California Collaborative Fisheries Research Program 2021 Update

CAL POLY
Center for Coastal Marine Sciences

Thank you to all of our CCFRP Anglers, we could not keep this project going without you!

And a special thank you to our 2020 CCFRP Anglers:

Jim W.
Roger Y.
Ralph B.
John (Jay) C.
Zach K.
David K.
Eddie G.
Tim D.
Ray L.
Bill M.
Duane G.
Phil E.
Marcy D.
Paul H.
Jeff B.
Kelley M.
Lyndon M.
Mike B.
Don M.

We also want to give a special warm welcome to our 2020 first time CCFRP anglers

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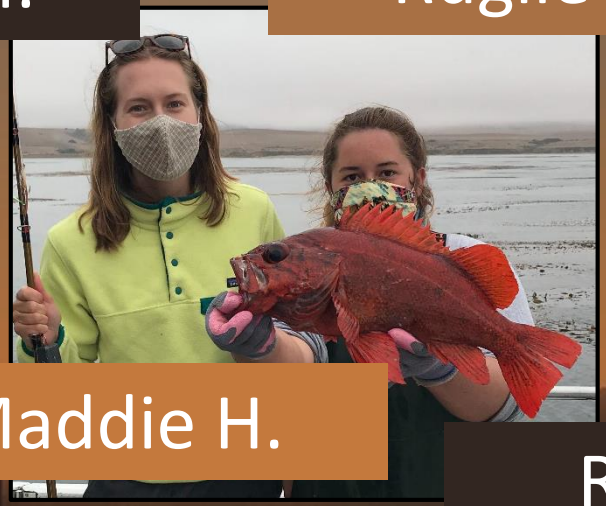
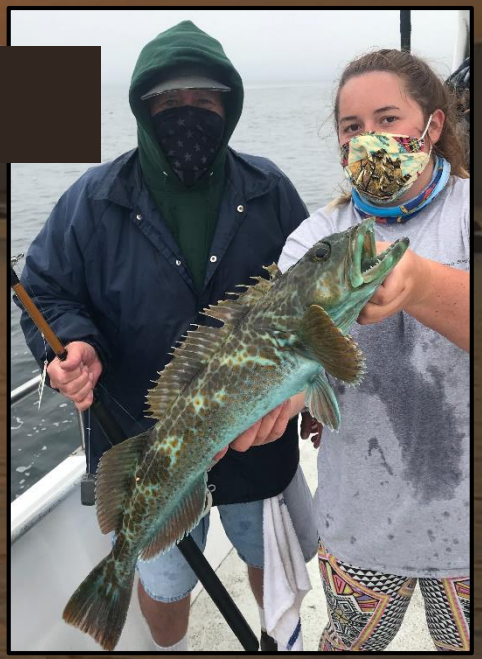
Ellie M.

Rugile P.

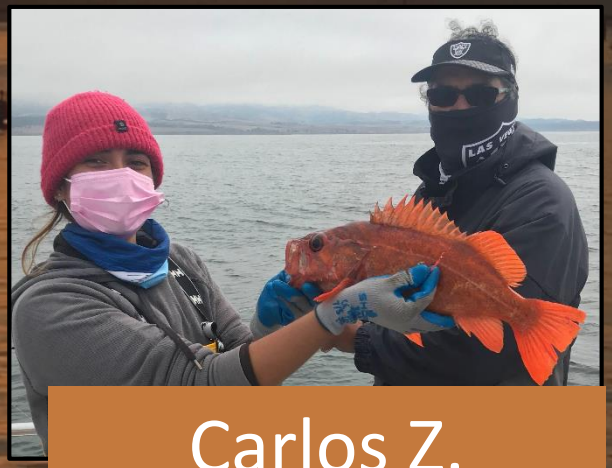


Maddie H.

Ron F.



Emily S.



Carlos Z.


CALIFORNIA COLLABORATIVE
FISHERIES RESEARCH

MPA Management Program

Outreach and Education

Photo: MPA Collaborative Network

Research and Monitoring

Photo: CDFW, A. Van Diggelen

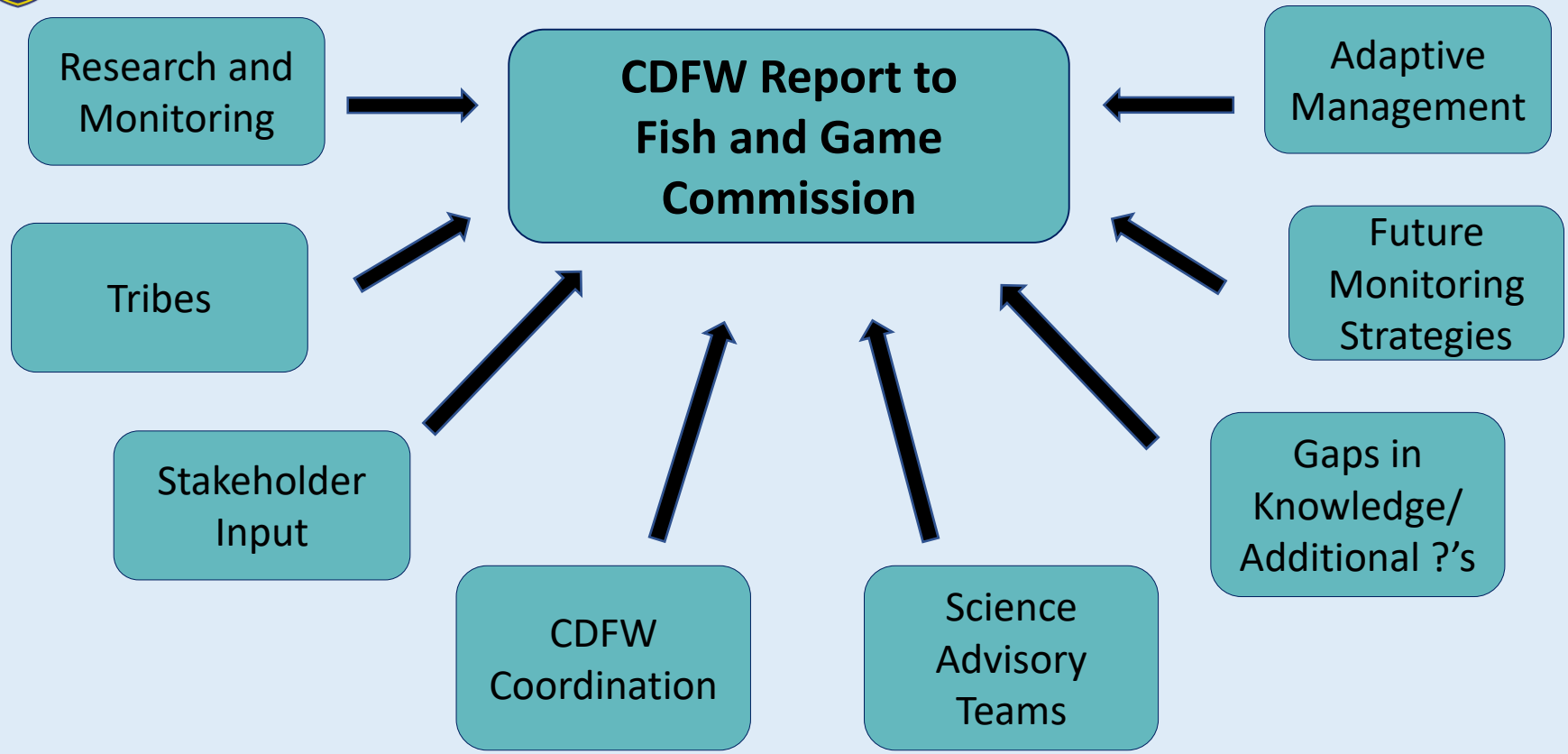
Enforcement and Compliance

Photo: CDFW, A. Van Diggelen

Policy and Permitting

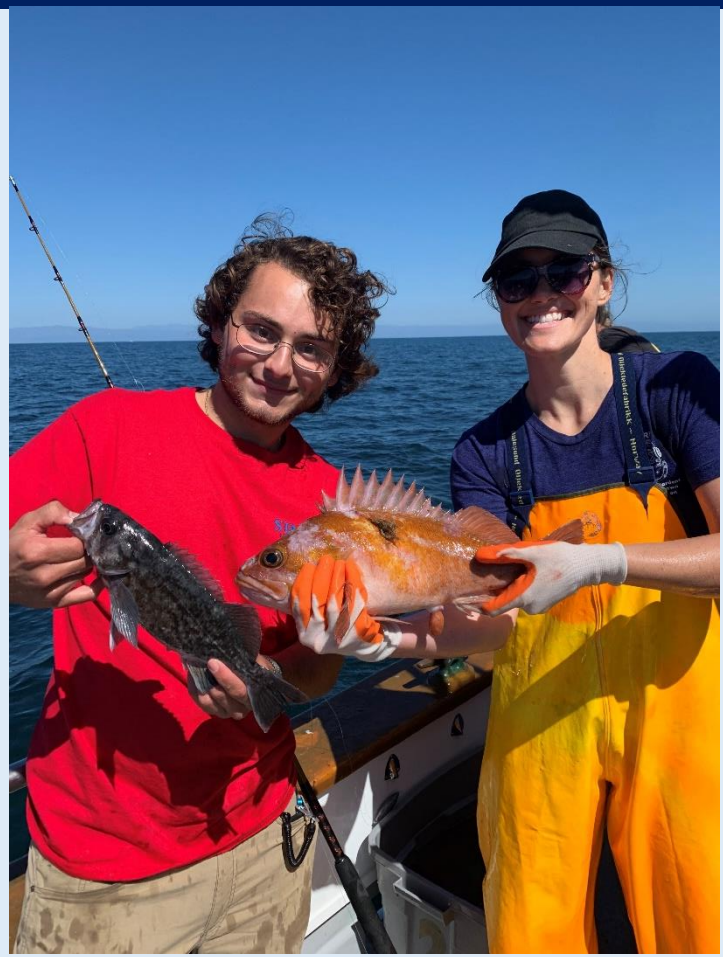
Photo: Jeff Landesman

Decadal Management Review: 2022



Resources to stay up to date

- Fish and Game Commission meetings: **fgc.ca.gov** for meeting schedules
- Communications Plans
- MPA Collaboratives: **mpacollaborative.org**
- CCFRP involvement
- Marine Management News: **cdfwmarine.wordpress.wordpress.com**
- Send your questions to: **AskMarine@wildlife.ca.gov**



Questions?

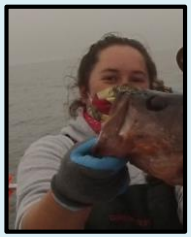
Sara Worden, CDFW
Sara.worden@wildlife.ca.gov

Mike Esgro, OPC
Micheal.esgro@resources.ca.gov

CALIFORNIA MARINE PROTECTED AREAS

When we're not fishing with all of you, we are publishing data from CCFRP and giving presentations to other researchers on the data you helped us all collect!

Ellie Brauer, WSN 2020 Presentation: "Utilizing a blood-based biomarker to explore spatial and temporal trends in growth rates of Blue Rockfish (*Sebastes mystinus*)"



Meghan Fox, WSN 2020 Poster: "Examining the influence of location, length, and year on sex ratios of Lingcod (*Ophiodon elongatus*)"

Erin Johnson, CCFRP Institution Presentation: "Investigating the Associations between Oceanographic Processes and *Sebastes mystinus* Population Parameters"

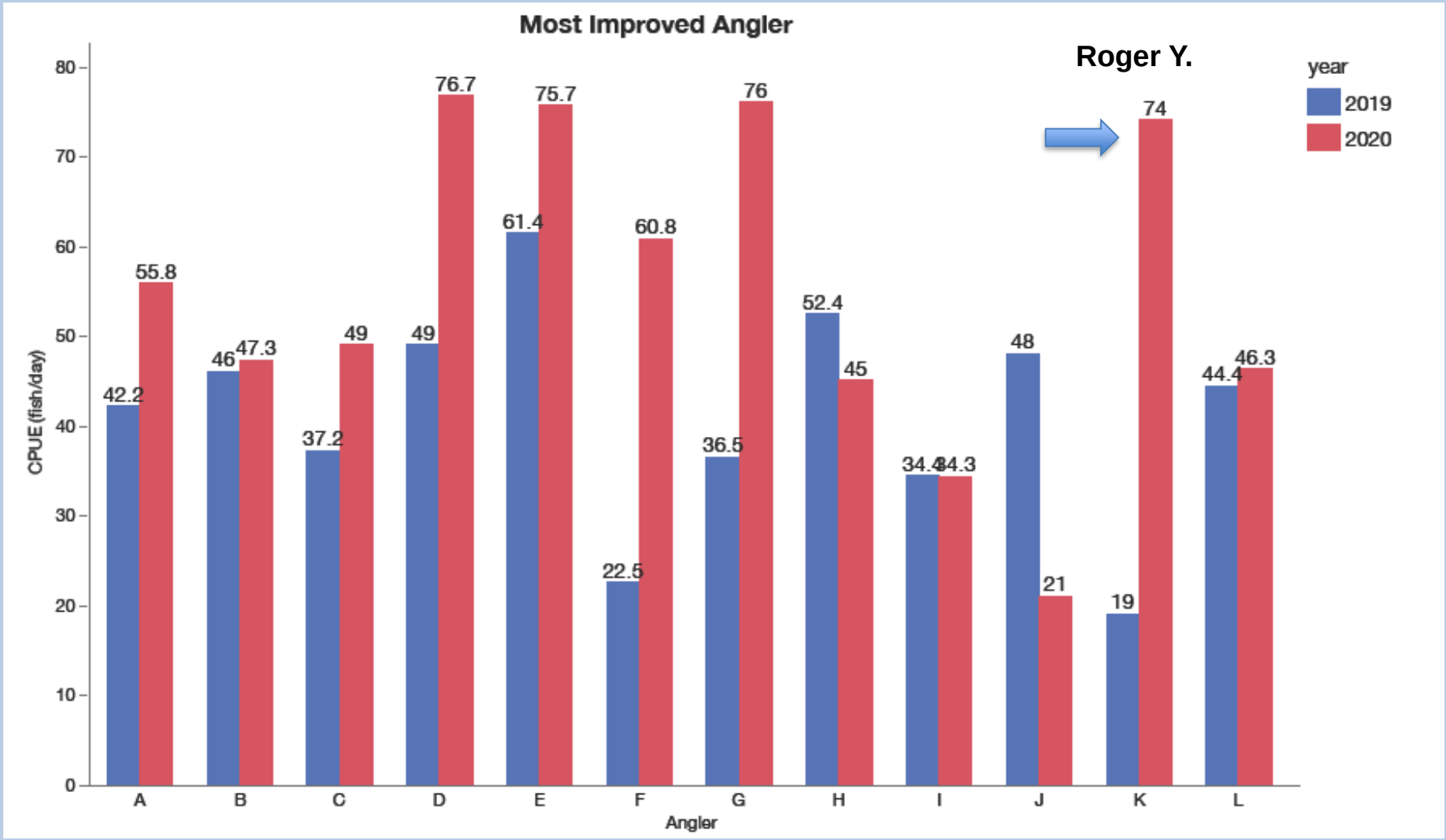
Survey publication (Mason et. al 2020) // Citizen Science publication (Bonney et. al 2020)

NOAA citizen science feature (April 7, https://www.noaa.gov/education/stories/countdown-to-earth-day-noaa-unlocks-citizen-science-project-of-day)

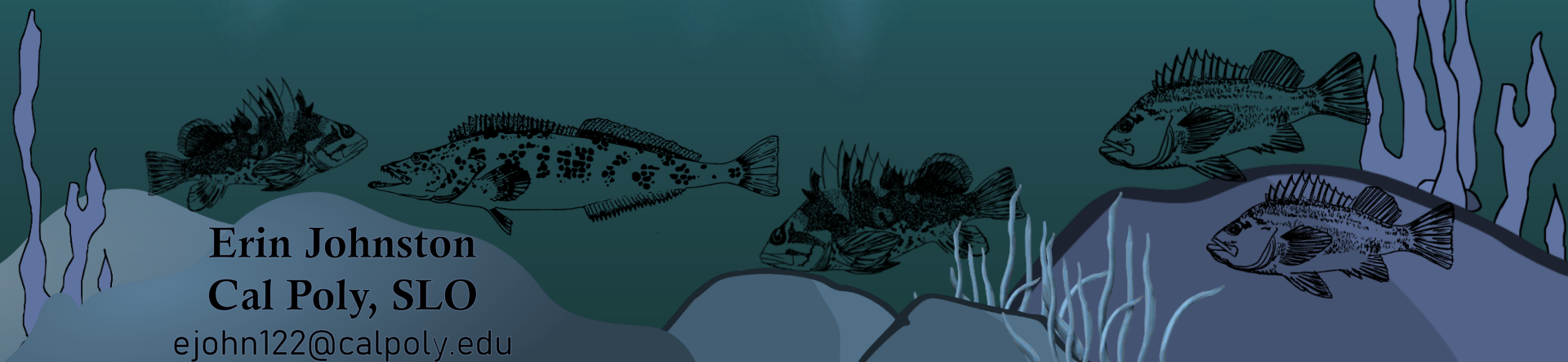
Summary of the 2020 Fishing Season

- Total caught fishes: 4,416 (4,706 - 2019)
- Statewide – 16,758
- Total number of trips: 12
- Total number of anglers: 28

Most Improved Angler 2019-2020

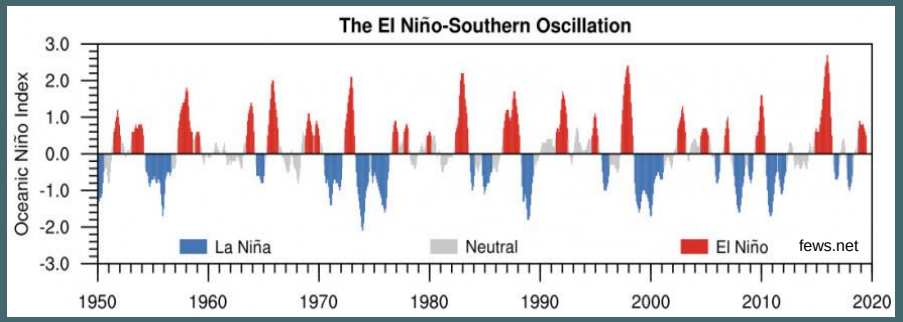


Relationship between Ocean Climate and Blue rockfish



Erin Johnston
Cal Poly, SLO
ejohn122@calpoly.edu

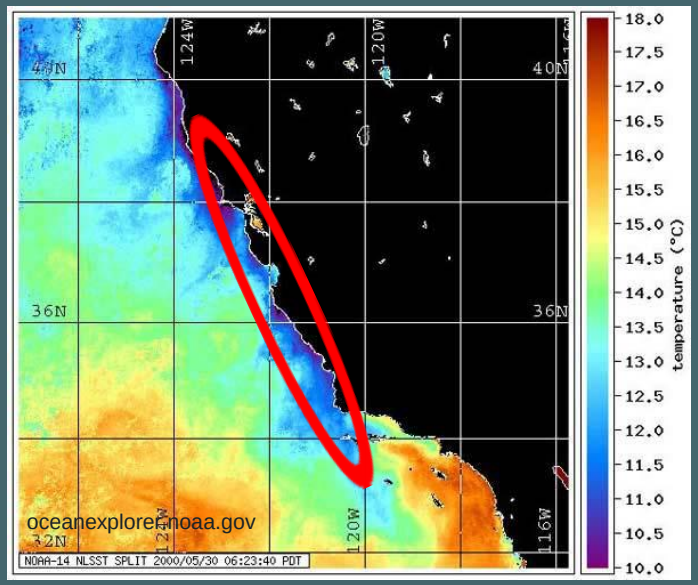
What is Ocean Climate?

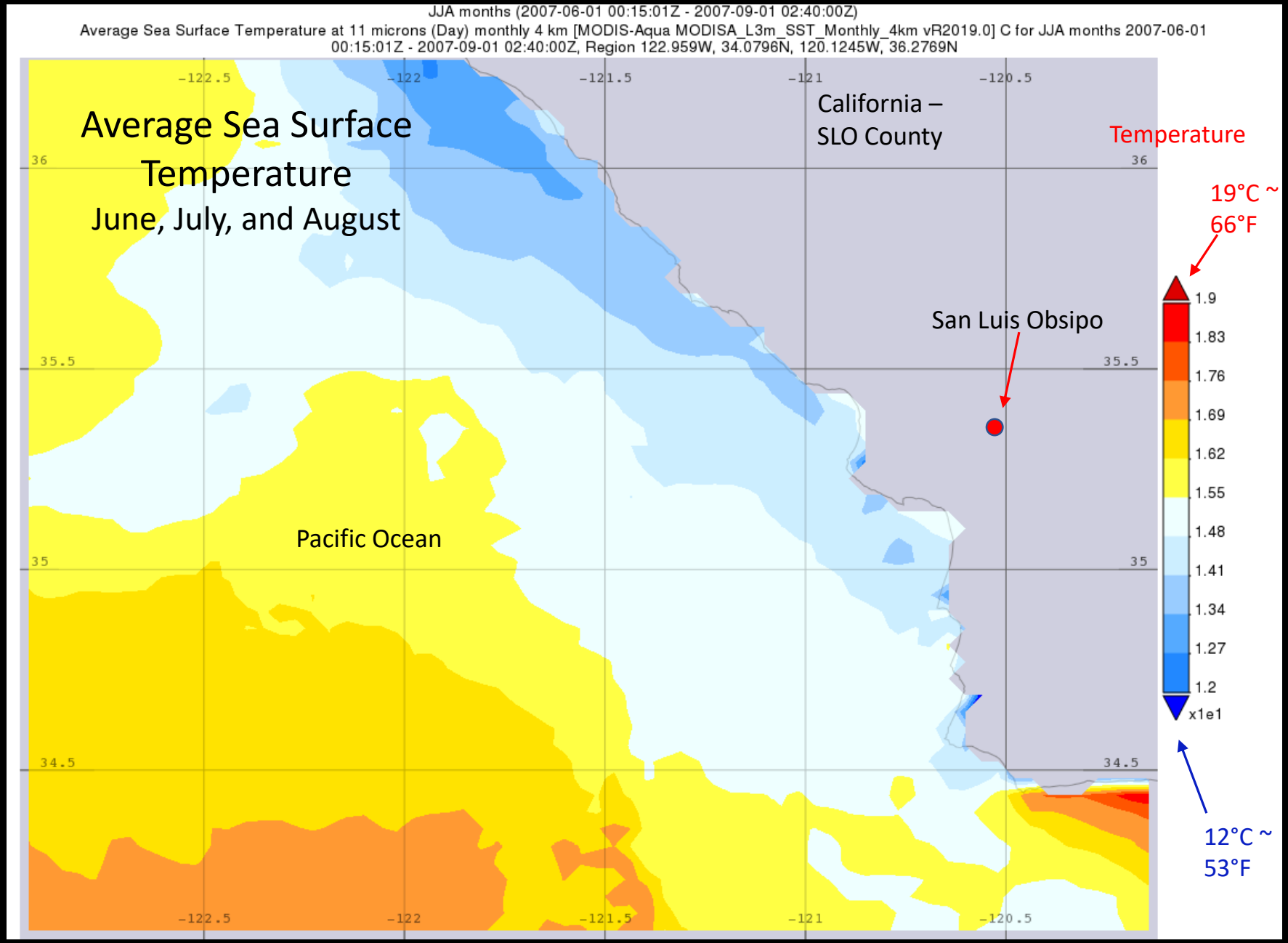


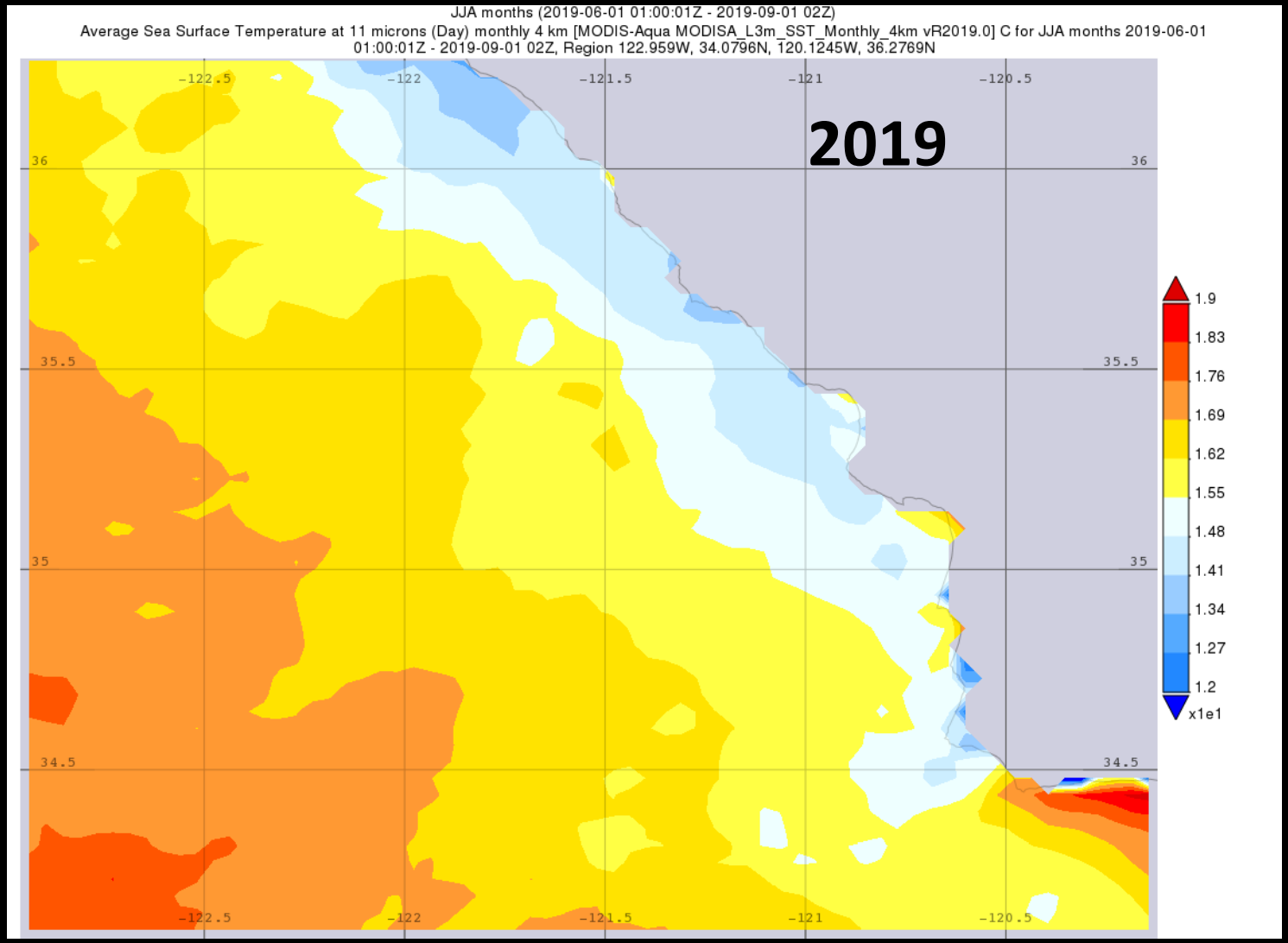
Ocean Processes
- Spatial Scales: local and regional
- Temporal Scales: days → decades

Local Ocean Climate
- Sea Surface Temperature –days to months
- Upwelling – weeks to months

Regional Ocean Climate
- El Niño-Southern Oscillation – years
- Pacific Decadal Oscillation - decades



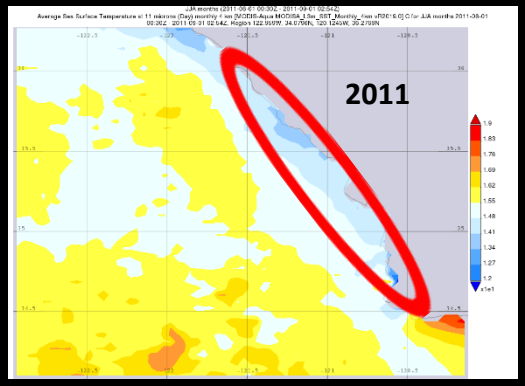

JJA months (2007-06-01 00:15:01Z - 2007-09-01 02:40:00Z)
Average Sea Surface Temperature at 11 microns (Day) monthly 4 km [MODIS-Aqua MODISA_L3m_SST_Monthly_4km vR2019.0] C for JJA months 2007-06-01 00:15:01Z - 2007-09-01 02:40:00Z, Region 122.959W, 34.0796N, 120.1245W, 36.2769N
Average Sea Surface Temperature
June, July, and August
California – SLO County
Temperature
19°C ~ 66°F
San Luis Obsipo
Pacific Ocean
1.9
1.83
1.76
1.69
1.62
1.55
1.48
1.41
1.34
1.27
1.2
x1e1
12°C ~ 53°F
-122.5
-122
-121.5
-121
-120.5
36
35.5
35
34.5

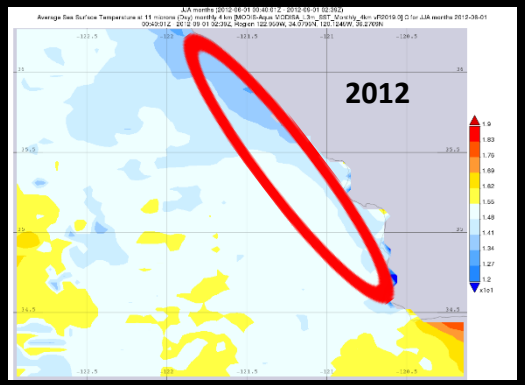


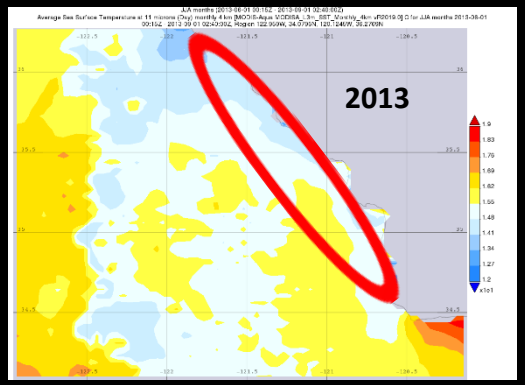
Data: NASA Giovanni
giovanni.gsfc.nasa.gov

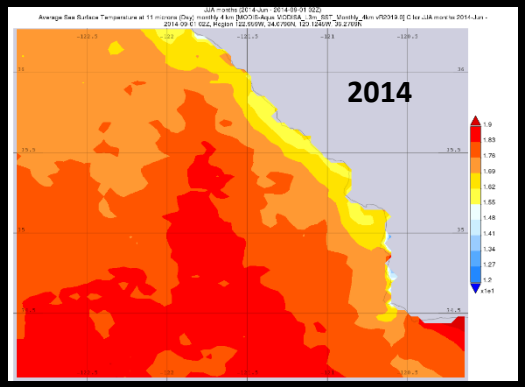
Average summer temperatures – June, July, & August

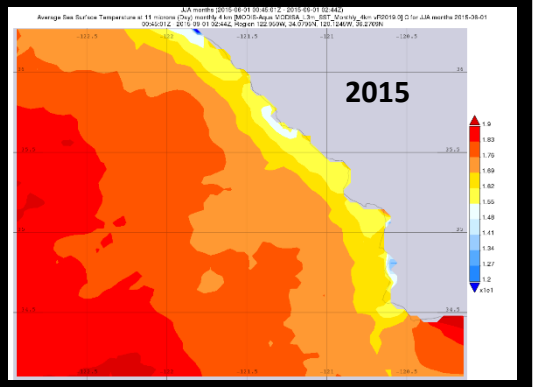
El Niño

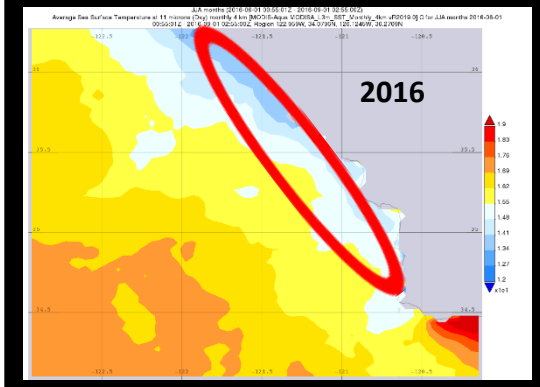


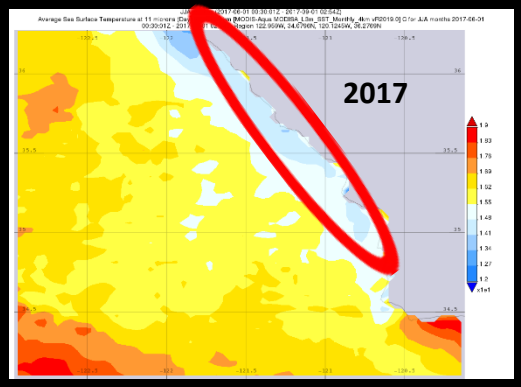


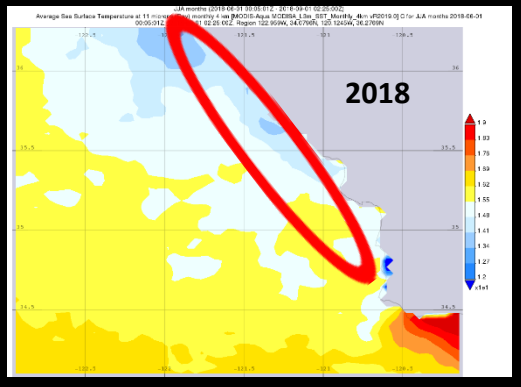


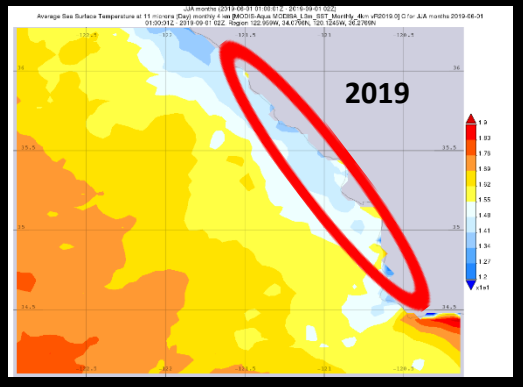








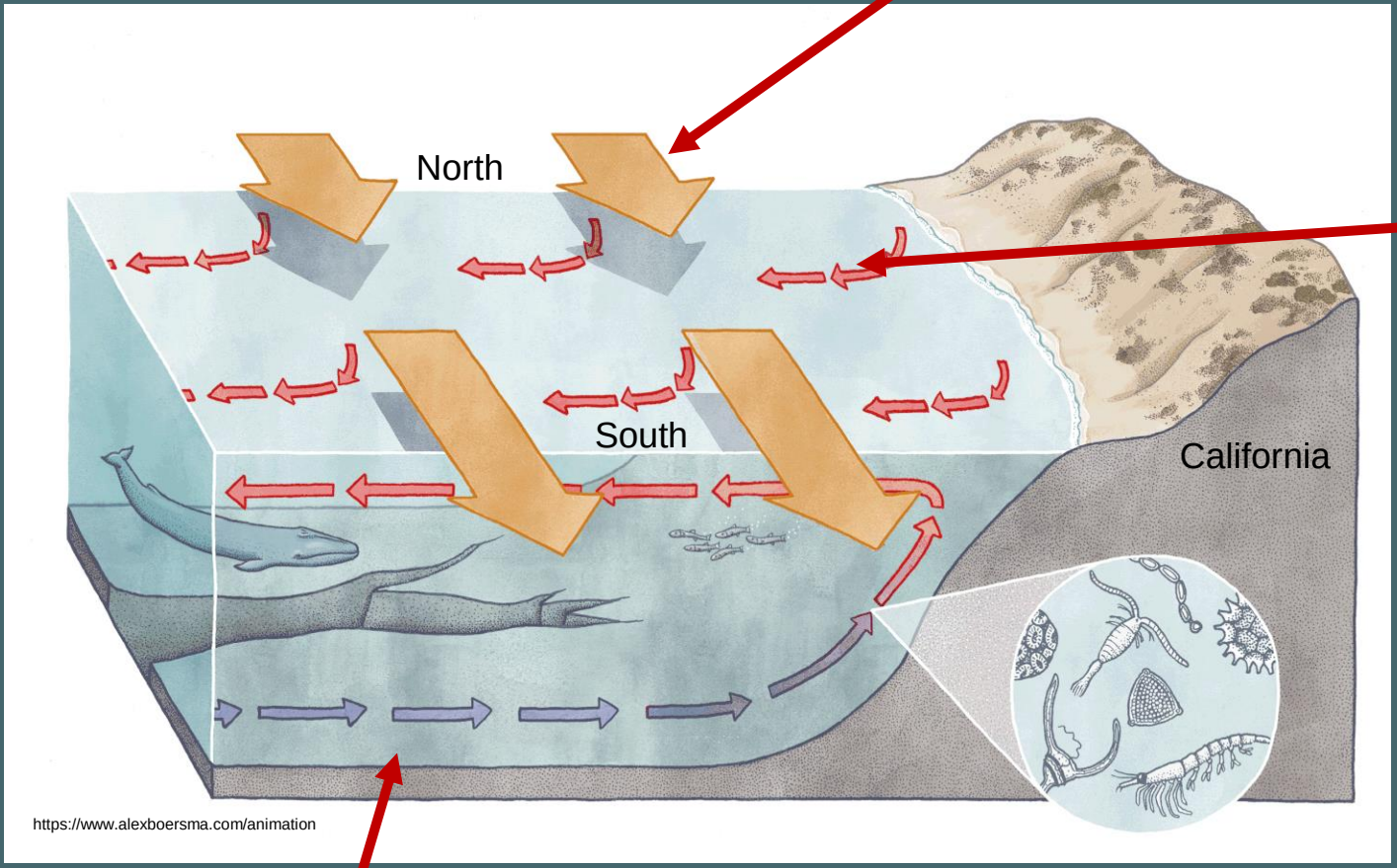




Data: NASA Giovanni
giovanni.gsfc.nasa.gov

Coastal Upwelling Process

1. Winds blows down the coast

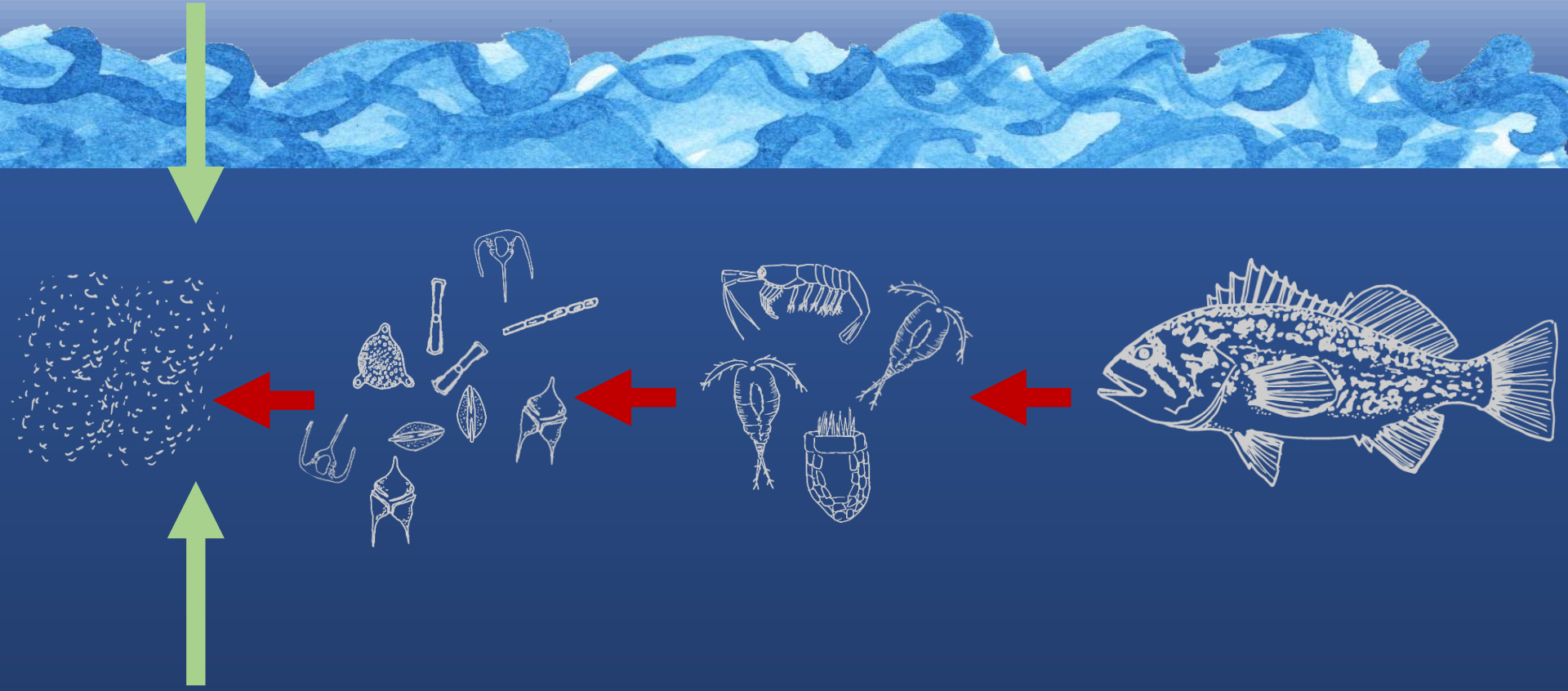


2. Surface water moves off the coast

3. Cold, nutrient-rich water comes to fill the spot

- Upwelling Period: Spring- early Summer
- Upwelling Relaxation/Downwelling: Fall

Coastal Upwelling Biology



Nutrients

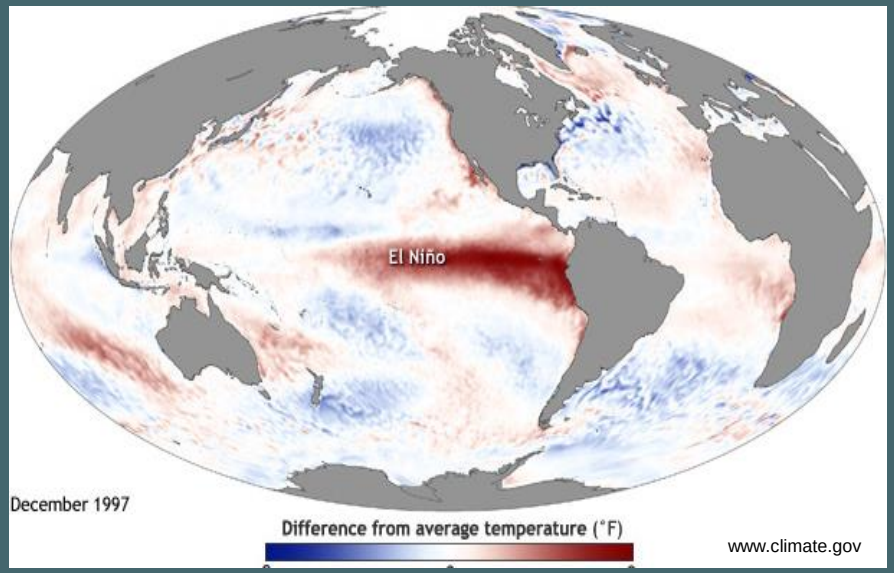
Phytoplankton

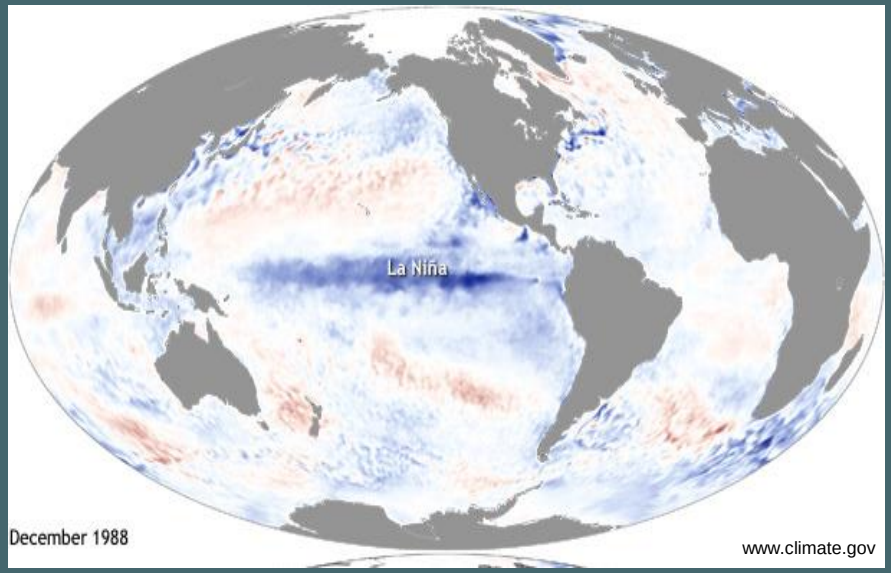
Zooplankton

Fishes

El Niño – Southern Oscillation (ENSO)

- Three Phases
  - **El Niño**: Sea Surface Temperatures (SST) above average in central and eastern Pacific, coastal upwelling reduced
  - **La Niña**: SST below average in central/eastern Pacific, coastal upwelling increases
  - **Neutral**: SST, upwelling, and winds close to average



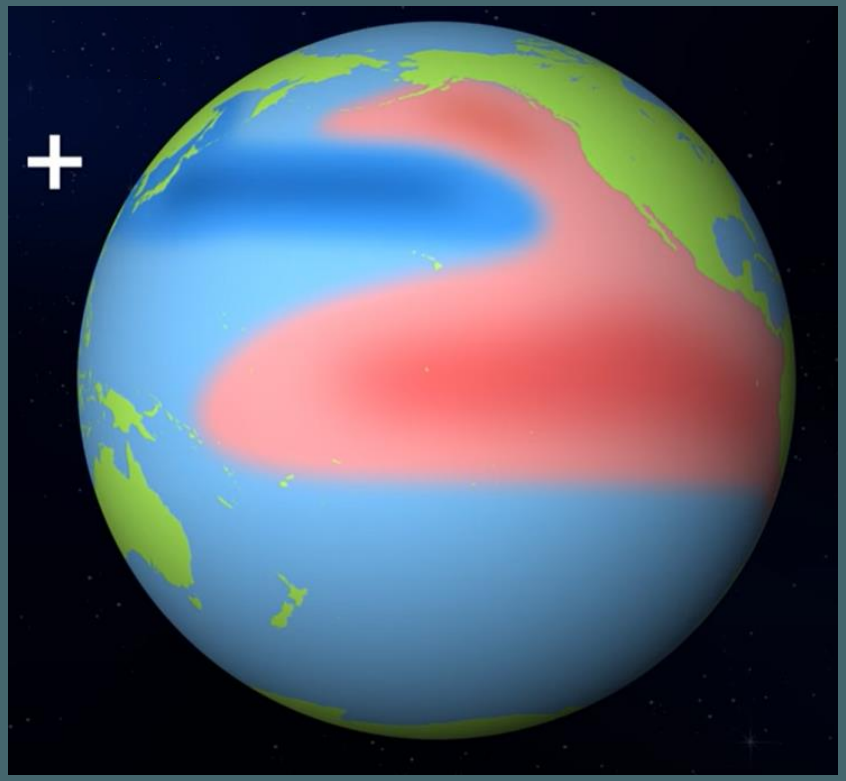


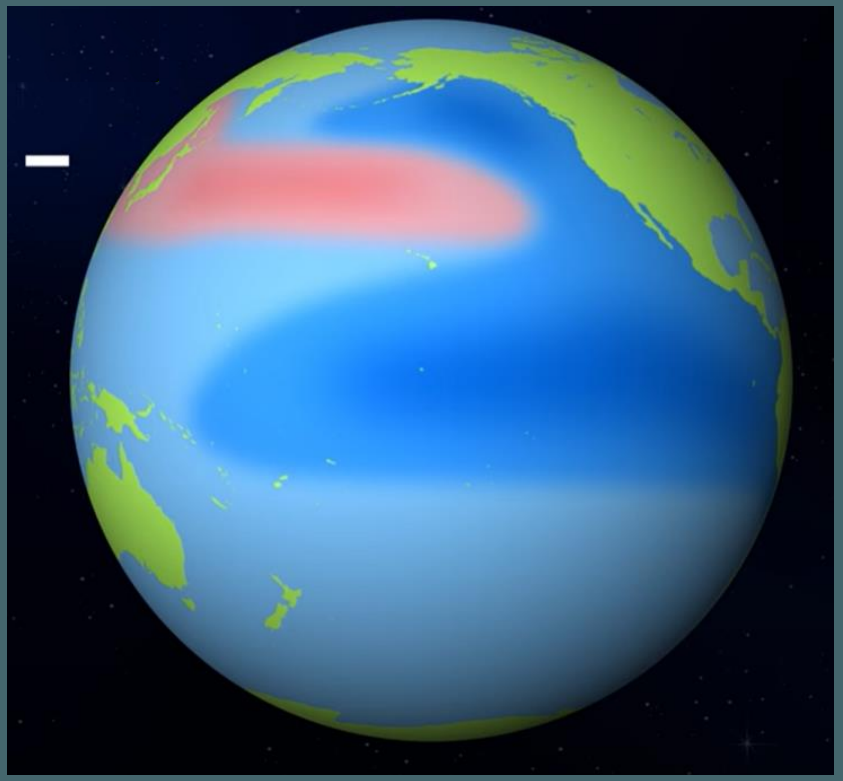
Pacific Decadal Oscillation

‘long-lived El Niño-like pattern of Pacific climate variability’ (Mantua and Hare 2002)

Positive: Sea Surface Temperatures (SST) above average in central/eastern/northeastern Pacific, coastal upwelling reduced

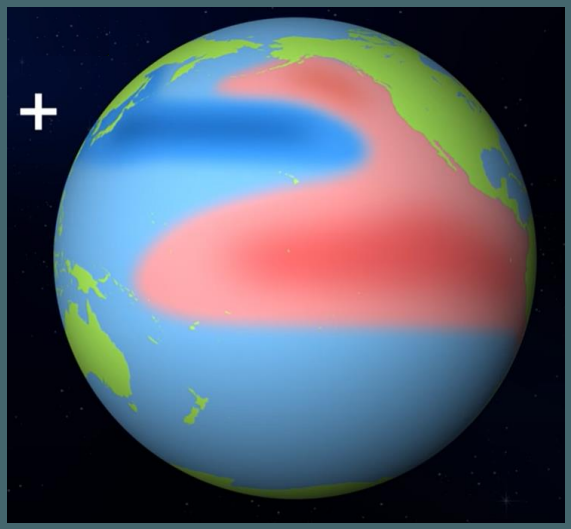
Negative: SST below average in central/eastern/northeastern Pacific, coastal upwelling increases

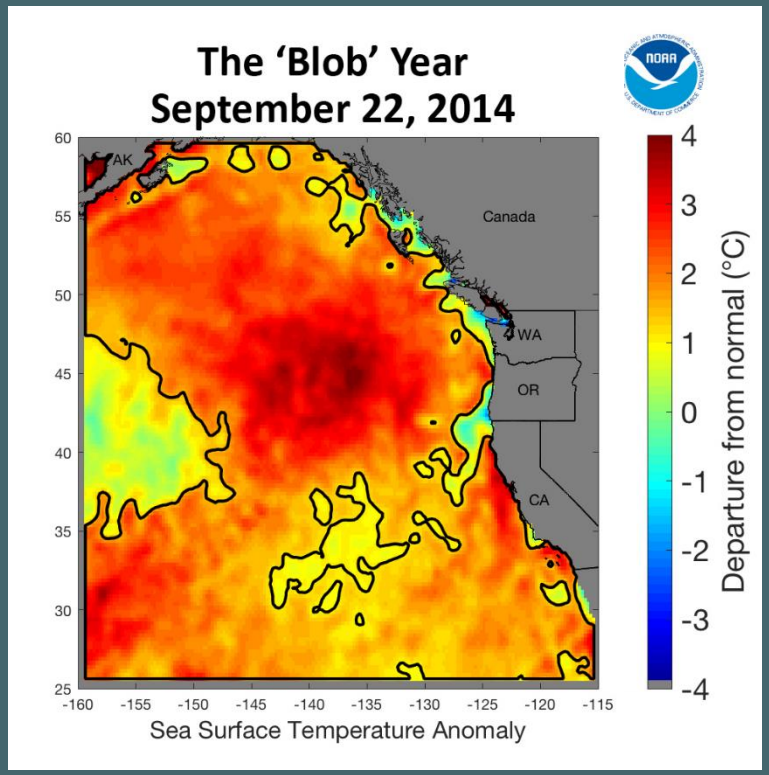


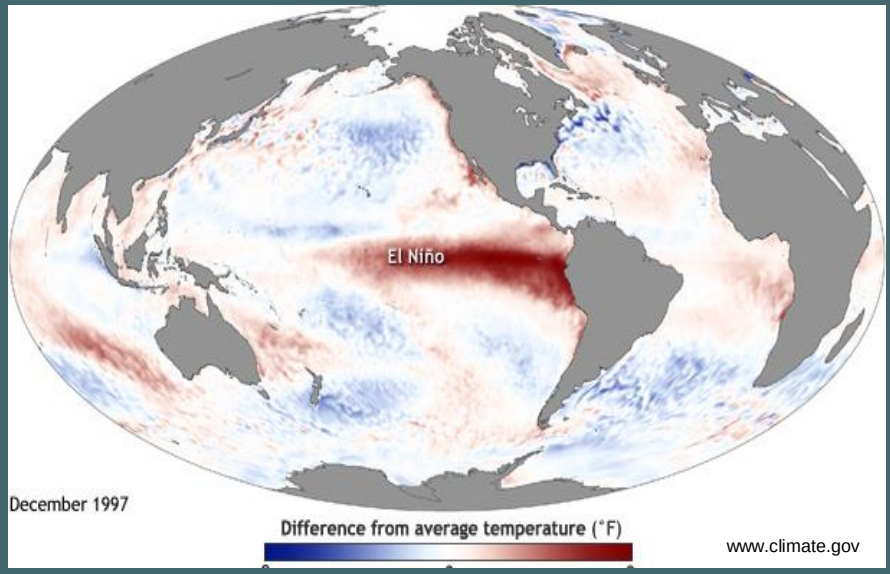


https://www.metoffice.gov.uk/weather/learn-about/weather/oceans/pacific-decadal-oscillation

Ocean Climate Anomalies







Biological Impacts

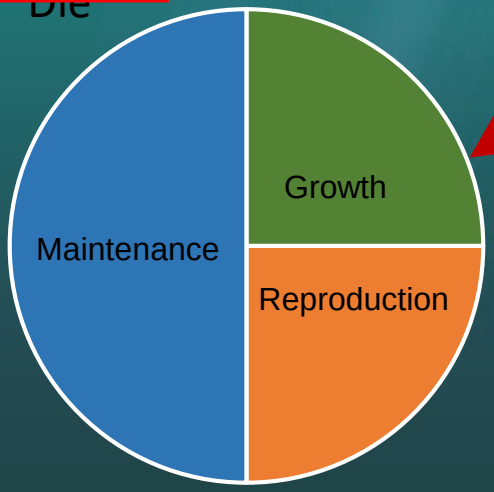
Ocean climate changes, fishes respond

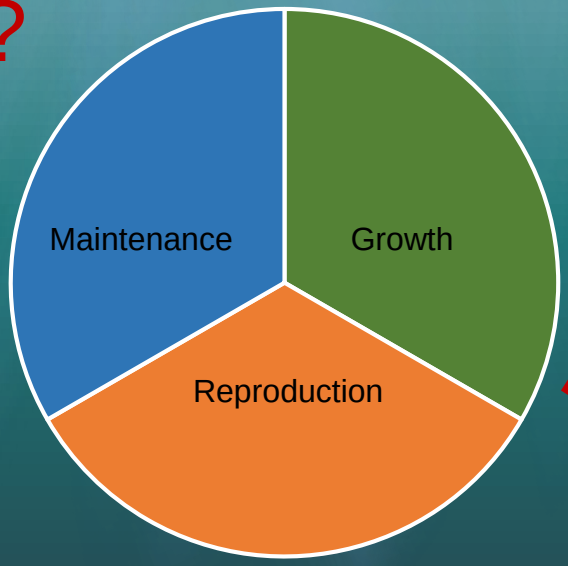
- Change how energy is spent

ENERGY

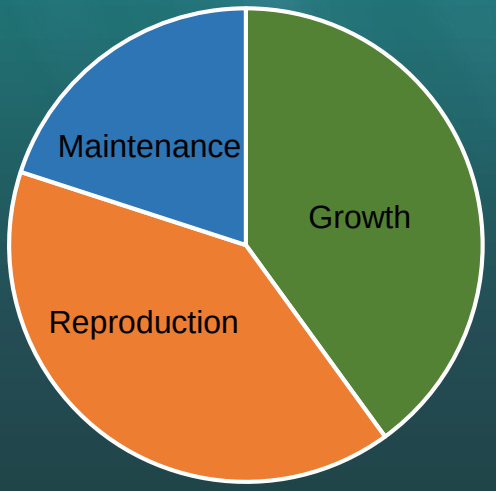
Heat
Lower Food Availability

- ~~Leave~~
- ~~Die~~





Higher Food Availability



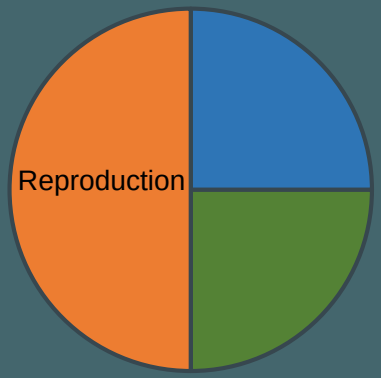
Blue rockfish life history

JUVENILE

- Size: 100% immature 21 cm and smaller
- Habitat: kelp beds or rocks
- Prey: small zooplankton

ADULT

- Size: 100% mature 32-35 cm
- Habitat: as they grow larger, they go higher into the water column during day
- Prey: larger zooplankton



Fisheries Impacts

?

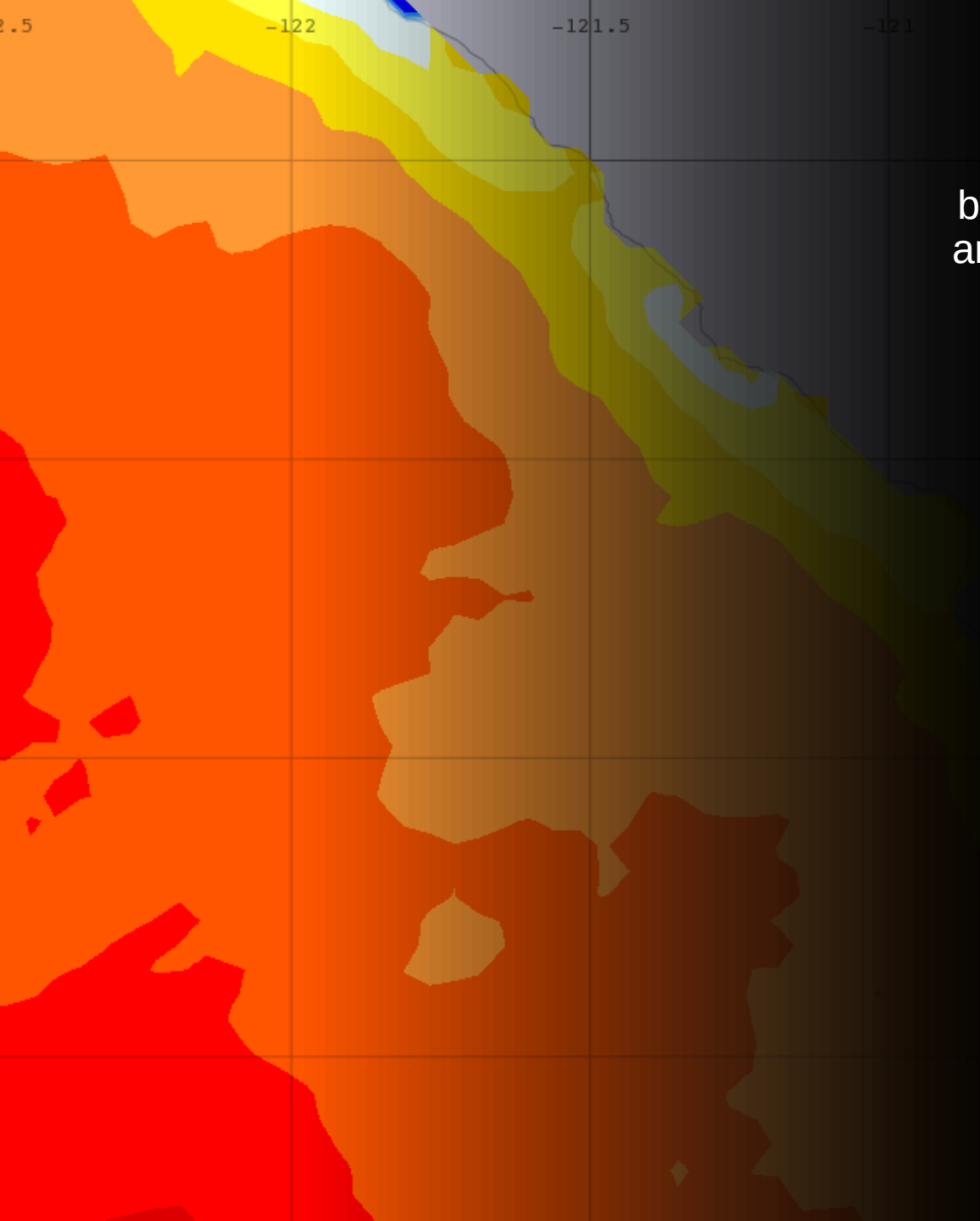
\+

Birth
Immigration

Population

\-

Death
Emigration



QUESTION

Can we detect an association between large ocean climate events and the abundance of Blue rockfish?

IMPORTANCE

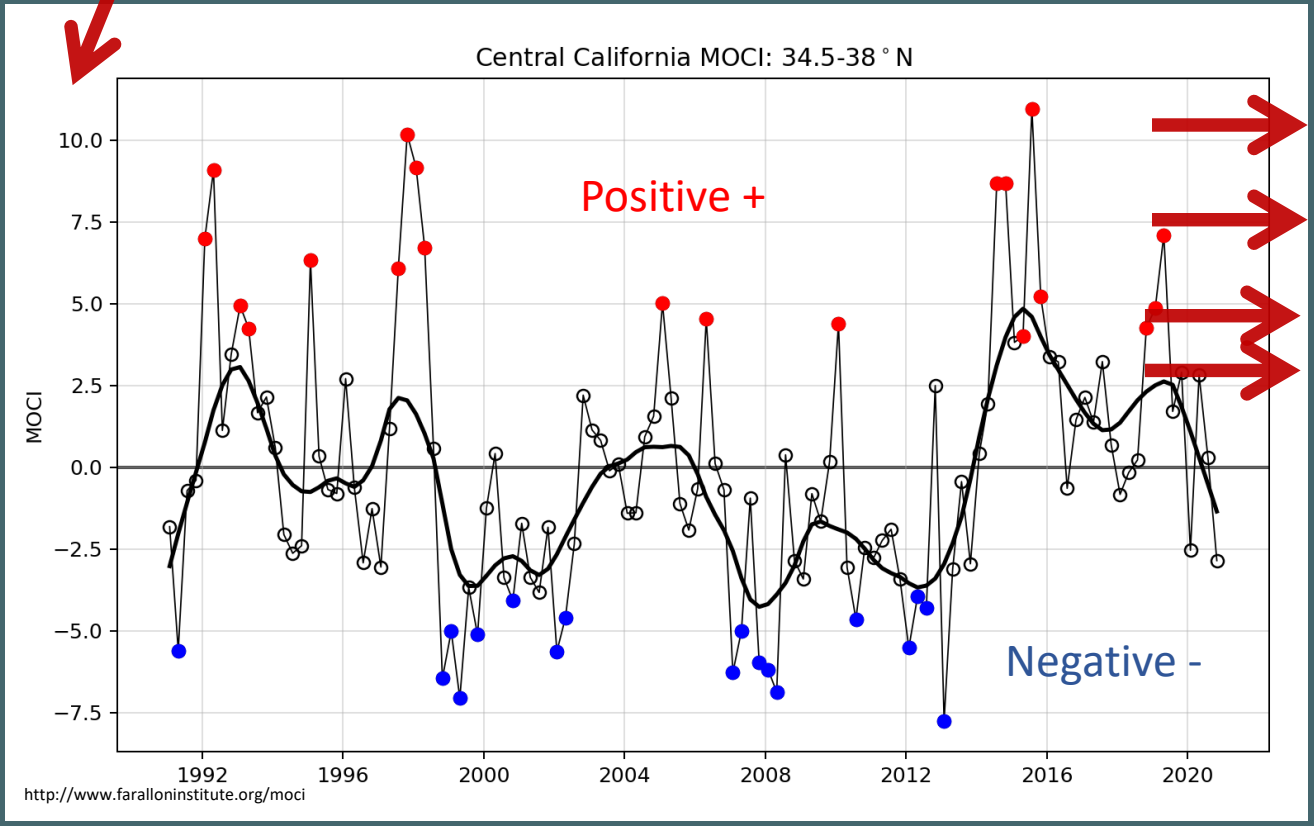
Management implications
Fishing

BUT… TIME LAG?

What is the lag time between change in ocean climate and when fish respond?

- Catch Per Unit Effort (CPUE)
- Ocean Climate = Multivariate Ocean Climate Indicator (MOCI)

Multivariate Ocean Climate Indicator (MOCI)



MOCI includes:

- Upwelling index
- Sea level
- Wind, SST, air temp, sea level pressure
- Multivariate ENSO Index (MEI)
- Pacific Decadal Oscillation (PDO)
- Northern Oscillation Index (NOI)

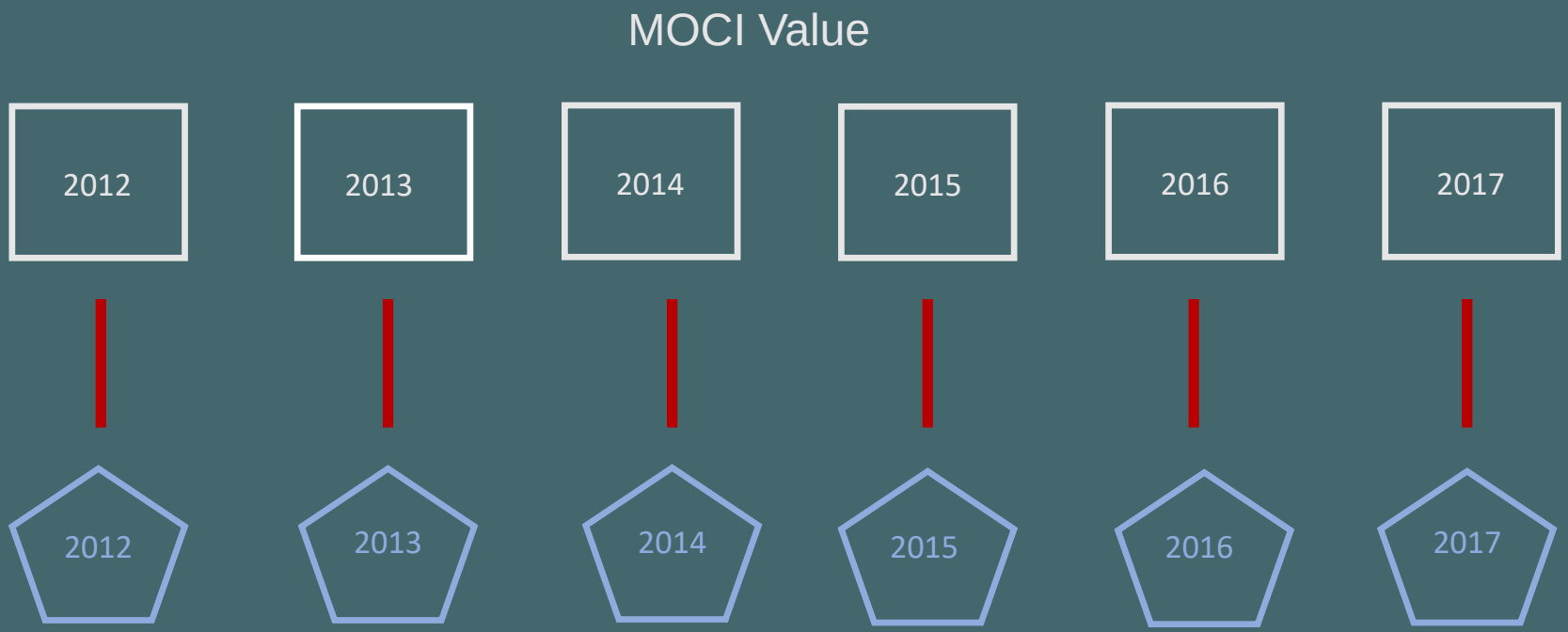
Season:

- Jan-Feb-Mar (winter)
- Apr-May-Jun (spring)
- Jul-Aug-Sep (summer)
- Oct-Nov-Dec (fall)

Time Lag?

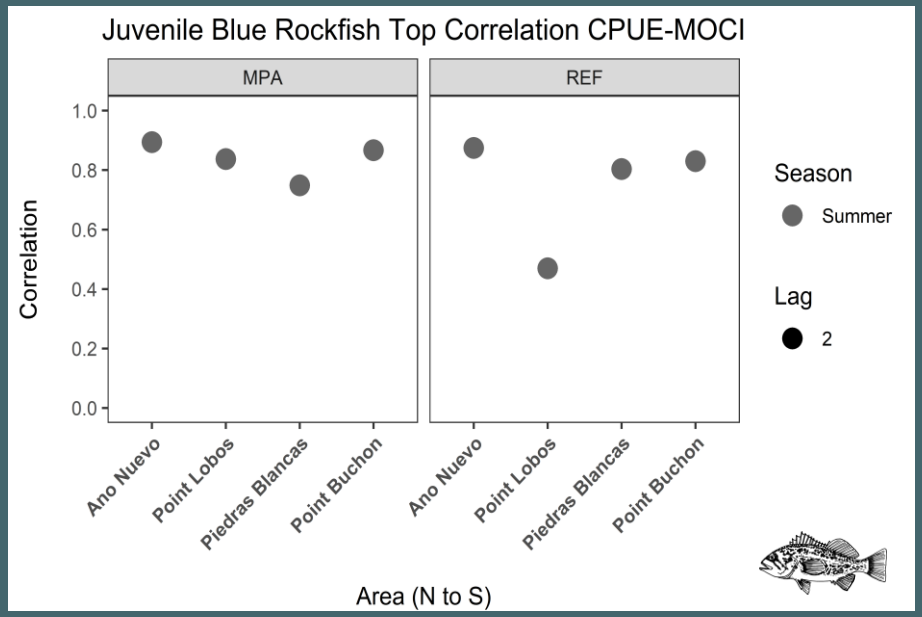
1. MOCI Value
2. CPUE

- Correlation = evaluate the strength of the relationship between two things
- Number between -1 and 1
- 1 = STRONG positive relationship
- -1 = STRONG negative relationship
- 0 = no relationship

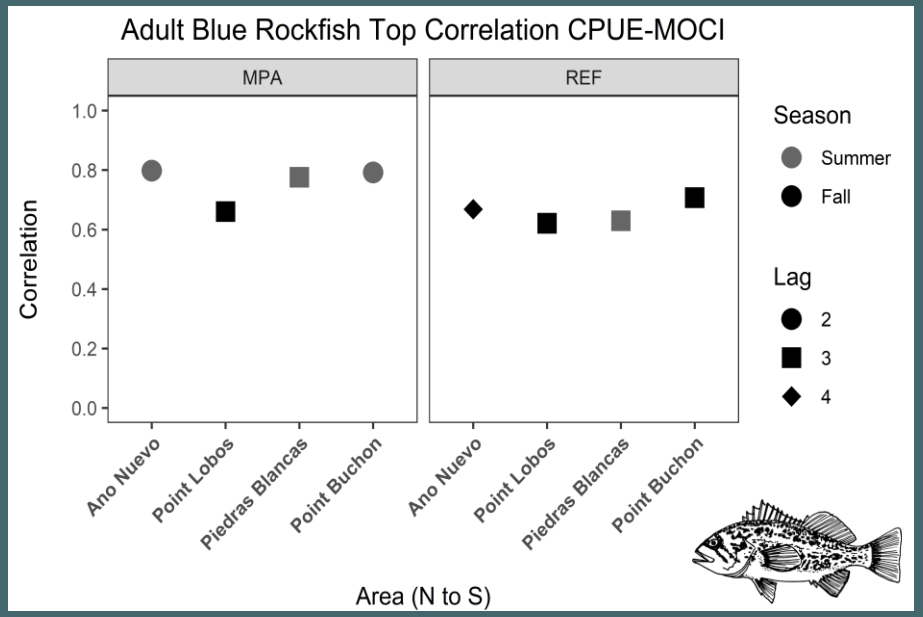


Correlation is calculated between CPUE and every past MOCI value

Juvenile <= 21 cm



Adult > 21 cm



MPA and REF: CPUE at present correlates strongly with ocean climate two years ago in the summer

MPA: CPUE at present correlates strongly with ocean climate two or three years ago in the summer or fall

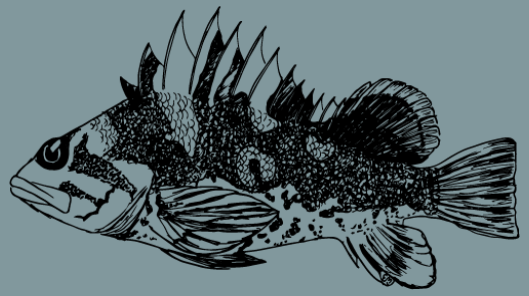
REF: CPUE at present correlates strongly with ocean climate three or four years ago in the summer or fall

Blue rockfish

Lingcod

Vermilion rockfish

Gopher rockfish

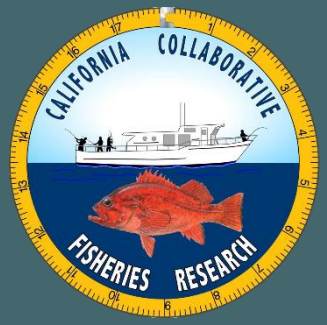


Thank You!

CCFRP Volunteer Anglers – past, present, future

CPFV Captains & Deckhands

Cal Poly Crew & project PIs



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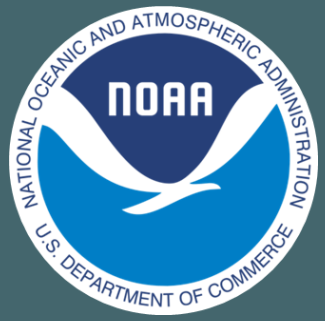
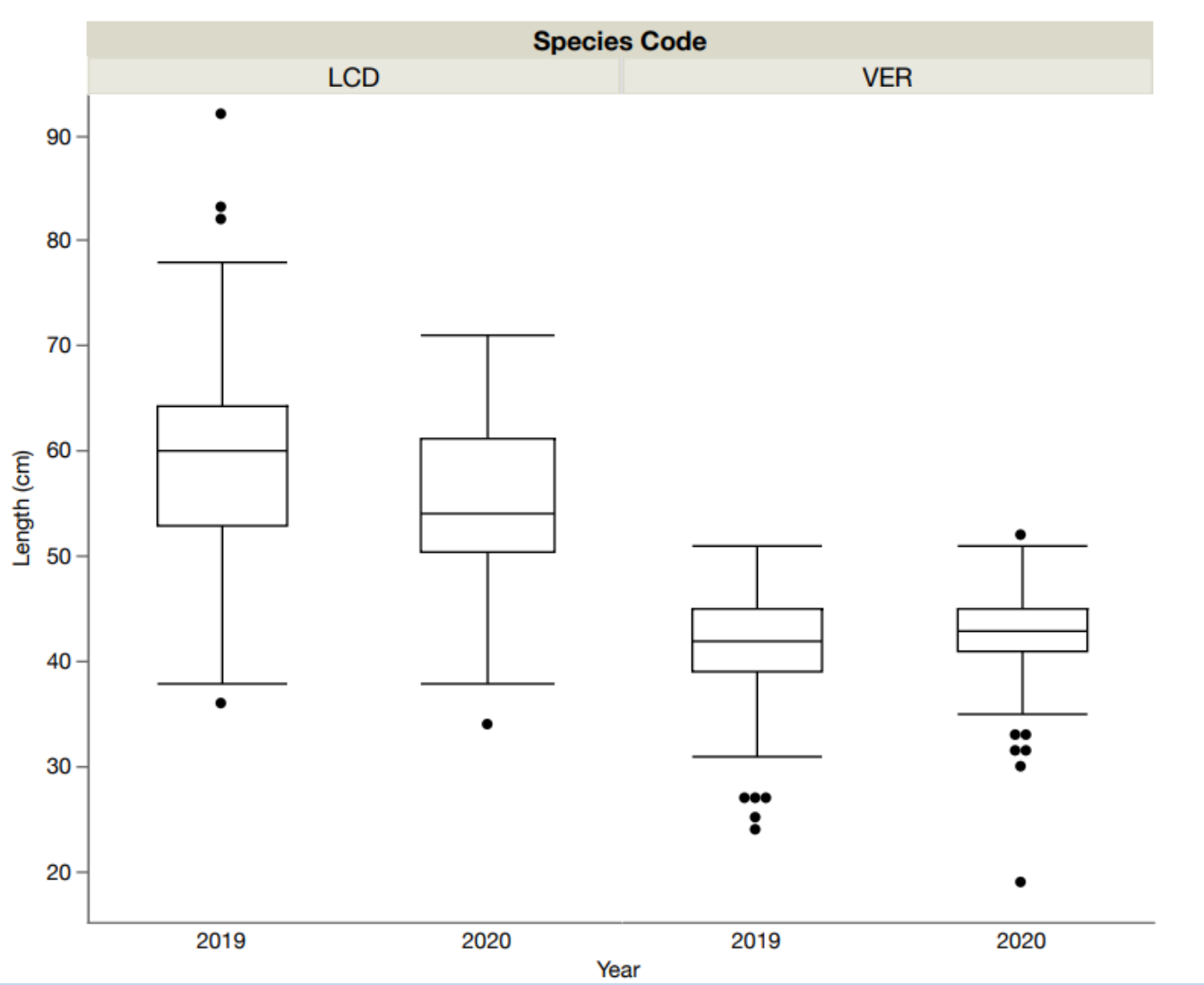



Questions?

Changes in Fish Length: COVID to Average Year



Winner of the most fashionable use of a COVID-19 face shield

Alicia E

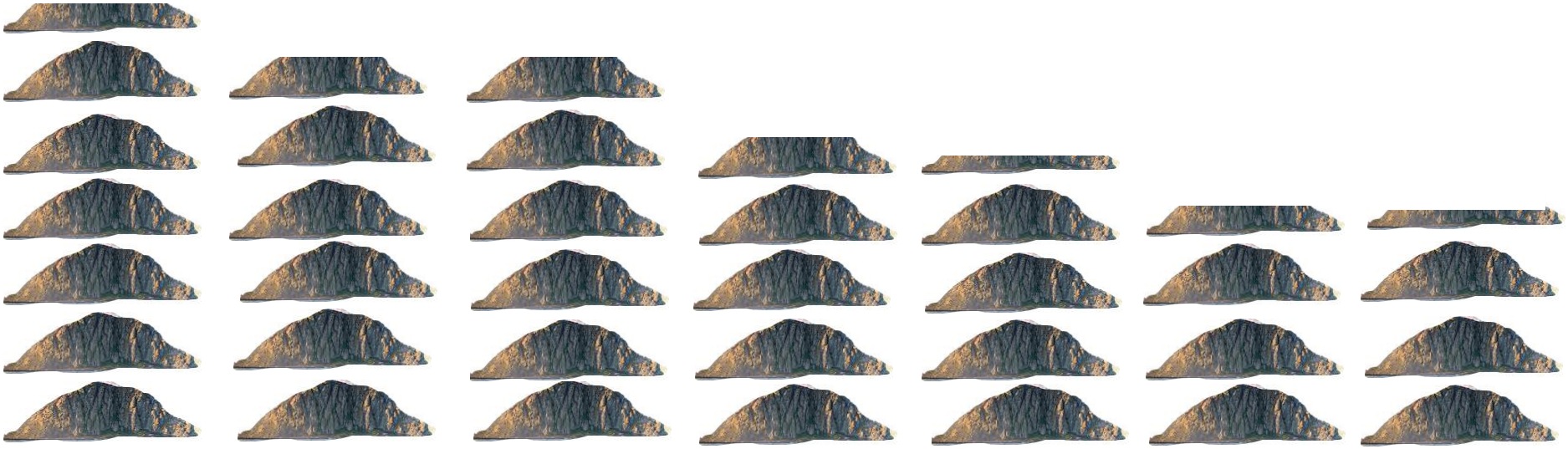
Eddie G

We all know that bananas are a sign of unending luck...

Marcy D. caught the smallest fish of the season: a Boccaccio at 11cm equal to 0.6 Chiquita bananas.

Ron F. caught the longest fish of 2020: a Lingcod at 71cm equal to 4 Chiquita bananas.

Top Fishers of All-Time: Total Fish Length in Morro Rocks (580 ft)



Jim W.
3679 ft.
6.33 Rocks

Phil E.
3441 ft.
5.92 Rocks

Marcy D.
3431 ft.
5.91 Rocks

Bill M.
2650 ft.
4.58 Rocks

Ralph B.
2385 ft.
4.11 Rocks

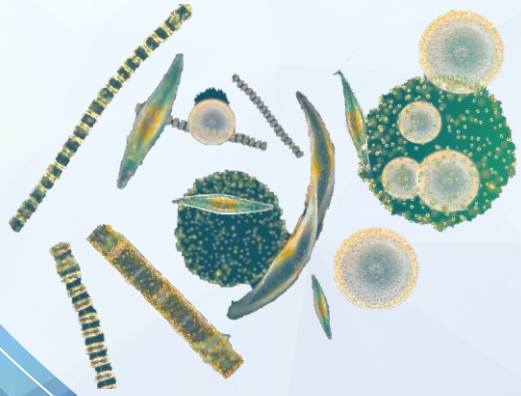
Tim D.
1909 ft.
3.39 Rocks

Eddie G.
1820 ft.
3.15 Rocks

Anglers catching greater than 1 Morro Rock length of fish (all-time)

Angler	Number of Morro Rocks
Jim W.	6.33
Phil E.	5.92
Marcy D.	5.91
Bill M.	4.58
Ralph B.	4.11
Tim D.	3.39
Eddie G.	3.15
Mike B.	2.82
Duane G.	2.59
Jason A.	2.55
Ron G.	2.43
Jeremy H.	2.15
Gary A.	1.95
Lyndon M.	1.88
Nancy A.	1.41
Richard D.	1.28
Roger Y.	1.23
Sean C.	1.06

From Phytoplankton to Fish: Unicellular Algae and their Contribution to Rockfish Populations

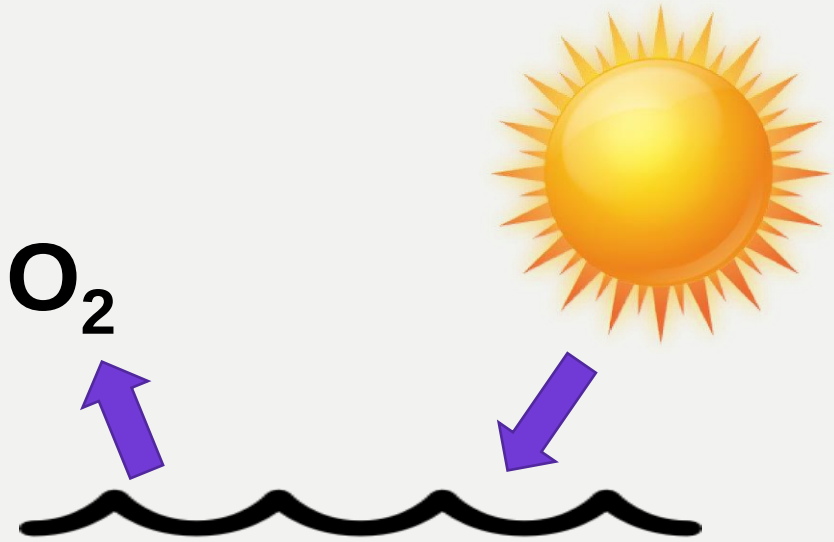


Nicholas Soares
nasoares@calpoly.edu

https://albernicharters.com/target-species/vermilion-rockfish

Phytoplankton Characteristics

- Unicellular algae
- Greek for “drifting plant”
- Generate oxygen through photosynthesis
- Primary producers
- Base of the marine food web
- Regular seasonal cycles along the California Current System

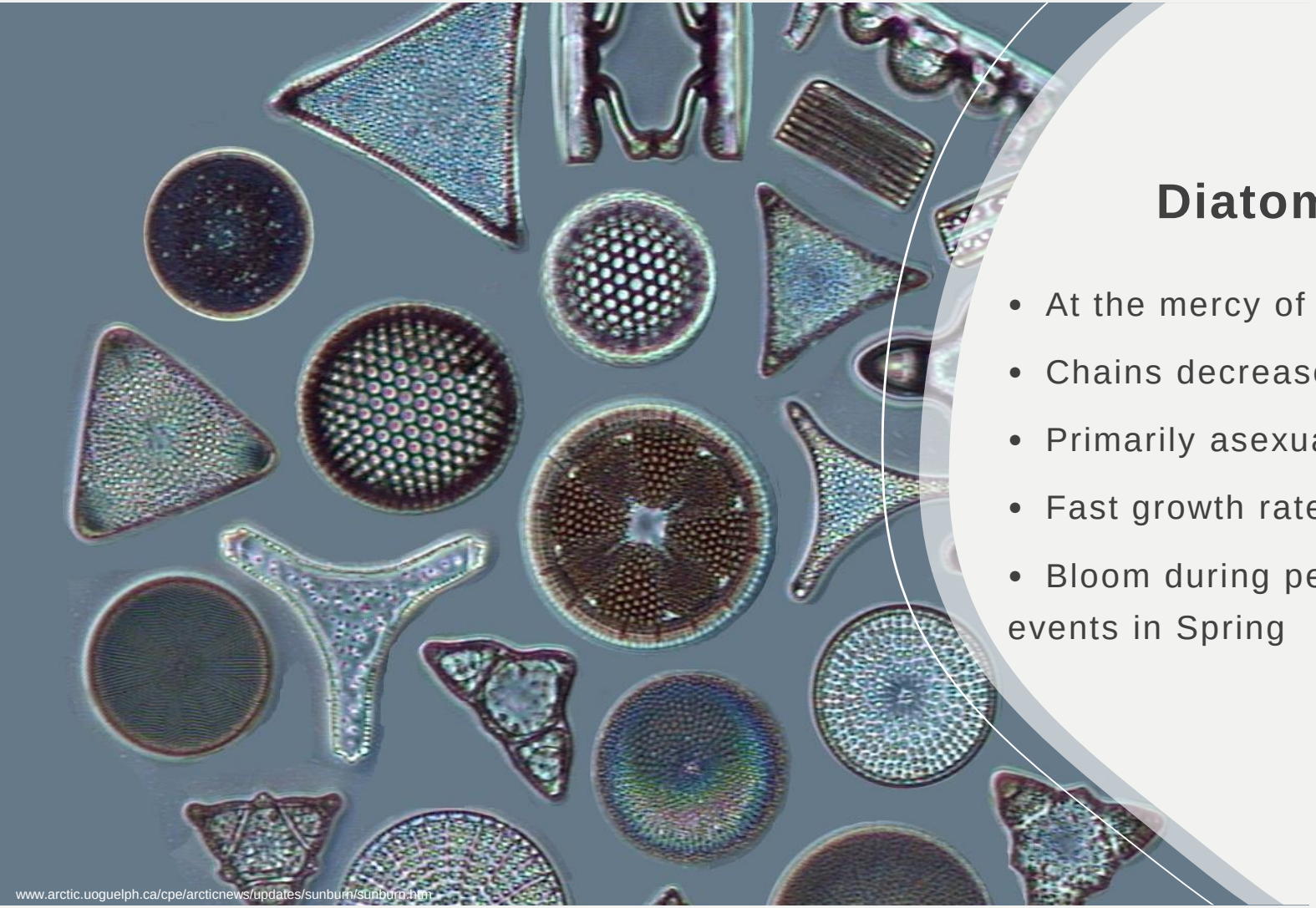


Collection and Analysis


www.sea-gear.net/plankton-nets.html

profilab24.com

https://www.bodc.ac.uk/data/documents/nodb/pdf/turner_10au_11apr2011.pdf

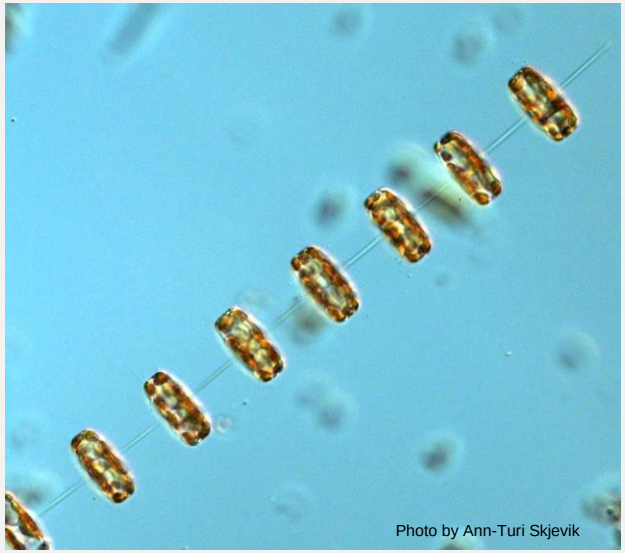


www.arctic.uoguelph.ca/cpe/arcticnews/updates/sunburn/sunburn.htm

Diatoms

- At the mercy of the currents
- Chains decrease sinking rate
- Primarily asexual
- Fast growth rates
- Bloom during peak upwelling events in Spring

Diatom Examples



Thalassiosira

Coscinodiscus

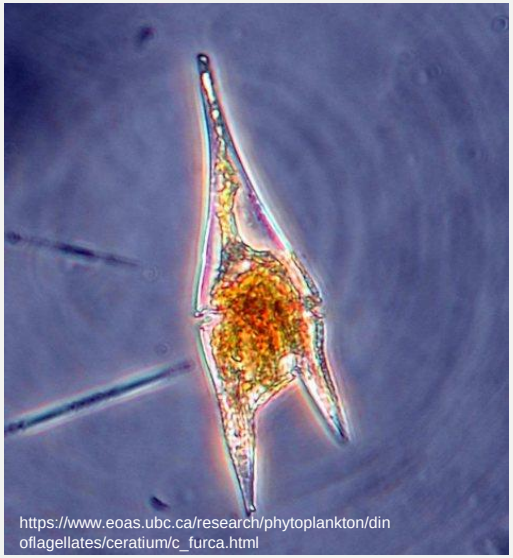
Chaetoceros

Dinoflagellates

- Two flagella for movement
- Wide variety of feeding strategies
- Some capable of bioluminescence
- Harmful Algal Blooms (Red Tides)
- Bloom in stratified water during the Fall

https://www.algaebarn.com/blog/phytoplankton/using-live-microalgae-to-control-nuisance-dinoflagellates/

Dinoflagellate Examples



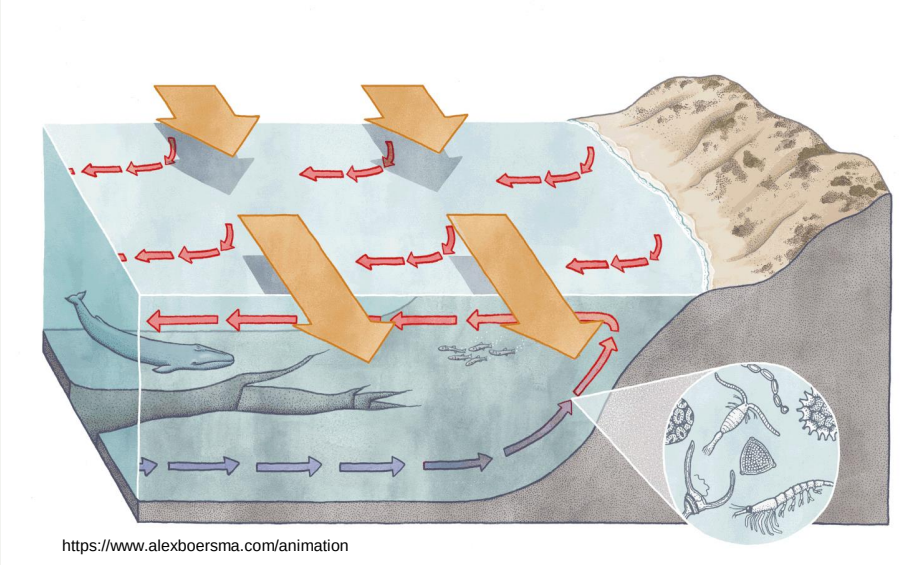
Ceratium

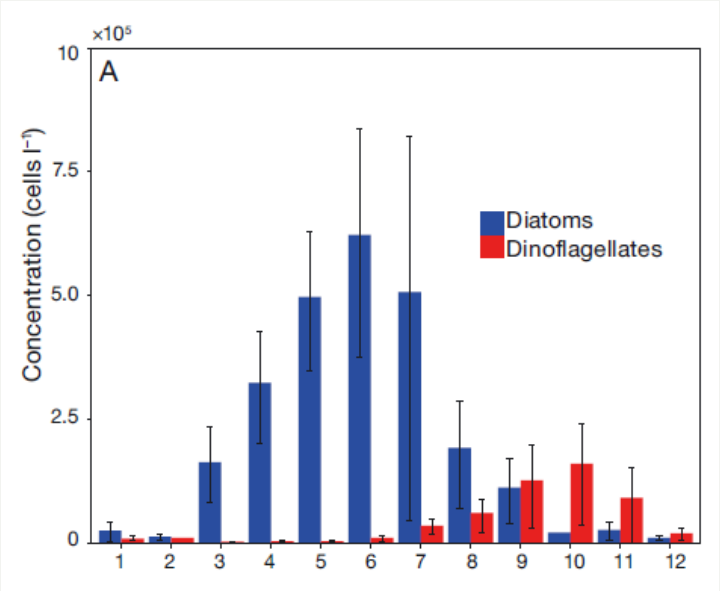
Protoperidinium

Dinophysis

Seasonal Changes

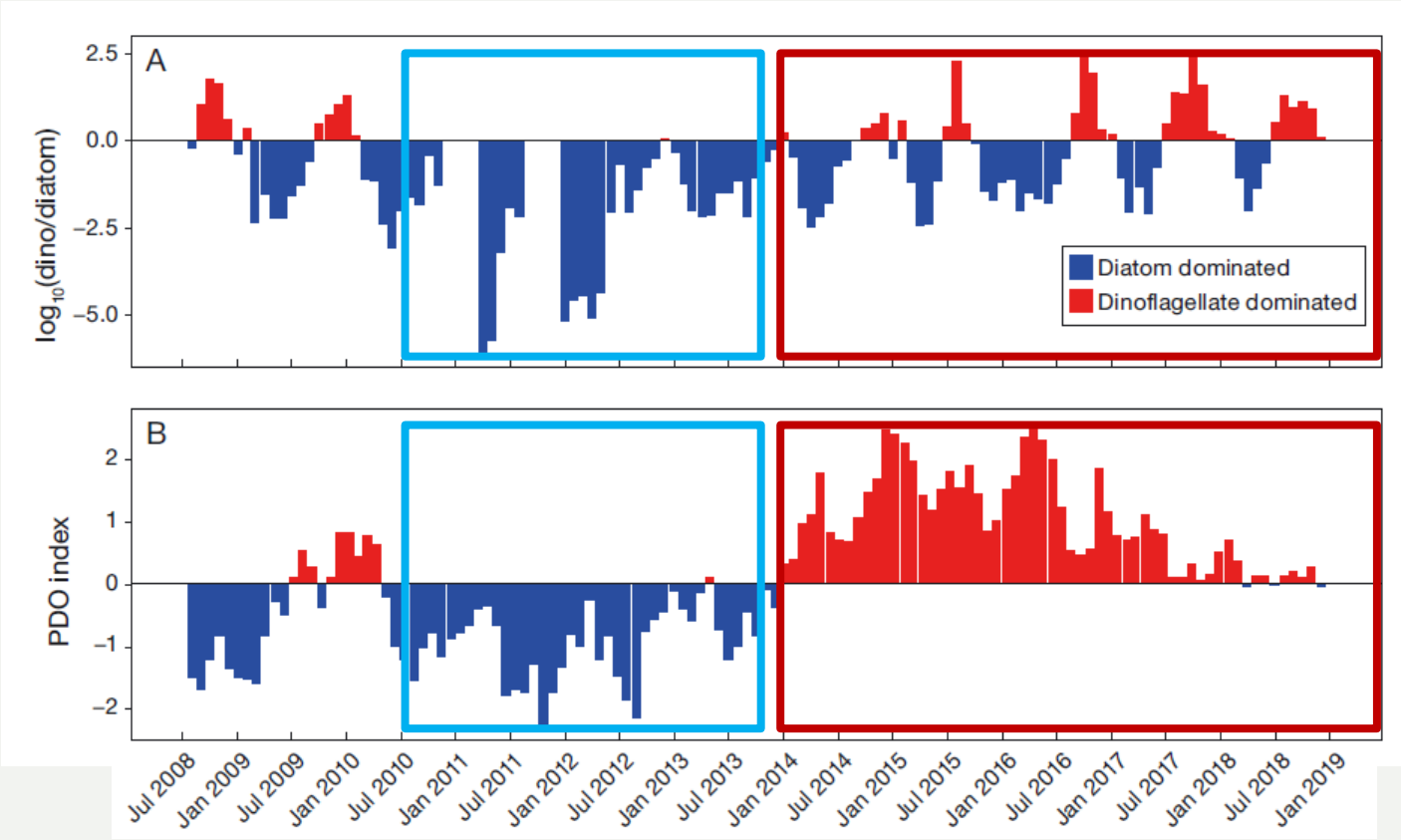
- Strong correlation with upwelling cycles
- Wind stress
- Stratification
- Nutrient availability





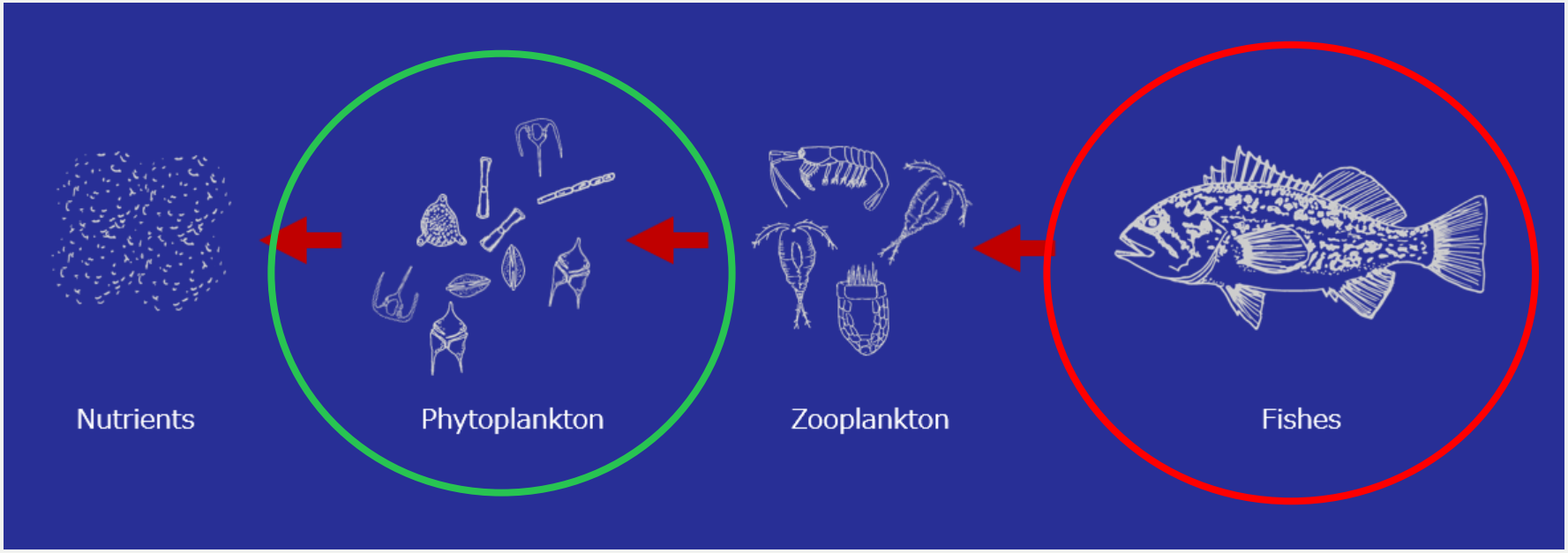
Barth et al (2020)

Response to Changes in Ocean Climate

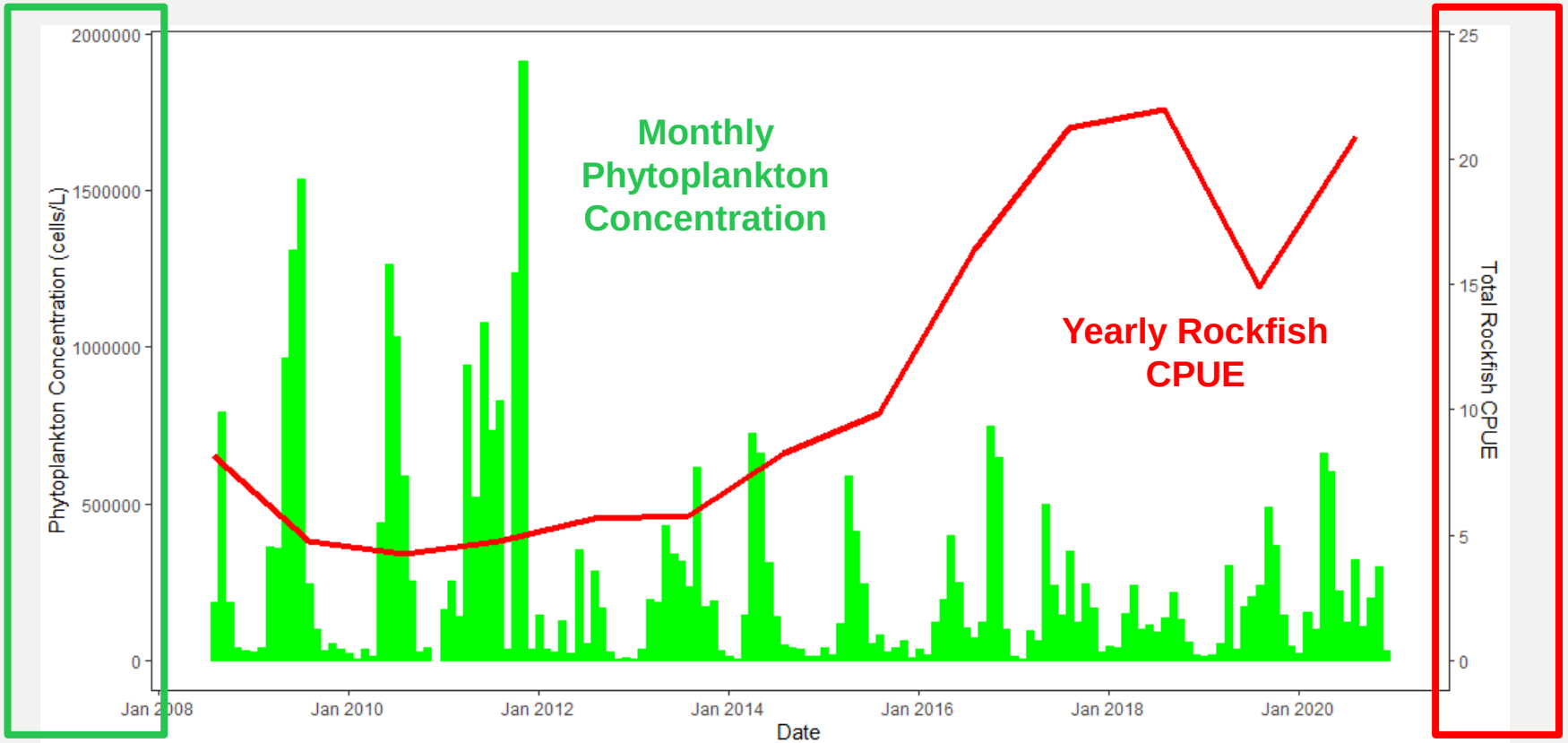


Barth et al (2020)

Food Web Interactions

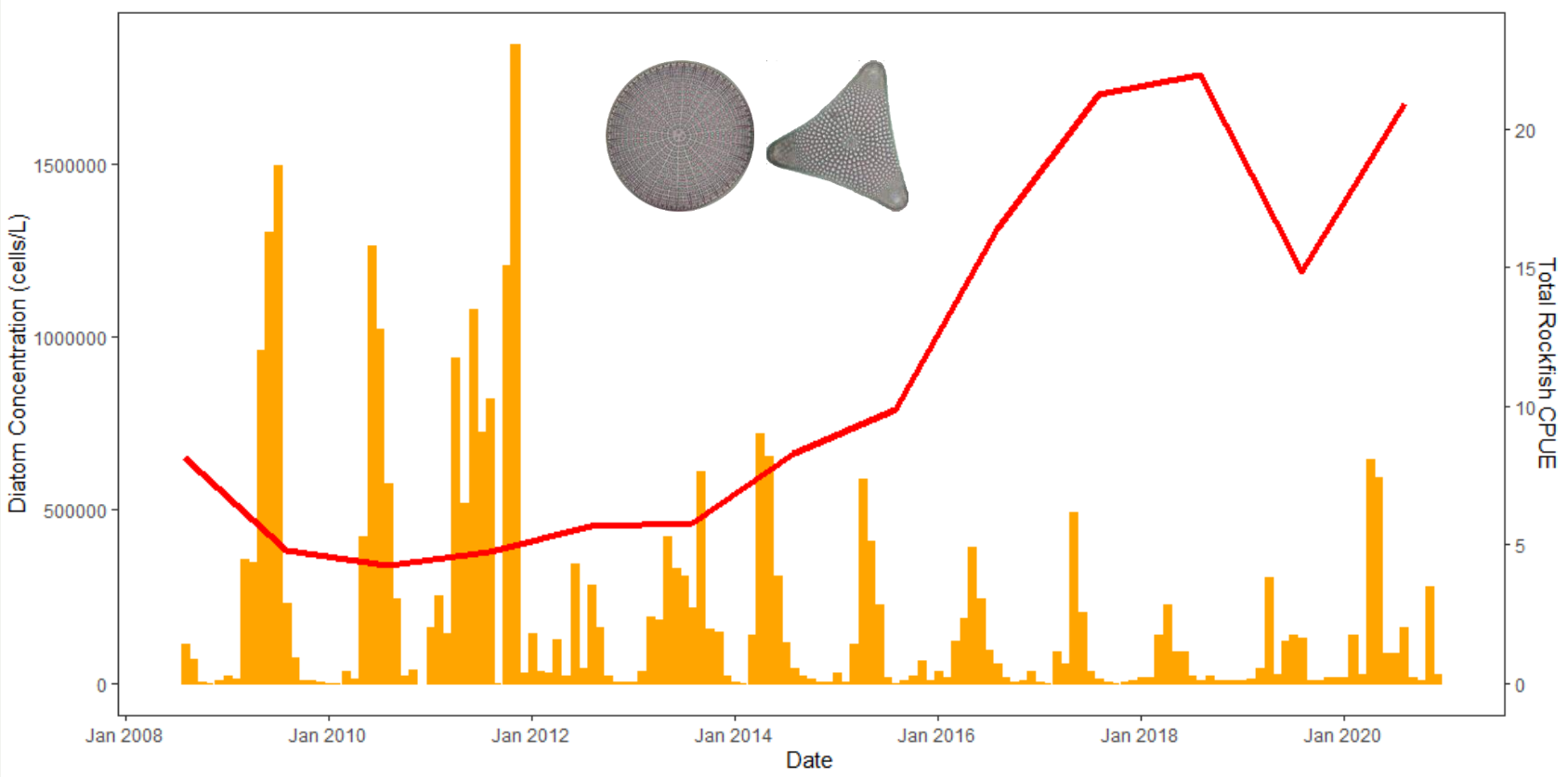


Phytoplankton and Rockfish Abundance*



*preliminary trends

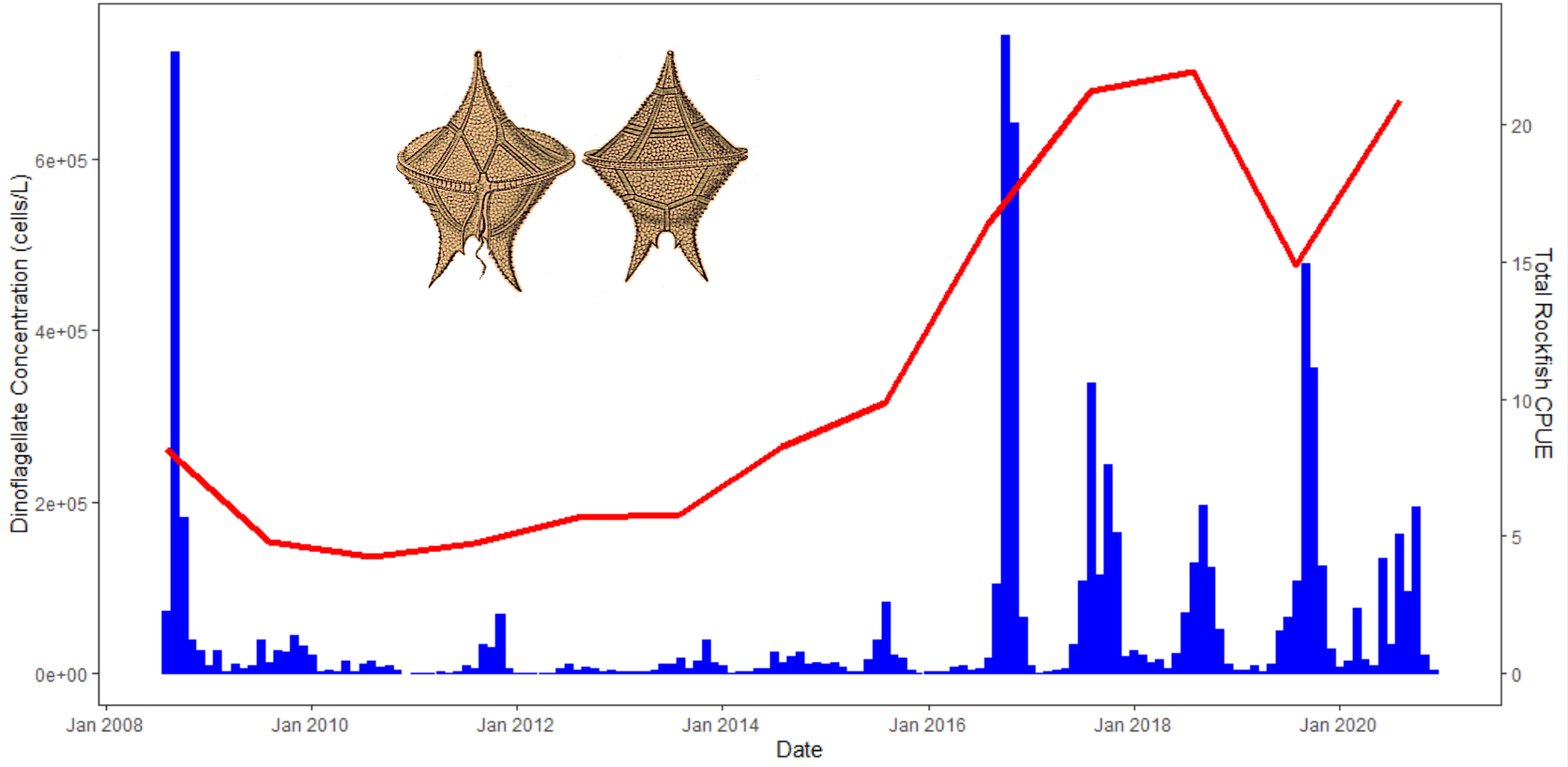
Diatoms and Rockfish Abundance*



*preliminary trends

https://commons.wikimedia.org/wiki/File:Diatom_2.png & Diatom_3.png

Dinoflagellates and Rockfish Abundance*

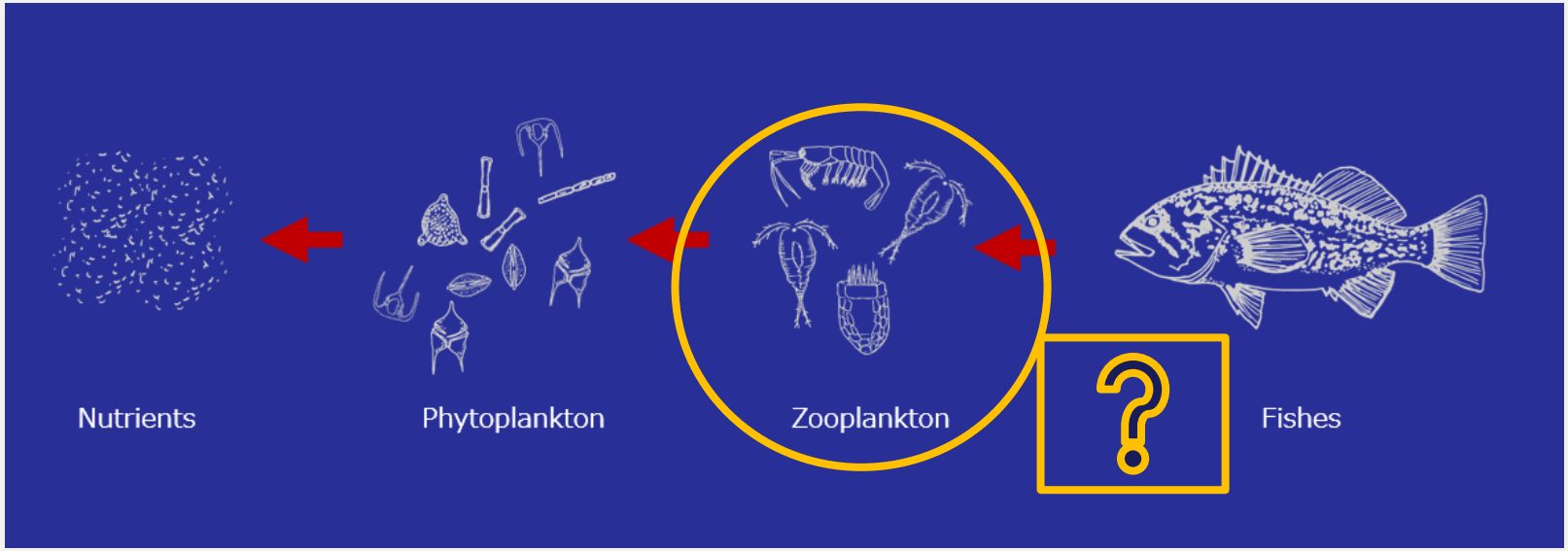


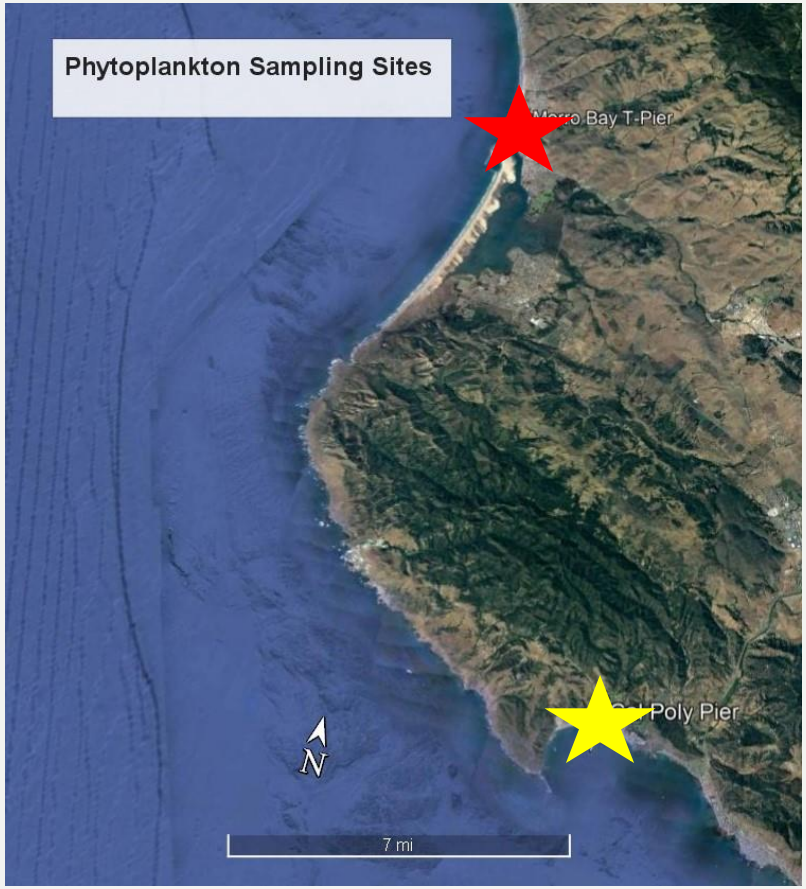
*preliminary trends

https://alchetron.com/Dinoflagellate

Main Takeaways

- Similar trends – needs further analysis
- Ocean climate?
- Food availability?
- Other factors or combination of factors?





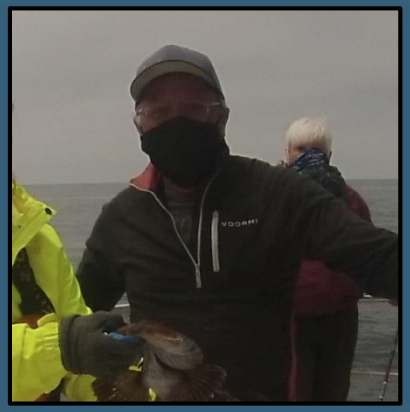
Future Analyses

- Sampling in Morro bay since September 2020
- Short term goal: Compare phytoplankton community composition
- Long term goal: Food web interactions

Photo: www.treehugger.com/conservation-4846077

Most Caught Fishes July 2020

July 27, Piedras Blancas
MPA:
Phil E. 30 fishes



July 28, Piedras Blancas
Reference Area:
Roger Y. 93 fishes

July 13, Piedras Blancas
Reference Area:
Tim D. 74 fishes

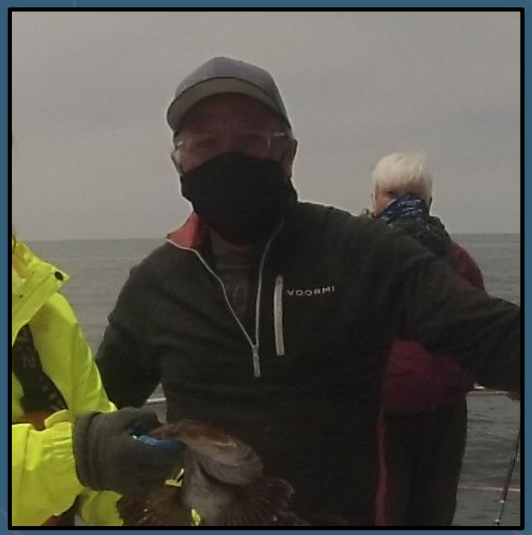
July 14, Piedras Blancas
MPA:
Jim W. 86 fishes

July 20, Point Buchon
Reference Area:
Eddie G. 30 fishes

Most Caught Fishes August 2020

August 25, Point Buchon Reference Area:
Tim D. 28 fishes

August 24, Point Buchon MPA:
Eddie G. 71 fishes



August 31, Piedras Blancas Reference Area:
Roger Y. 79 fishes

Most Caught Fishes September 2020

September 13, Piedras Blancas MPA:
Mike B. 92 fishes

September 8, Point Buchon Reference Area:
Duane G. 29 fishes

September 9, Point Buchon MPA:
Duane G. 29 fishes

Most Caught Fishes Overall 2020

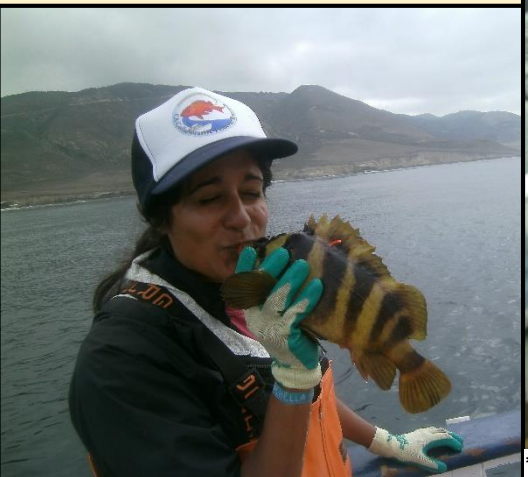
July 21, Point Buchon
MPA:
Bill M. 103 fishes

July 21, Point Buchon
MPA:
Roger Y. 103 fishes

Treefish!

(*Sebastes serriceps*)

From 2007-2020, our anglers have caught a total of 176 treefish…



*The images on this slide are from pre-2020, hence the lack of social distancing protocols.

…On September 8, at Point Buchon Reference Area, we caught 11 Treefish. This represents 6.25% of total Treefish caught!

Bill M.
2 Treefish

Duane G.
3 Treefish

Paul H.
2 Treefish

Ray L.
3 Treefish

Tim D.
1 Treefish

Top 4 Treefish Days:

1. September 8, 2020; Point Buchon Reference Area: 11 Treefish
2. July 28, 2008; Point Buchon MPA: 8 Treefish
3. October 24, 2007; Point Buchon MPA: 6 Treefish
4. September 9, 2020; Point Buchon MPA: 5 Treefish

Using the Hormone IGF1 to Explore Variation in Growth Rates of Blue Rockfish

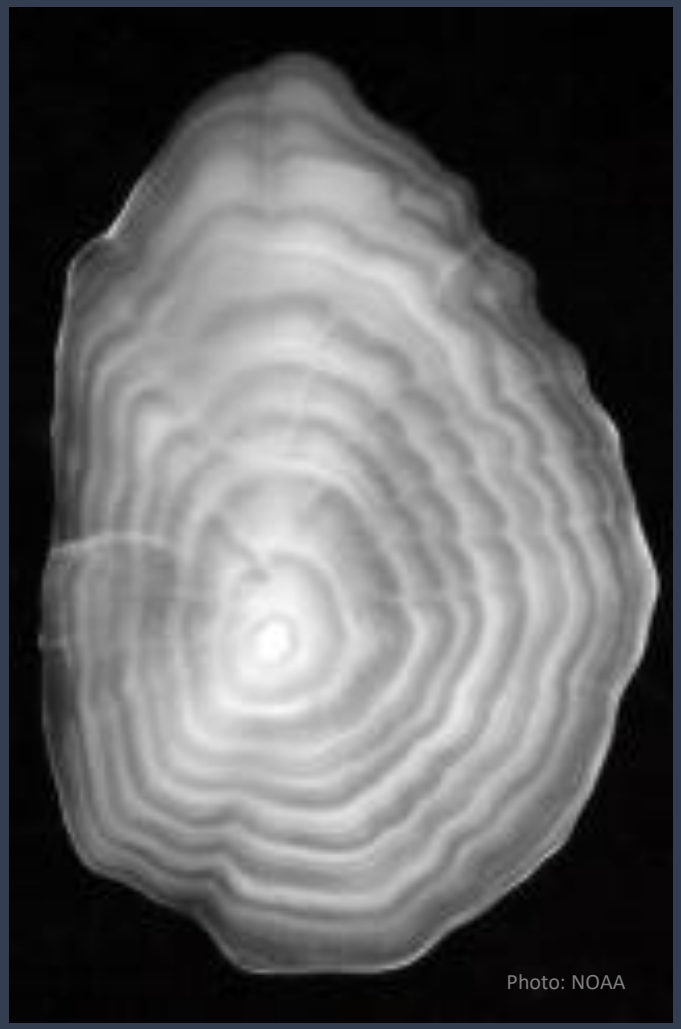
Ellie Brauer
ebrauer@calpoly.edu

Why Is Growth Rate Important?

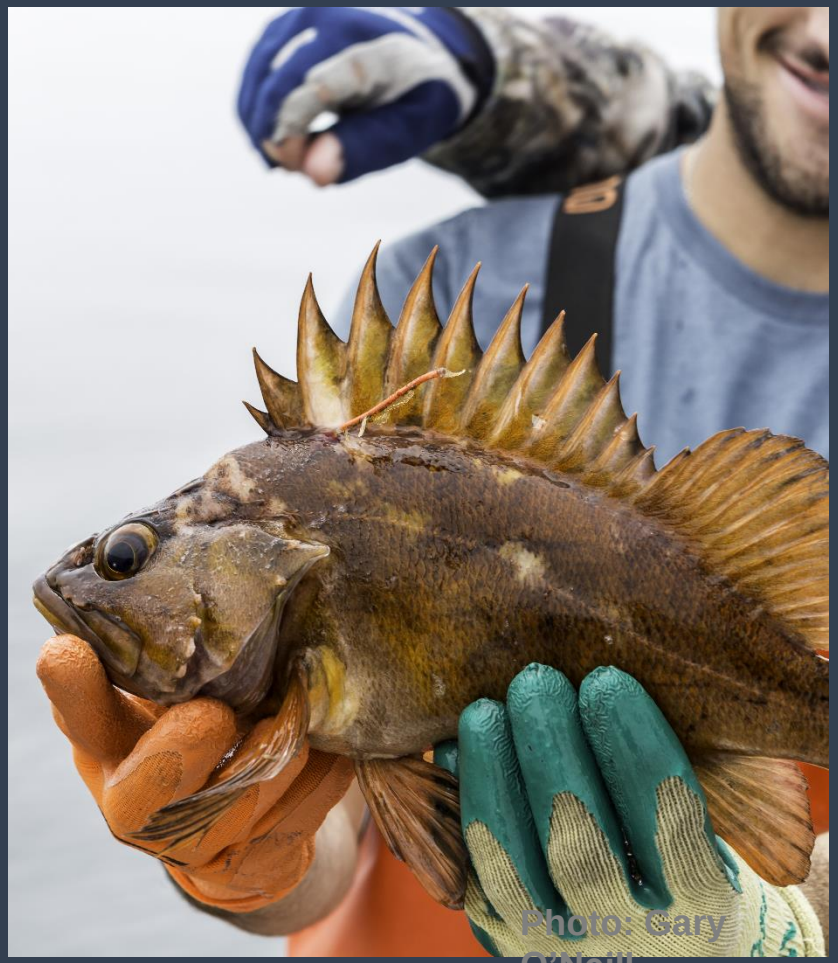
- Growth affects individuals'
  - Reproductive success
  - Recruitment success
  - Biomass
- Variation in growth rate of individual fish impacts the entire population

How do we measure growth rate in fish?

Otoliths (ear bone)



Mark Recapture

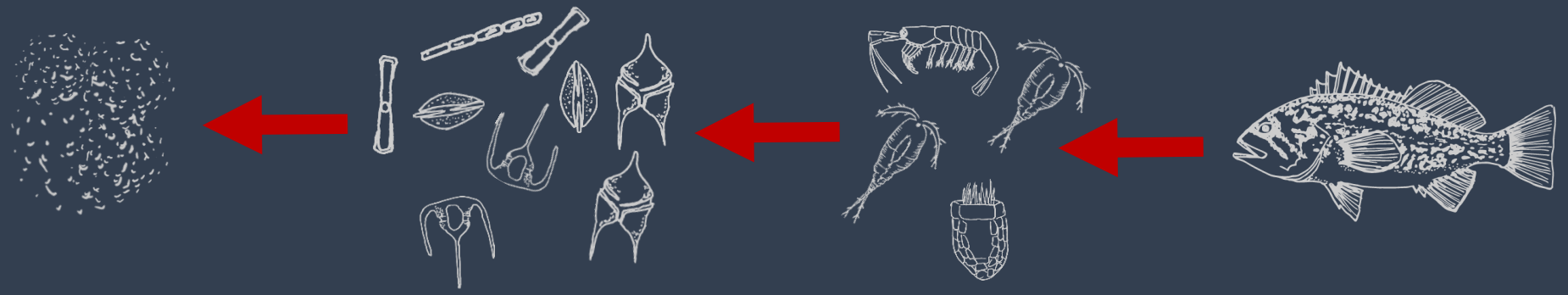


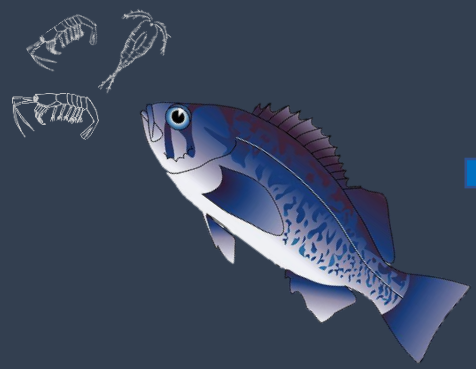
What Can Hormones do for us?

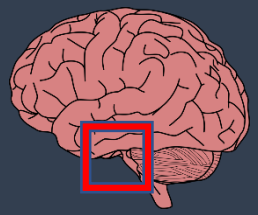
Photo: Gary O'Neill

- Hormones can serve as biomarkers (indicators) for growth rate in fish
- Non-lethal, fast, and relatively inexpensive
- Insulin-like growth factor I (IGF1) is a reliable biomarker for growth in many fish species

IGF1 Production







Brain

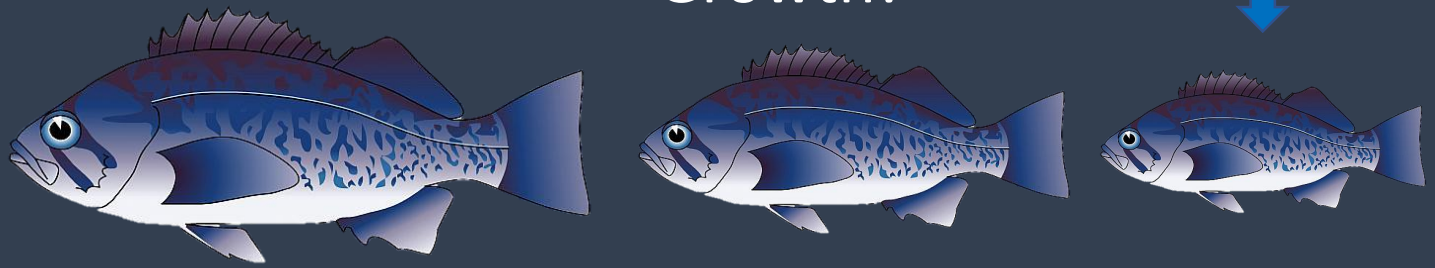
Pituitary Gland

Growth Hormone

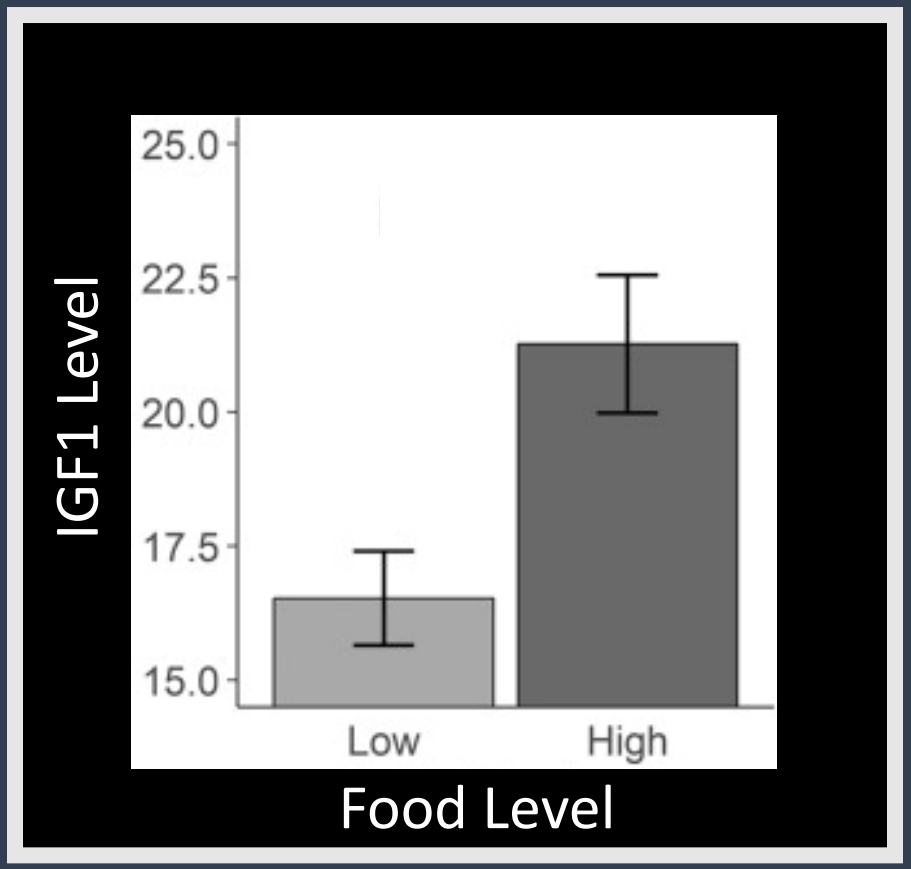
Liver

IGF1

Growth!



IGF1 in rockfish



* The images on this slide were taken prior to 2020

Project Goals: IGF1 in the wild

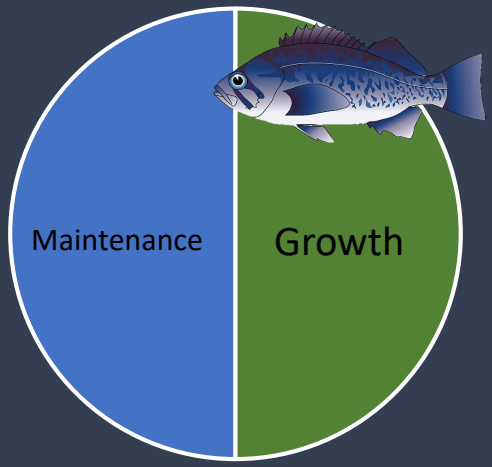
- Identify locations where fish are growing relatively fast
- Assess changes in growth rates over time
- Explore the effect that marine protected areas have on growth rate

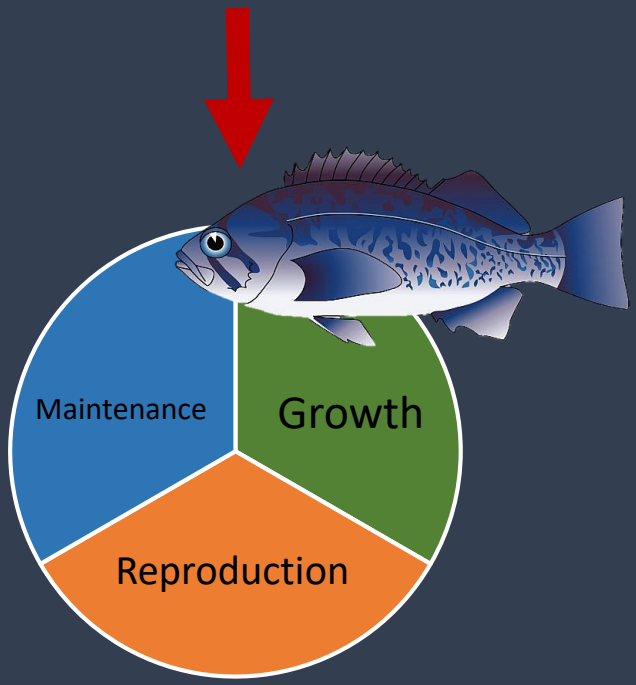
Methods

- Collected ~ 2,000 blood samples from juvenile Blue Rockfish from 2016 through 2018
- Obtained levels of the hormone IGF1 in a laboratory using fluorescence

* The images on this slide were taken prior to 2020

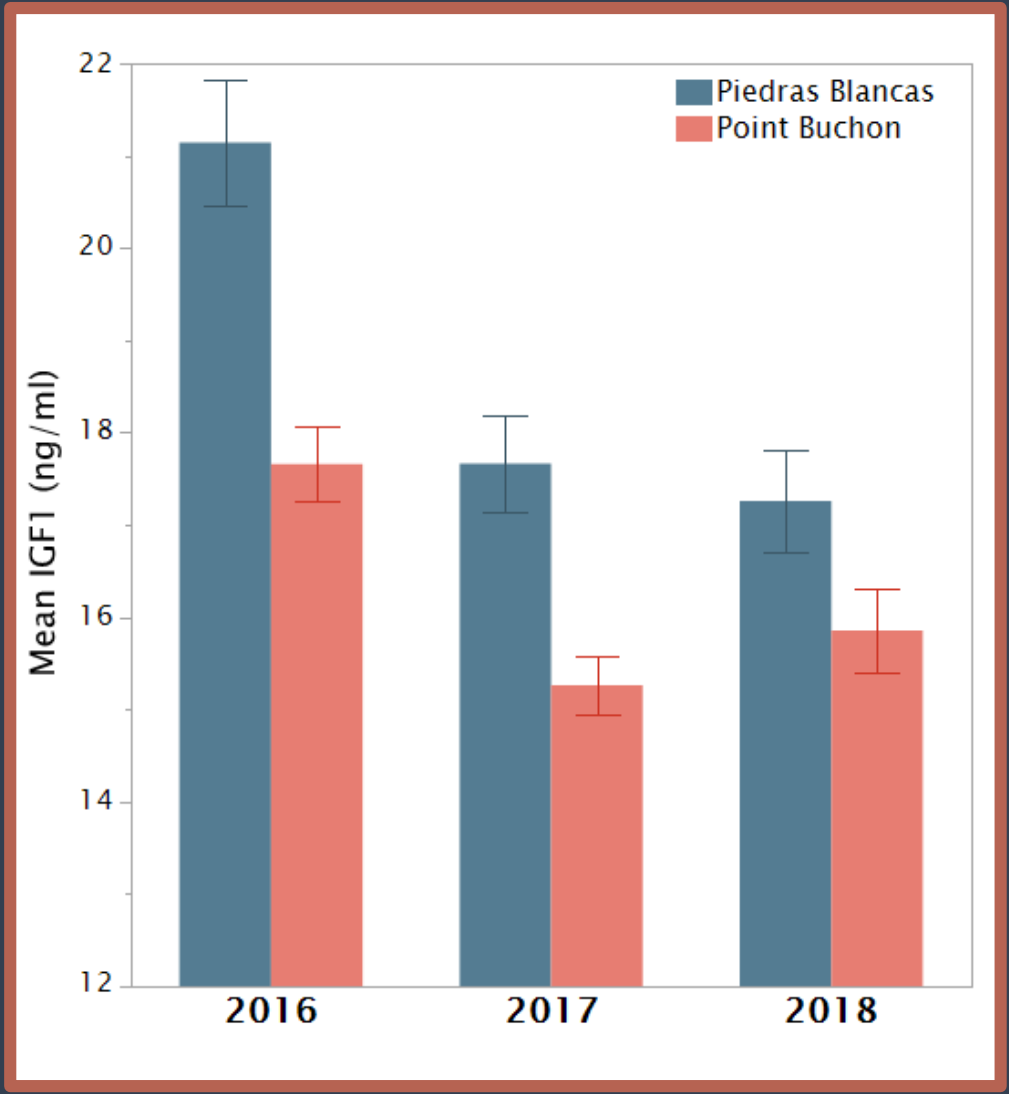
Methods

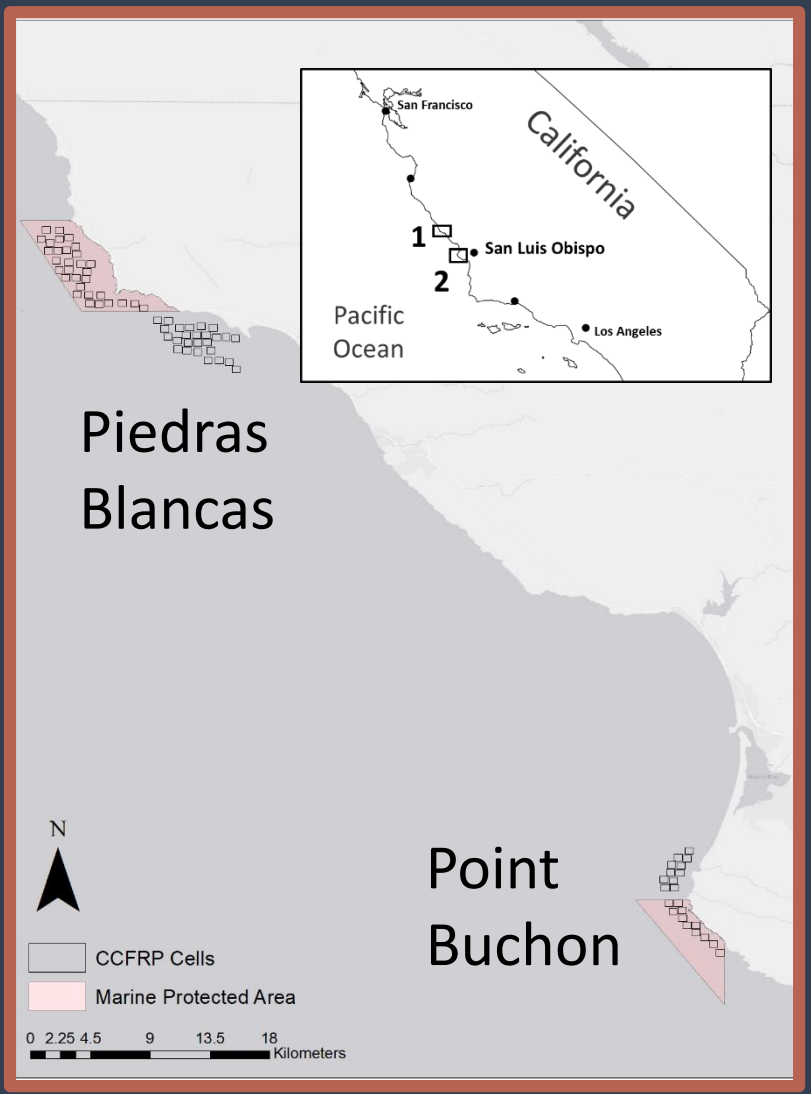




- Explored the differences in IGF1 levels for **juvenile** Blue Rockfish between:
  - ➢ Point Buchon and Piedras Blancas
  - ➢ marine protected areas and reference areas

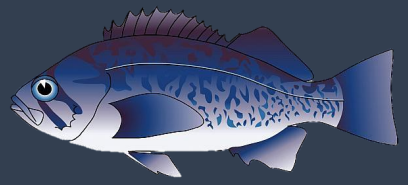
Point Buchon vs. Piedras Blancas



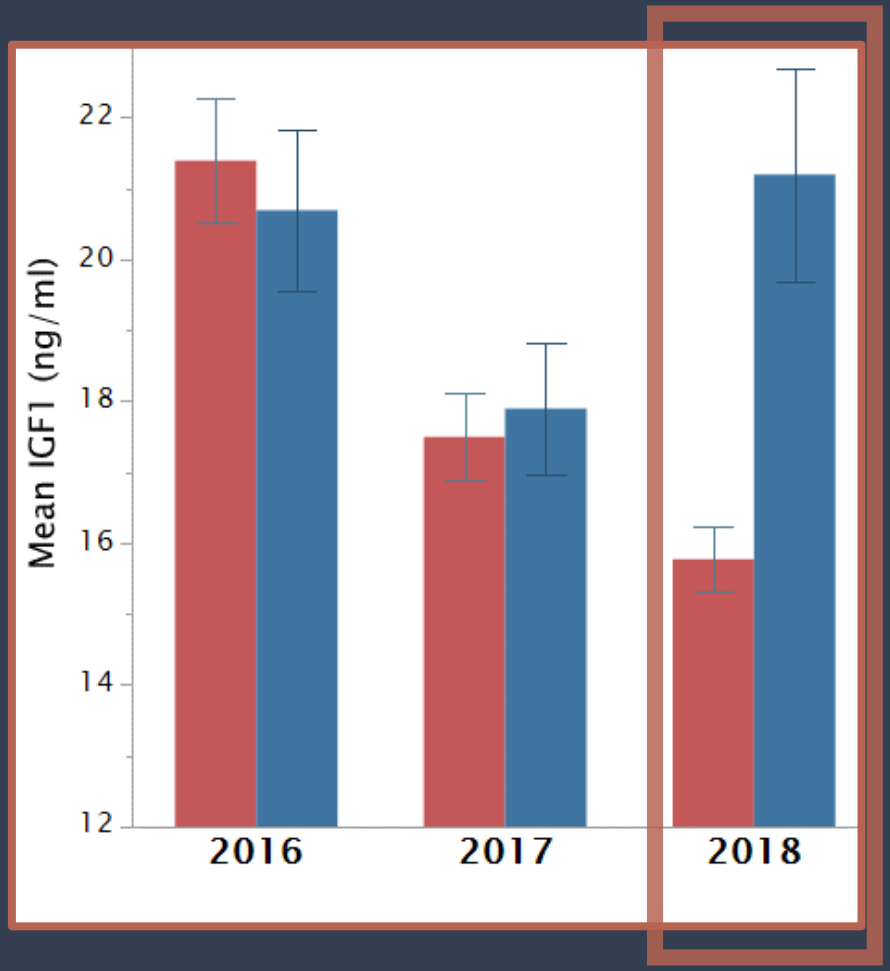


Piedras Blancas had higher levels of IGF1 for all three years sampled

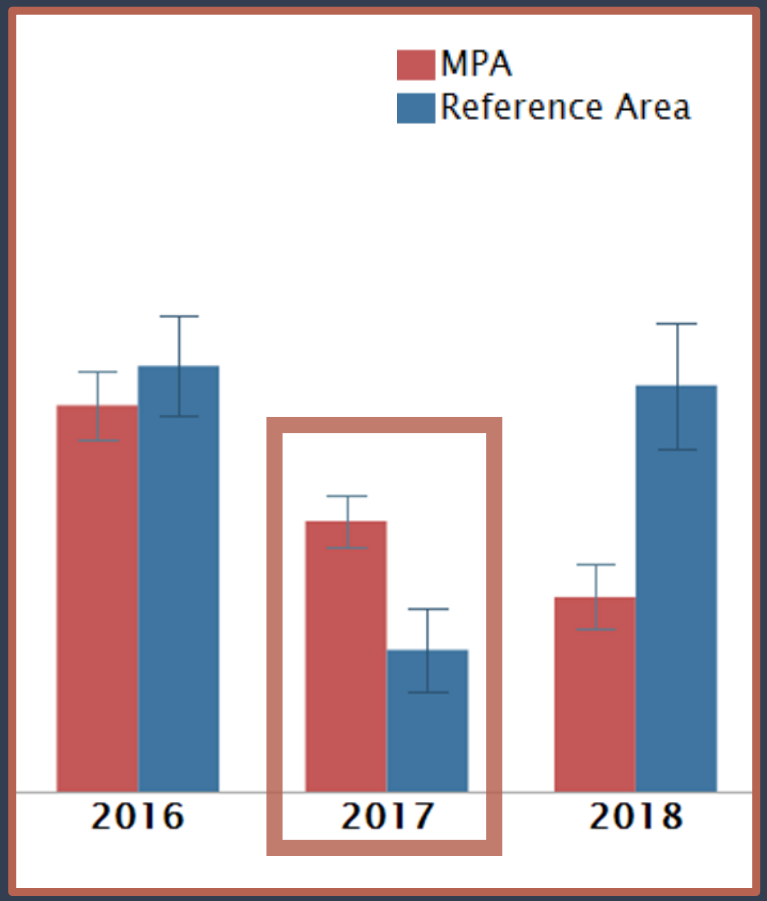
Marine Protected Areas



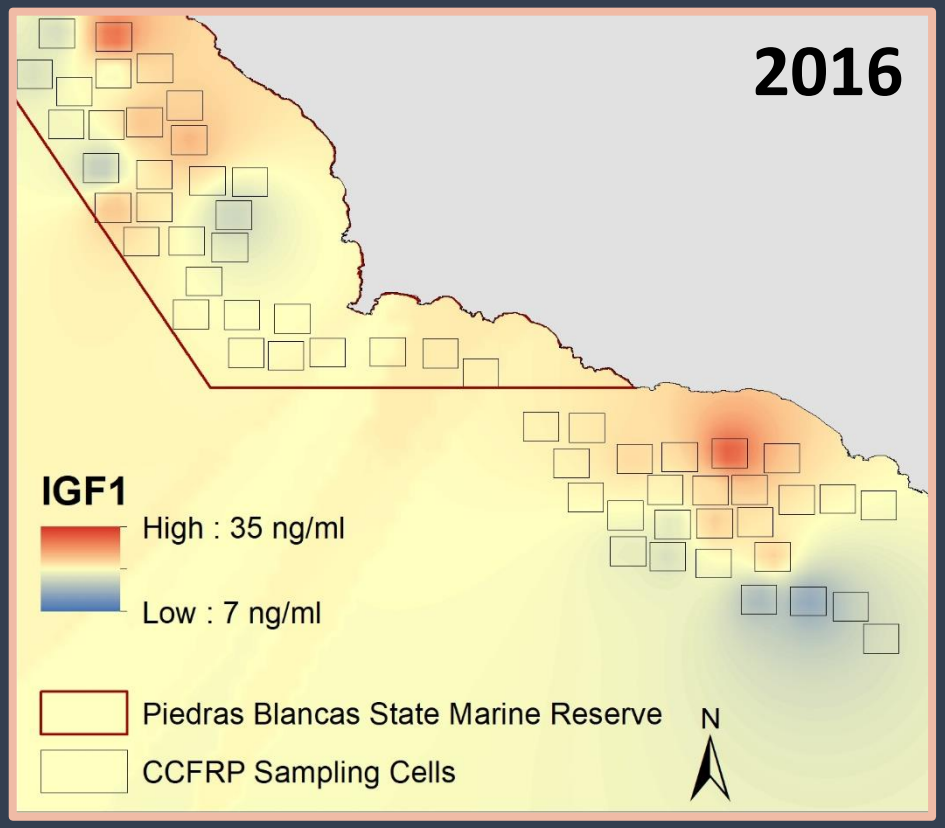
Piedras Blancas

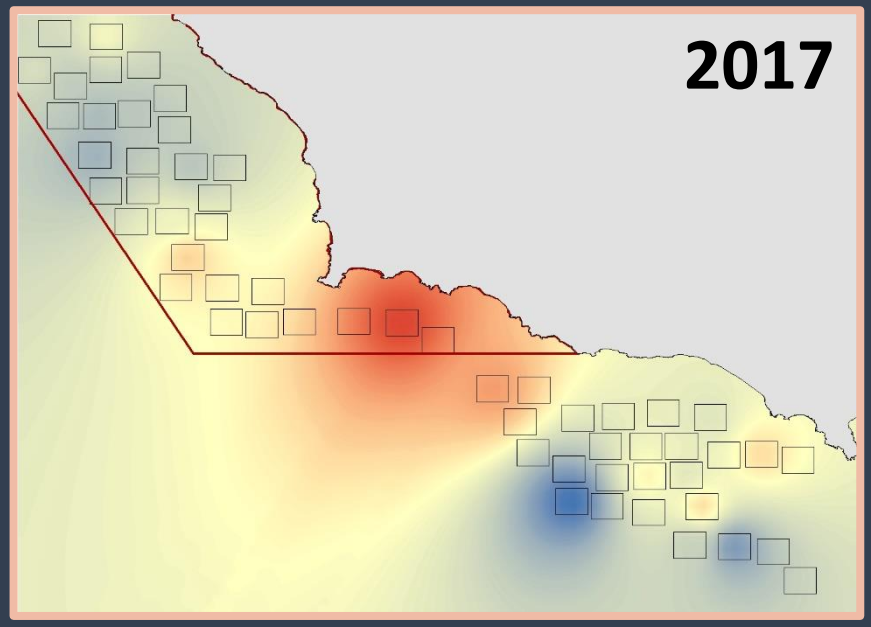


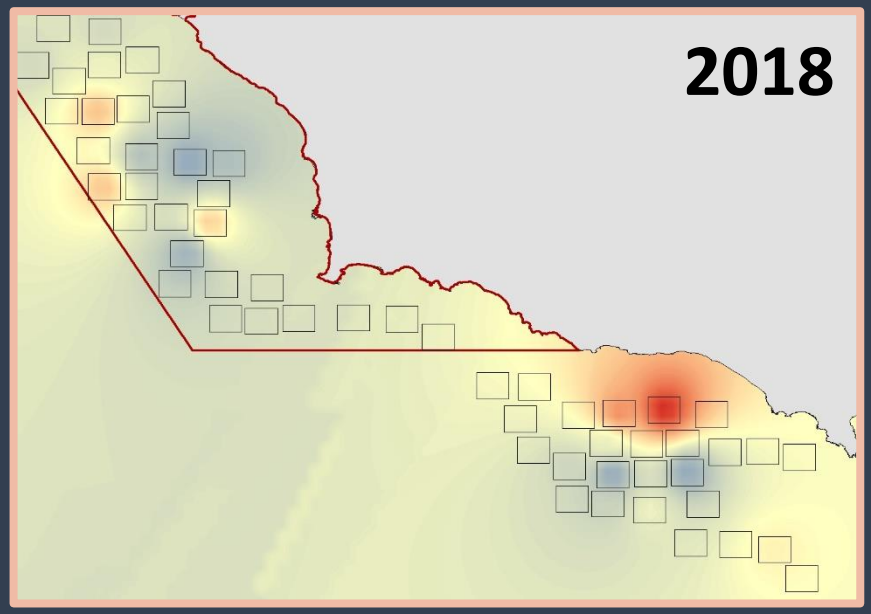
Point Buchon

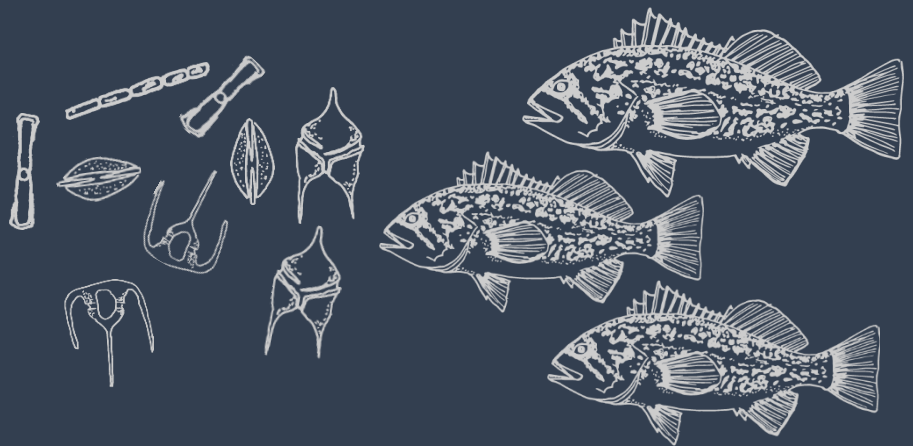


Cell to Cell Variation



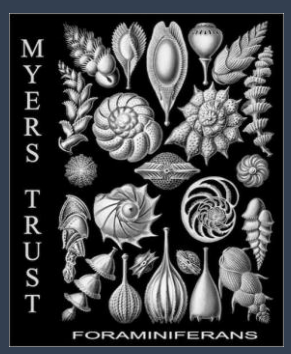






Acknowledgements

- CCFRP Volunteer Anglers!
- Sean Lema Lab, Including Theresa Bersin and Nicole Hack
- Brian Beckman and Meredith Journey
- Virg's Landing, Patriot Sportfishing, and Morro Bay landing, and especially to the captains and crews of *F/V Patriot, F/V Avenger, F/V Fiesta, F/V Rita G, F/V Phenix, F/V Flying Fish, and F/V Endeavor*.
- All DEW Lab Members, Current and Former
- Funding: California Sea Grant, AFS Cal-Neva Small Grants Program, NOAA Northwest Fisheries Science Center Internal Grants Program, William and Linda Frost Fund in the Cal Poly College of Science and Mathematics, Dr. Earl H. Myers & Ethel M. Myers Oceanographic & Marine Biology Trust



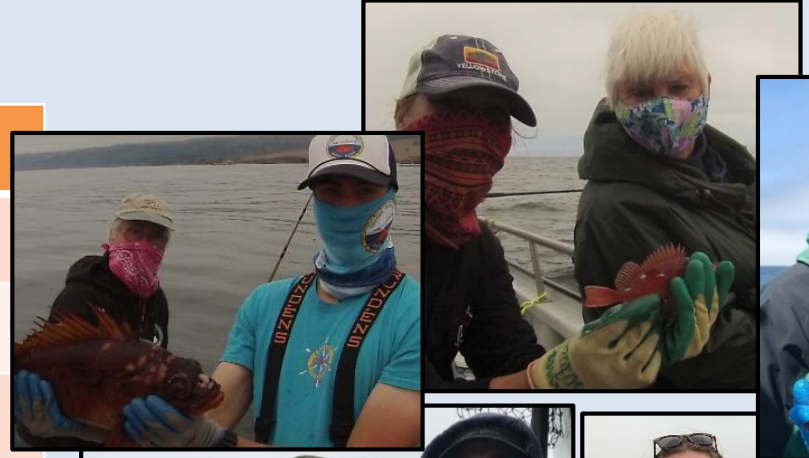
Questions?

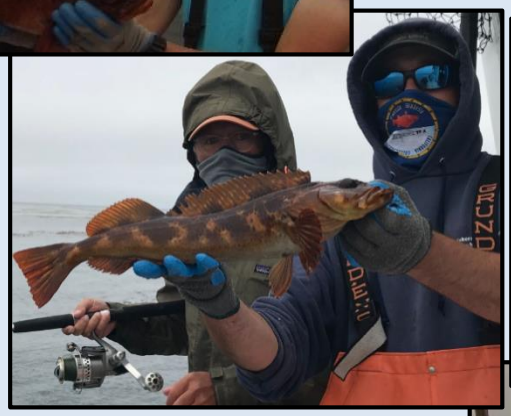
CPUE Top 10, All Time

	Angler Name	CPUE
1	Carley B.	98.00
2	Eli C.	95.00
3	Elizabeth H.	88.00
4	Ed E.	87.00
5	John S.	82.00
6	Dan F.	79.00
7	Andrew M.	78.00
8	Holly L.	77.00
9	Steven J.	77.00
10	Phil E.	71.23

CPUE Top 10, 2020

	Angler Name	CPUE
1	Jeff B.	76.67
2	Mike B.	72.50
3	Roger Y.	72.40
4	Jim W.	71.00
5	Zach K.	63.00
6	Jay C.	61.00
7	Marcy D.	59.00
8	Bill M.	53.40
9	Maddie H.	48.00
10	Eddie G.	42.25









The Effect of Marine Protected Areas on the Fine-Scale Depth Segregation of two Rockfish (*Sebastes*) Species

Callie Perdue
csperdue@calpoly.edu

Sebastes chrysomelas

Black and Yellow rockfish

Sebastes carnatus

Gopher rockfish

- Similar body morphology besides differences in coloration
- Demersal fishes that inhabit rocky reefs from Southern Oregon to Baja
- Feed of the same prey and both occupy intermediate trophic levels

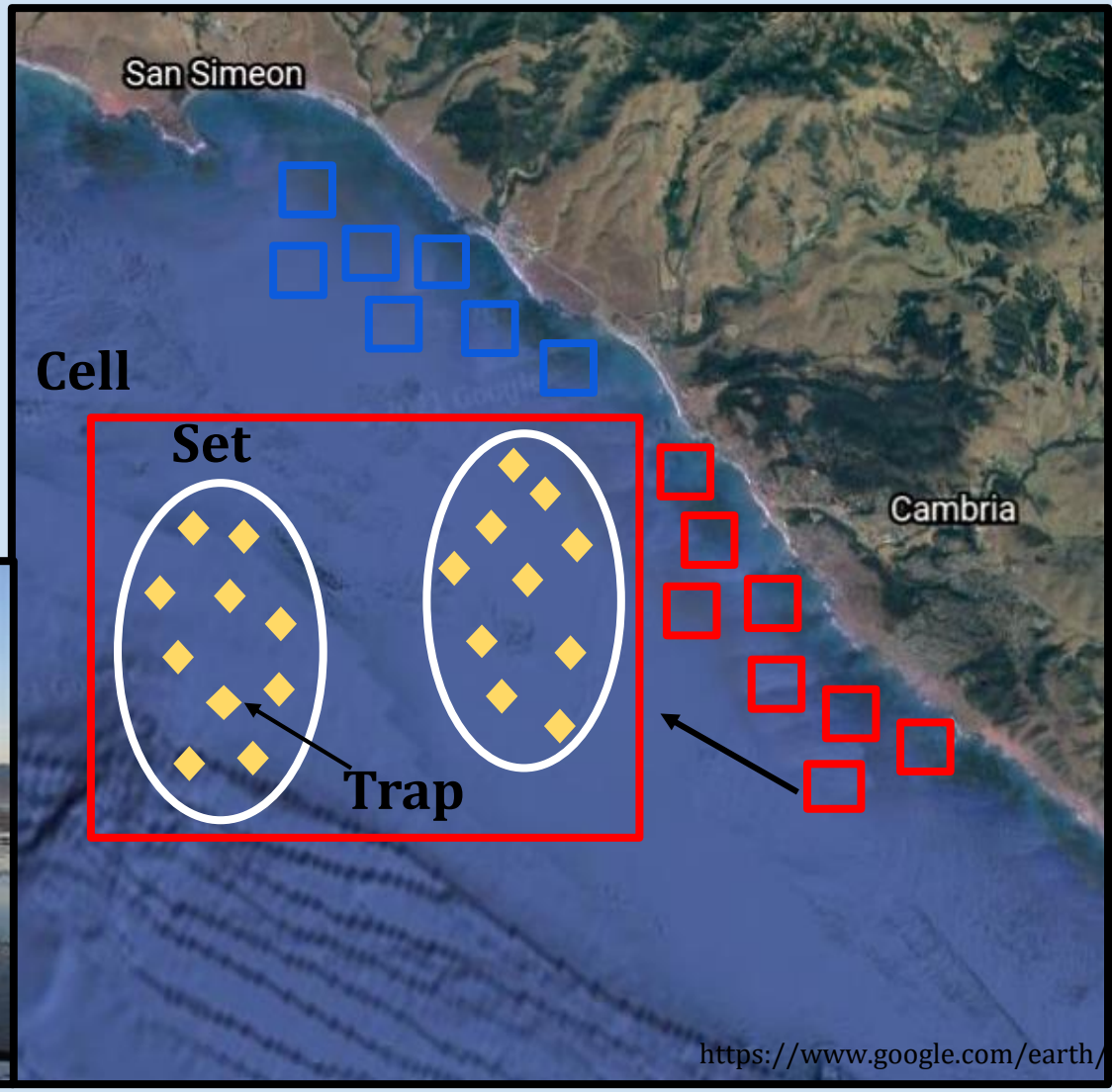
https://marinespecies.wildlife.ca.gov/

Removal Experiment (Black and Yellows) Larson 1980

Social Dominance Experiment
Larson 1980

CCFRP Trapping Dataset

- Data collected in 2008 and 2015
- Sampled at discrete depths of 10 ft - 80 ft



Questions

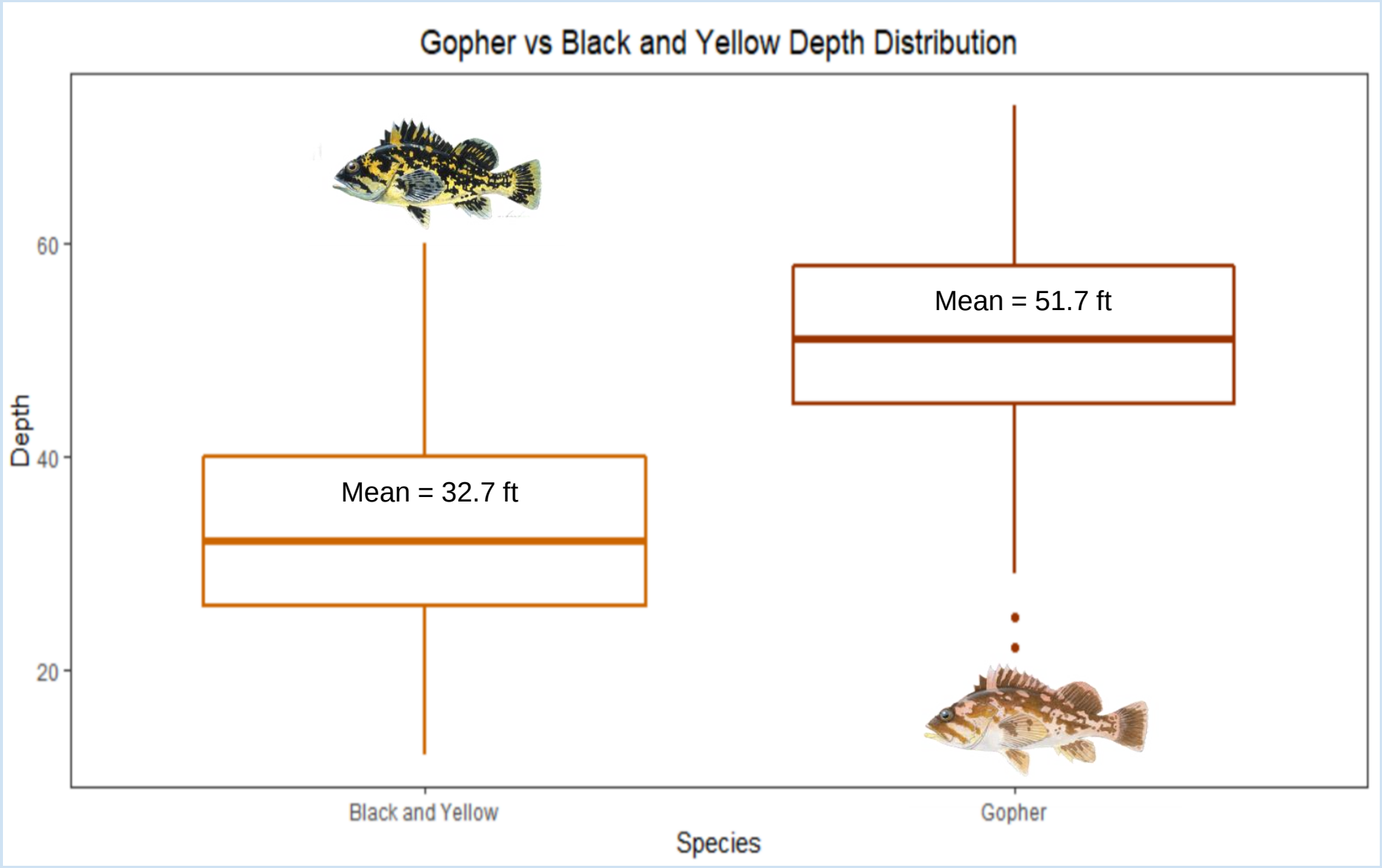
1. Is there a change in abundance of *S. carnatus* and *S. chrysomelas* within MPAs compared to areas open to fishing?

2. Do *S. chrysomelas* and *S. carnatus* occupy different depths throughout our study area?

3. Is the mean depth each species is found at different between MPAs and reference sites?

4. Is there a change in the depth range that each species occupies between MPA and reference sites?

https://sanctuaries.noaa.gov/


Gopher vs Black and Yellow Depth Distribution
Depth
60
40
20
Mean = 32.7 ft
Mean = 51.7 ft
Black and Yellow
Gopher
Species

Acknowledgements

Advisors:
Dean Wendt, Ben Ruttenberg, Grant Waltz, Erin Johnston, Ellie Brauer, and all members of the DEW Lab

Captains:
Tom Hafer, Pete Griffin, Joe Loiseau, Roger Cullen

Vessels:
Kathryn H, Fog Dog, and Dorado

Field and Lab Crew:
Connor Healy, Megan Wilson, Carly Banks, Courtney Hart, Parker Kalan, Matt Mckechnie, and Hali Morgenroth

MBCQF

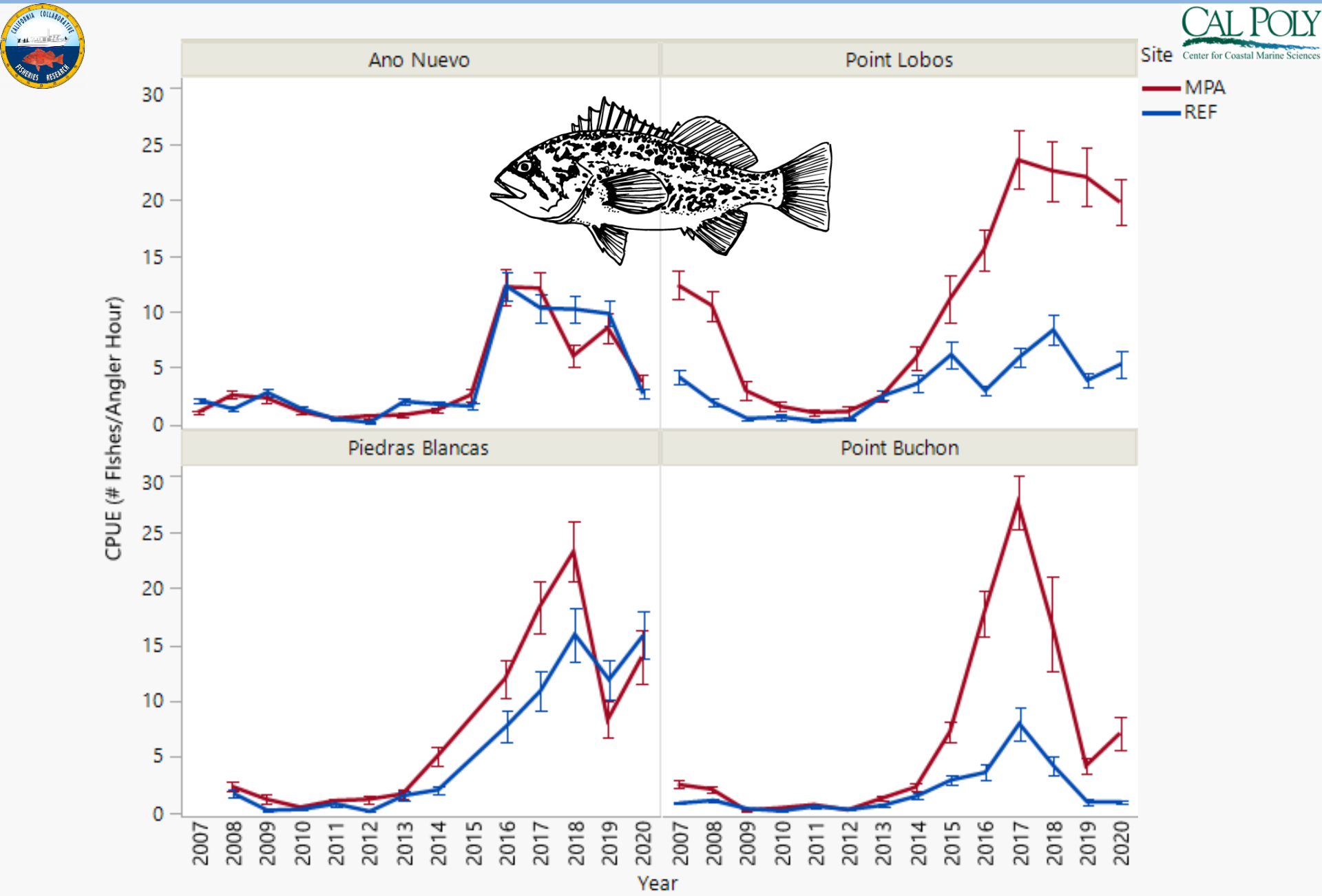
CA Collaborative Fisheries Research

CAL POLY
Center for Coastal Marine Sciences

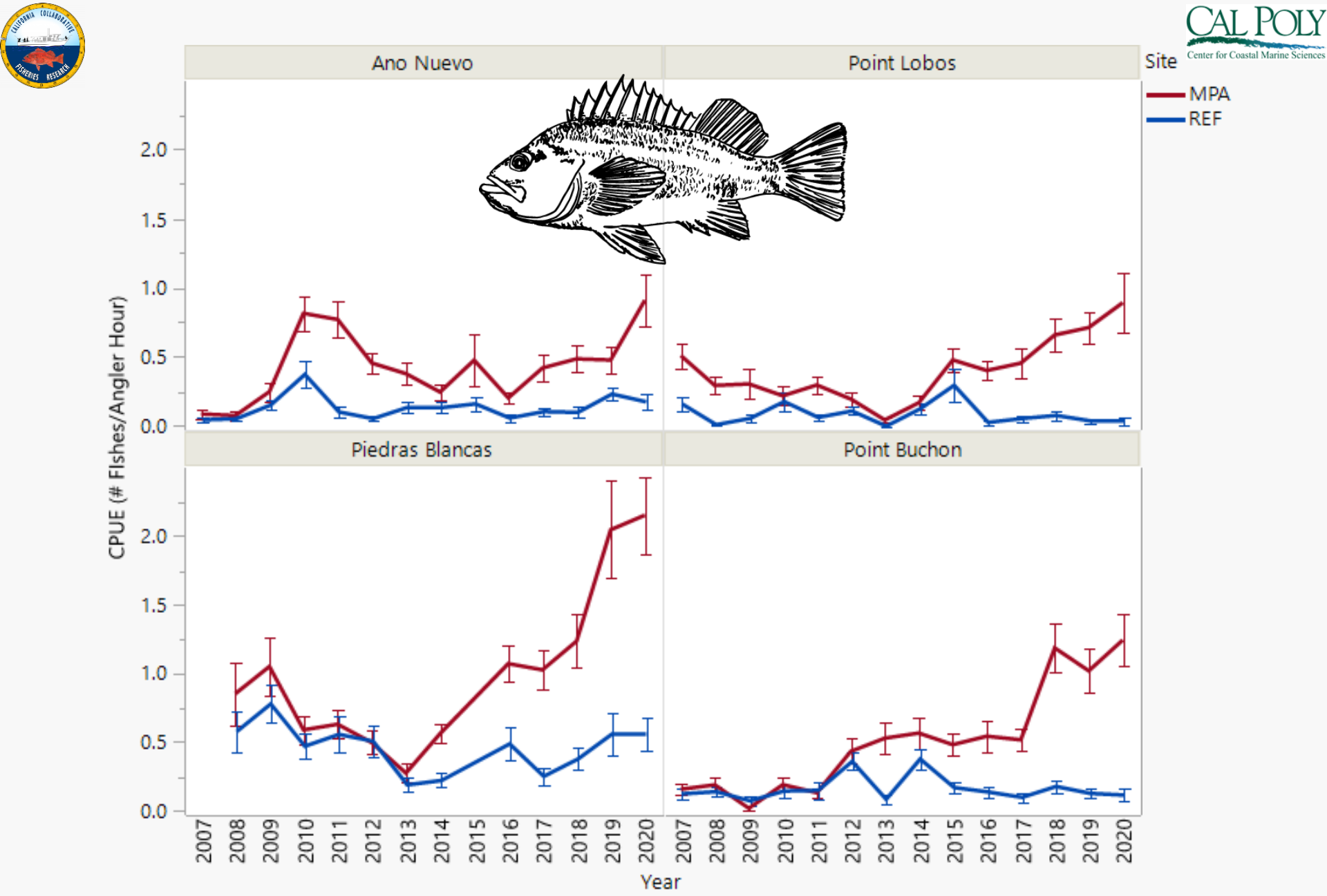
PG&E

Sea Grant
California

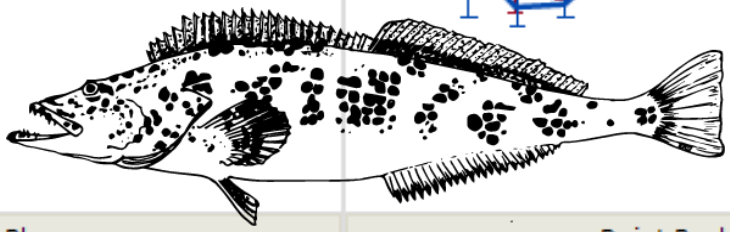
CPUE (# Fishes/Angler Hour) by Area & Site: Blues



CPUE (# Fishes/Angler Hour) by Area & Site: Vermilion



Length (cm) by Area & Site: Lingcod

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