Pseudo-nitzschia occurrence in the central California Current

PICES Conference / MEQ Workshop (W2)

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CDPH California Department Of PublicHealth

NOAA National Oceanic and Atmospheric Administration U.S. Department of Commerce

National Marine Sanctuaries

Issue: Climate change and HABs

For the north-central California region, climate change is predicted to bring:

- Increase in coastal upwelling
- Increase in nutrients in surface waters
- Warmer, more stratified waters

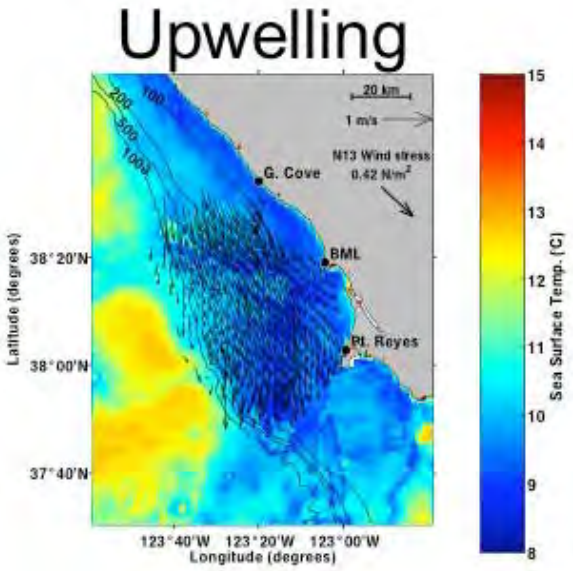

Fig. 3.9 (Largier *et al.* 2010)

(More nutrients) +
(Warm surface waters) +
(Retention from upwelling jet)
= ***Increase in phytoplankton blooms (and HABs)***

Largier *et al.* 2010. *Climate Change Impacts: Gulf of the Farallones and Cordell Bank National Marine Sanctuaries.*

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Applied California Current Ecosystem Studies

Research that supports marine wildlife conservation and healthy marine ecosystems to inform management, policy, and conservation in central CA

Founders:

Point Blue Conservation Science

National Marine Sanctuaries

National Oceanic and Atmospheric Administration · U.S. Department of Commerce · NOAA

Members:

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FMSA Farallones Marine Sanctuary Association

National Wildlife Refuge System

U.S. Fish & Wildlife Service

California Department of Fish & Wildlife

National Park Service

Bodega Marine Laboratory

Stanford

Hawai'i Pacific University

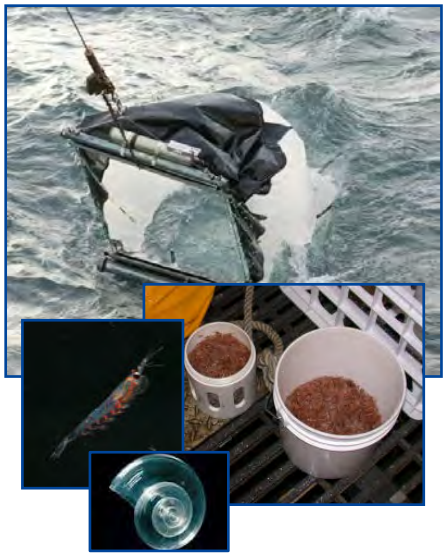
Pomona College

Sonoma State University

San José State University

Research takes ecosystem approach

- Birds/mammals (standardized strip and line transects)
- Zooplankton/fish (hydroacoustics and nets)
- Oceanography (CTD, bottles, OA, nutrients and continuous CT)



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ACCESS study area

3-4 cruises a year (spring/summer and fall)

Phytoplankton collections (2010-15):

- 8 transect lines
- Nearshore and offshore stations
  - ✓ CTD (water properties)
  - ✓ Nutrients
  - ✓ Water color & clarity
  - ✓ Zooplankton

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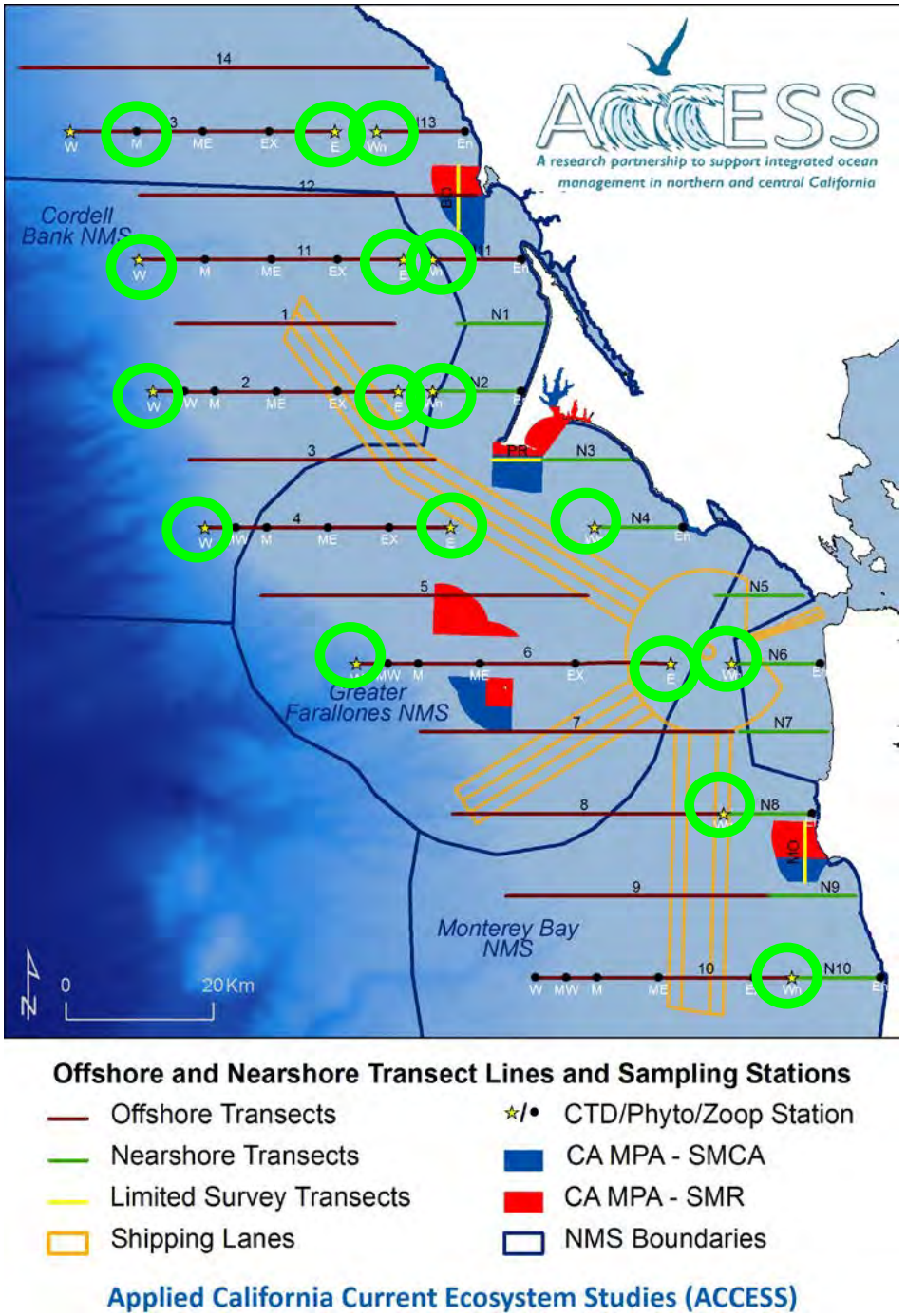

Phytoplankton data –
CDPH Biotoxin Monitoring Program

Relative Abundance Index (RAI) – qualitative measure of abundance

$$RAI = (a*b)/c$$

a = estimate of cell mass as determined by settled cell volume

b = percent composition of species

c = sampling effort as determined by the total tow length

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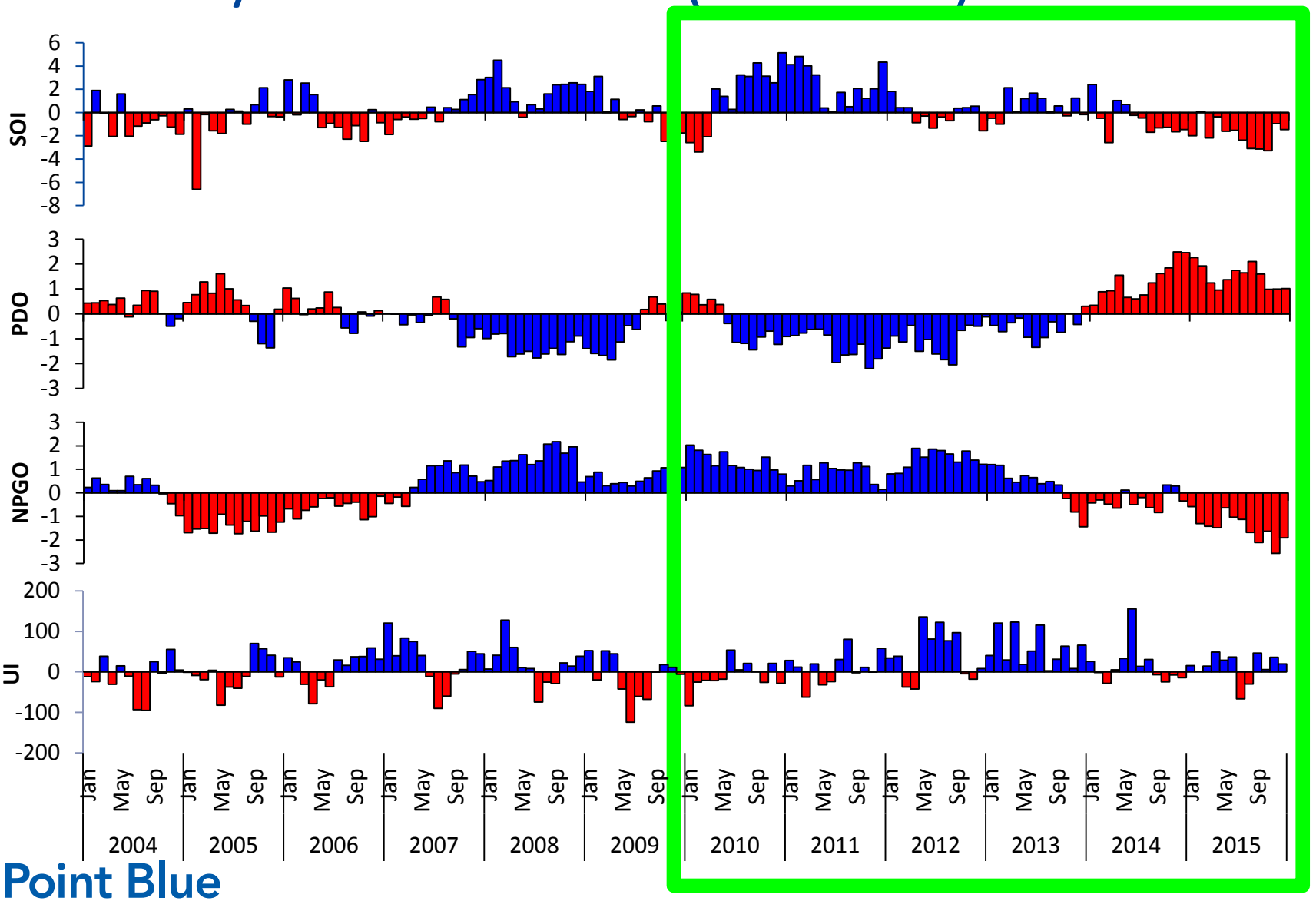
Climate/ocean indices (2004-15)



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Results - **Frequency of occurrence**

		# samples	% frequency of occurrence			
			***Pn* (all spp)**	***Pn delicatissima***	***Pn seriata***	***Pn* spp**
2010	May	12	100.0	50.0	91.7	0.0
	Jul	14	85.7	50.0	78.6	0.0
	Sep	16	81.3	0.0	81.3	0.0
	2010 total	42	88.1	31.0	83.3	0.0
2011	May	2	100.0	50.0	100.0	0.0
	Jul	8	100.0	25.0	100.0	0.0
	Sep	5	80.0	0.0	80.0	0.0
	2011 total	15	93.3	20.0	93.3	0.0
2012	Jun	10	0.0	0.0	0.0	0.0
	Jul	10	0.0	0.0	0.0	0.0
	Sep	10	0.0	0.0	0.0	0.0
	2012 total	30	0.0	0.0	0.0	0.0
2013	May	10	70.0	0.0	50.0	0.0
	Sep	9	100.0	0.0	100.0	0.0
	2013 total	19	84.2	0.0	73.7	0.0
2014	Jun	4	75.0	0.0	25.0	50.0
	Jul	6	66.7	33.3	50.0	0.0
	Sep	15	93.3	0.0	73.3	13.3
	2014 total	25	84.0	8.0	60.0	16.0
2015	Jun	3	100.0	0.0	100.0	0.0
	Jul	11	63.6	0.0	45.5	0.0
	Sep	9	100.0	33.3	100.0	0.0
	2015 total	23	82.6	13.0	73.9	0.0
Total (2010-15)		**154**	**69.5**	**13.6**	**61.7**	**2.6**

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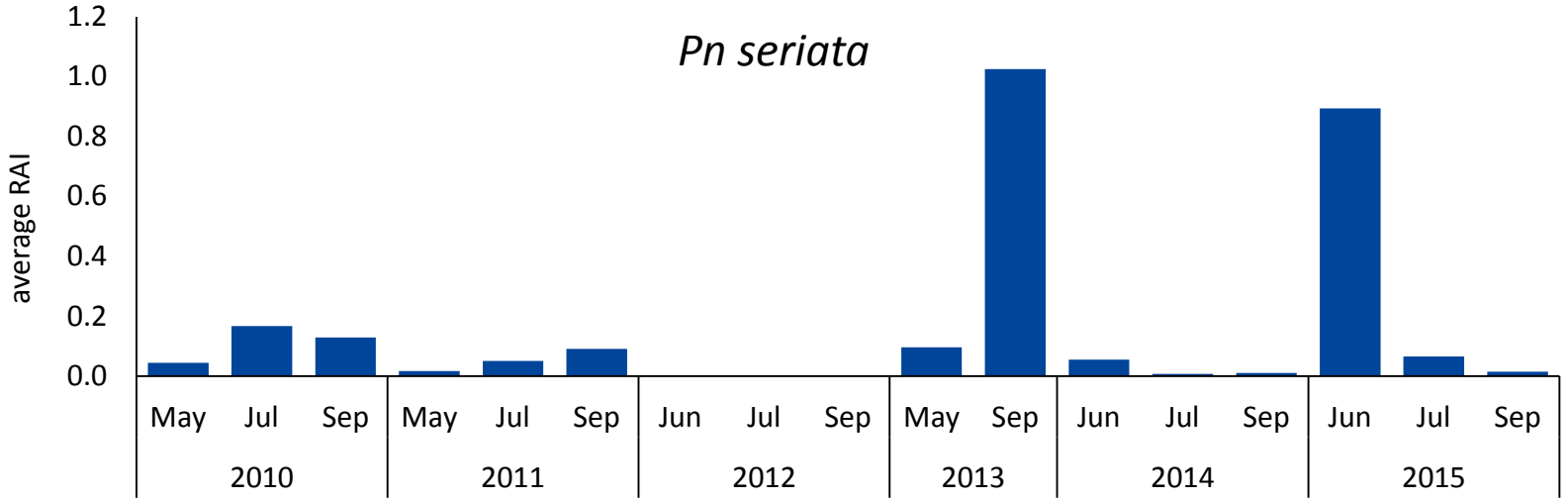
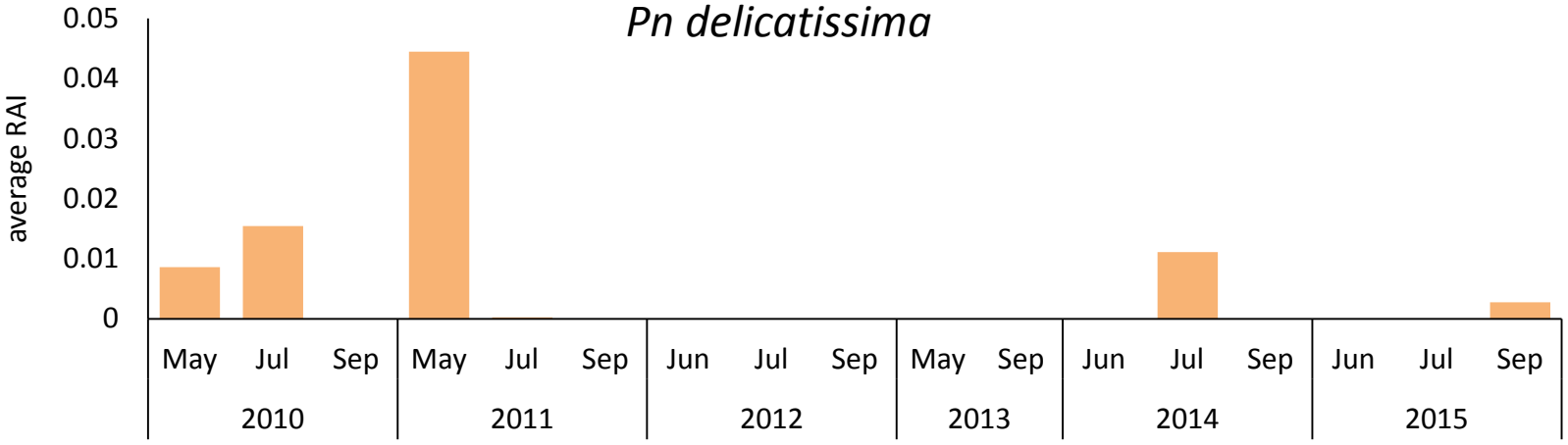
Results – **Temporal trends**





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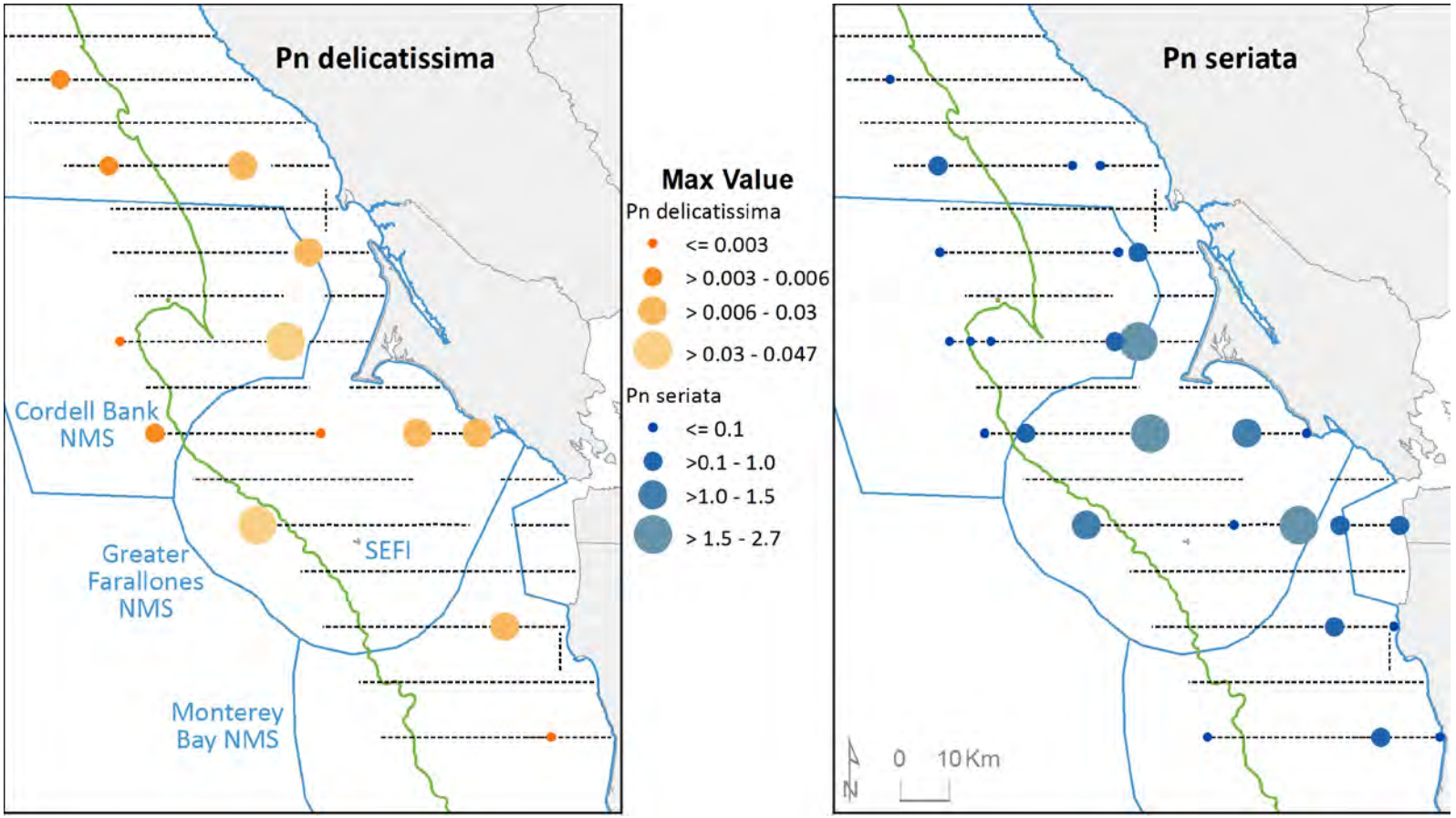
Results – **Spatial distribution**



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Results – **Stepwise regression (*Pn seriata*)**

Pn seriata

- Temperature
- Salinity
- NO_3+NO_2
- PO_4
- Si
- SOI
- PDO
- NPGO
- UI

Pn seriata – **significant results**

- **Temperature (-)**
- **NO_3+NO_2 (-)**

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Results – **Stepwise regression with lags (*Pn seriata*)**

Pn seriata

- Temperature
- Salinity
- NO_3+NO_2
- PO_4
- Si
- SOI (current, -1 & -2 months)
- PDO (current, -1 & -2 months)
- NPGO (current, -1 & -2 months)
- UI (current, -1 & -2 months)

Pn seriata – **significant results**

- **Temperature (-)**
- **NO_3+NO_2 (-)**
- **SOI (current) (-)**
- **SOI (-2 months) (+)**
- **PDO (current) (+)**
- **NPGO (current) (-)**
- **NPGO (-1 month) (+)**
- **UI (current) (-)**

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Summary

Pn seriata and *Pn delicatissima* (2010-15)

Pn seriata	***Pn delicatissima***
Absent in 2012	Absent in 2012
Increased in warmer years	Declined through time
Nearshore & southern stations, more widely distributed	Along upwelling jet
Low temperature & low nitrates/nitrites	
Importance of cold, productive conditions prior to warm, low-productivity conditions	

Pn seriata may become more frequent in the future?

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Thank you!

Joe Christen (CDPH)

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Boring Family Foundation

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California Dept. of Fish and Wildlife

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Cordell Bank NMS (NOAA)

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