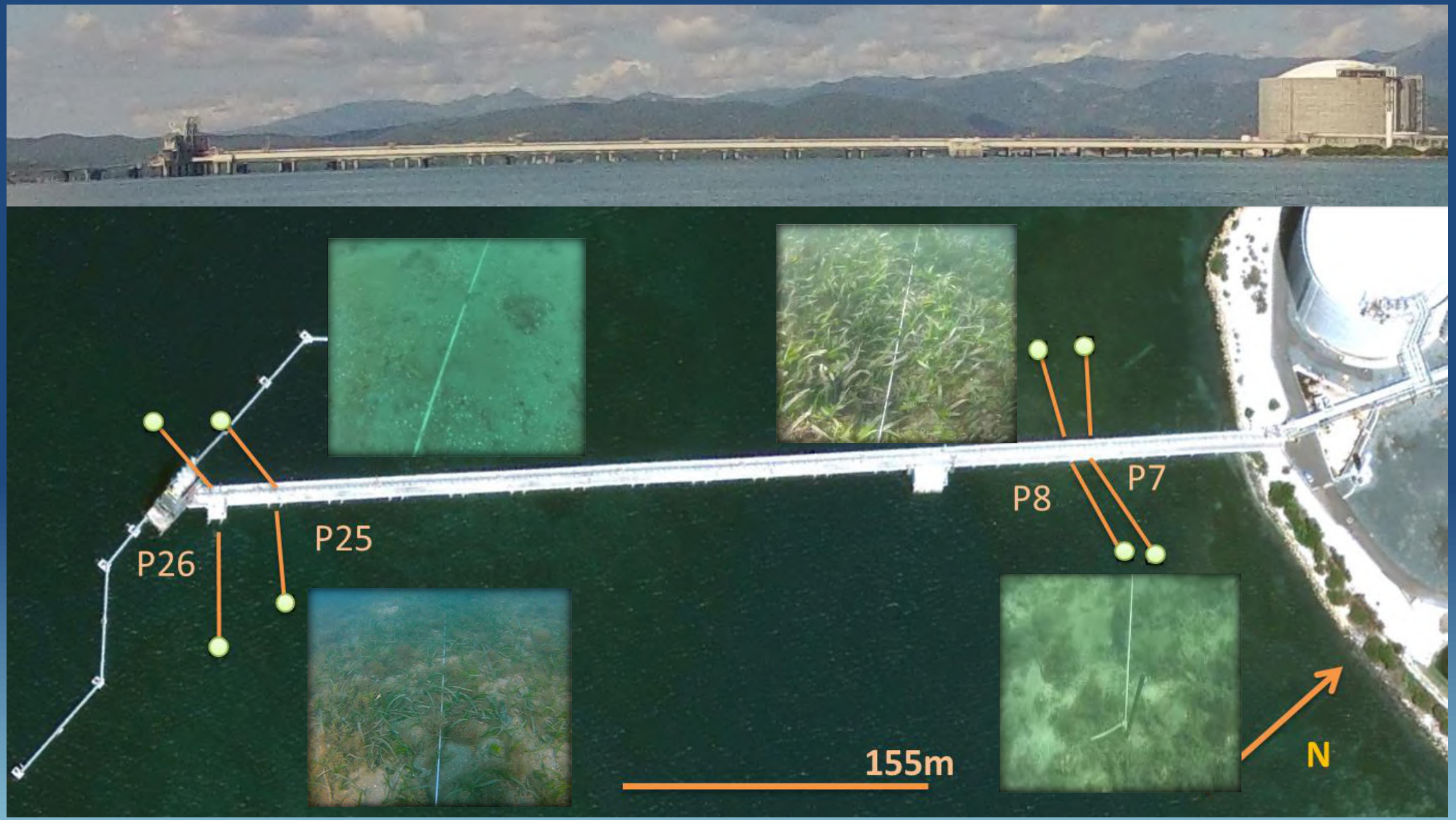
Halodule wirightii

C

Syringodium filiformis

D

Halophila descipiens


P26
P25
P8
P7
155m
N

Work Flow

Collect hundreds of benthic photos.

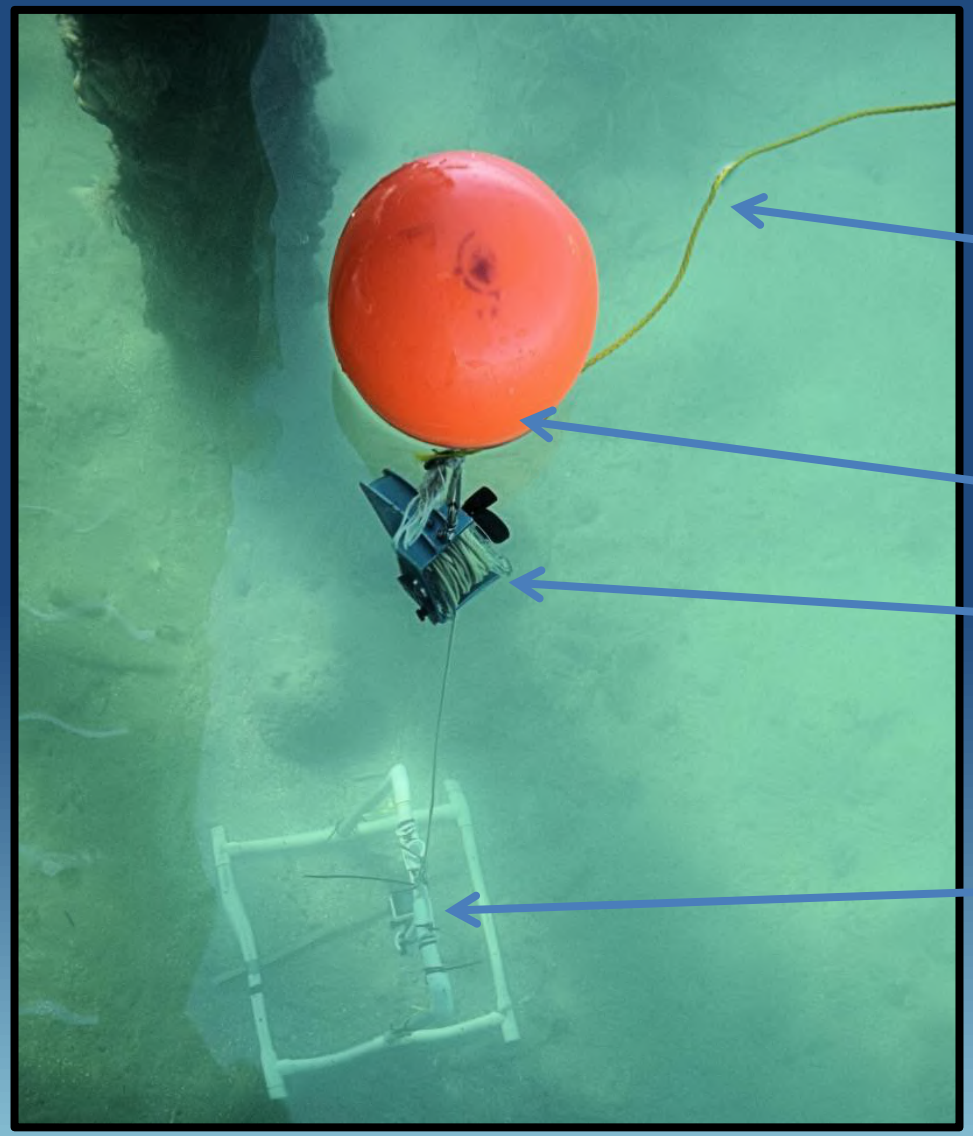
Estimate seagrass cover in 0.1m2 quadrats (CPCe 4.1*)

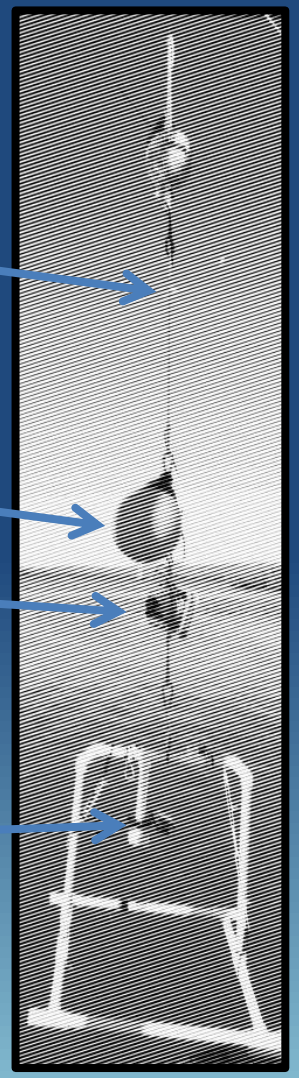
GeoRef photos and produce kml files (RoboGeo Ver 6.3.3) for desktop visualization.

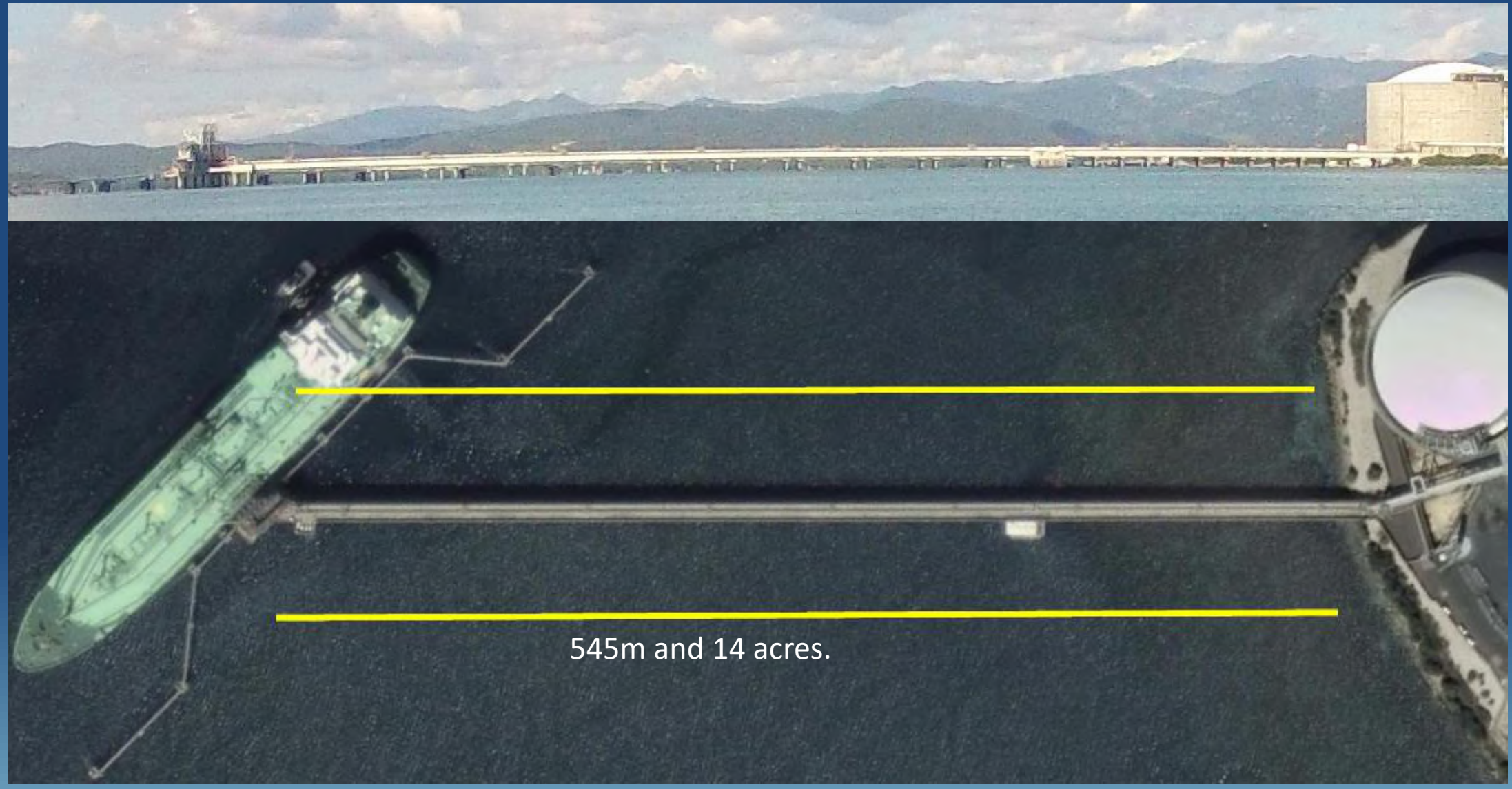
Construct % seagrass cover layers using software packages such as Grapher.

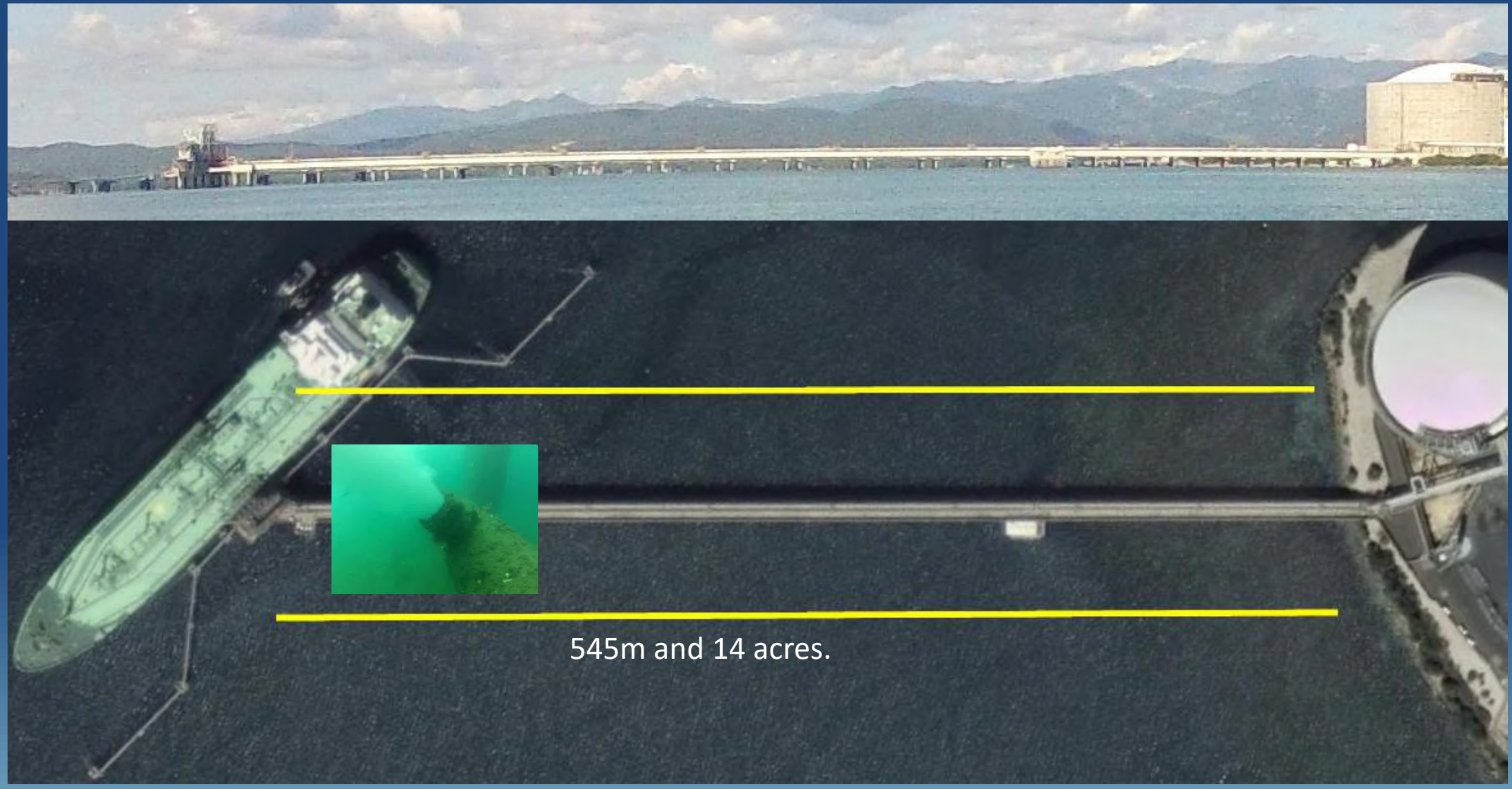
*Kohler, K.E. and S.M. Gill, 2006. Coral Point Count with Excel extensions (CPCe): A Visual Basic program for the determination of coral and substrate coverage using random point count methodology. Computers and Geosciences, Vol. 32, No. 9, pp. 1259-1269, DOI:10.1016/j.cageo.2005.11.009.

CAmera-BUoY-Array (CABUYA)

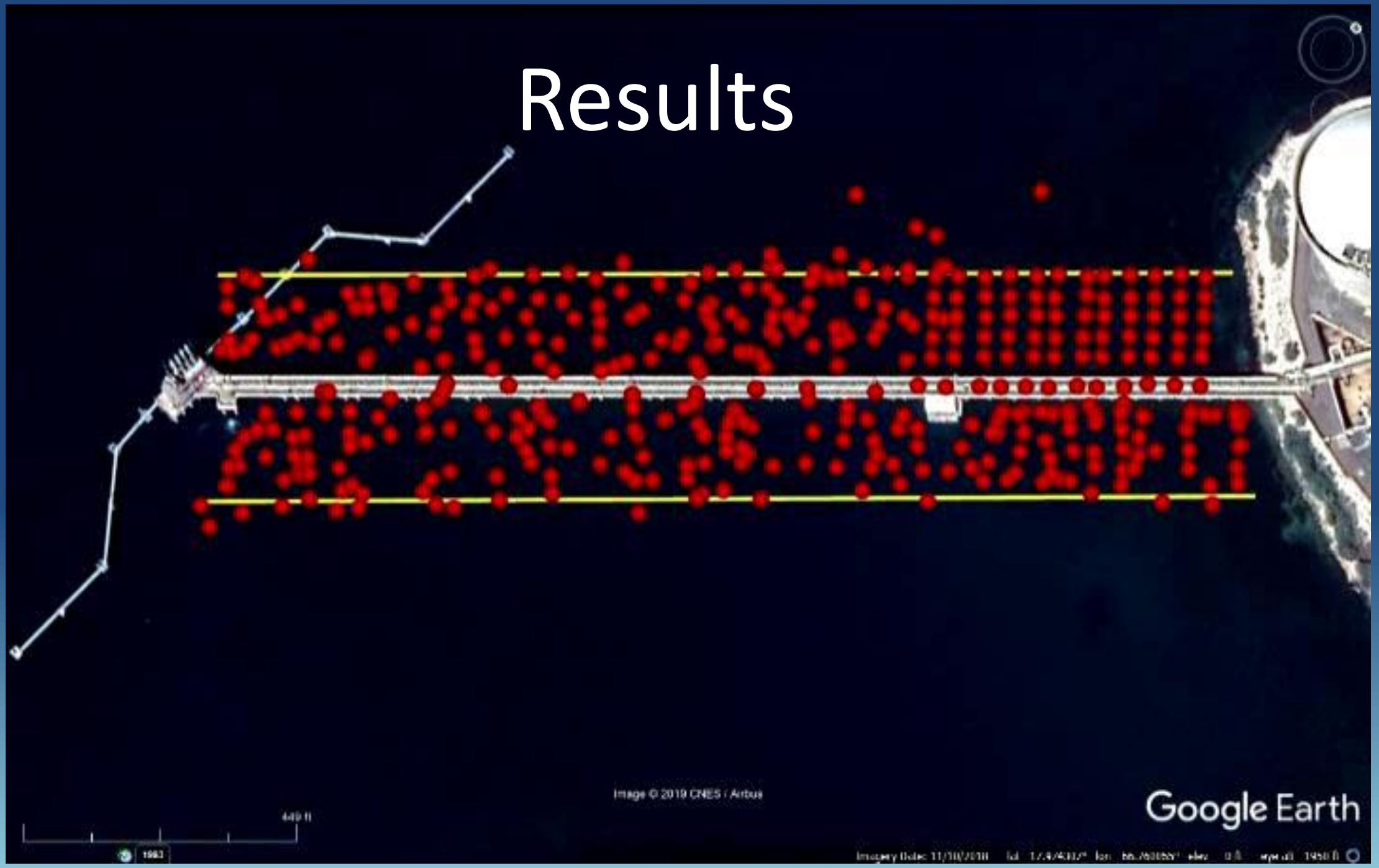




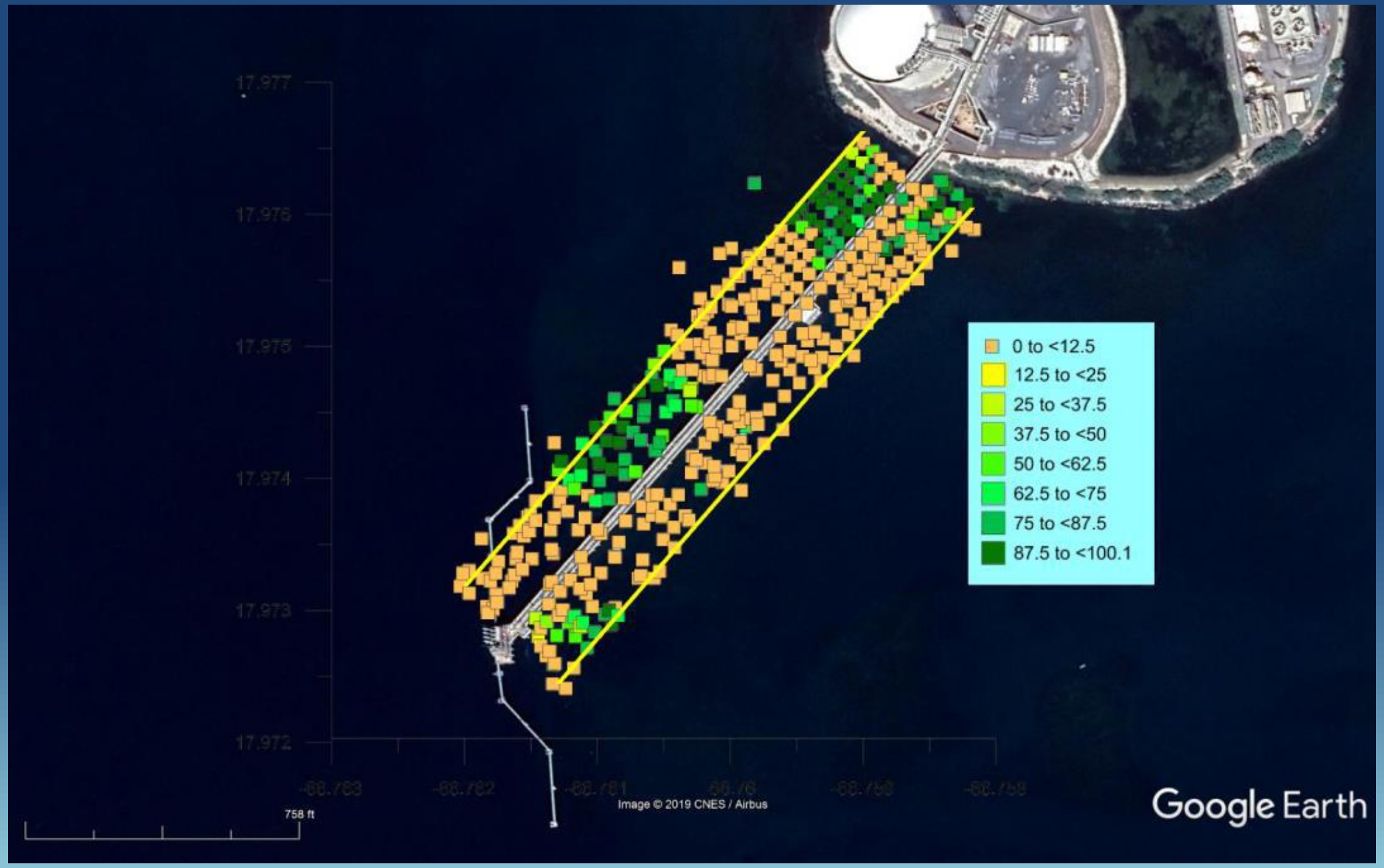

545m and 14 acres.


545m and 14 acres.

Results



Percent Seagrass Cover



CONCLUDING REMARKS

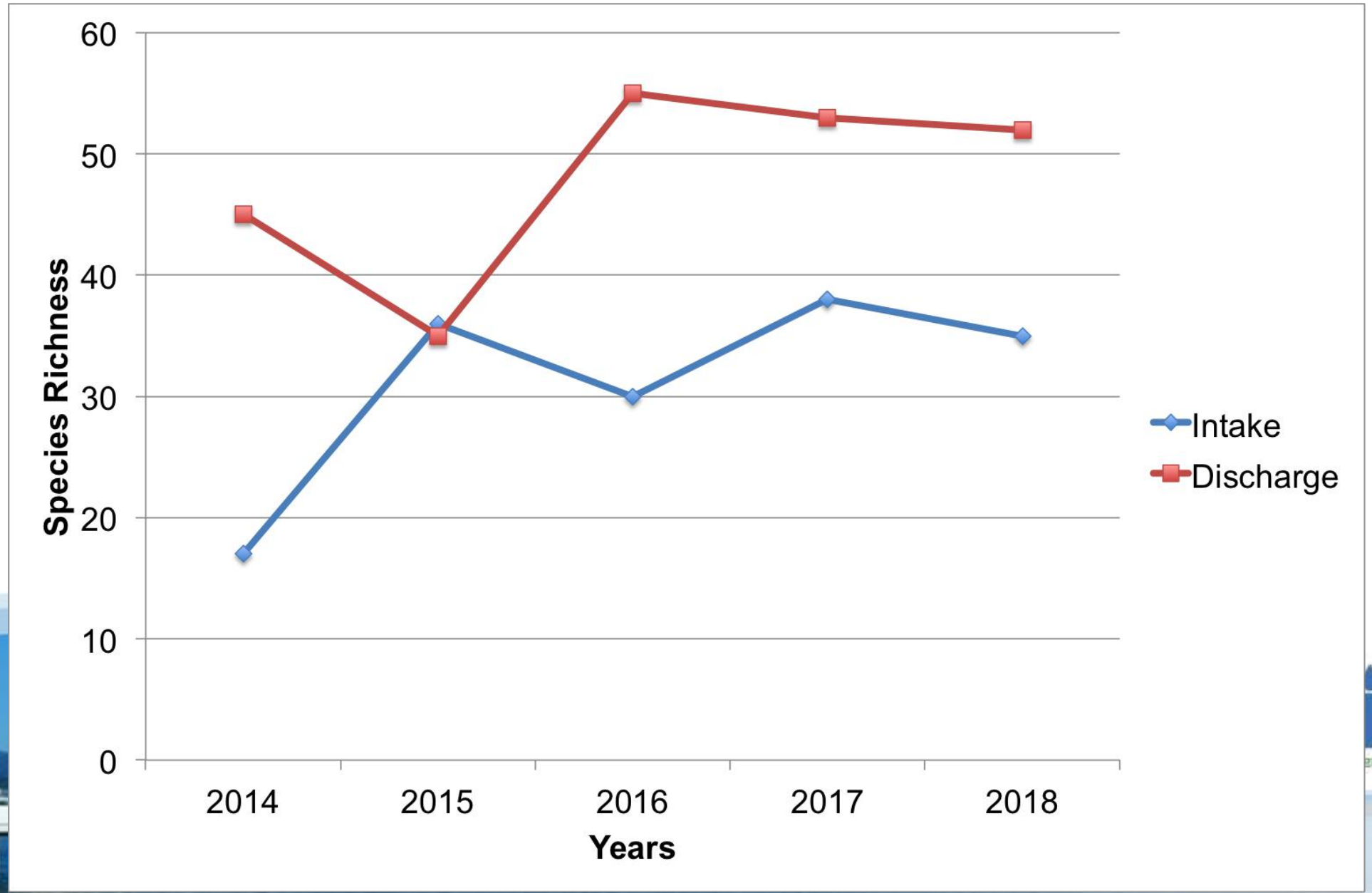
- The collection of underwater photographs is available for future reference in Google Earth kml format.

- The map expands knowledge on seagrass habitat distribution near EcoElectrica's pier and provides the opportunity to evaluate other biological components such as algae, and sponges as well as the condition of the bottom (rocky, sandy, muddy).

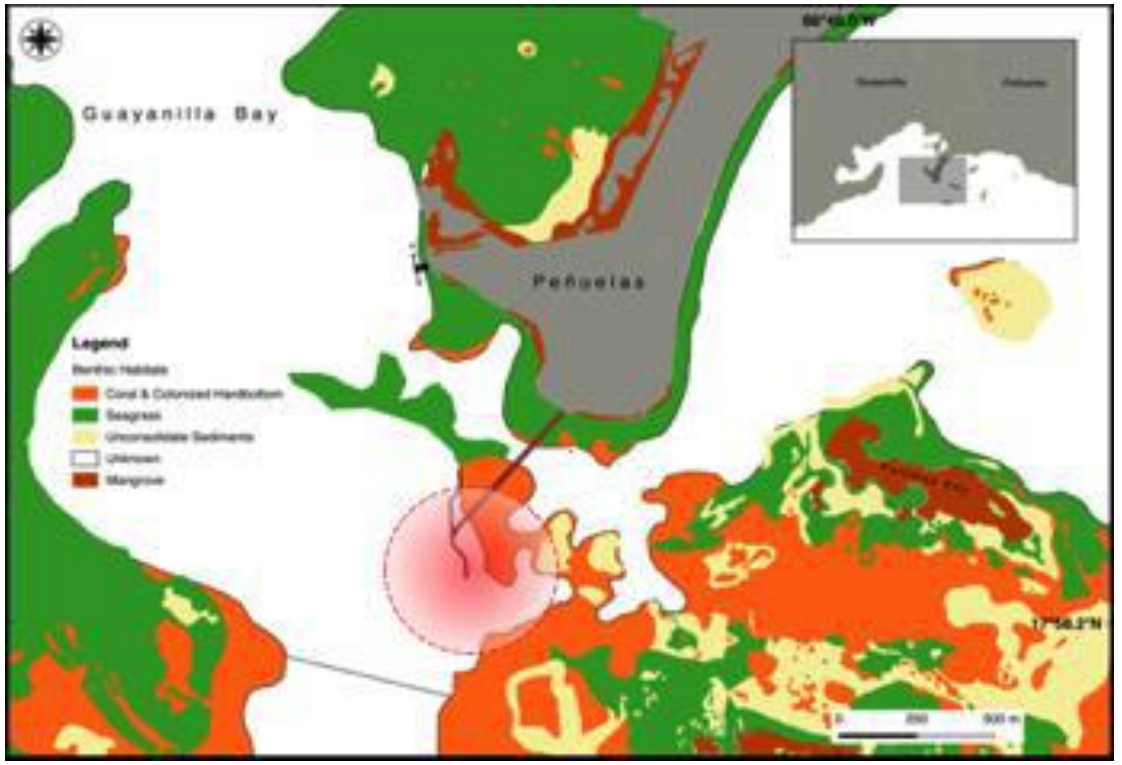
- However the short term variations (< 1 year) are unknown and have not been assessed.

FISHES

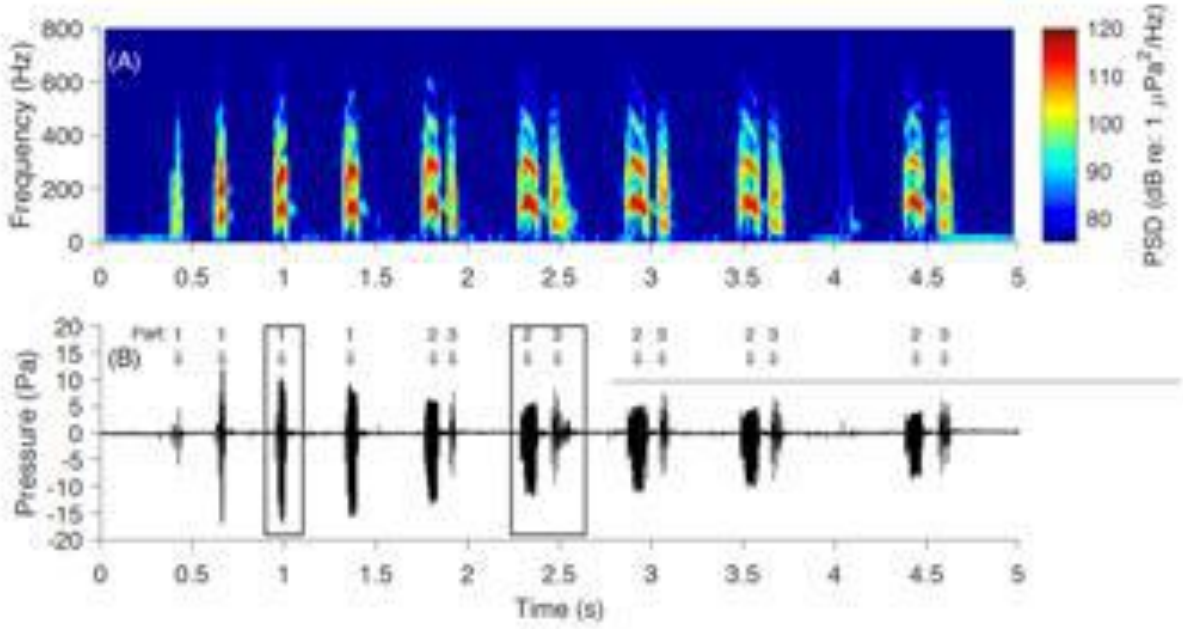
FISHES


60
50
40
30
20
10
0
Species Richness
2014
2015
2016
2017
2018
Years
Intake
Discharge

The most abundant species are small bodied or juveniles.



- Nassau grouper designated Endangered Species 2016
- Main threats are fishing and habitat degradation
- Form spawning aggregations in winter (January-April)
- During spawning aggregations they produce sounds
- Passive acoustic methods employed to determine presence
- Recorded from February 1, 2018 to April 2 , 2018 (62d)
- No evidence of Nassau grouper reproduction recorded



UPR-M OVERVIEW

- Water Quality (Continuous/Monthly)
- Outfall Plume
- Currents
- Impingement
- Entrainment
- Conservation Projects

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WATER QUALITY

Monthly and Continuous Water Quality Measurements

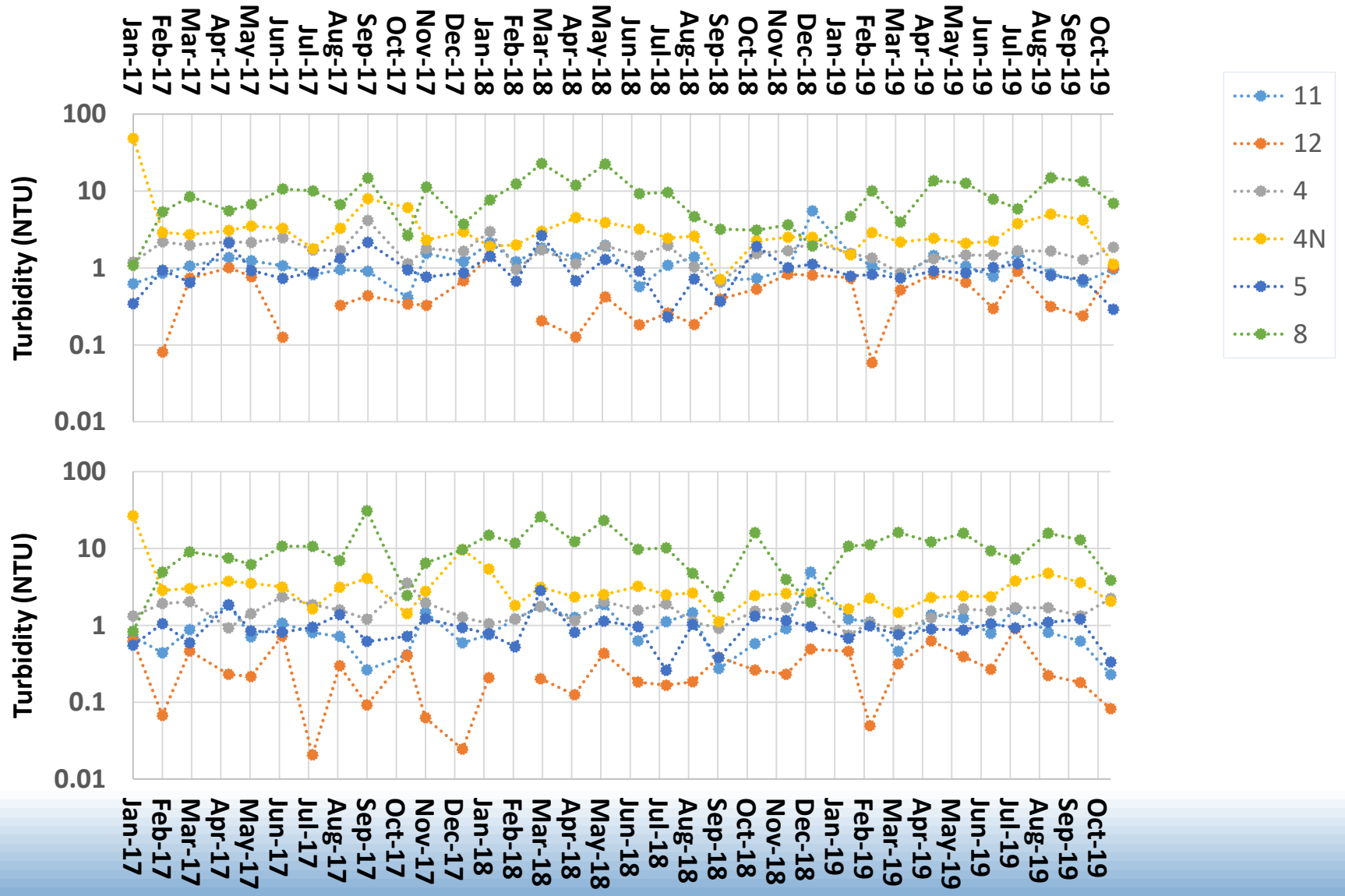
- Turbidity
- Temperature
- Chlorophyll
- Colored Dissolved Organic Matter
- Phycoerythrin

Location of monthly WQM stations.

Monthly Turbidity Records Jan 2017- Oct 2019

Near Surface

2-4 m



Monthly Turbidity Records Jan 2017- Oct 2019

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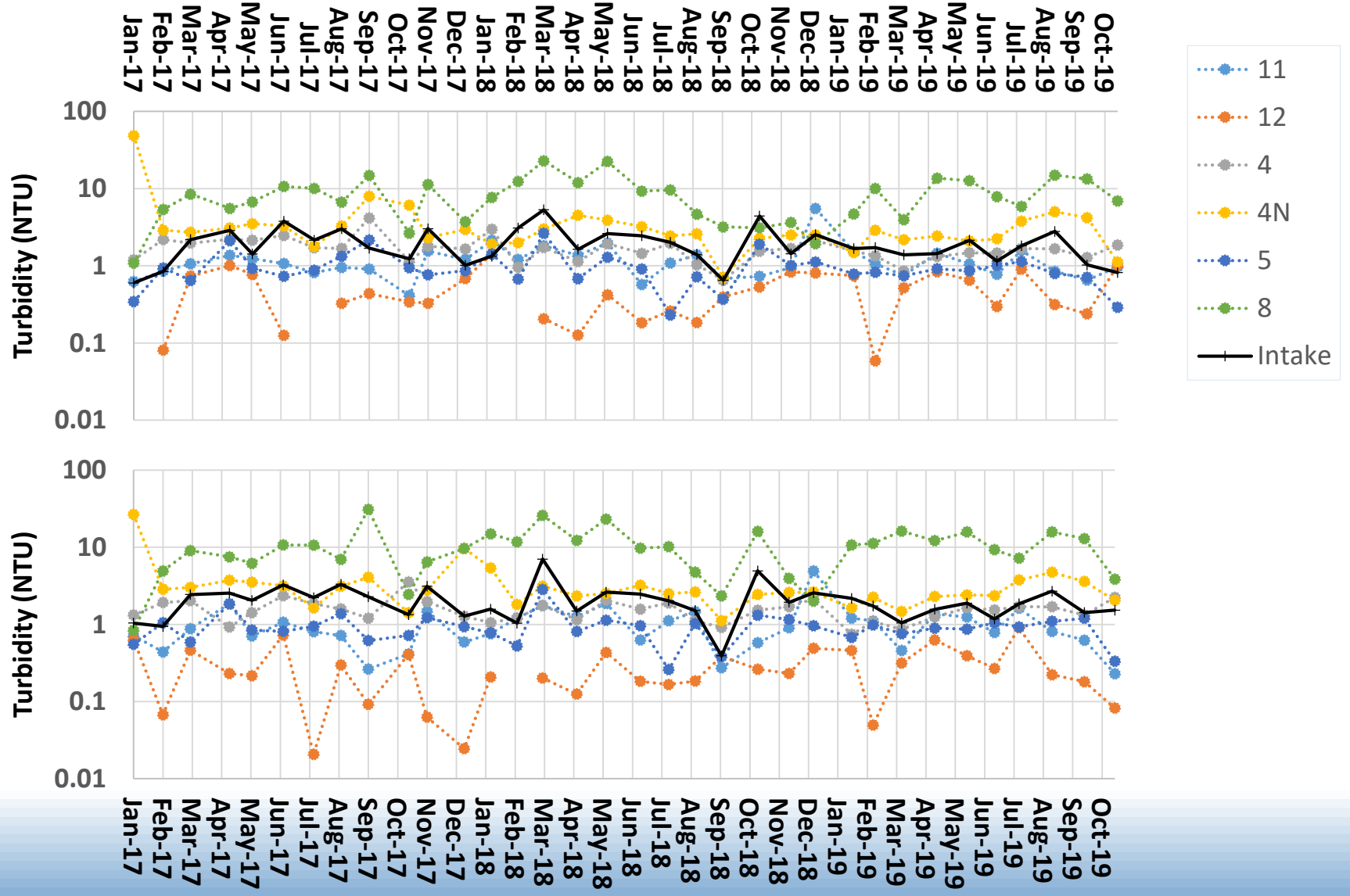

Monthly Turbidity Records Jan 2017- Oct 2019

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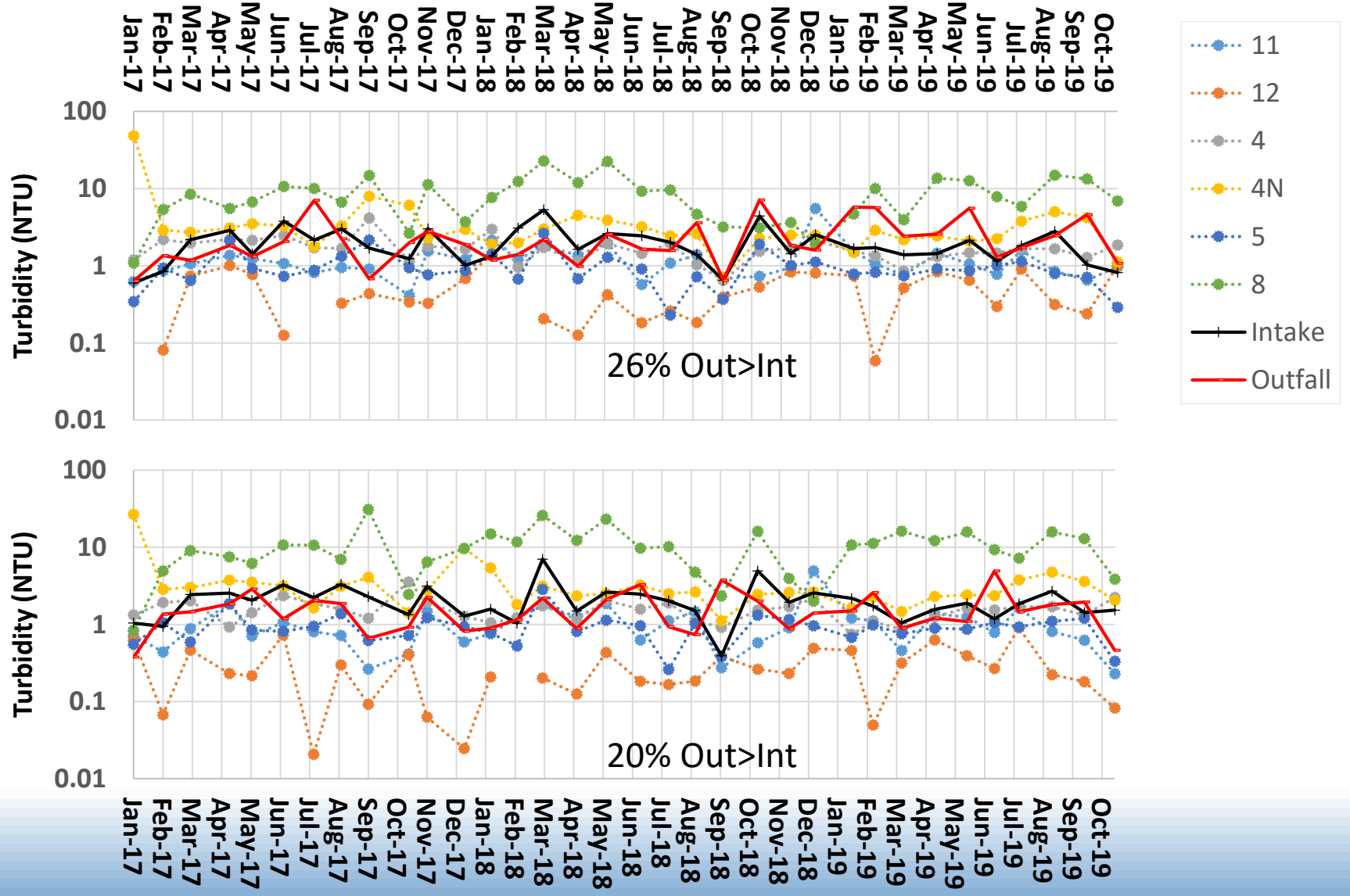
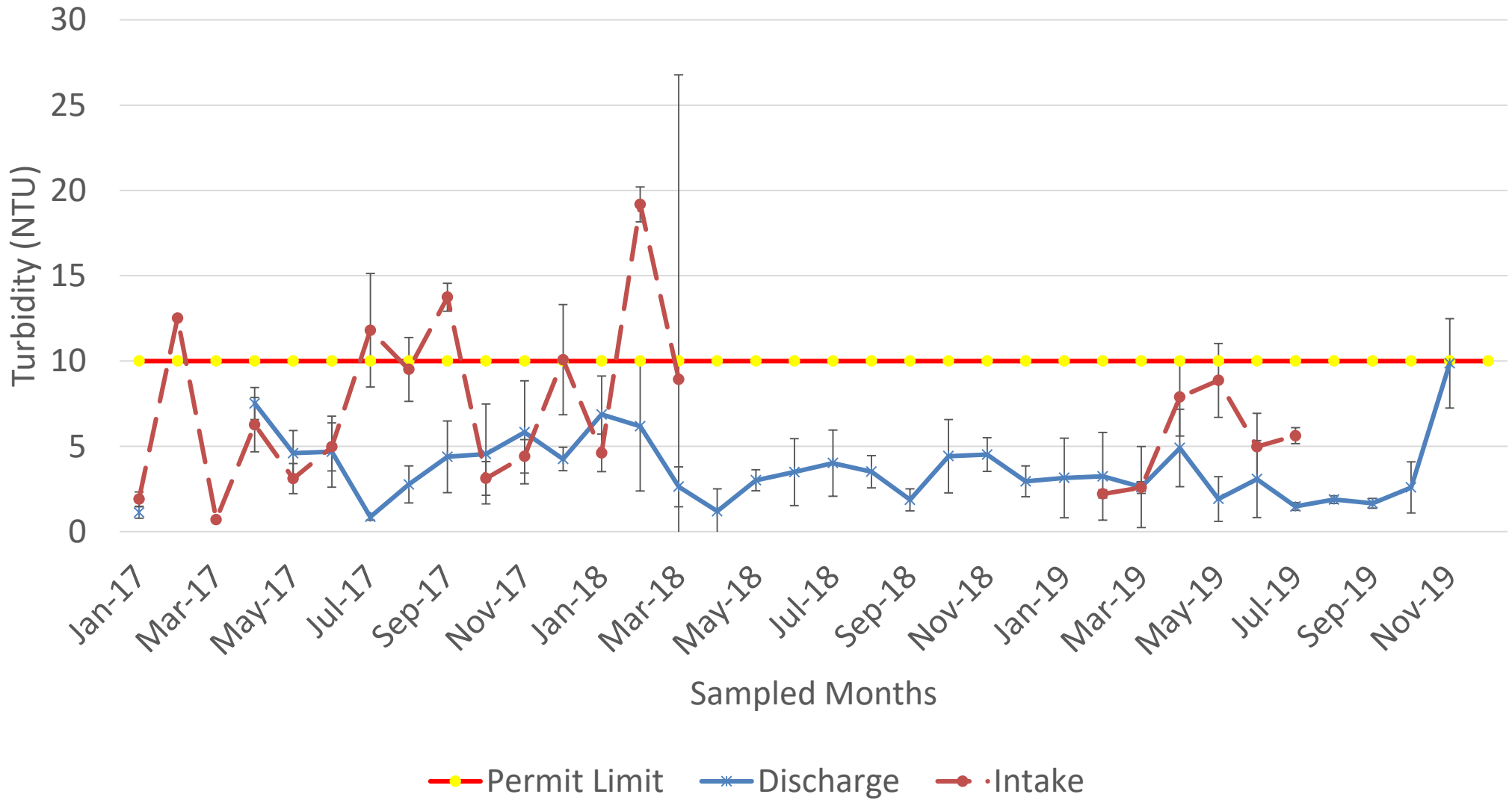
2-4 m



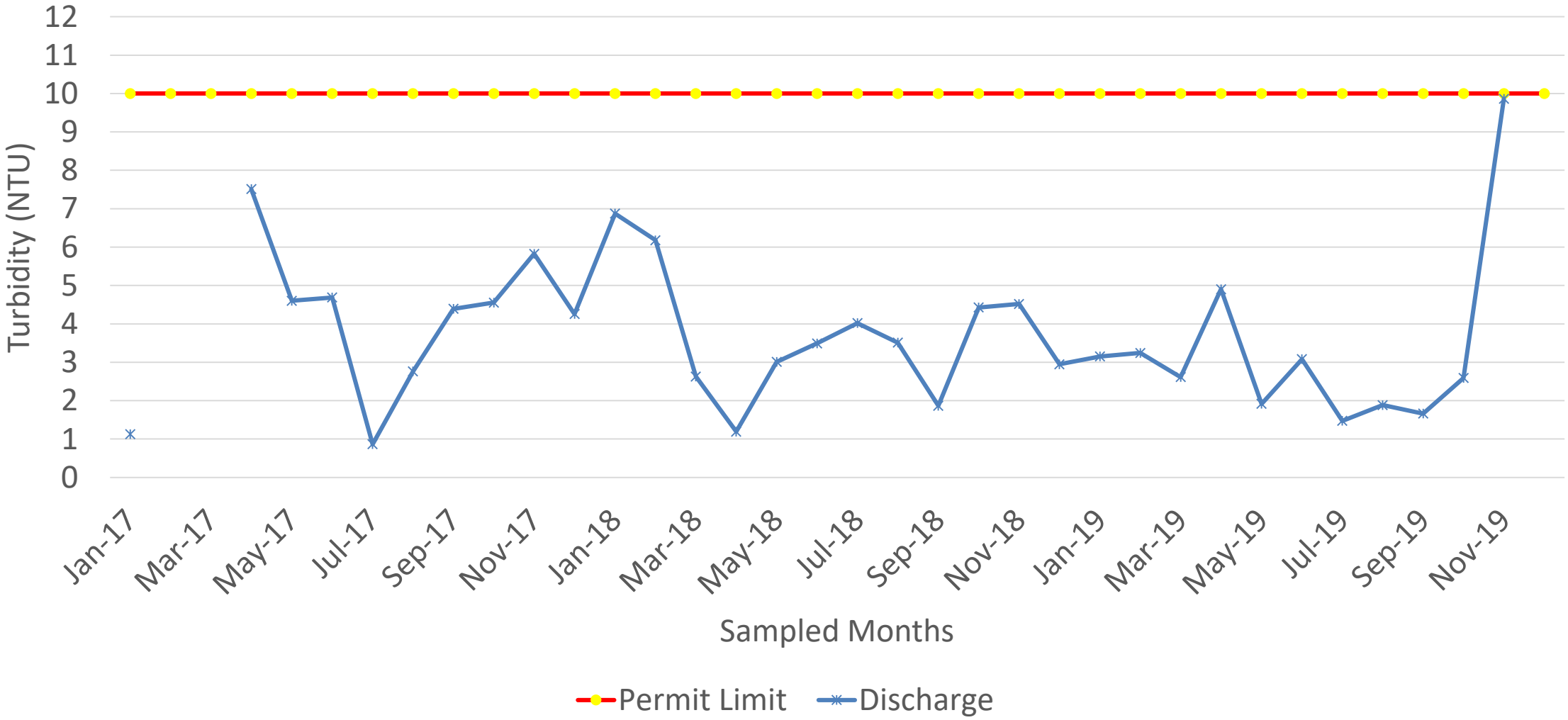
Continuous Monitoring of Turbidity at Discharge

Monthly Average; Error Bars=SE and include the effect of natural variability

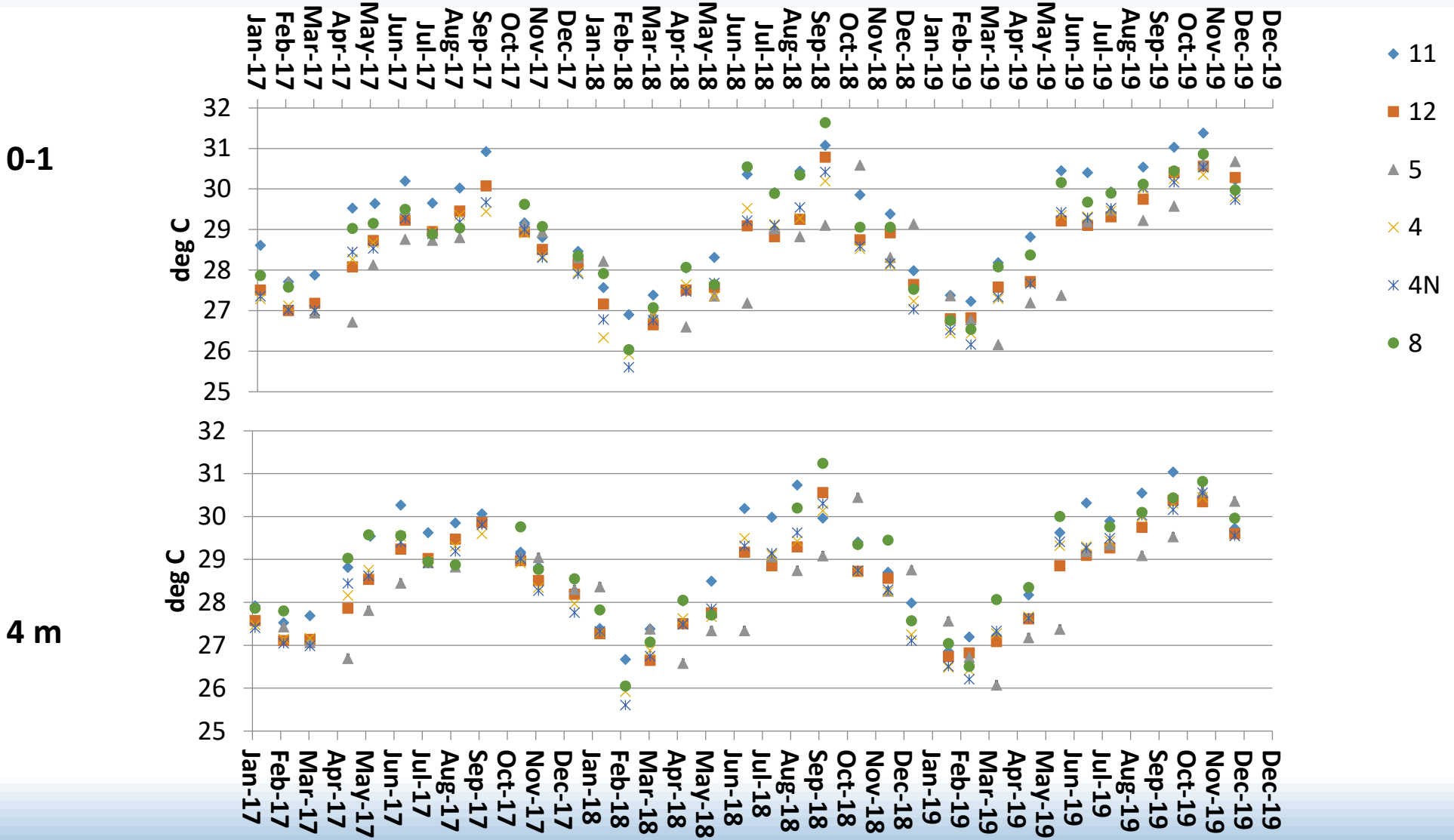


Continuous Monitoring of Turbidity at Discharge

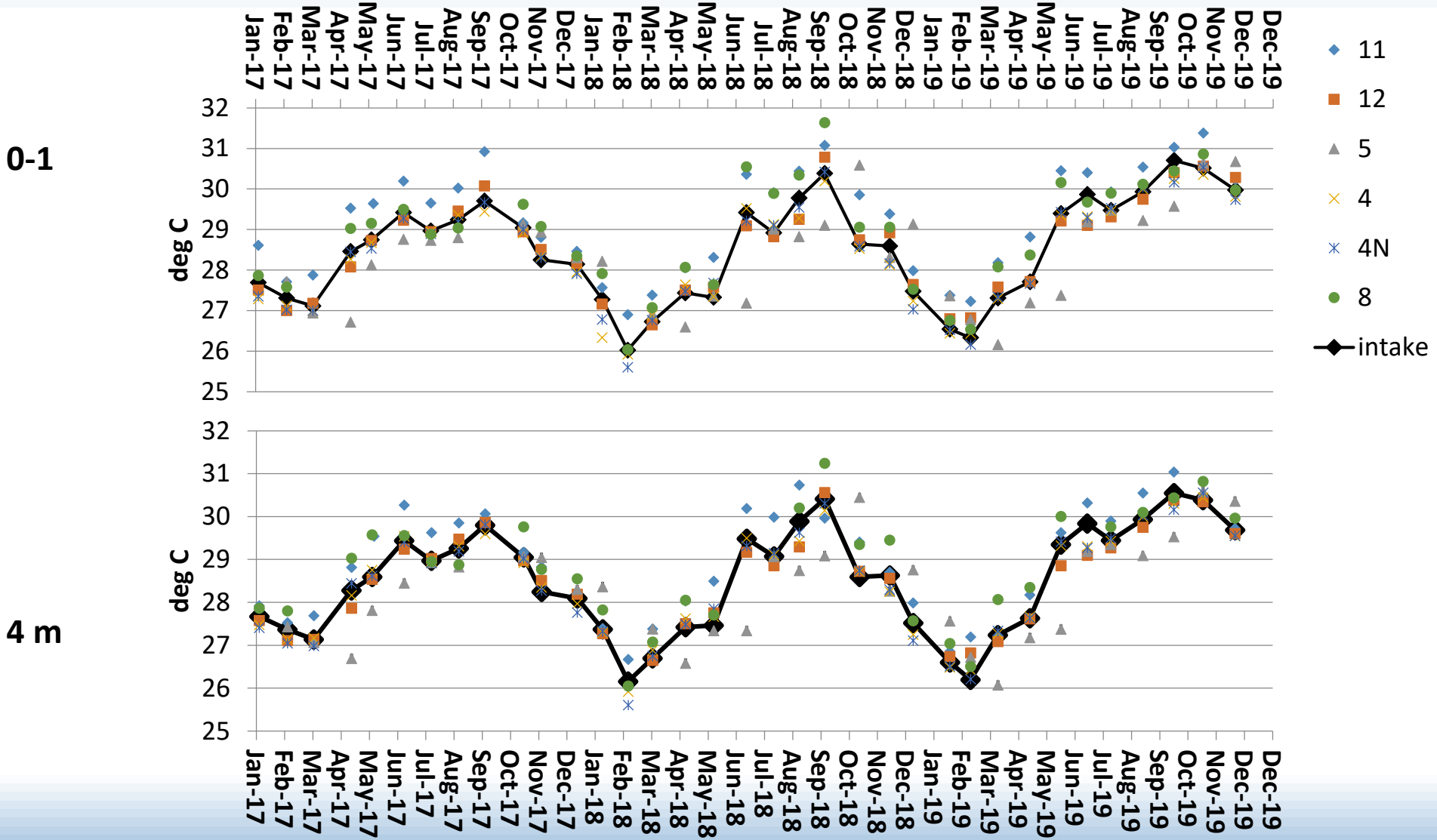
Monthly Average



Monthly Temperature Records Jan 2017- Nov 2019

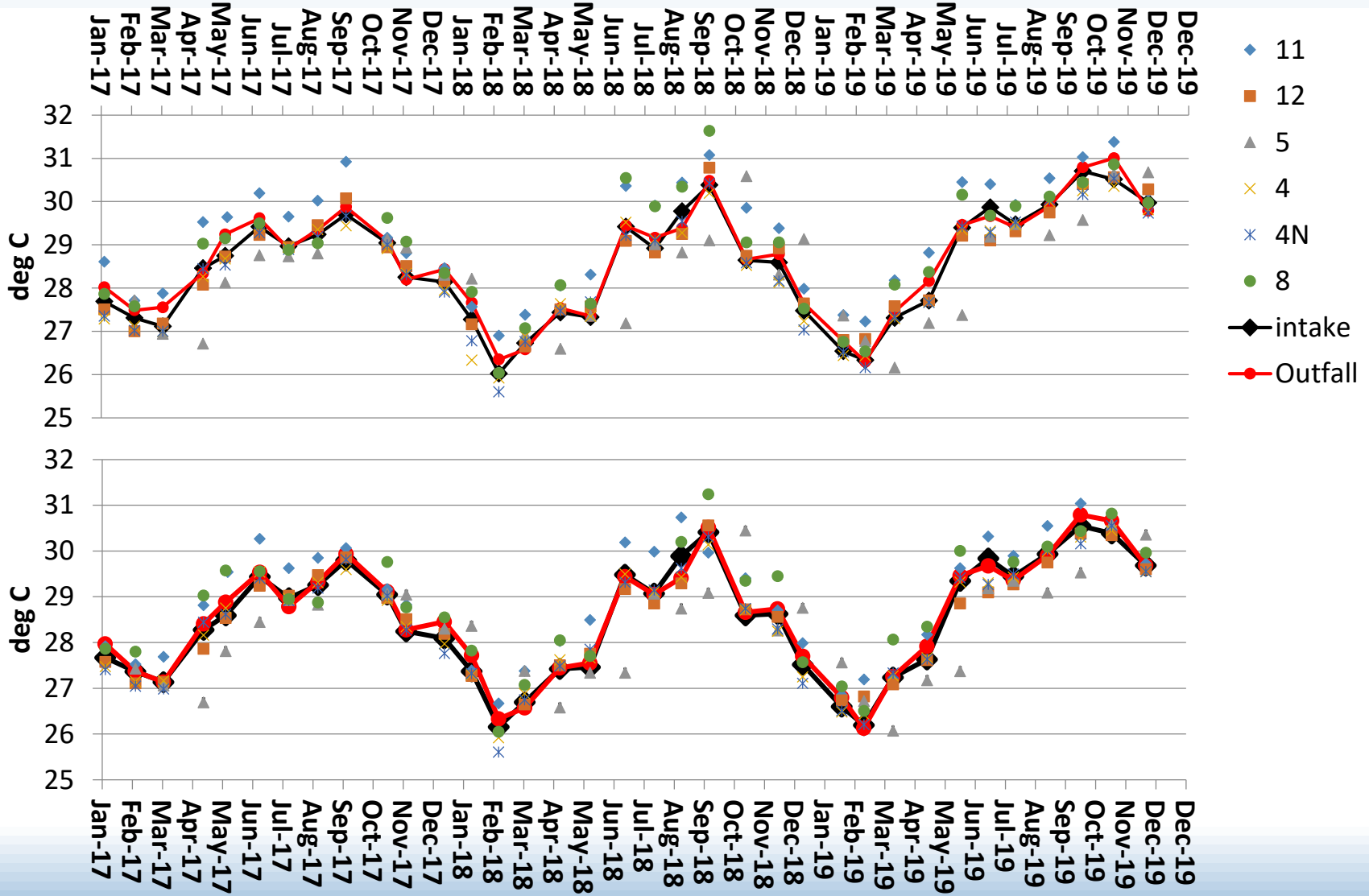


Monthly Temperature Records Jan 2017- Nov 2019



Monthly Temperature Records Jan 2017- Nov 2019

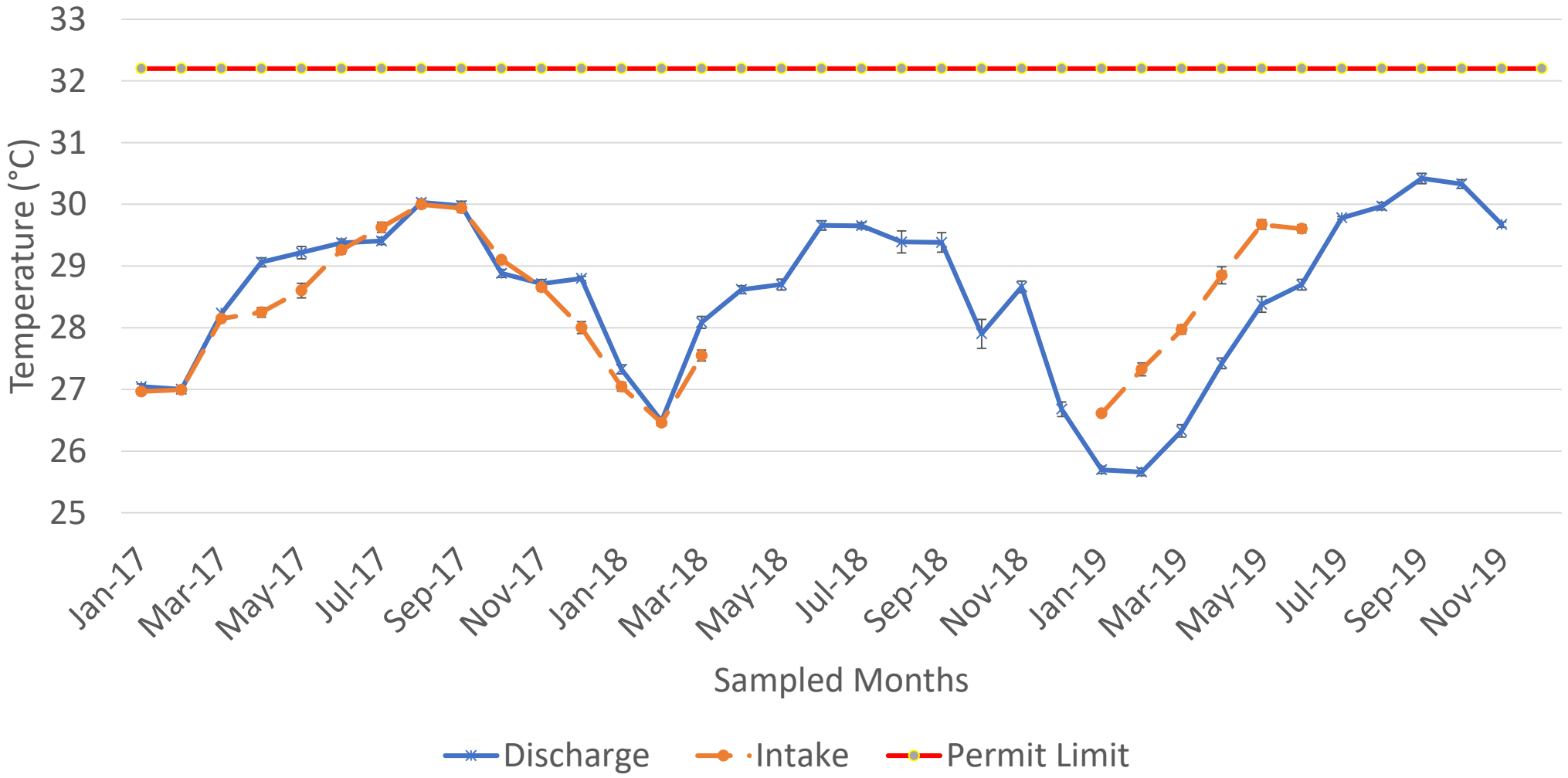
0-1



4 m

Temperature Continuous Monitoring

Monthly Average; Error Bars=SE and include the effect natural variability



DISCHARGE PLUME

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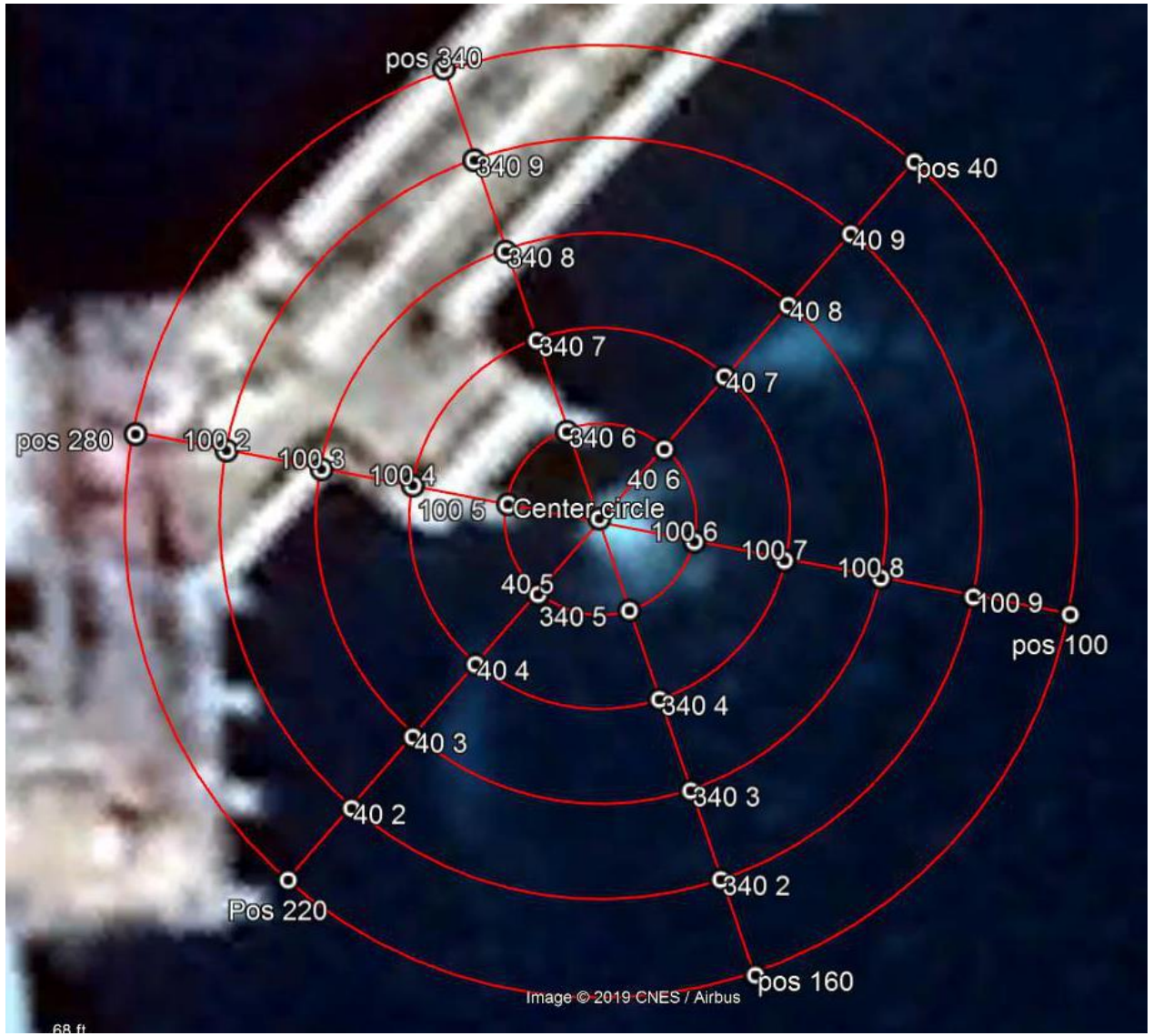
Temperature and Salinity at the Outfall Region

- Vertical measurements from 1-4 meters were collected every 5 meters along transects radiating from the center portion of the outfall.

- Divers used a MiniCTD deployed inversely towards the Surface.

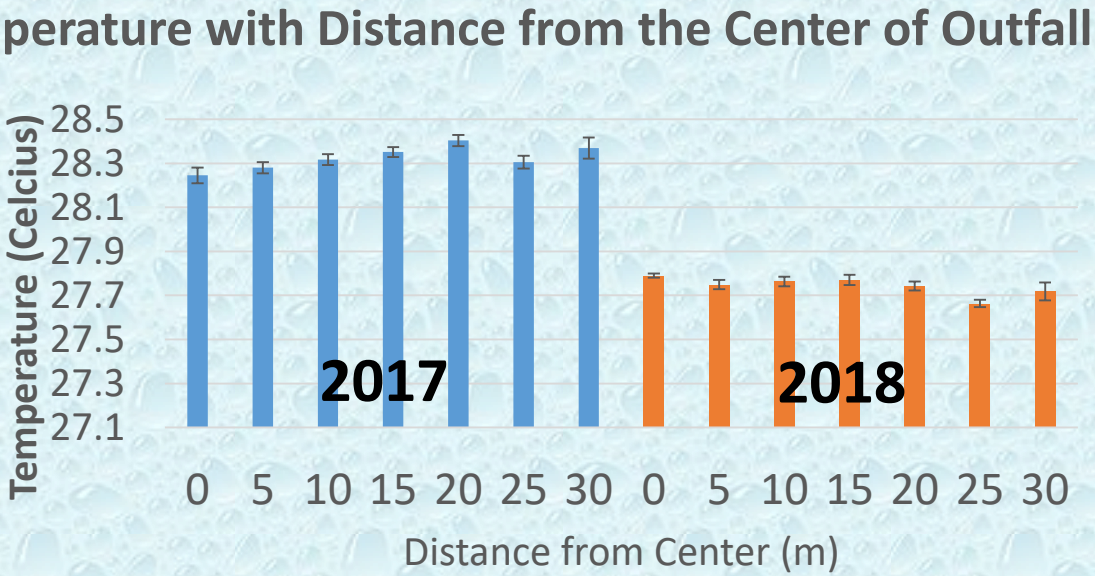


Are there Discernable pattern of temperature within the sampling area?

- Assumption: The effect of the outfall should be stronger towards the center of the diffuser. Data collected closer to the center should be discernable from that towards the outside perimeter. Higher temperatures should be clearly observed closer to the diffuser.

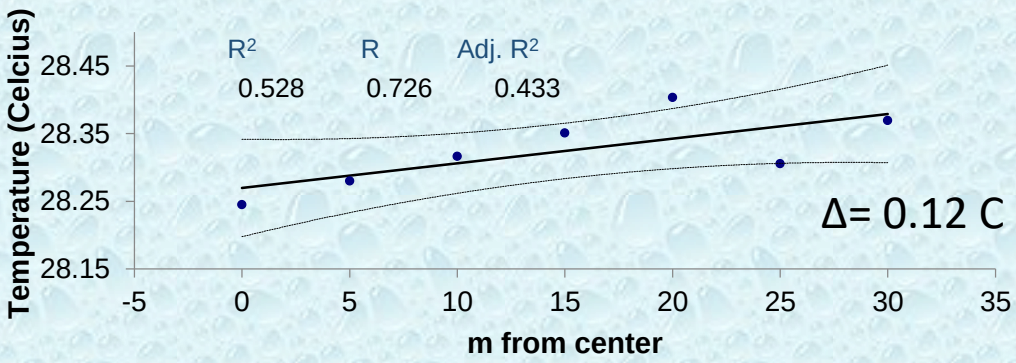
- An analysis to determine the correlation with distance from the center point using the data of the three transects at all depth was conducted.

Results



2017

(Regression Line with 95% Confidence Bands)

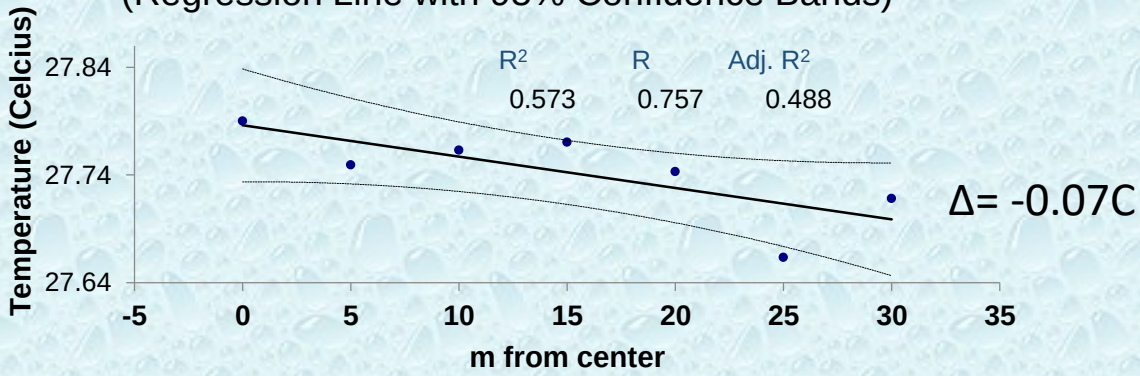


ANOVA

Source	Sum Sq.	D.F.	Mean Sq.	F	Prob.
Regression	0.009	1	0.009	5.586	0.064
Residual	0.008	5	0.002		
Total	0.018	6			

2018

(Regression Line with 95% Confidence Bands)



ANOVA

Source	Sum Sq.	D.F.	Mean Sq.	F	Prob.
Regression	0.006	1	0.006	6.714	0.049
Residual	0.004	5	0.001		
Total	0.010	6			

EcoEléctrica

"Un mejor ambiente con gas natural"

Observations

Salinity

- Vertical distribution was in general uniform during both sampling years. These can be observed fro both minimum and maximum values.
- Salinity for 2017 was approximately 0.9 PSU higher than 2018.

Temperature

- An overall well mixed vertical distribution was observed.
- 0.6°C higher during 2017.

Influence of Outfall

- Did not show a distinct signature of the water closer to the outfall relative to water farther away.

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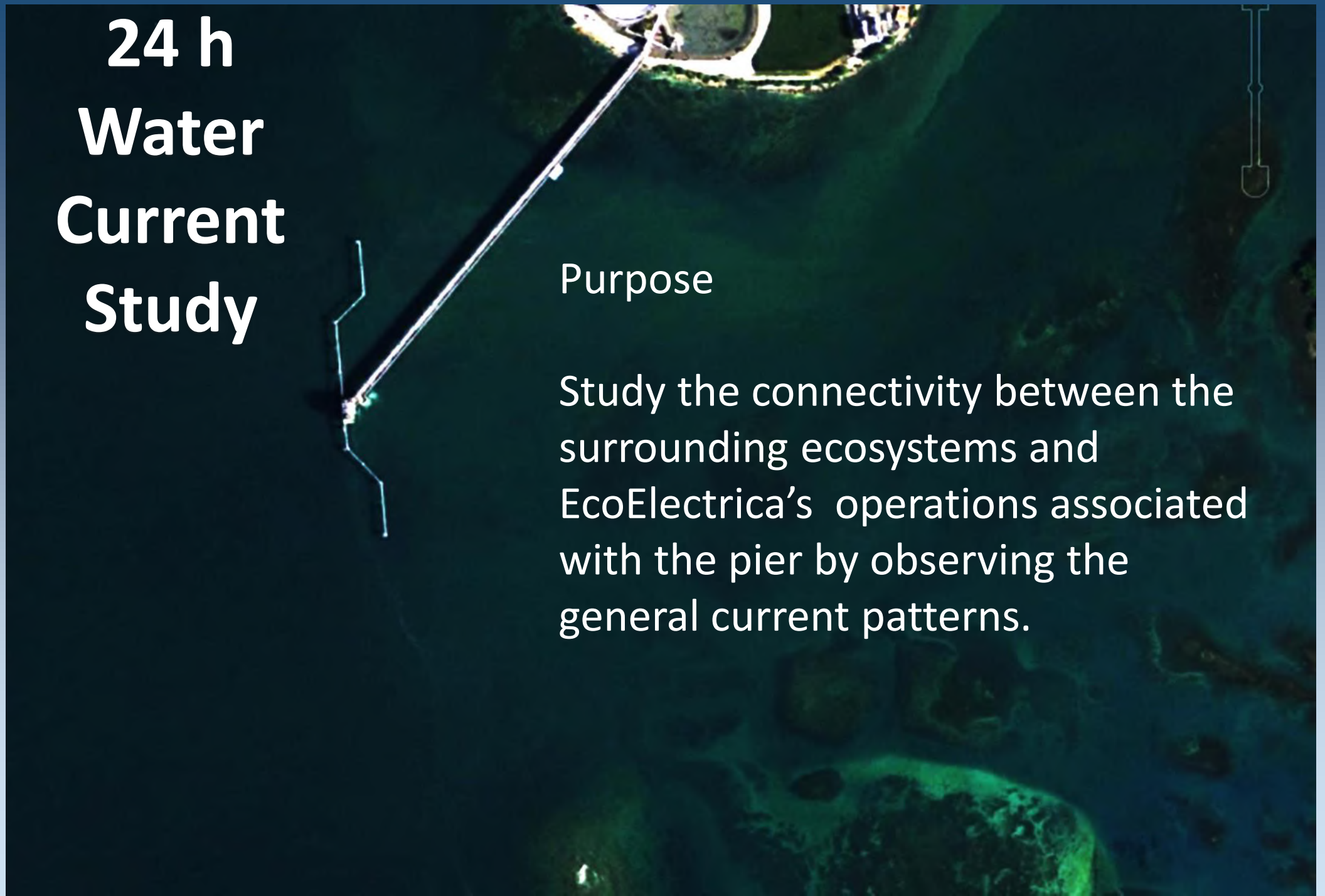
WATER CURRENTS

24 h Water Current Study



Purpose

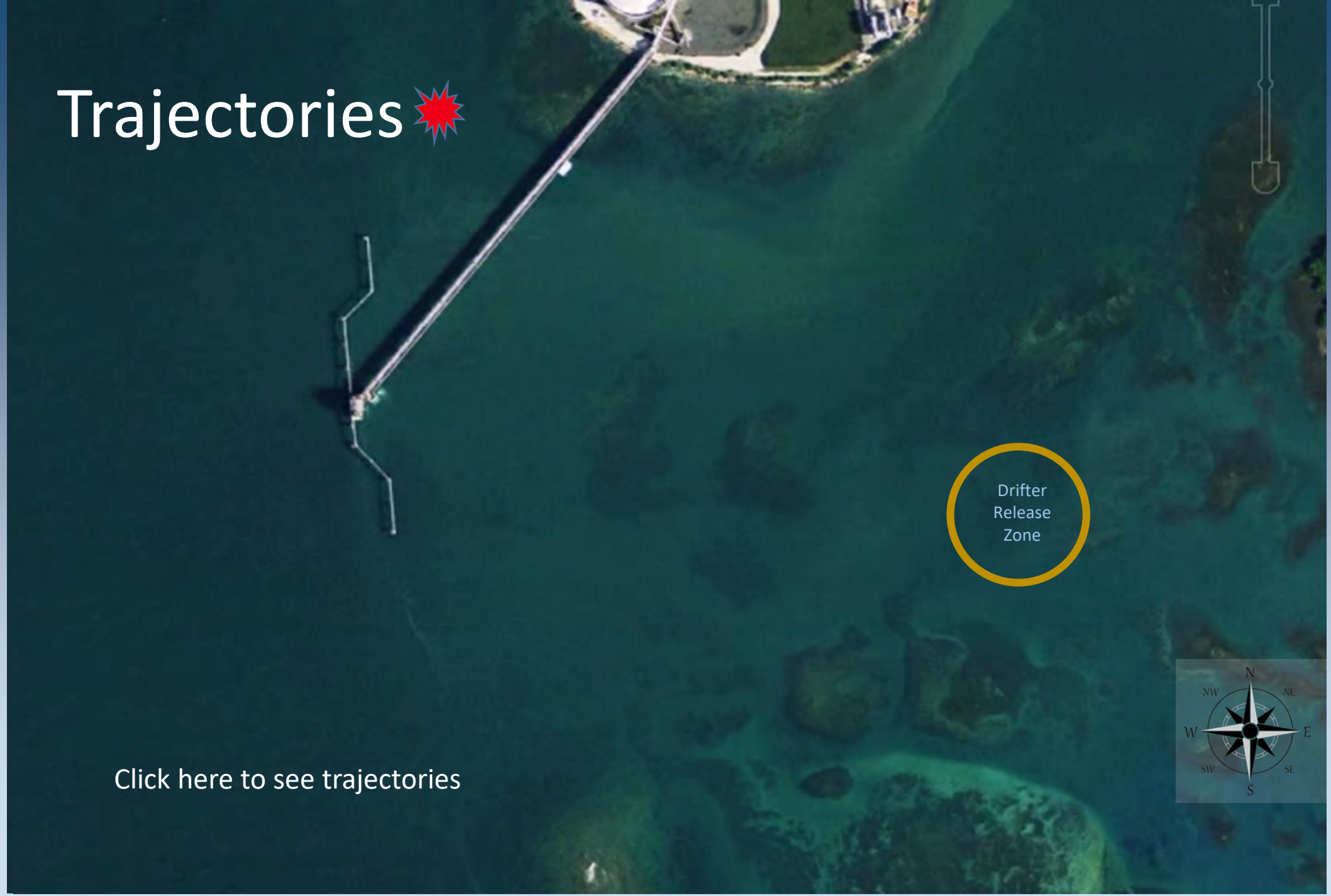
Study the connectivity between the surrounding ecosystems and EcoElectrica's operations associated with the pier by observing the general current patterns.

24 h Water Current Study

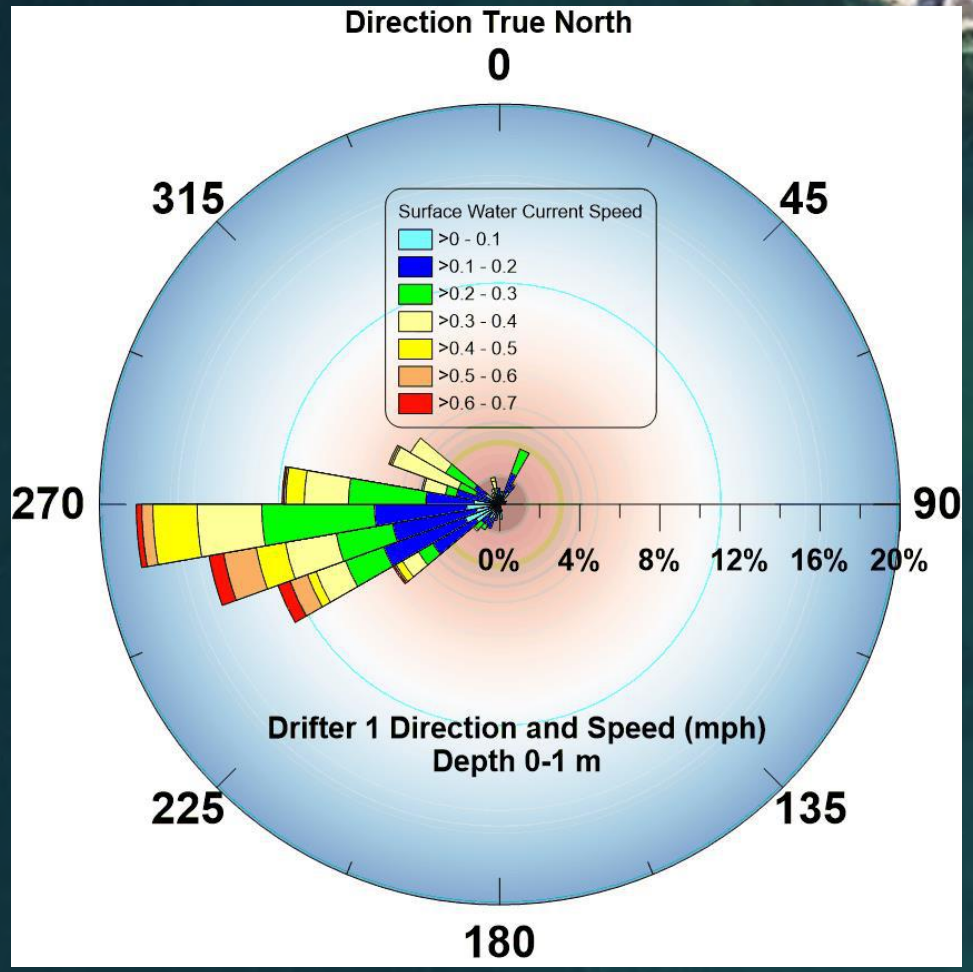
General Methods

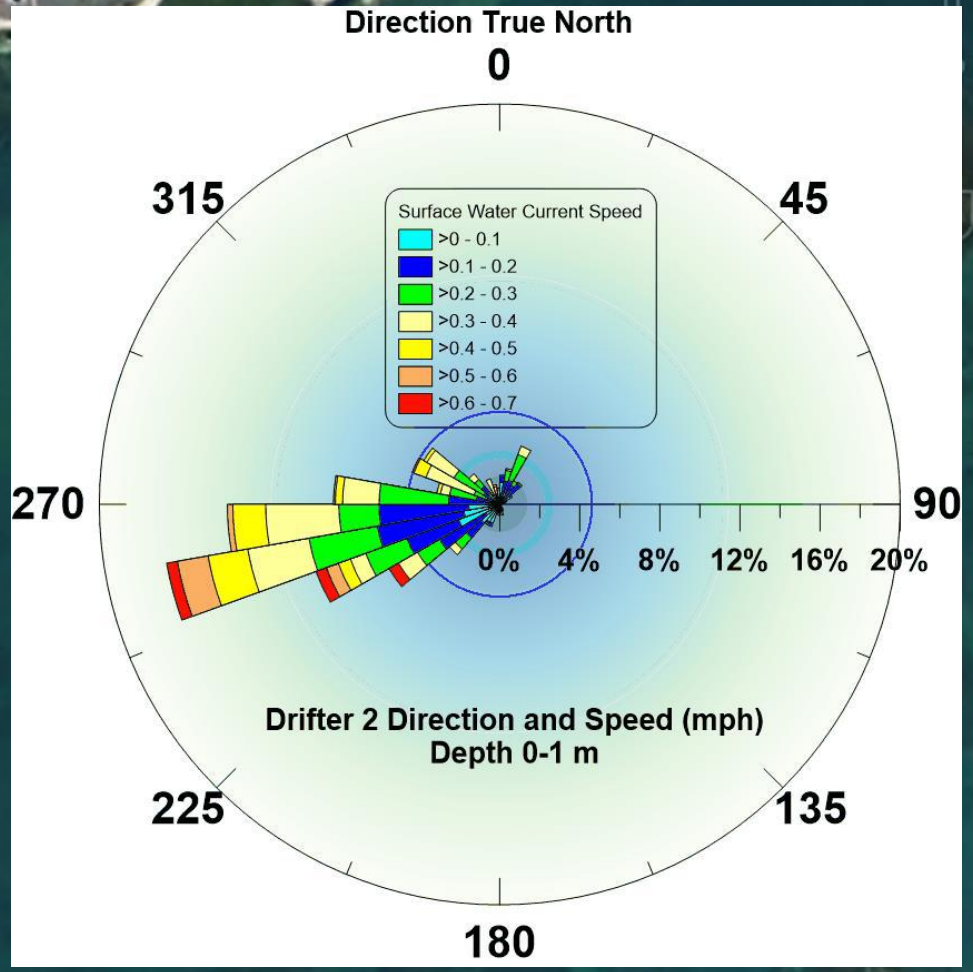
- Two GPS containing drifters were released from the area indicated.
- Drifters were recovered and released again 13-14 times over a period of 24h.
- The video shows the results of those trajectories for Drifter 1.
- Drifter 2 followed similar trajectories .

Trajectories



Click here to see trajectories





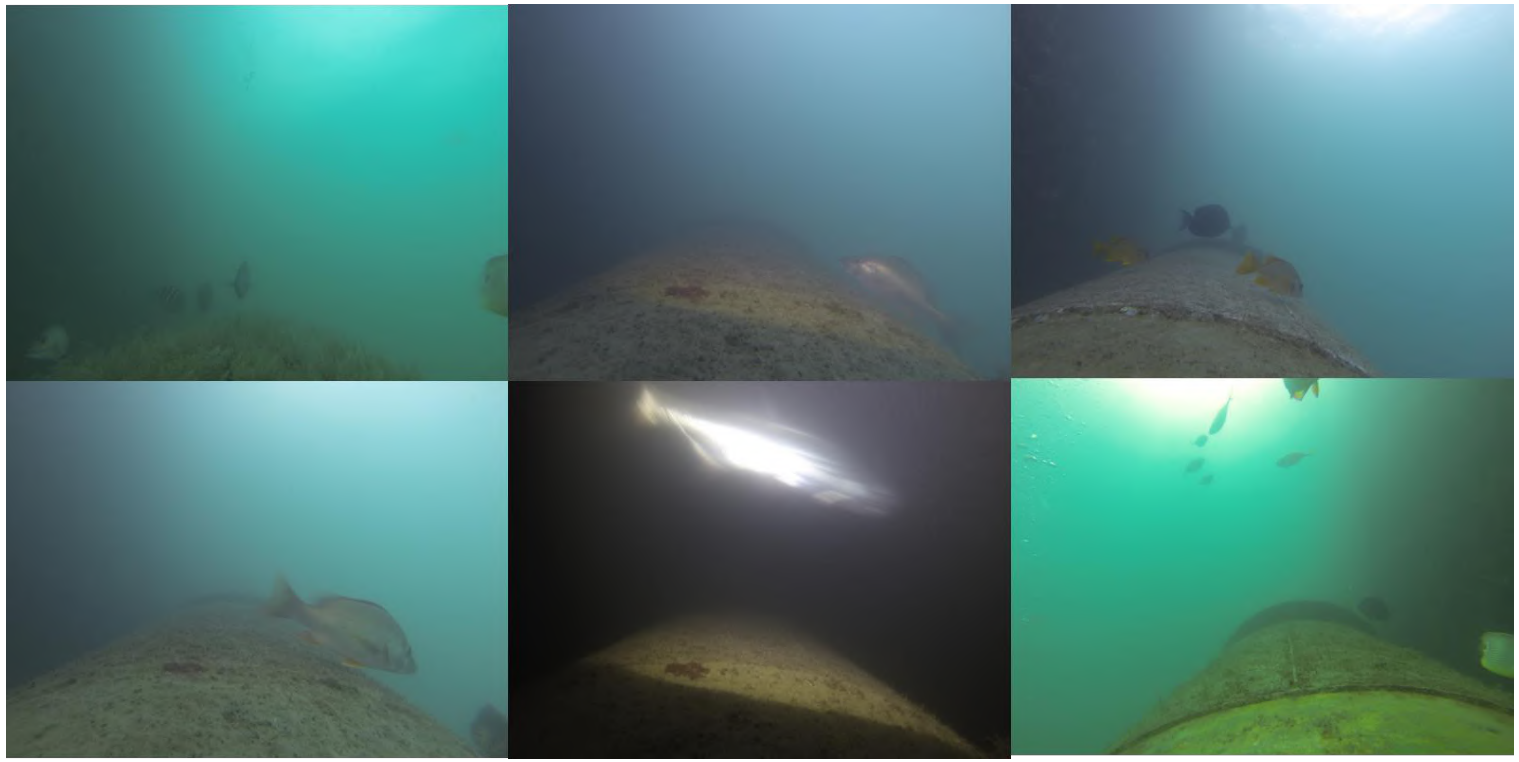
Average Trajectories Summary

Water Currents				
Bearing	NE	SE	WSW	WNW
% sampling time	10.1	2.1	57.2	30.6

IMPINGEMENT

Impingement Survey Summary

- Monthly photographic surveys were conducted since 2015 to 2017.
- 34 surveys (24-hrs) conducted:
  - 23040 photos
  - 6451 fish counts
  - 28 fish species
- No fish impingements were observed.
- 7 *Aurelia aurita* impinged.



ENTRAINMENT

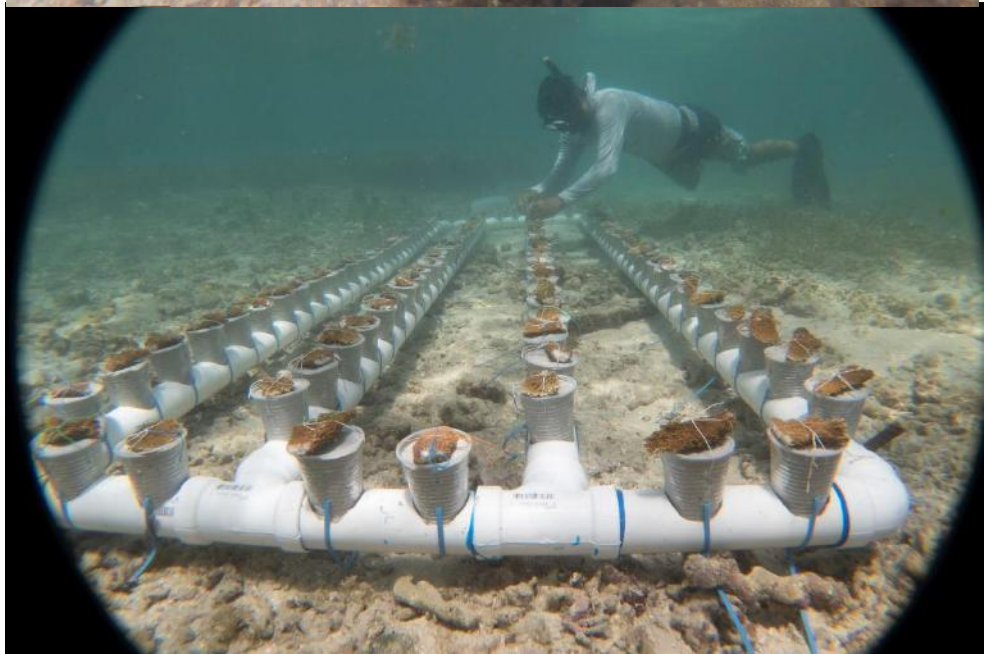
Entrainment

- Only 0.05% of ichthyoplankton was estimated to be entrained in the CWIS system.
- The proportions were even lower for planulae (0.02%) and fish eggs (0.05%).

CONSERVATION PROJECTS

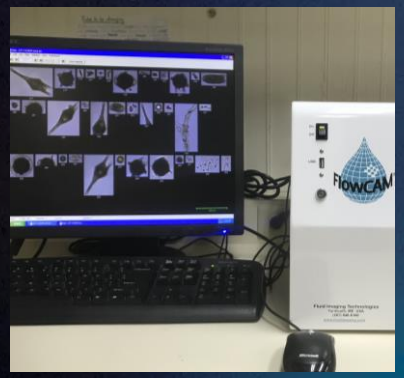
Restoration

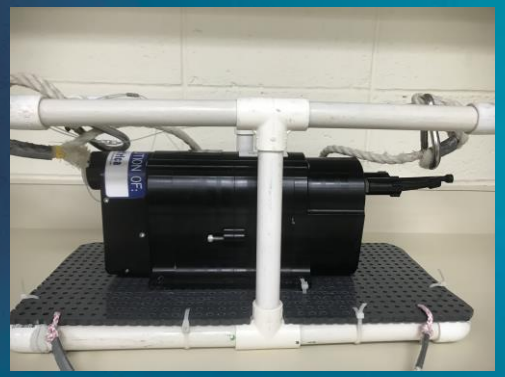
- 2016-12 colonies were outplanted from Guanica Nursery
- 91% survivorship
- 2019 – Established nursery at Maria Langa with Puerto Rico Department of Environmental and Natural Resources growing 156 colonies
- Expected to produce around 1,400 colonies in 3 years (using cuttings)

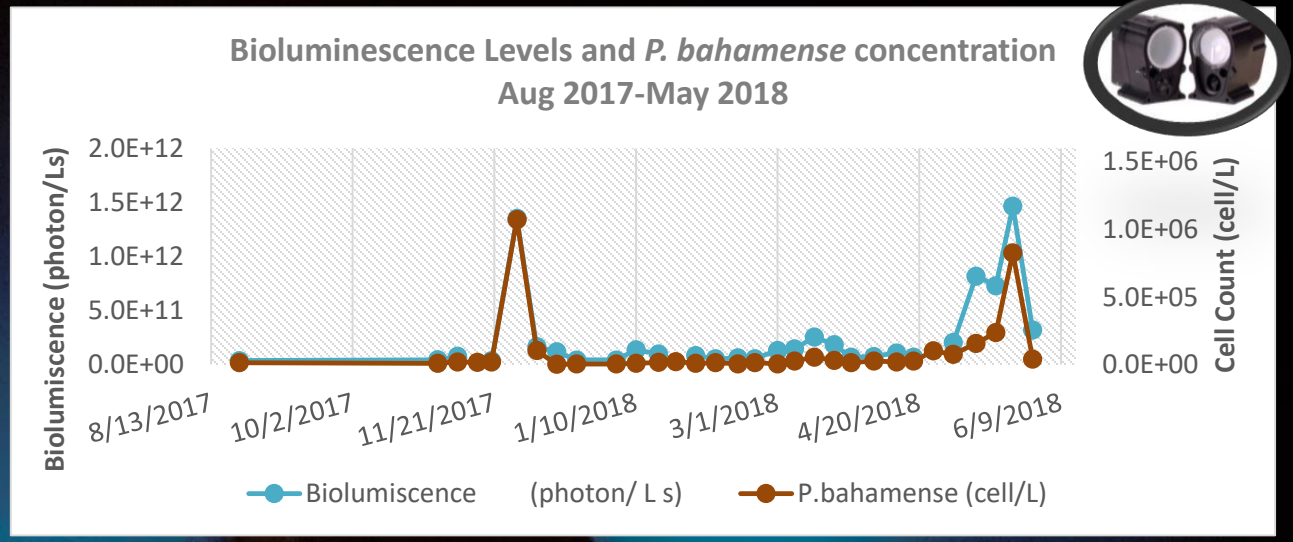


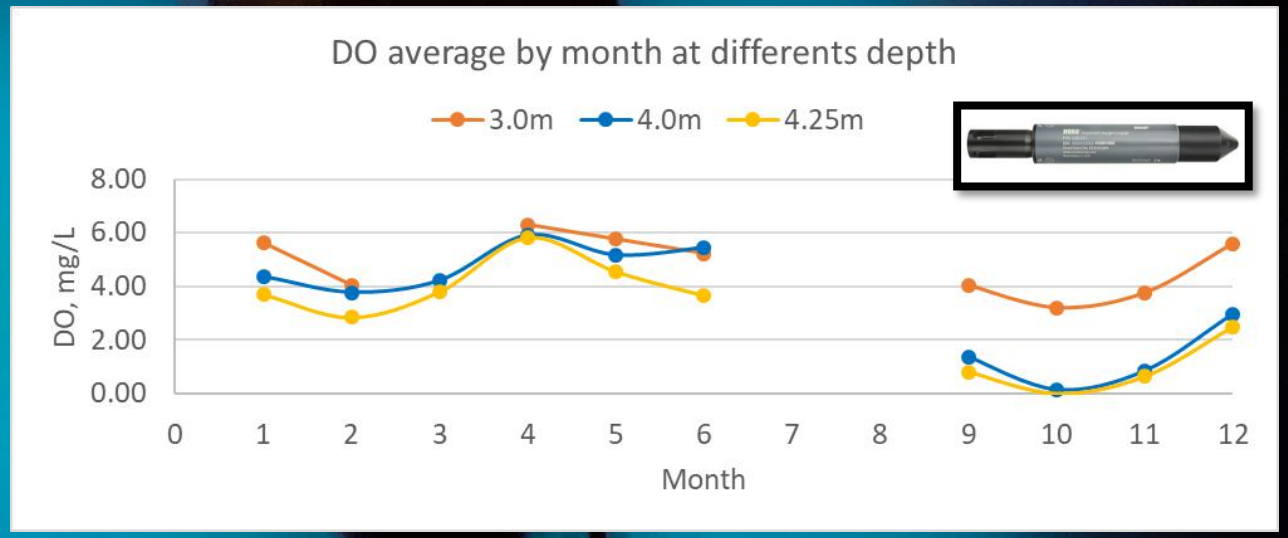
Bioluminescent Bay, La Parguera, Lajas

The aims of the projects develop at the Bioluminescent Bay are to obtain and corroborate knowledge about the bioluminescent phenomenon.





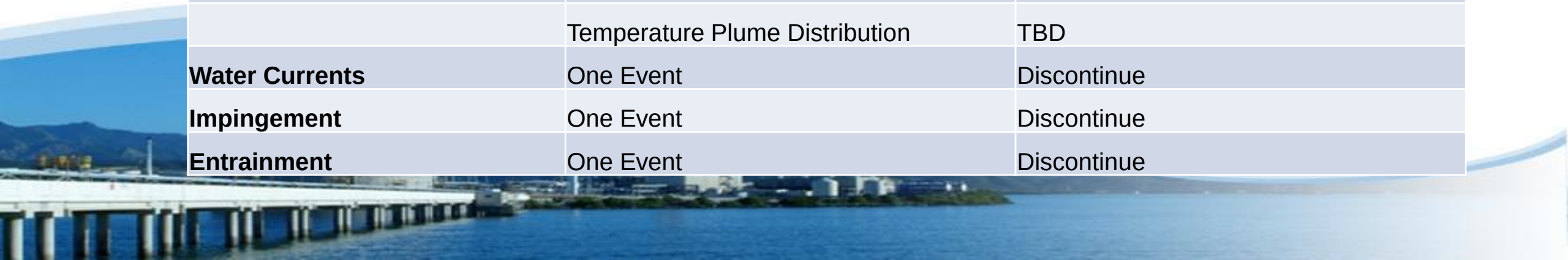




Mangrove

4 Wet Tables stablish as nursery for 3 species of mangrove

- Red Mangrove (*Rhizophora mangle*)
- Black Mangrove (*Avicennia germinans)*
- White Mangrove (*Laguncularia racemose*)

WHAT'S NEXT

Study	Details	Proposed Next Period
Coral Study	Coral large scale	Annual
	Cora small scale	Biannual
ESA and Action area	Coral ESA	Annual
	Coral ESA additional site	Annual
Seagrass large scale	Seagrass large scale	Annual
	Motile macro invertebrates	Biannual
	Seagrass Cover Mosaic	Biannual
Seagrass small scale	Seagrass productivity	Biannual
	Seagrass epiphytes	Discontinue
Fish Survey	Fish survey	Annual
	Passive acoustic	Discontinue
Water Quality Monitoring	Monthly	Monthly
	Continuous	Continuous
	Temperature Plume Distribution	TBD
Water Currents	One Event	Discontinue
Impingement	One Event	Discontinue
Entrainment	One Event	Discontinue