DSCRTP Webinar Series

Warm-water anomalies in the mesophotic depth range of the Southern California Bight with implications for gorgonian octocorals

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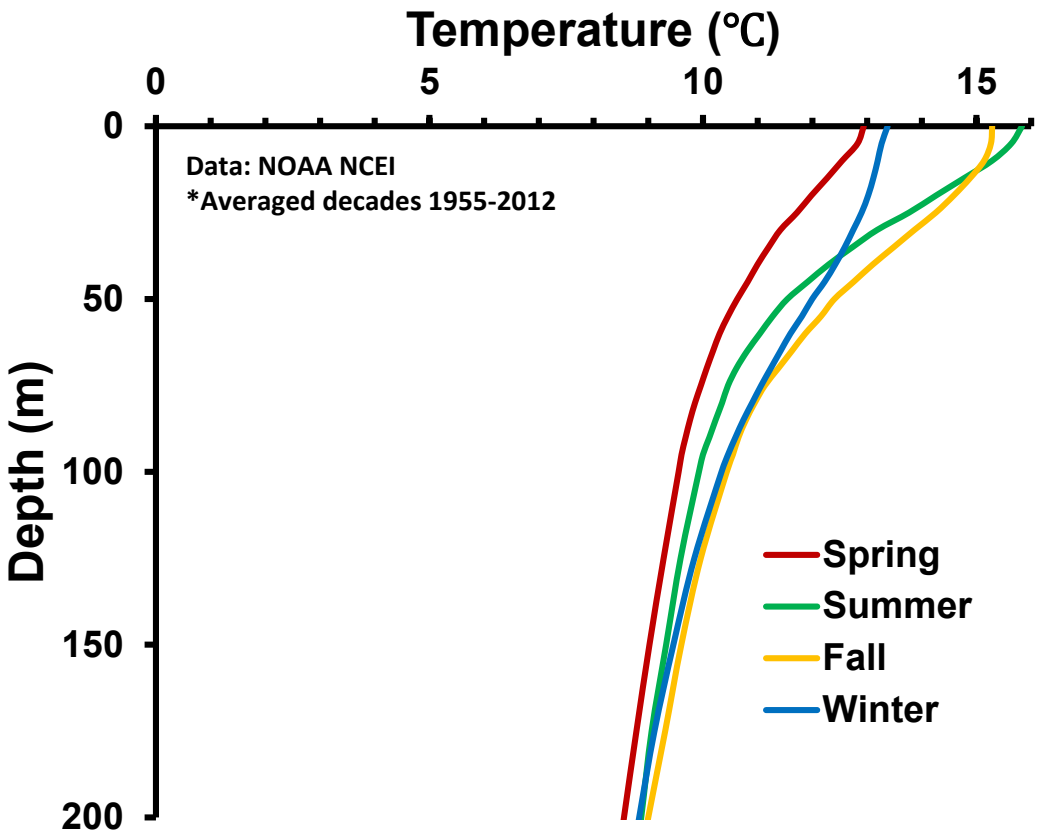
Southern California Bight



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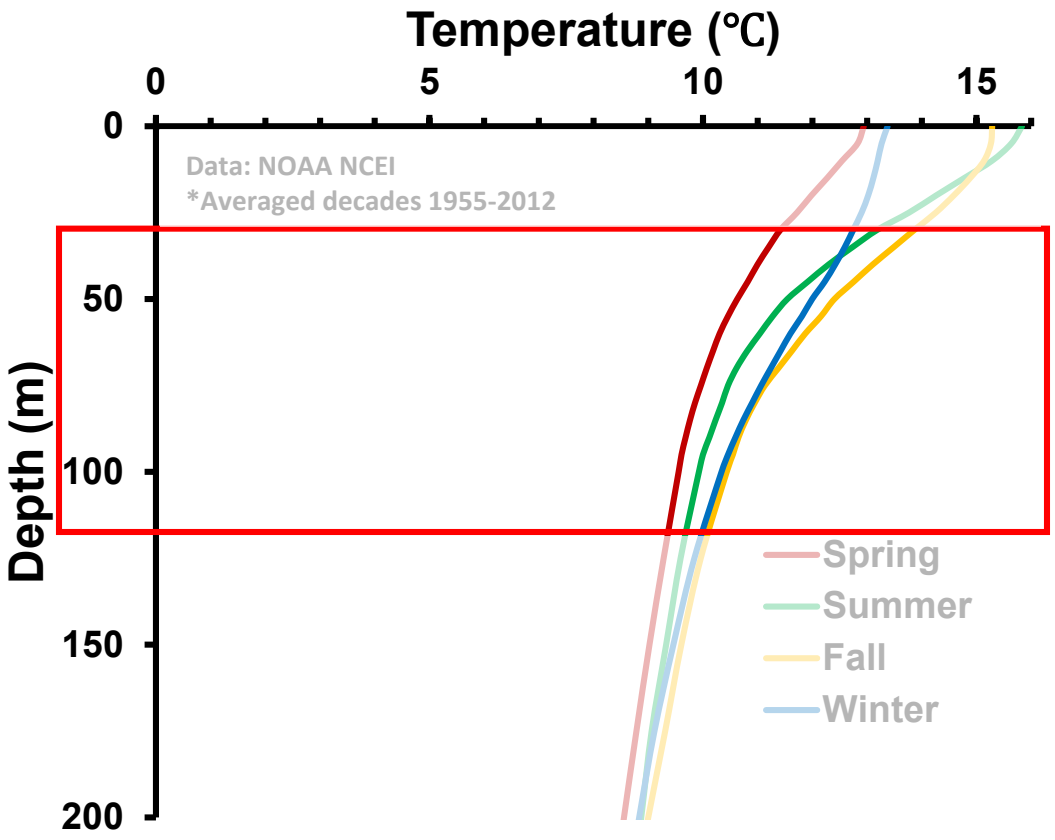


Southern California Bight

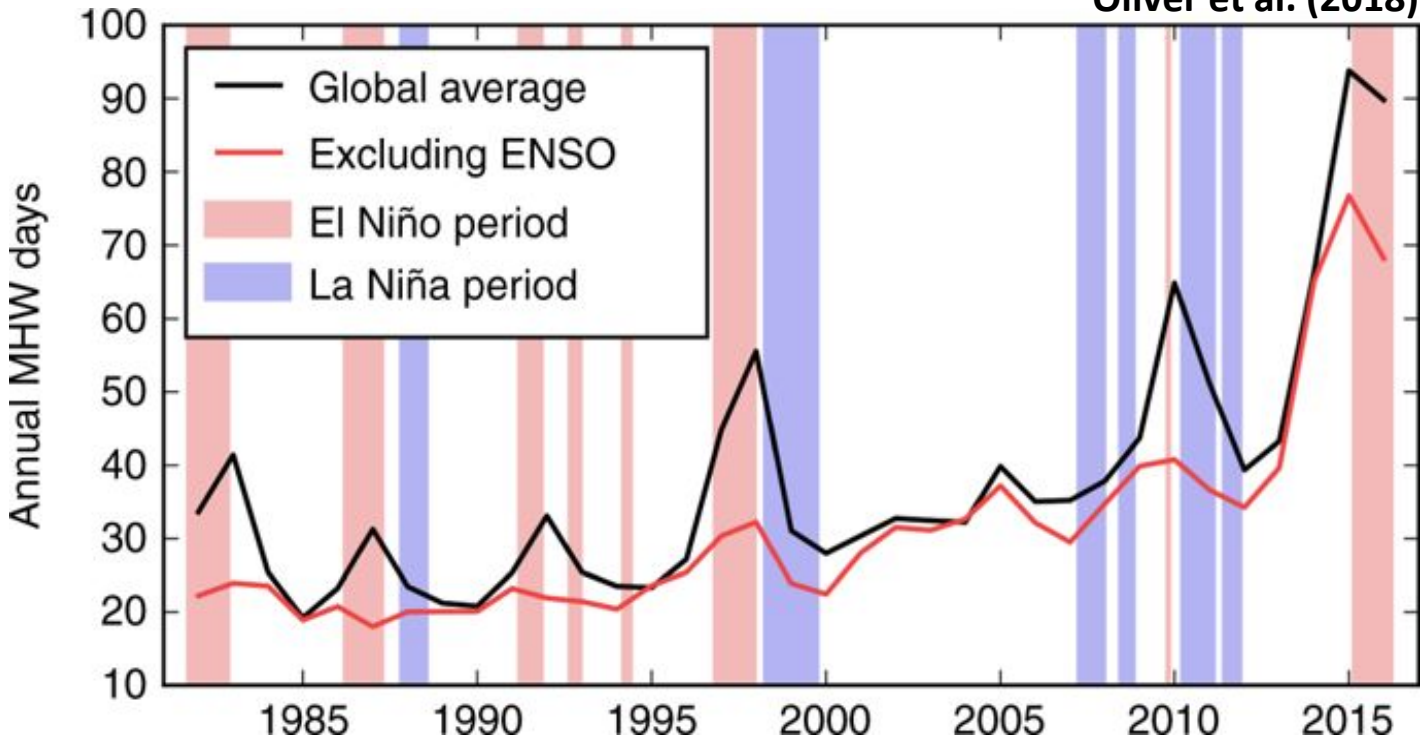
Higher Taxon	# of species
Class Anthozoa	
Subclass Hexacorallia	20
Subclass Octocorallia	63
Class Hydrozoa	1
Total	84

Whitmire et al. (2017)

El Niño & Marine Heatwaves (MHWs)

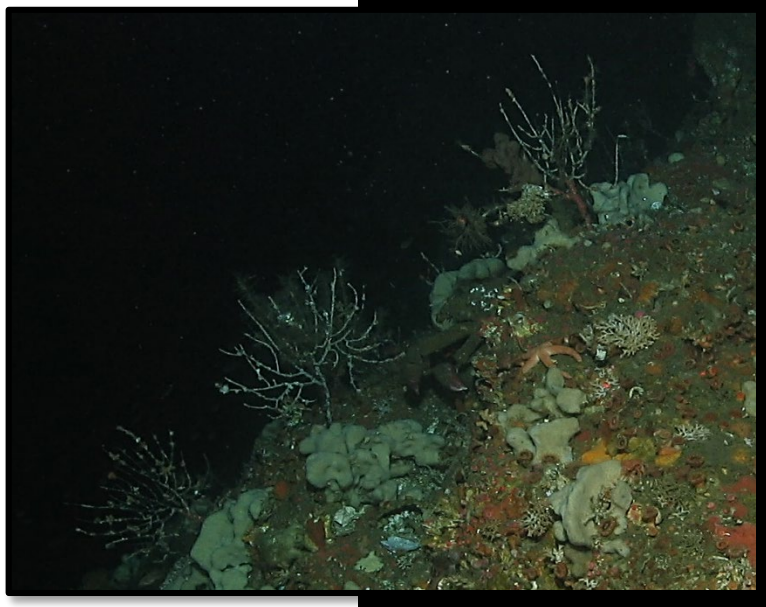
- **MHW variation attributed to ENSO**
- **Discrete, prolonged anomalously warm-water events**
- **Longer, more intense, & more frequent**
- **Mortality events of marine organisms**

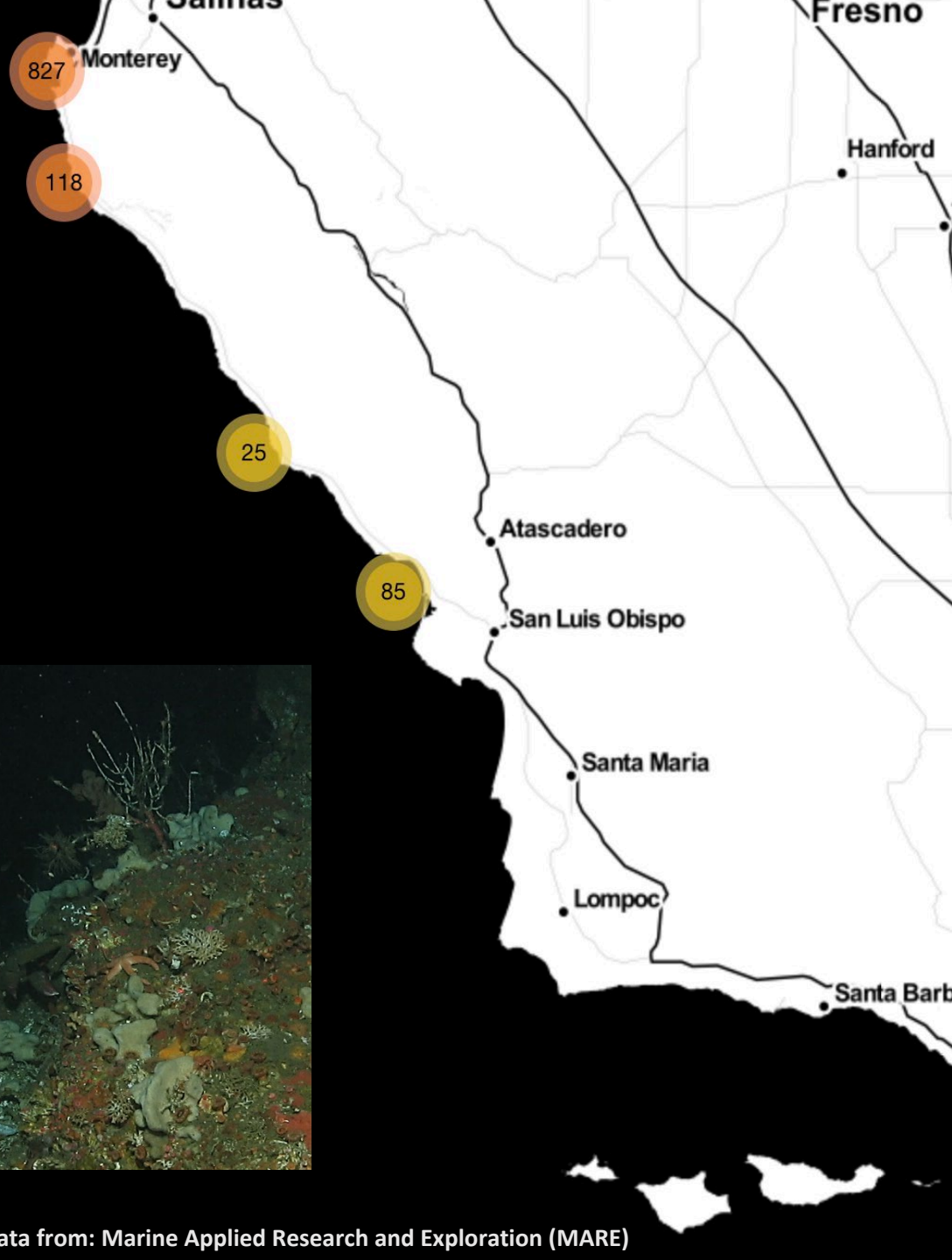
Oliver et al. (2018)



Gorgonian Mortality

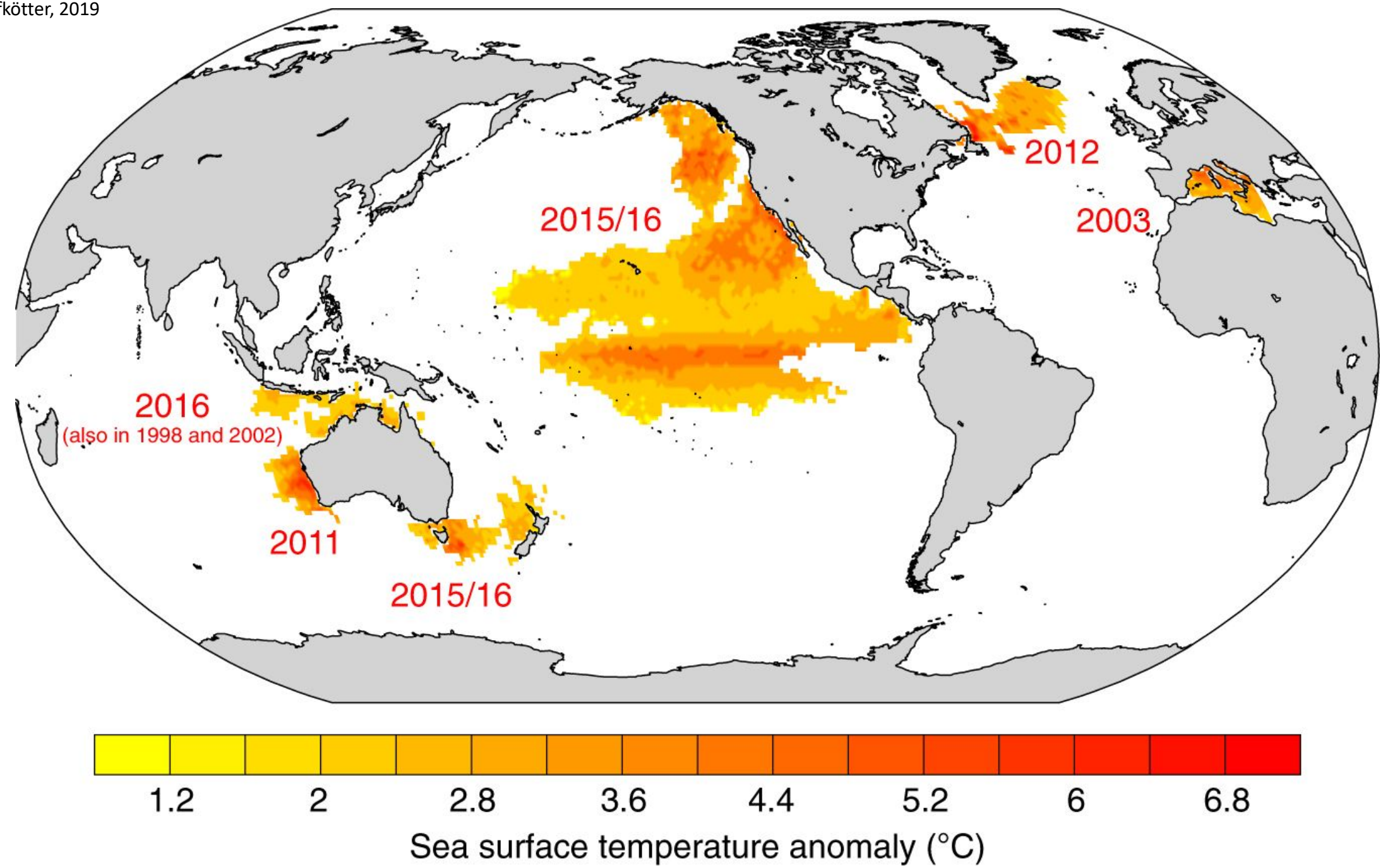
- **2016 survey**
- **2037 dead gorgonians**
- **Warm-water anomalies?**





Data from: Marine Applied Research and Exploration (MARE)

Frölicher & Laufkötter, 2019



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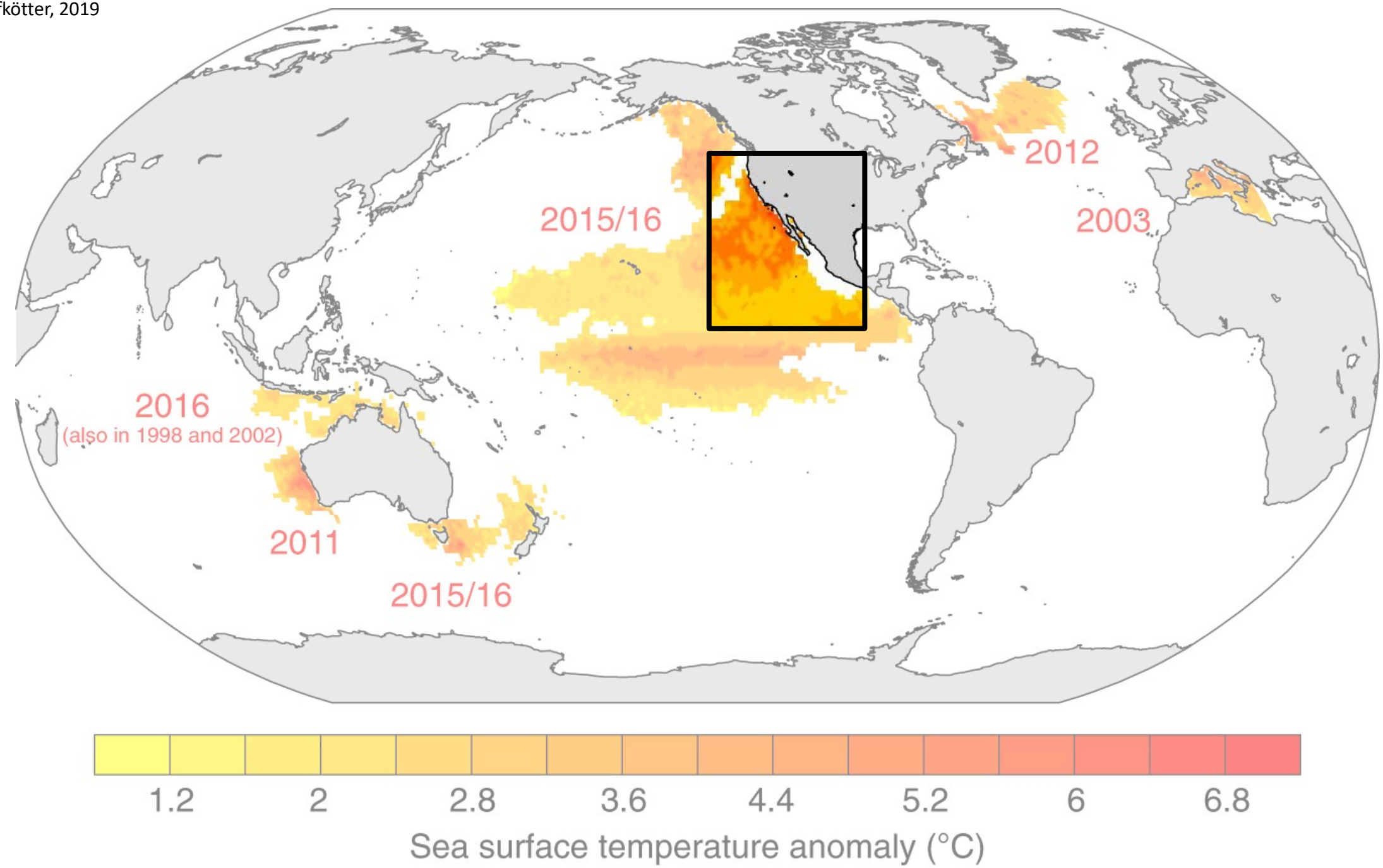

Warm-water anomalies occurred at 20-200 m depth range during the 2015-2016 ENSO event and these anomalies exceed the thermal limits of gorgonian octocorals at these depths.

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1. Characterize warm-water anomalies in the 20-200 m depth range during the 2015-2016 ENSO event

2. Experimentally determine the thermal limits of the gorgonian octocoral *Adelogorgia phyllosclera*

1

Characterizing warm-water anomalies during the 2015-2016 ENSO event

Methods

Define historical temperature anomaly threshold

- **California Cooperative Fisheries Investigations (CalCOFI)**
  - **1949-present**
- **3 stations (20, 50, 100, and 200 m)**
- **Historical anomaly threshold (mean plus 2SD)**

Methods

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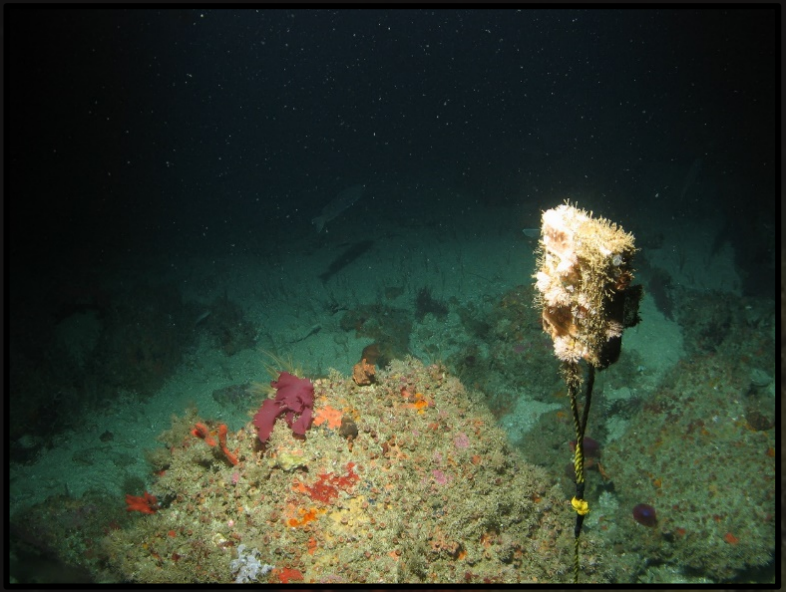
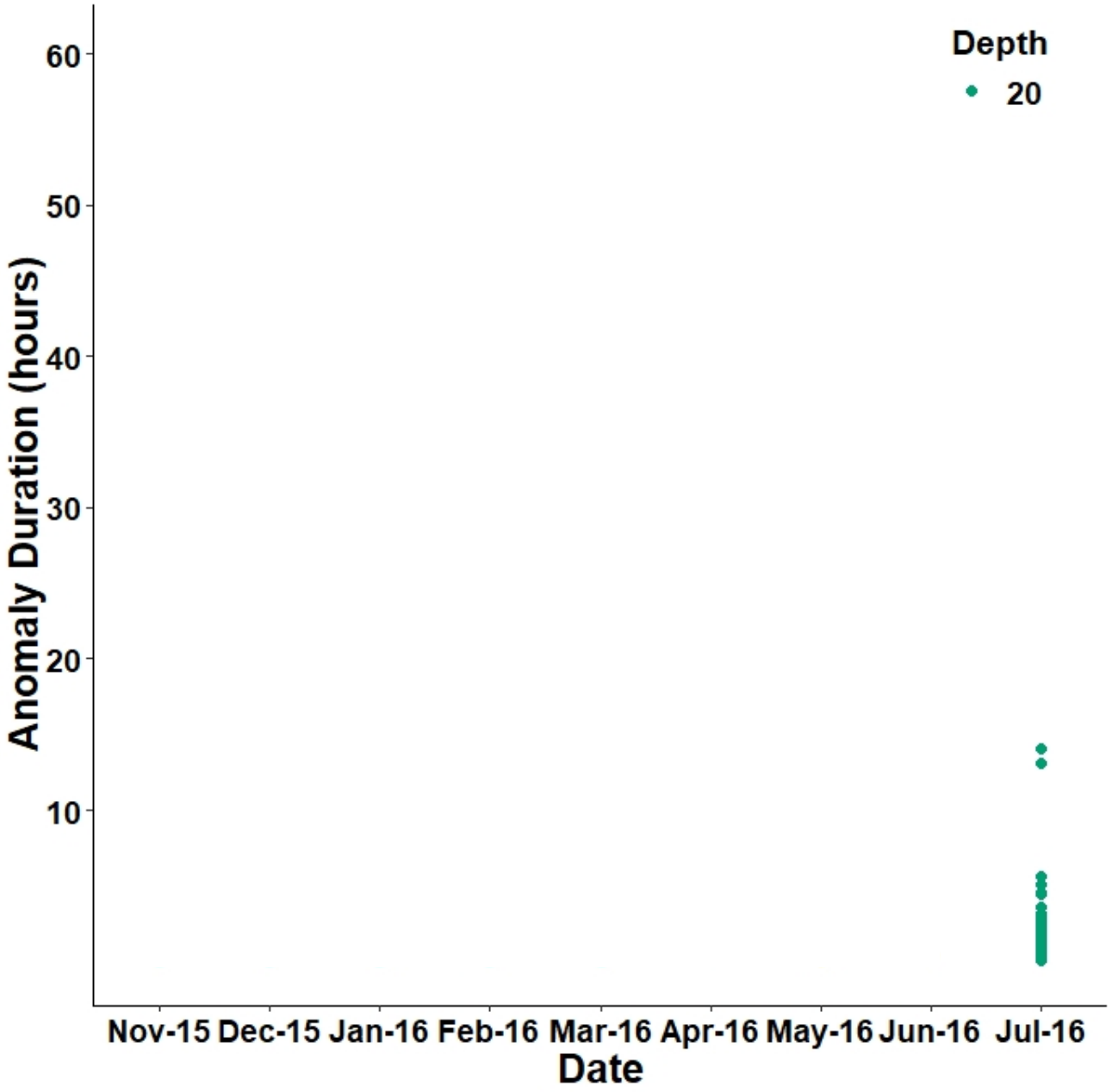
Anomalies during 2015-2016 ENSO event

- **Temperature loggers placed off Anacapa Island**
  - **November 2015 – July 2016**
  - **20, 50, 100, and 200 m**
- **Duration & # of anomaly events**



Results

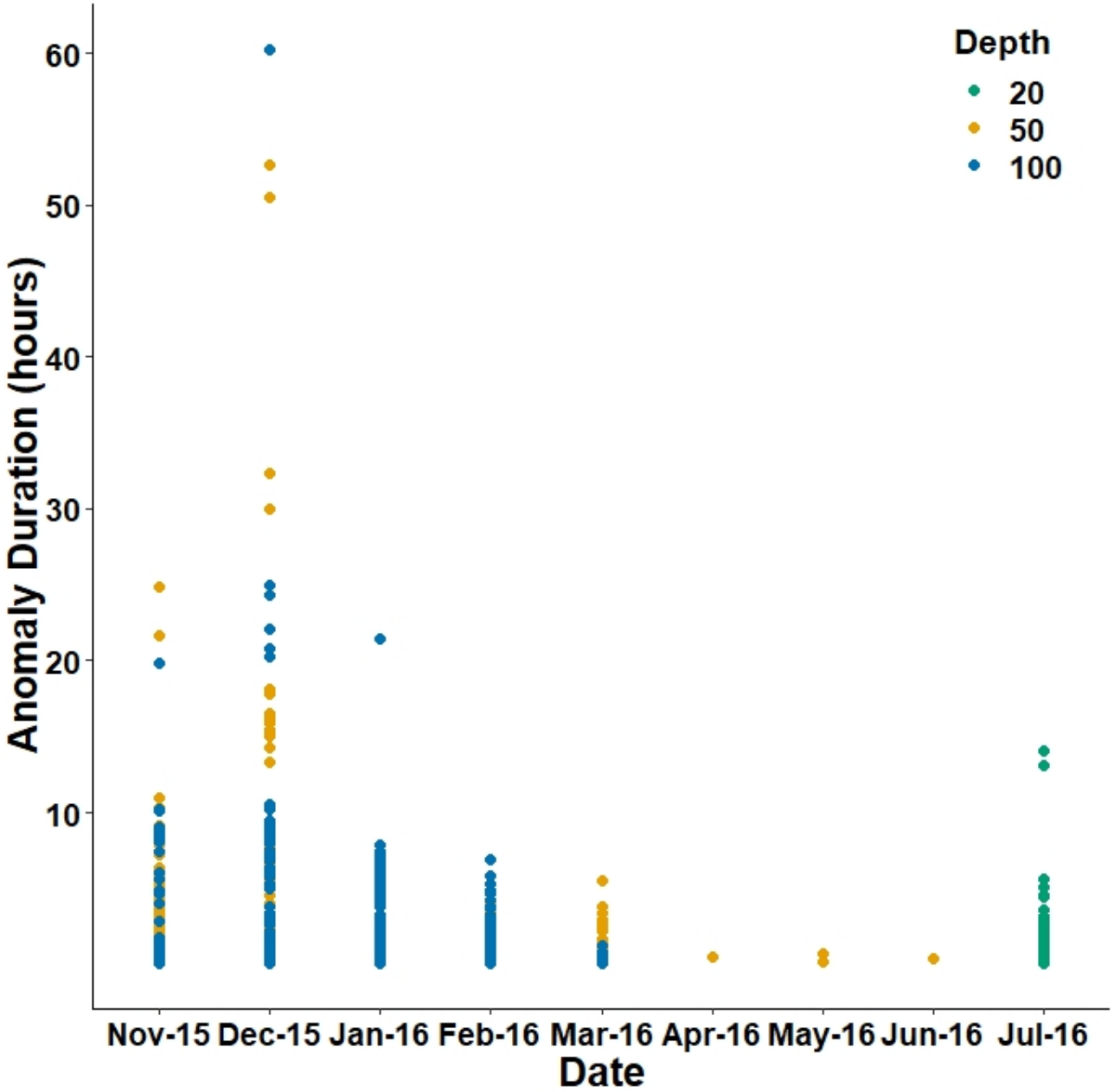
	20 m
Historical anomaly threshold (°C)	16.9
Total # of events	73
Max. event temperature (°C)	21.1



Results

	50 m	100 m
Historical anomaly threshold (°C)	13.7	11.0
Total # of events	206	609
Max. event temperature (°C)	18.3	13.8

* 200 m threshold = 9.6°C; no anomaly events



Conclusions

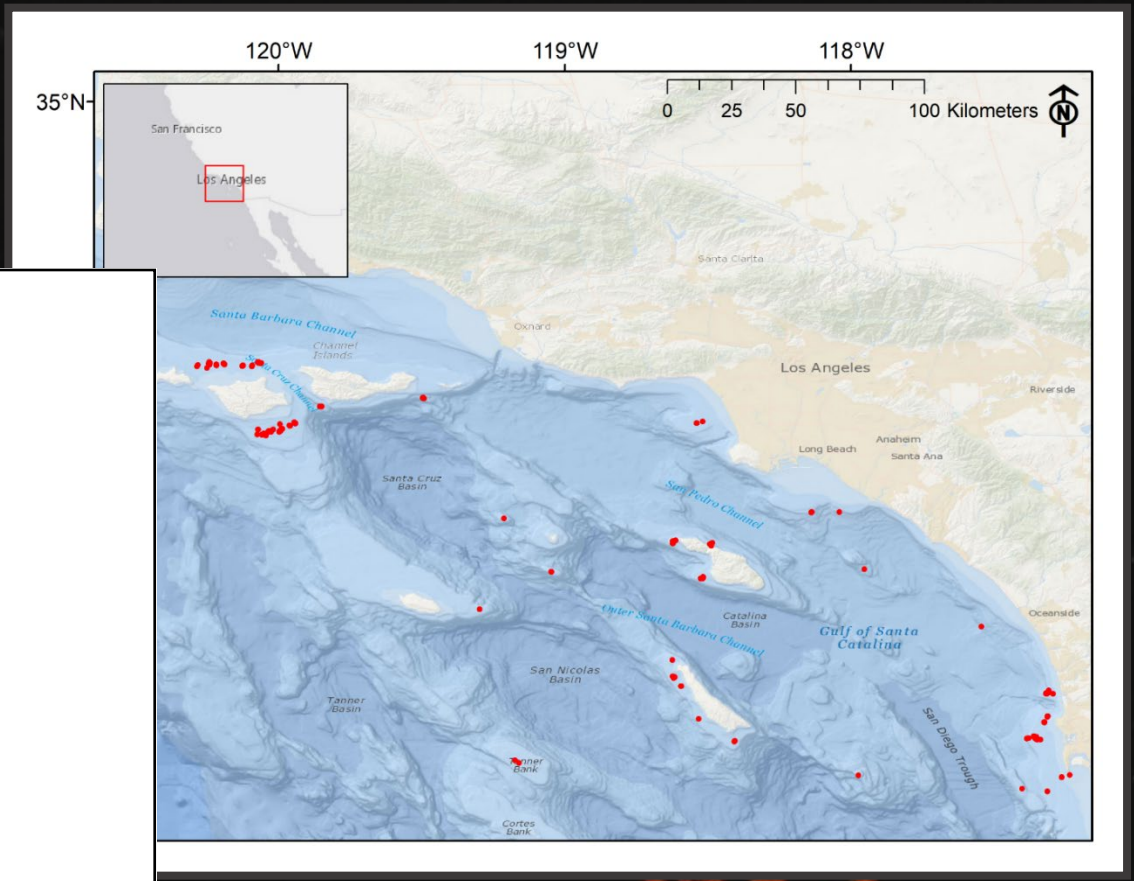
- **Anomalies are not restricted to < 50 m[1]**
- **Deep reefs (50-100 m) have:**
  - **More anomaly events**
  - **Longer anomaly events**

[1]Zaba & Rudnick (2015)

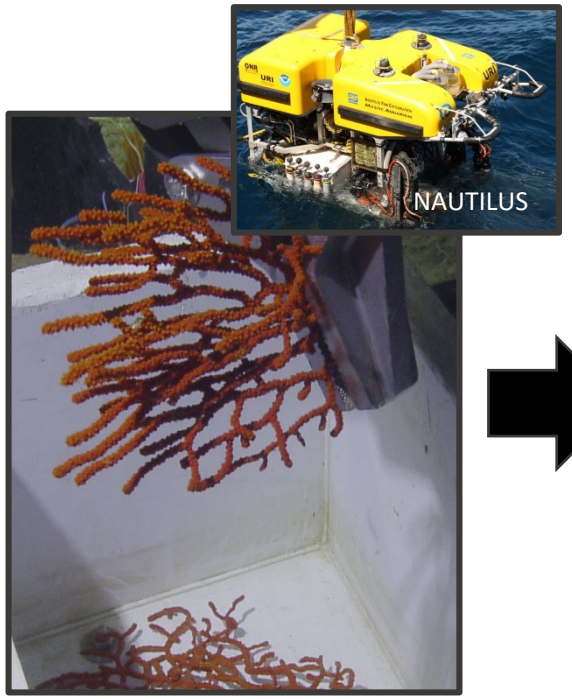
2

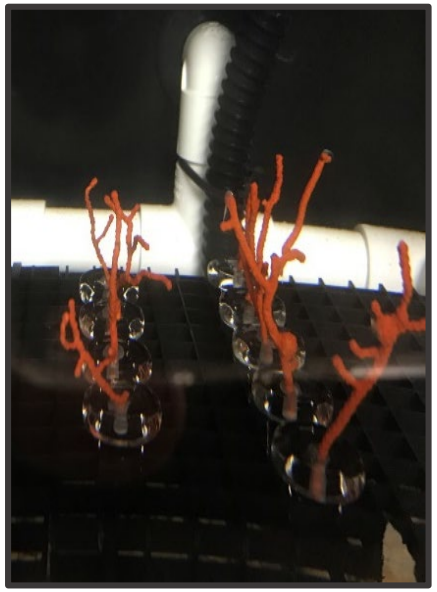
Experimentally determine the thermal limits of the gorgonian octocoral *Adelogorgia phyllosclera*

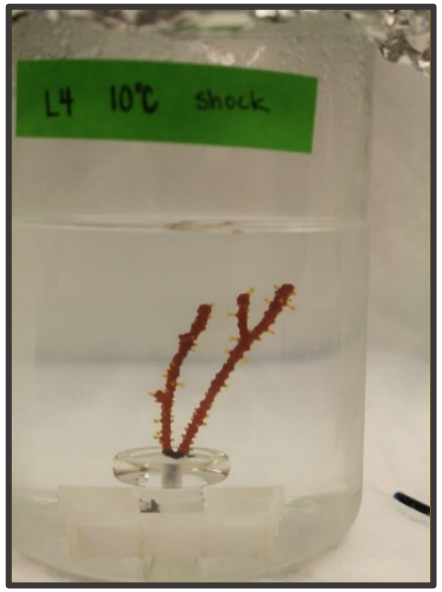
Adelogorgia phyllosclera



Methods | Field to Laboratory

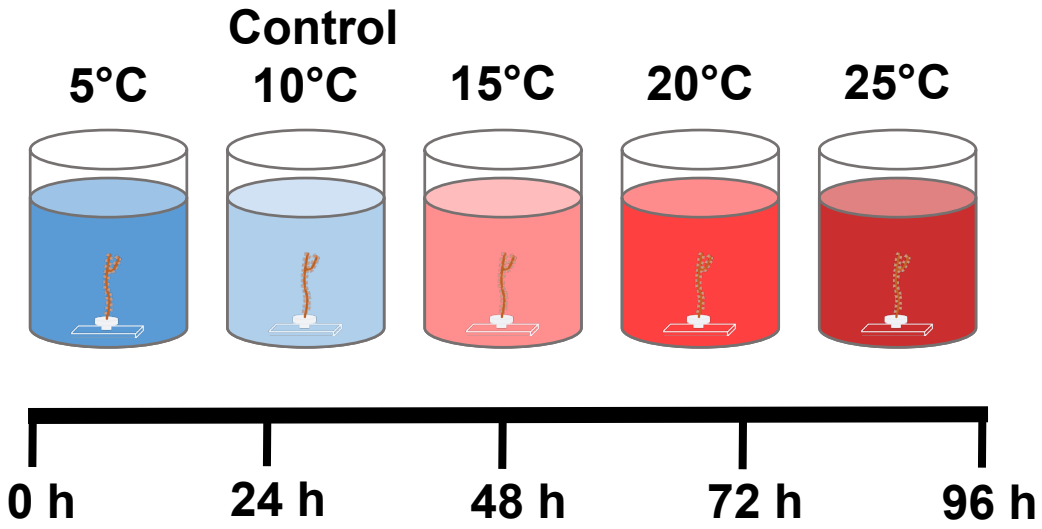






Methods | Temperature Assays

1. **Shock**
2. **Fast acclimation (1 °C hour^{-1})**
3. **Slow acclimation (1 °C day^{-1})**



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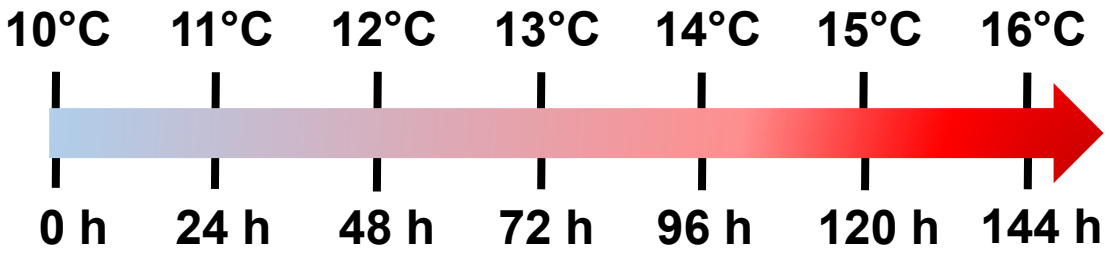
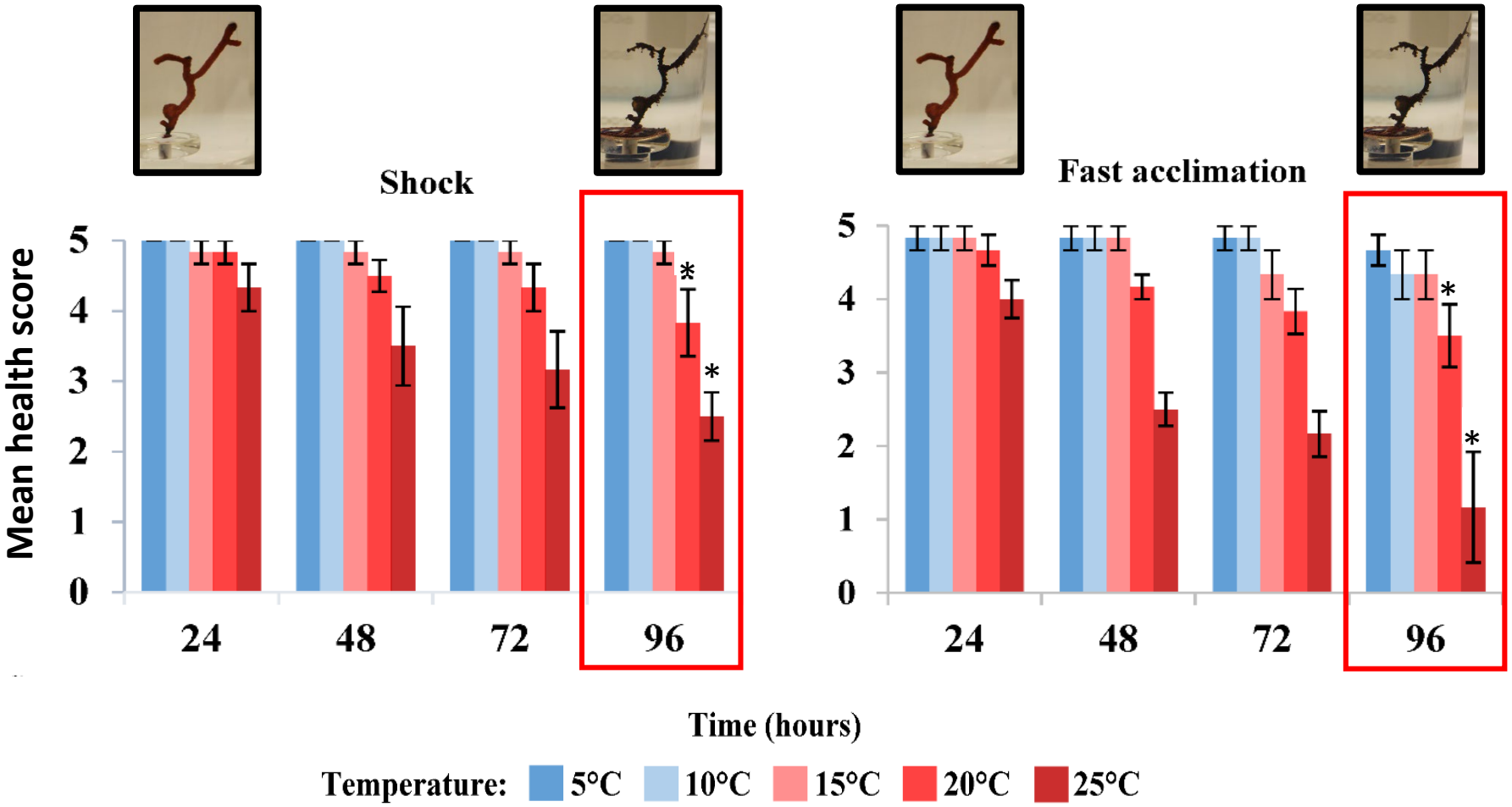


Health Scoring[4,5]

Survival Analysis[5]

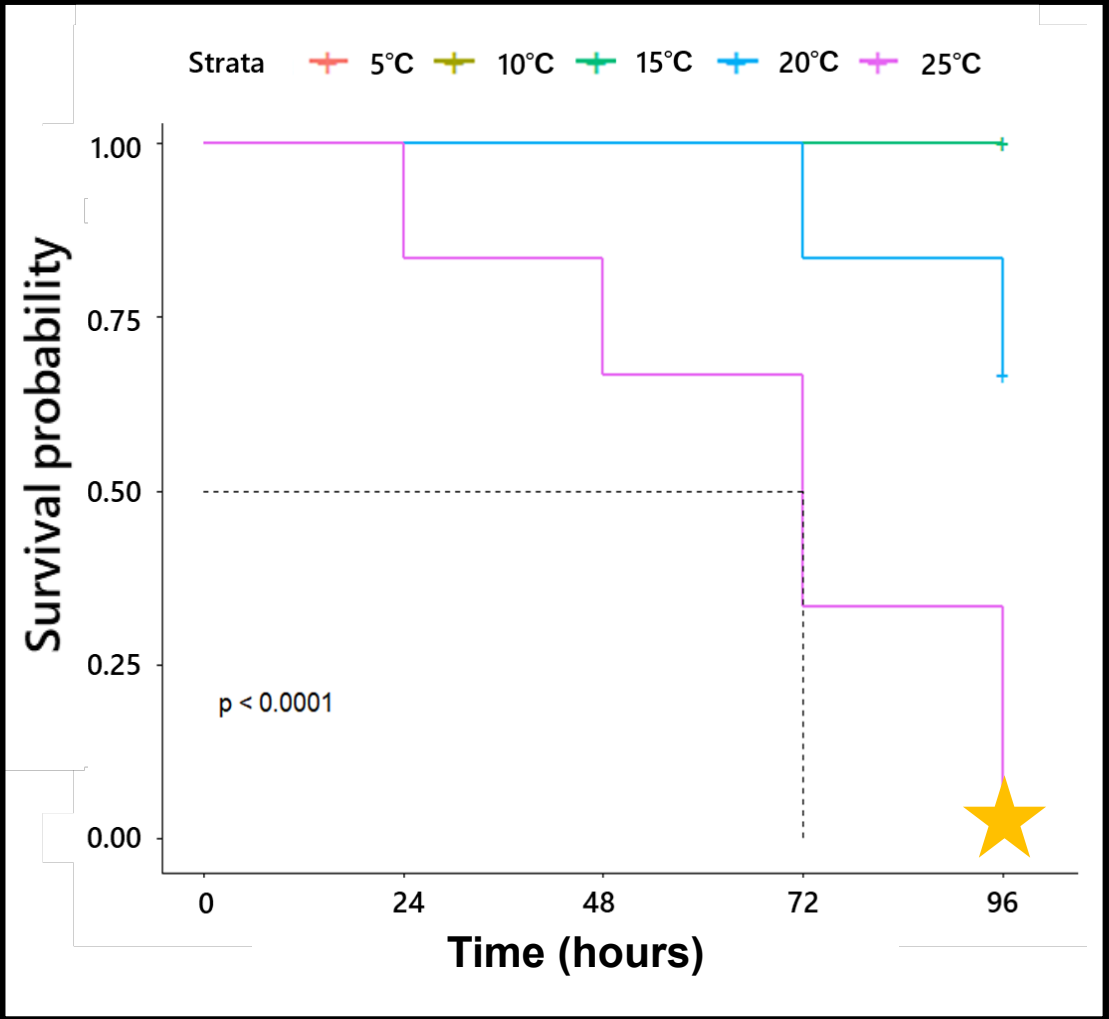
[4]De Leo et al. (2015)
[5]Frometa et al. (2016)

Results | Health Scores

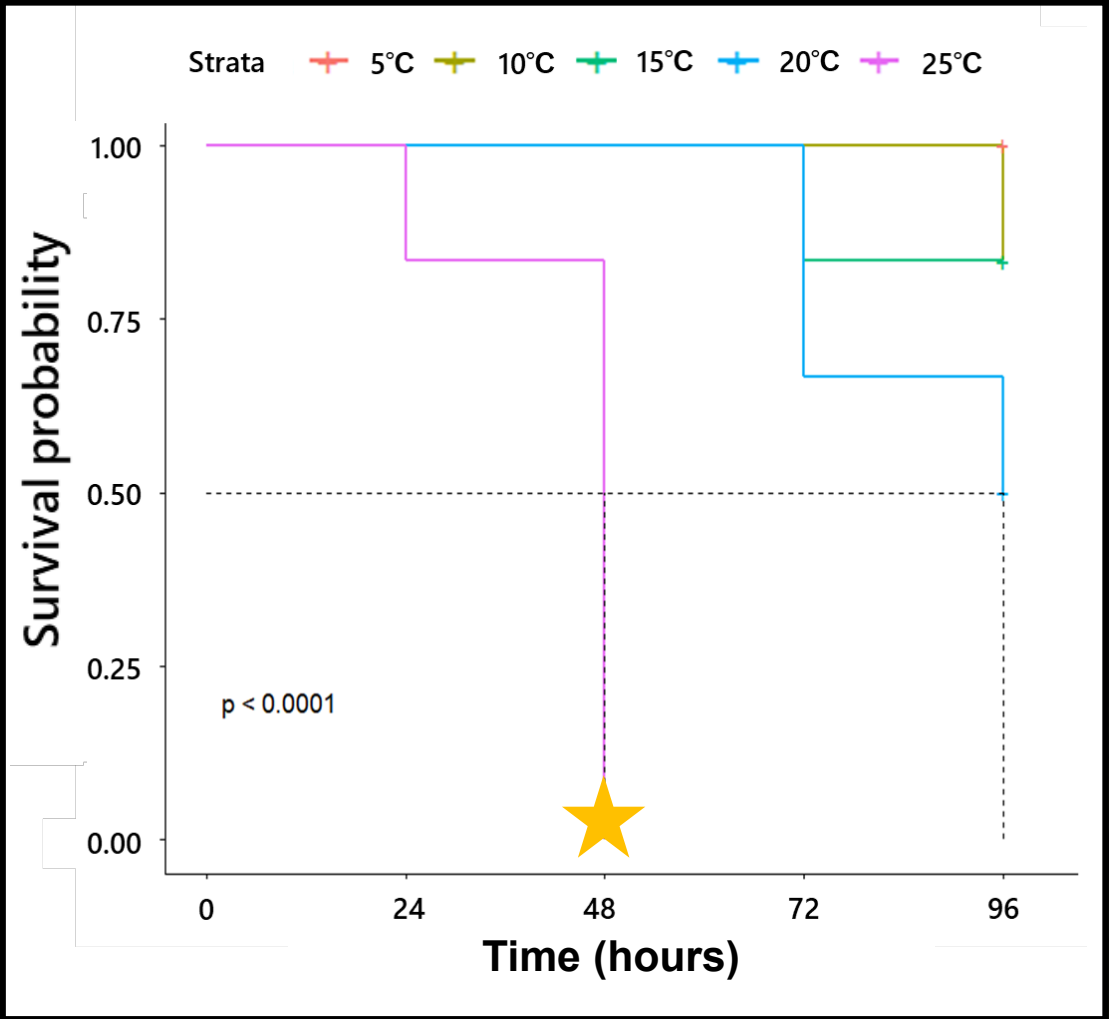


Results | Survival Analysis

Shock



Fast acclimation



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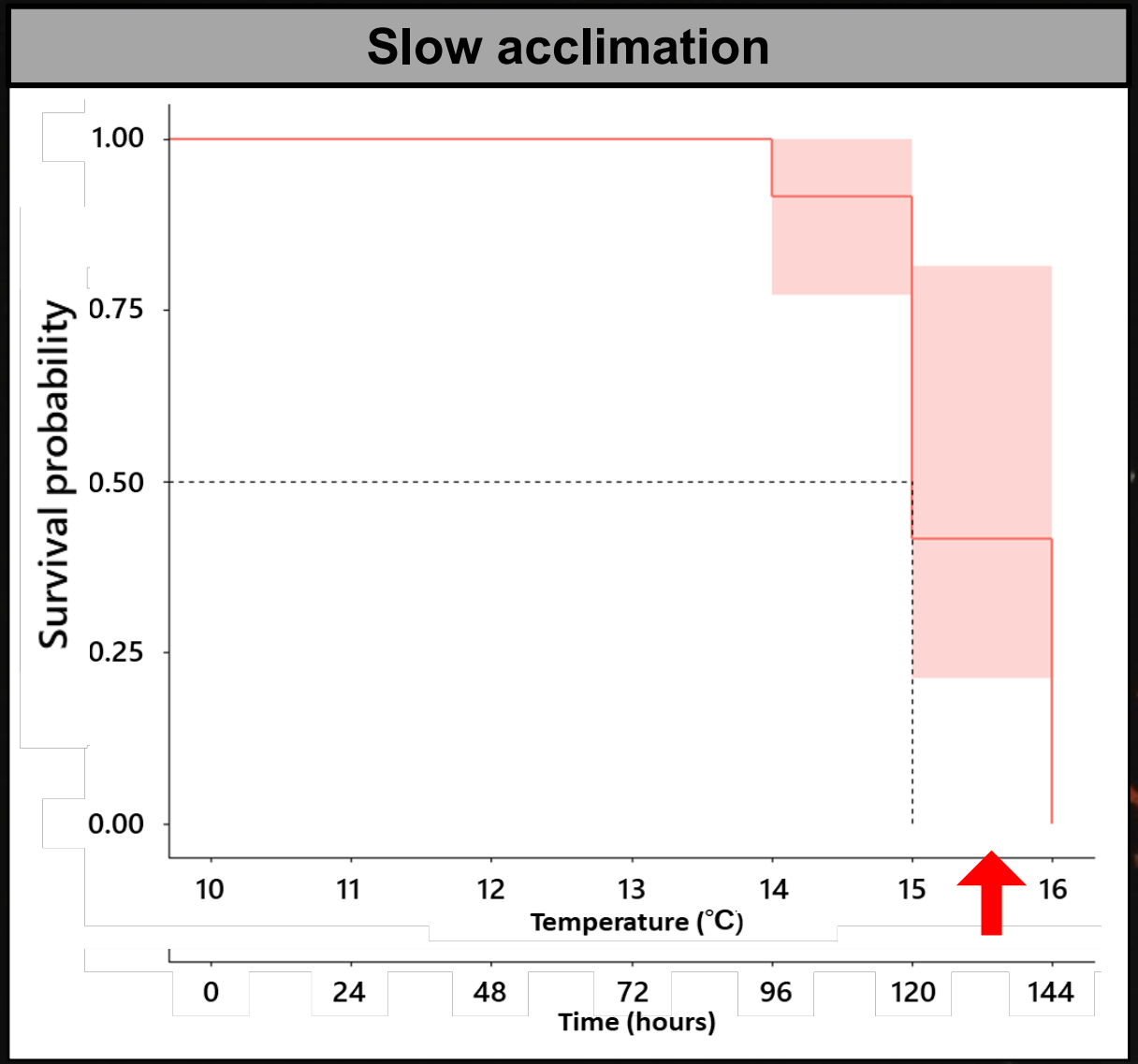


Conclusions

Shock and fast acclimation:

- ***A. phyllosclera*** **is sensitive to 25℃**
  - **Health score**
  - **Survival**

- ***A. phyllosclera*** **is sensitive to 20℃**
  - **Health score**

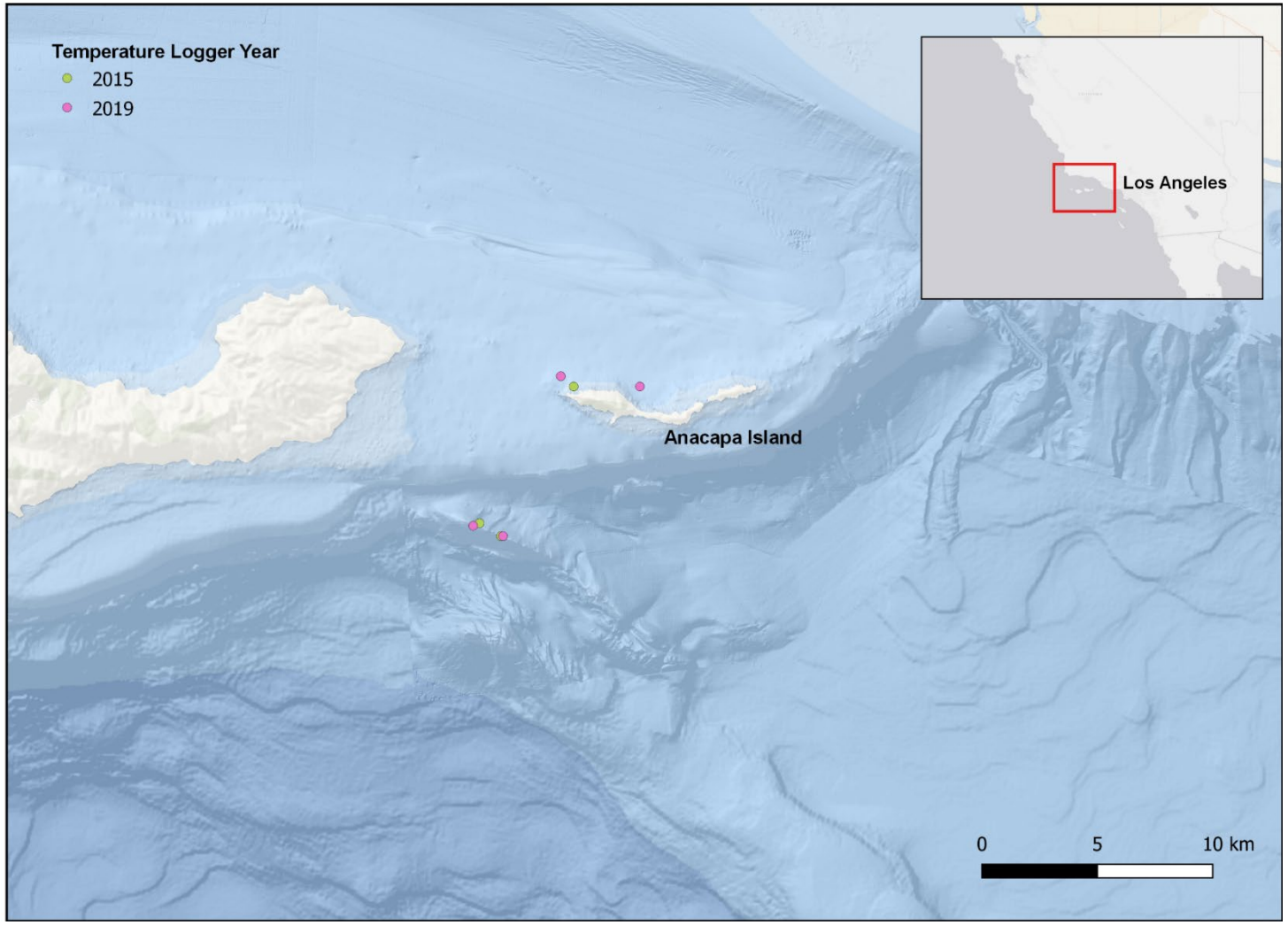
Slow acclimation:

- **Time-to-event 15℃-16℃**

Upper lethal limit ~20℃

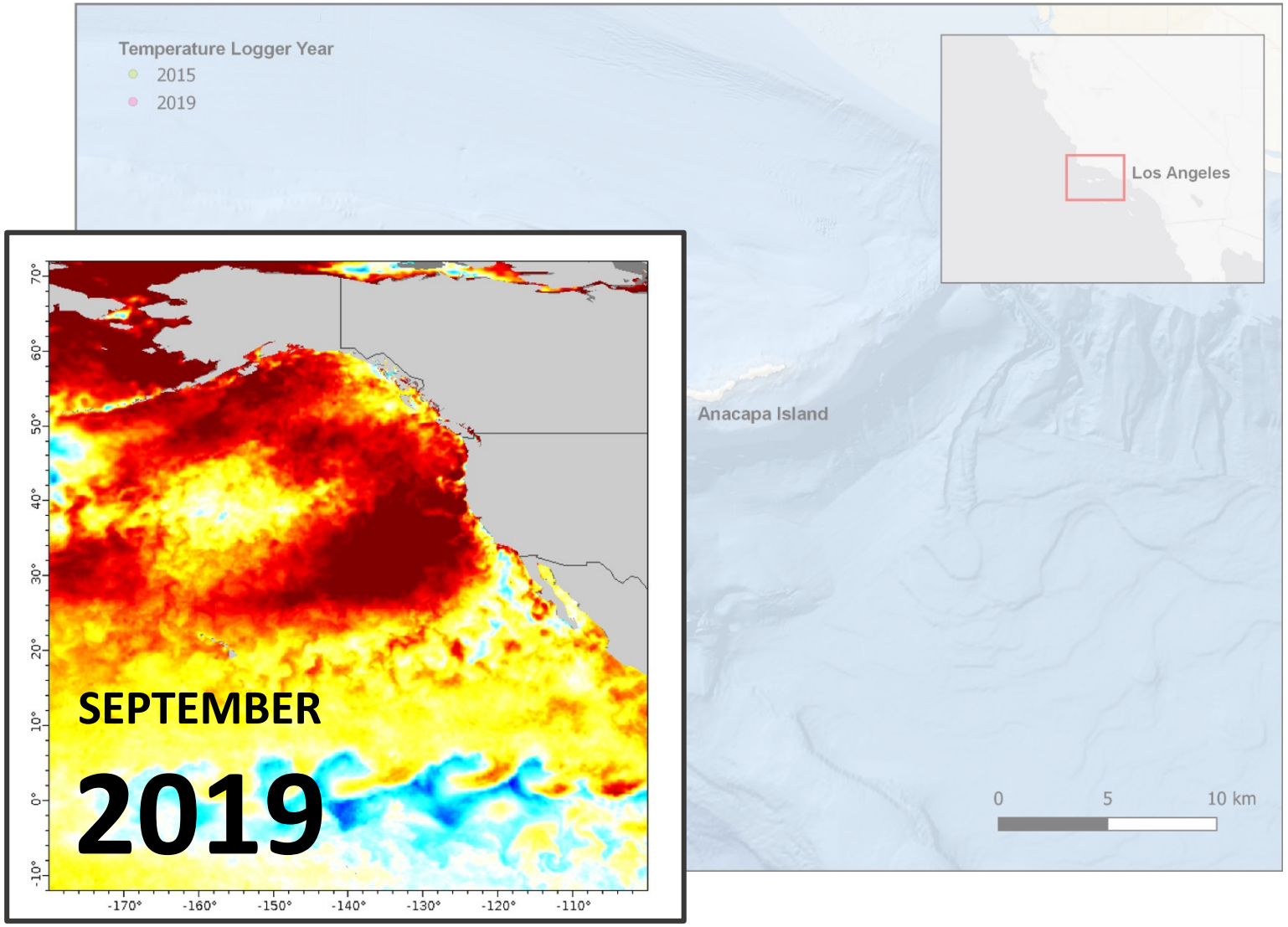
Continuing Research | Temperature Loggers

- **June 2019**
- **10 year battery life**



Continuing Research | Temperature Loggers

- **June 2019**
- **10 year battery life**
- **2019 Northeast Pacific Marine Heatwave**



Acknowledgements

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- Dr. Allan Strand

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- Andrew Shuler
- Robert McGuinn
- Ren Salgado

At sea

- ROV Beagle
- ROV Hercules
- RV Bell Shimada
- RV Shearwater

Grice Marine Lab

CINMS

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