International Training Centre for Operational Oceanography
(ITCOocean), Hyderabad, India.

Fish Physiology and Oceanography

Nimit Kumar, PhD

22 April, 2021

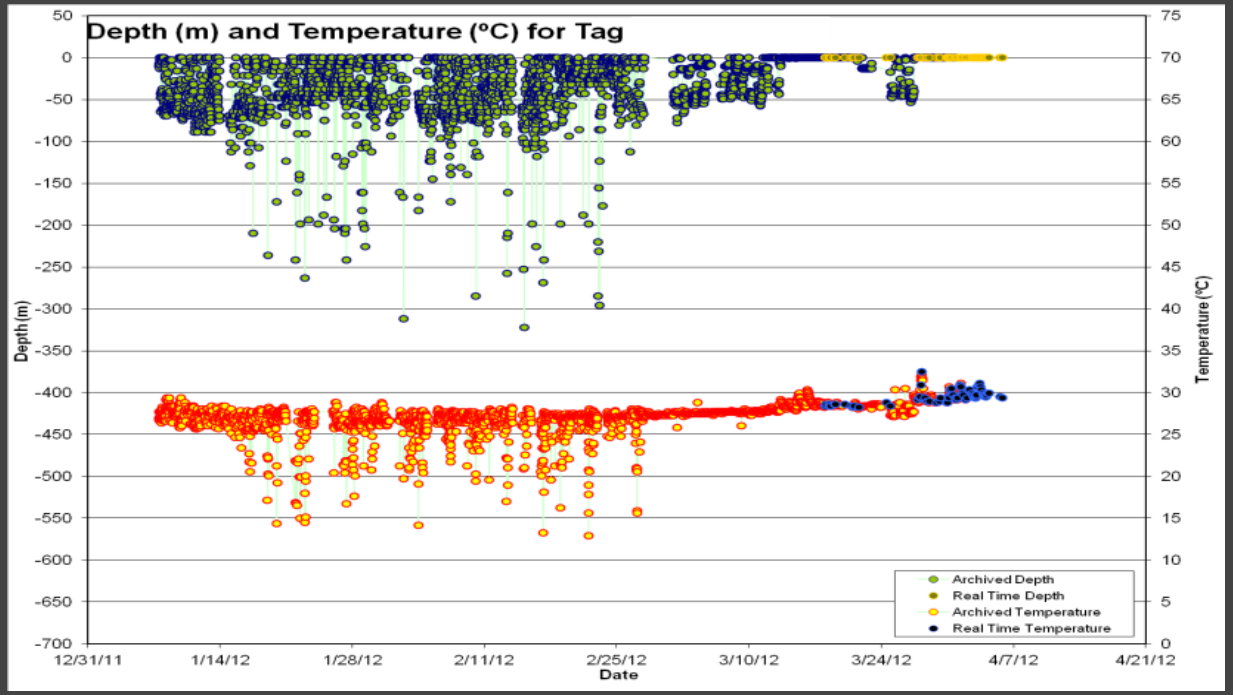
Fishery Oceanography for Future Professionals
19 – 23 April, 2021

INCOIS- SATTUNA

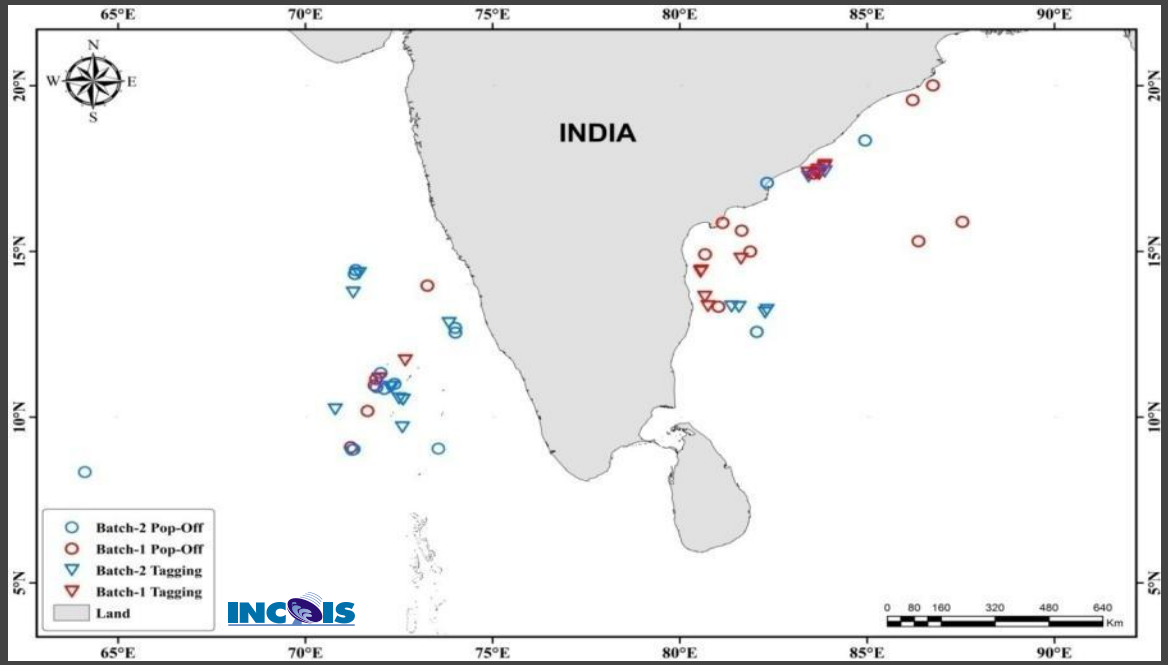
(Satellite Telemetry of Tuna in Indian Ocean)

INCOIS, FSI and CMFRI

What PSAT data looks like?

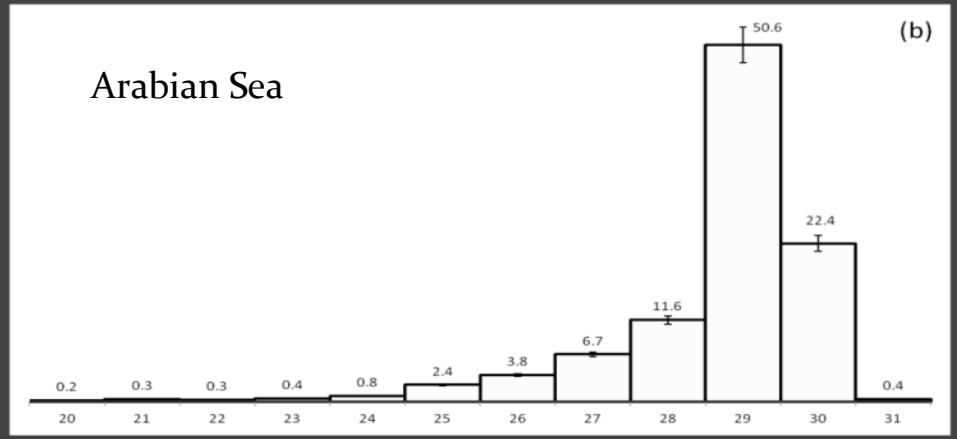


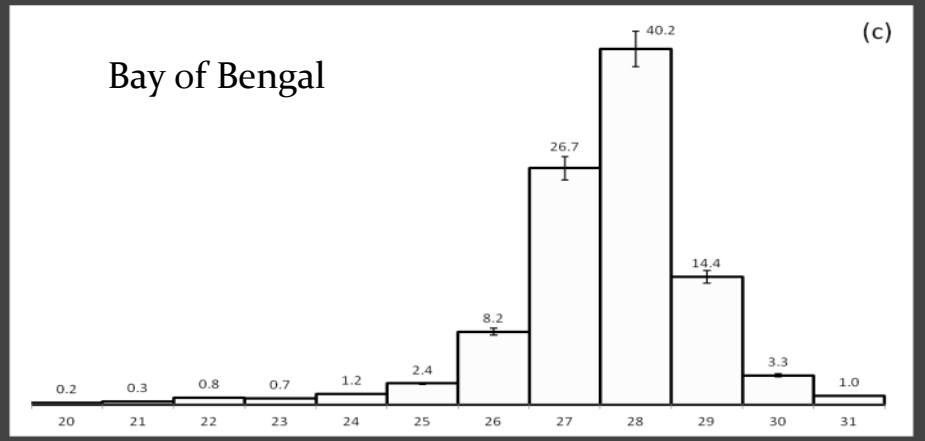
Study region

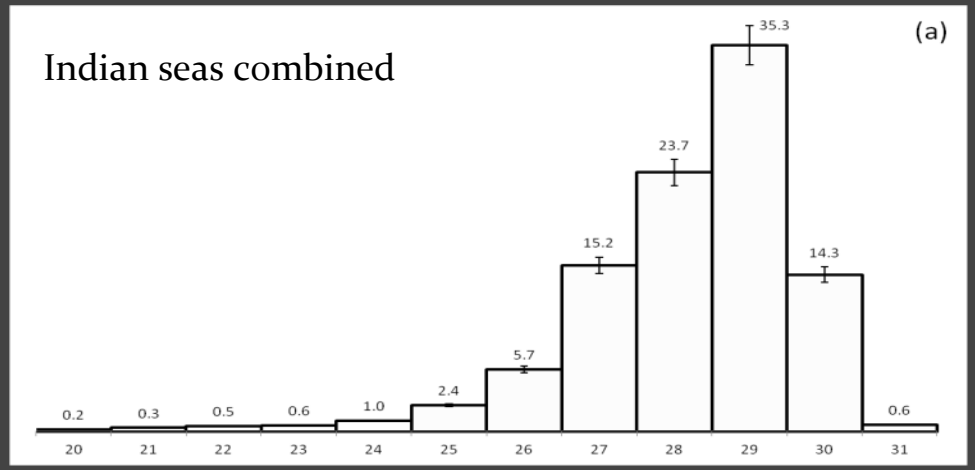


Nimit Kumar et al. Oceanographic preferences of yellowfin tuna (*Thunnus albacares*) in warm stratified oceans: A remote sensing approach. *International Journal of Remote Sensing* (2020): 1-21. DOI: 10.1080/01431161.2019.1707903

Temperature Preferences





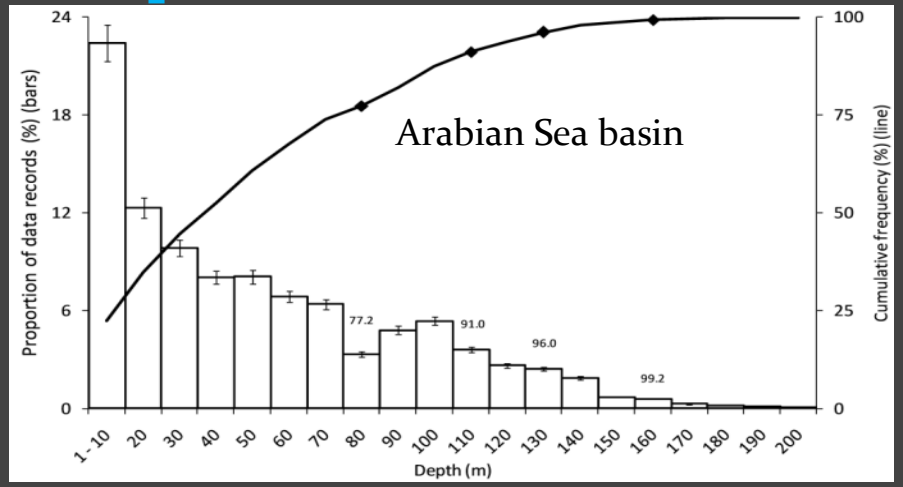


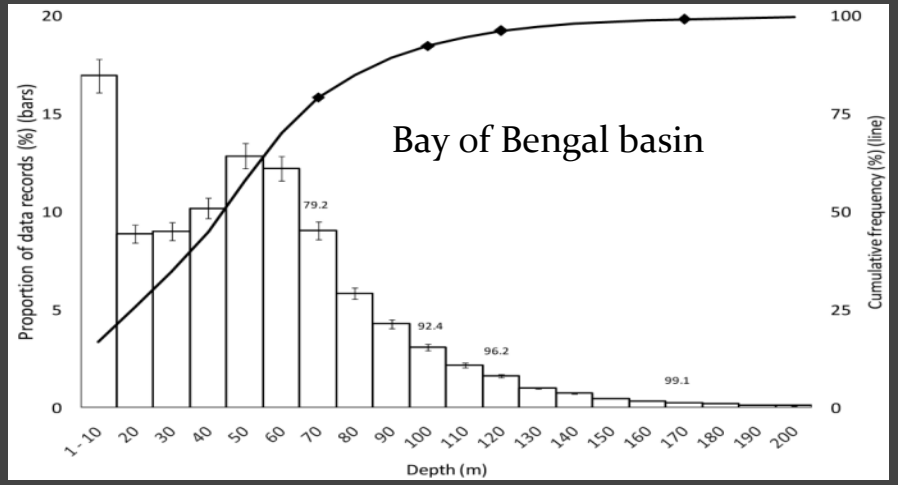
The data showed fishes swimming in relatively cooler waters in the Bay of Bengal.

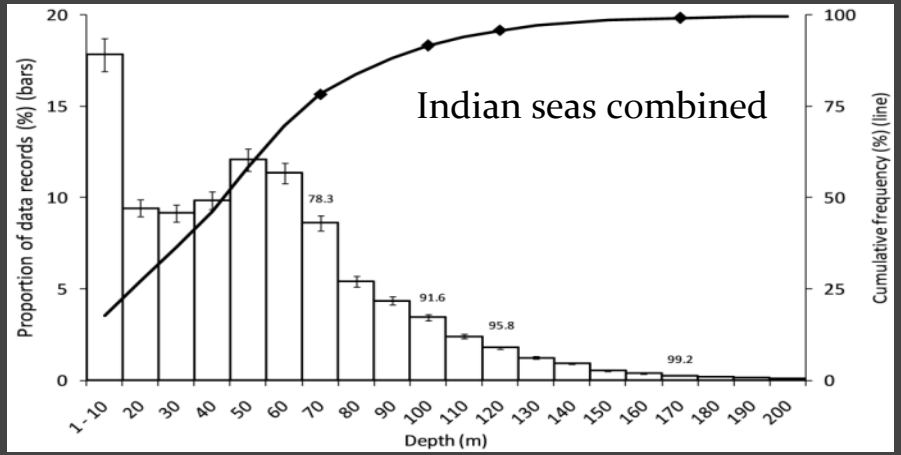
88.5% of the time fishes stayed within 27-30 °C

DOI: 10.1080/01431161.2019.1707903

Depth Access







- Affinity towards surface and no significant deep diving behavior, especially in the Bay of Bengal region.
- Tuna in Arabian Sea accessed indistinct three zones, viz. surface (≤30m), sub-surface (50-70m) and deep (90-100m).

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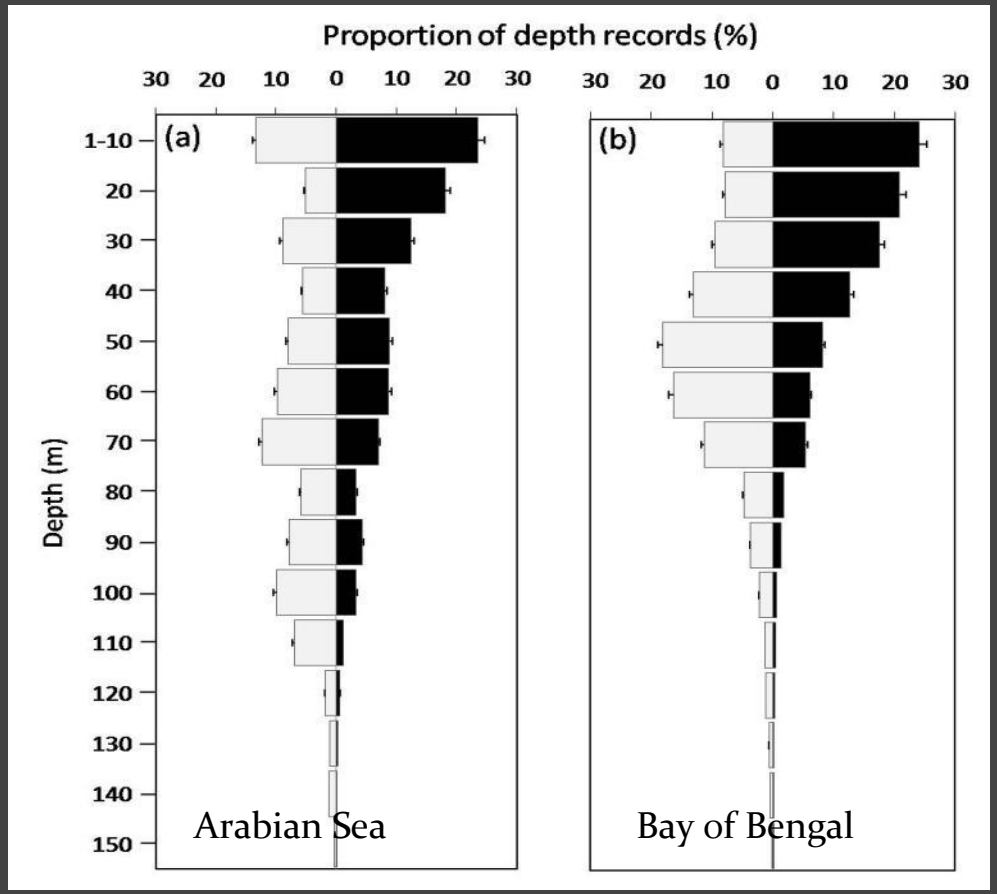
Diurnal Vertical Movements



Day

Night

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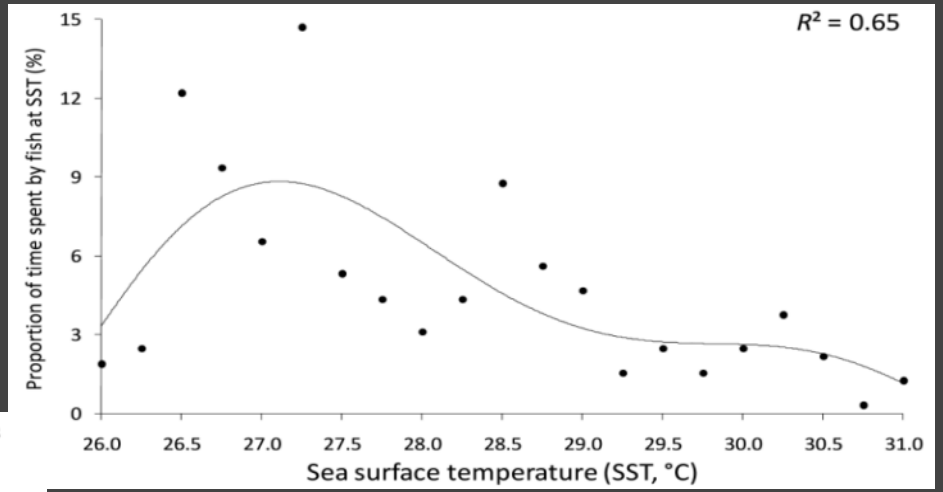
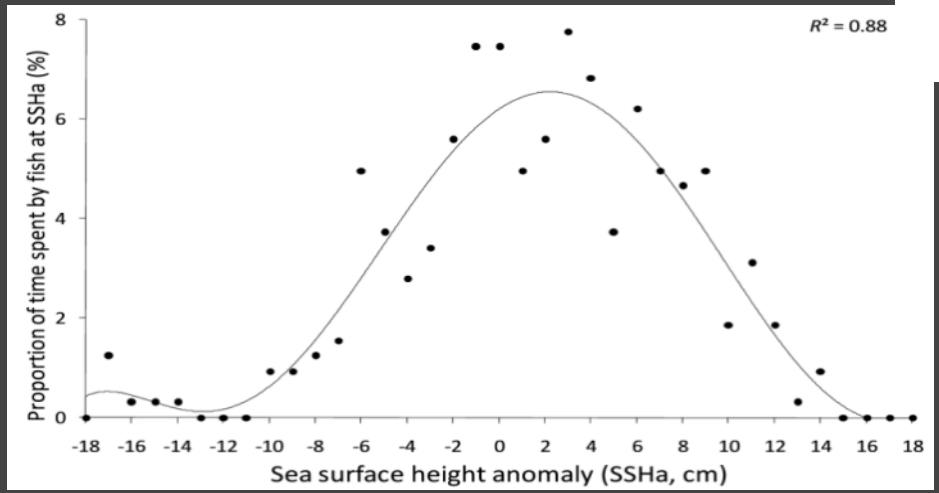
From the satellite data

Fishes tend to spend more time (~70%) in the periphery of divergence zones (between ±6cm SSHa) with frequency peak slightly towards negative side (Mean & Median of -1.1cm).





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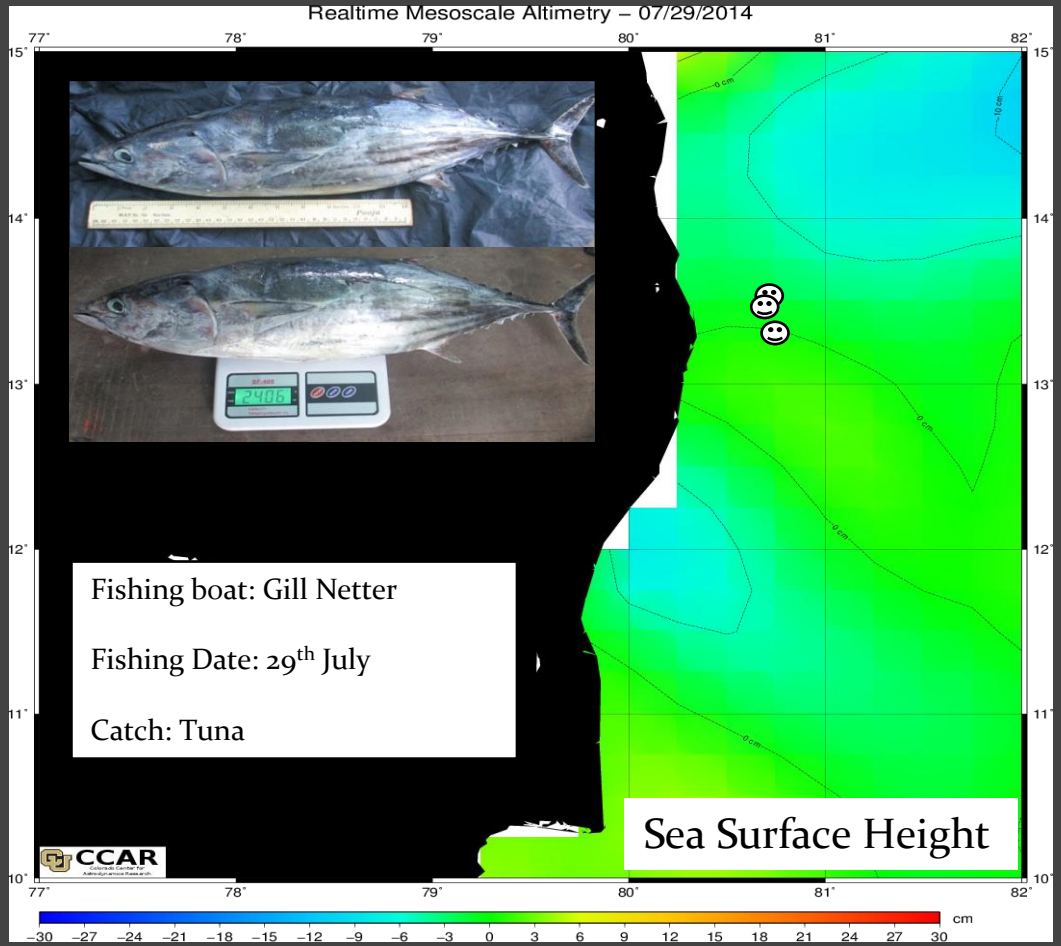
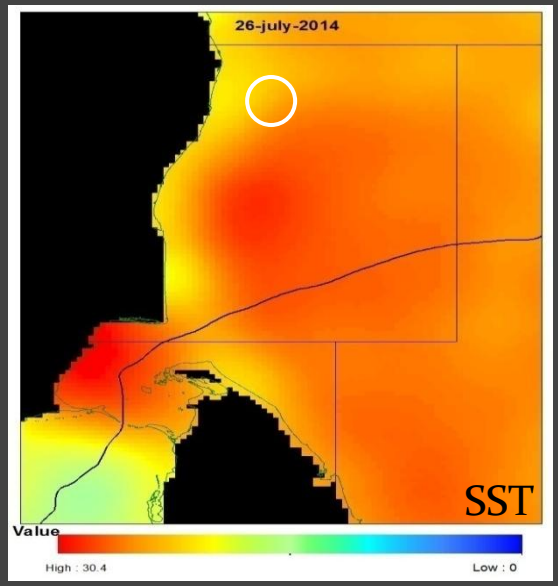
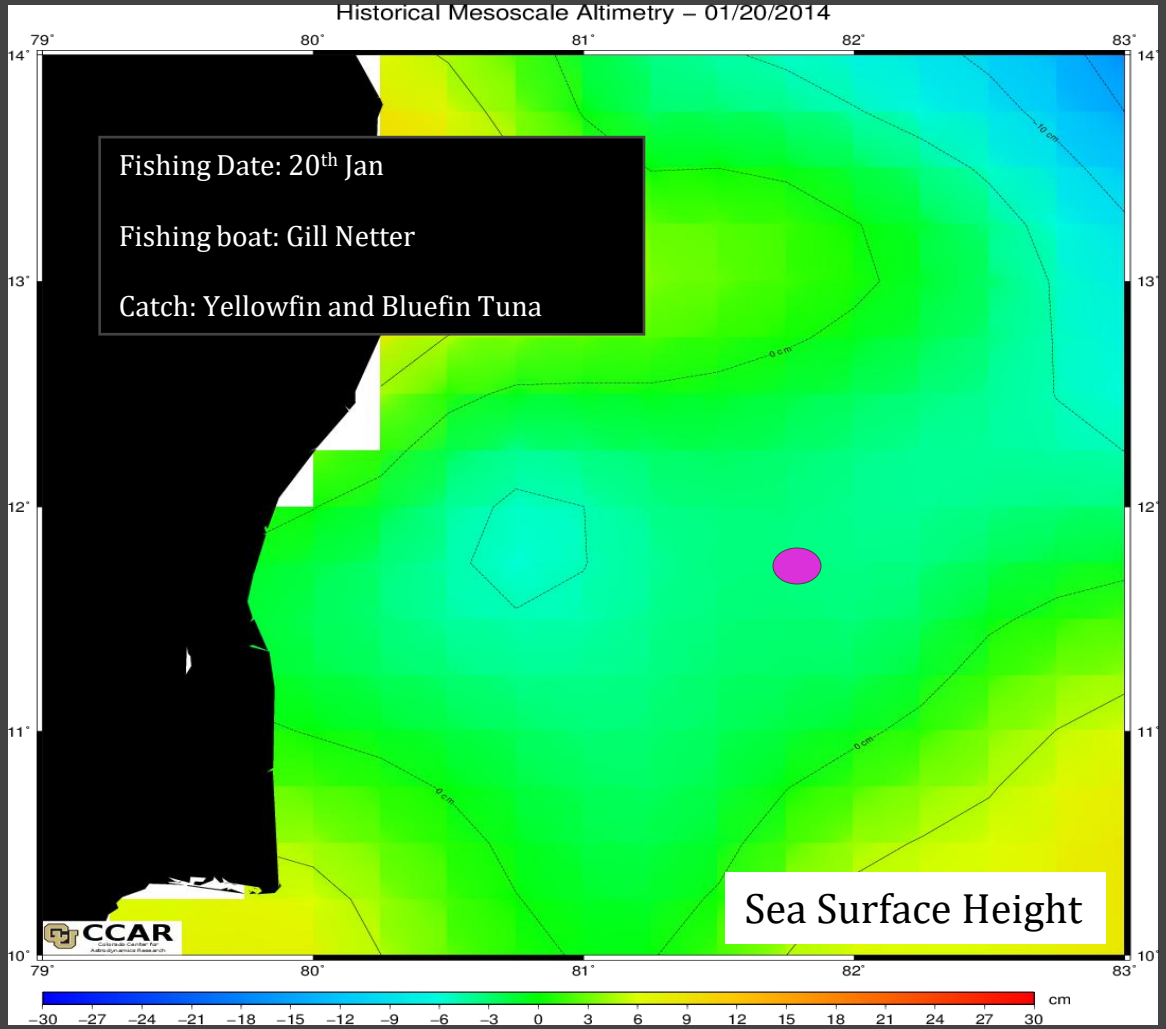
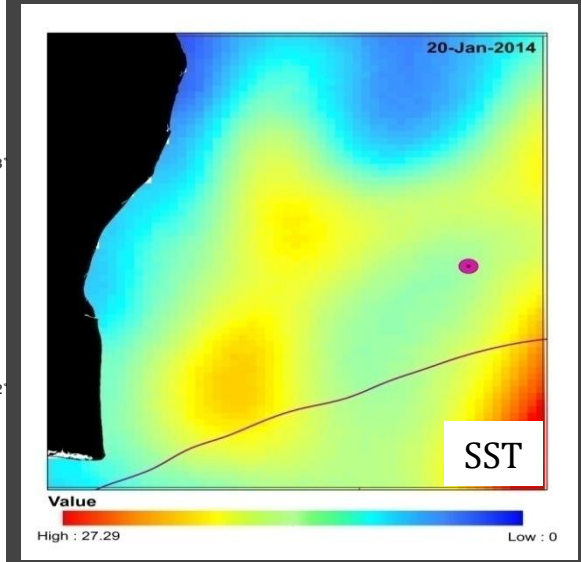
Validation from fishing





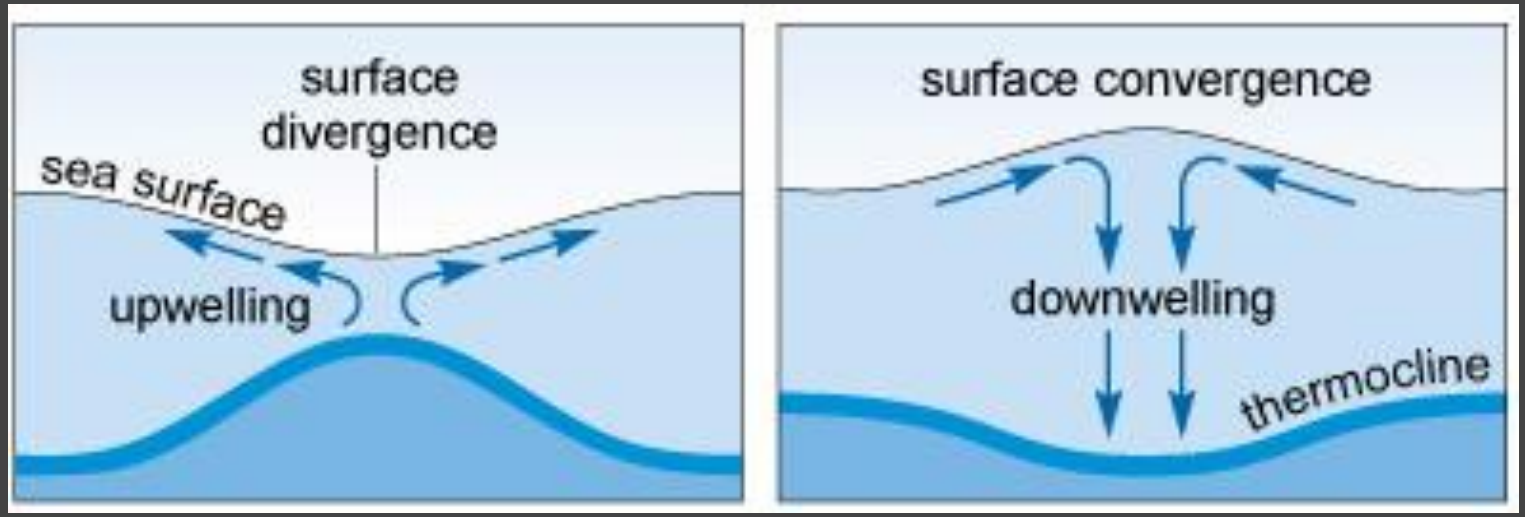
Feedback example -2



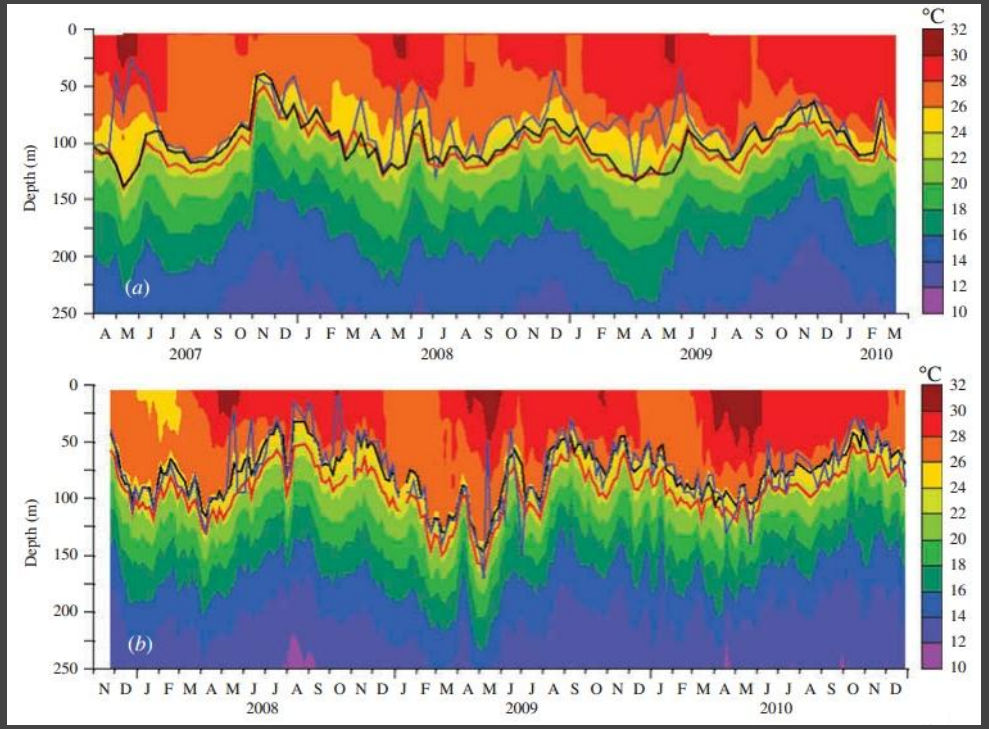


Fishermen feedback validates hypothesis about SSH and SST

Pits and Mounds in the Ocean



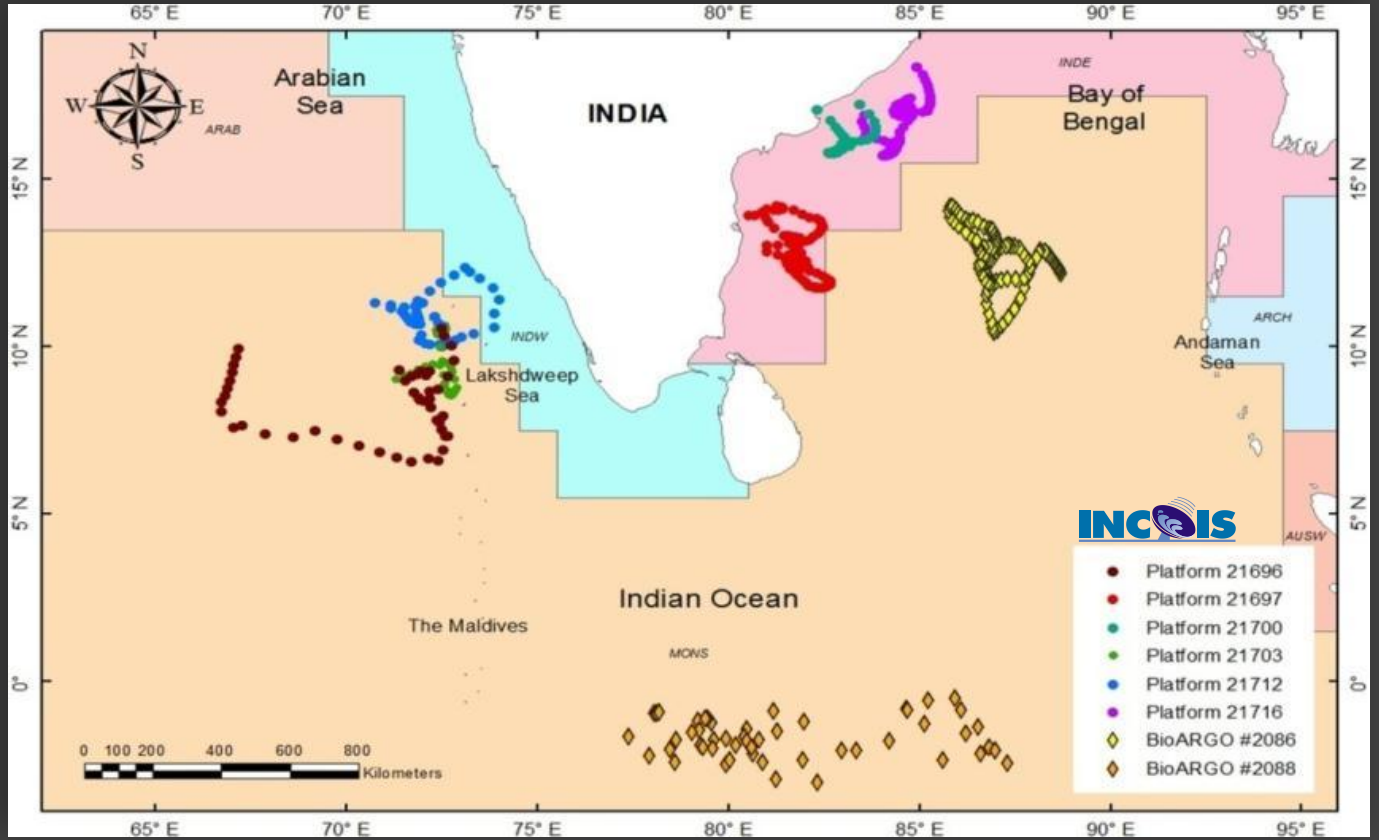
Courtesy: OpenLearn



Thermocline

Oxycline

DOI: 10.1080/2150704X.2013.842284



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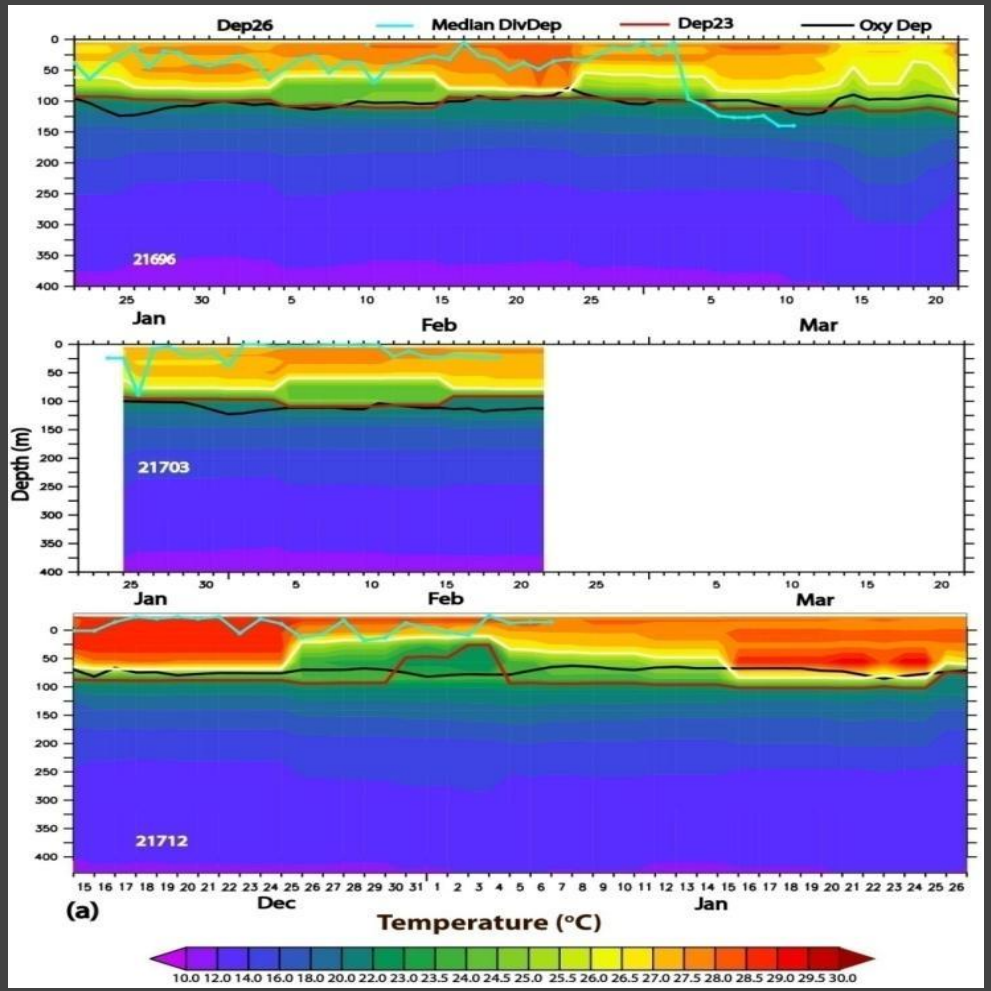

Along-track Dive Behavior (Arabian Sea)

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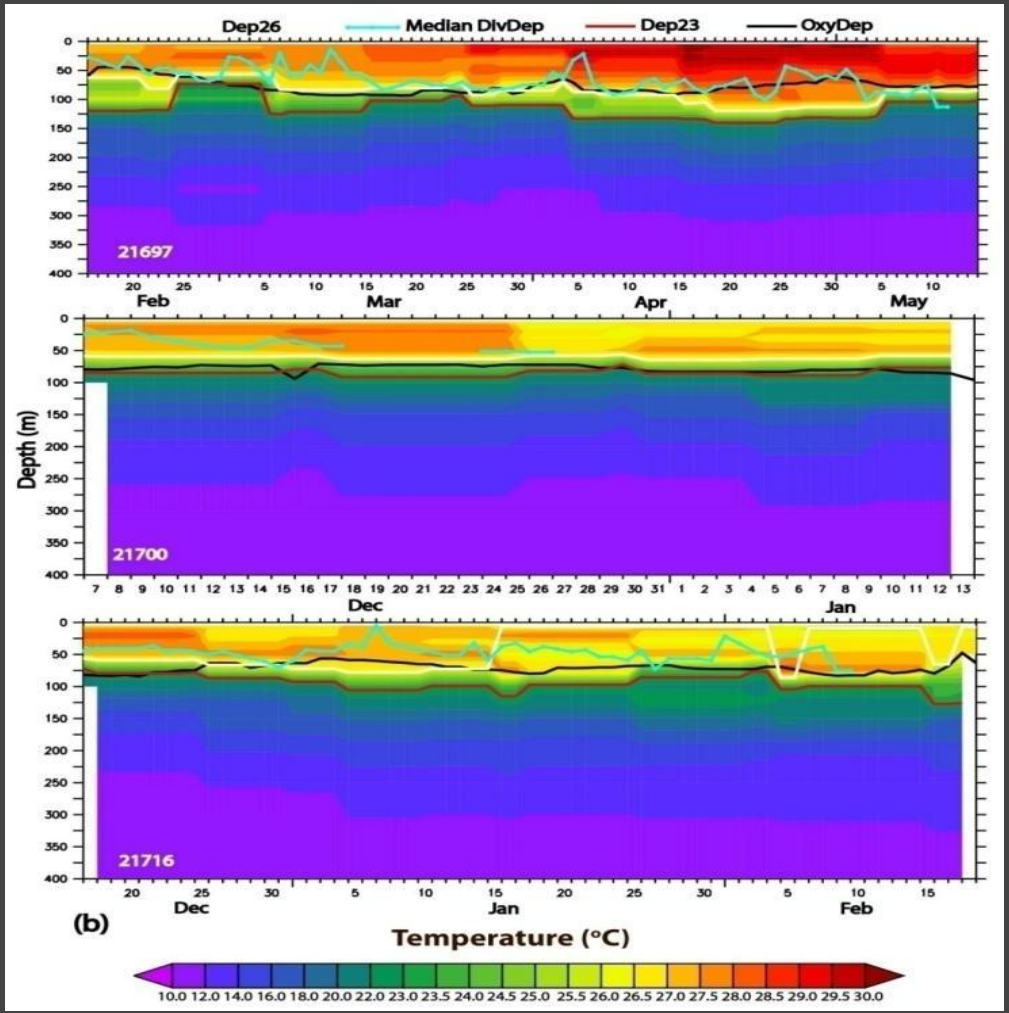
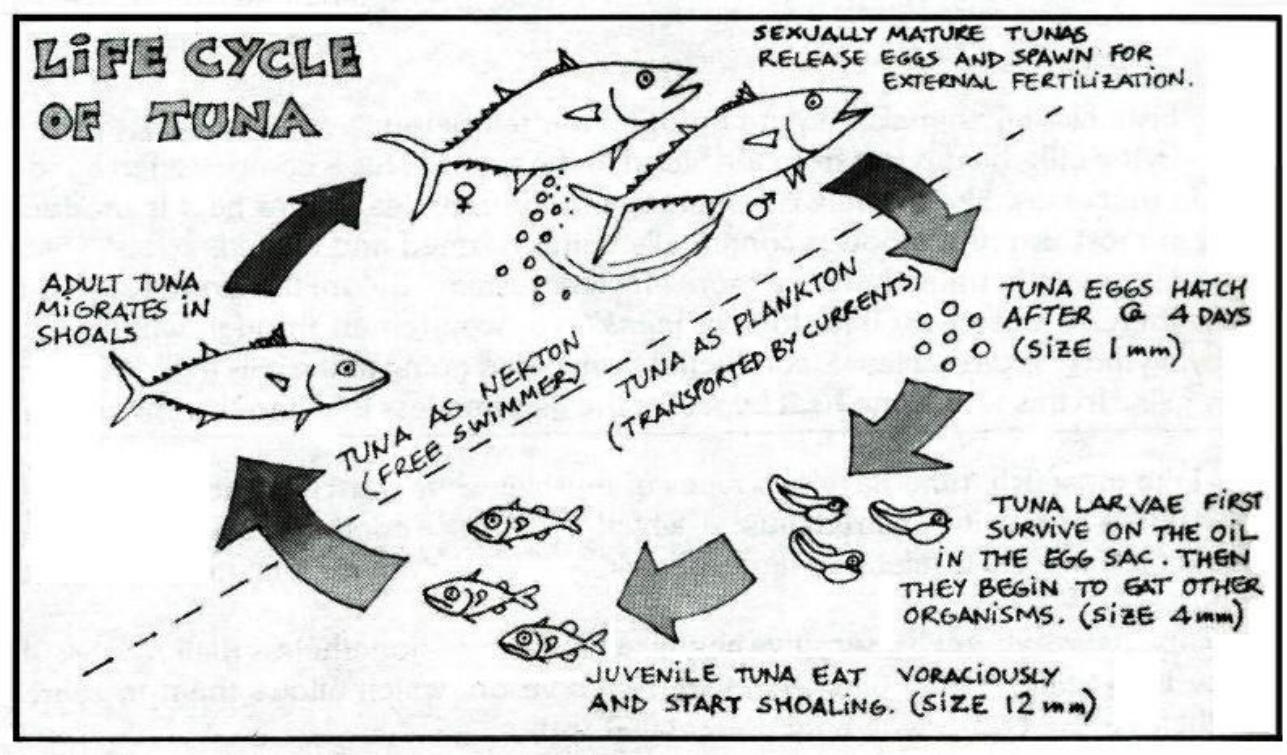


Along-track Dive Behavior (Bay of Bengal)

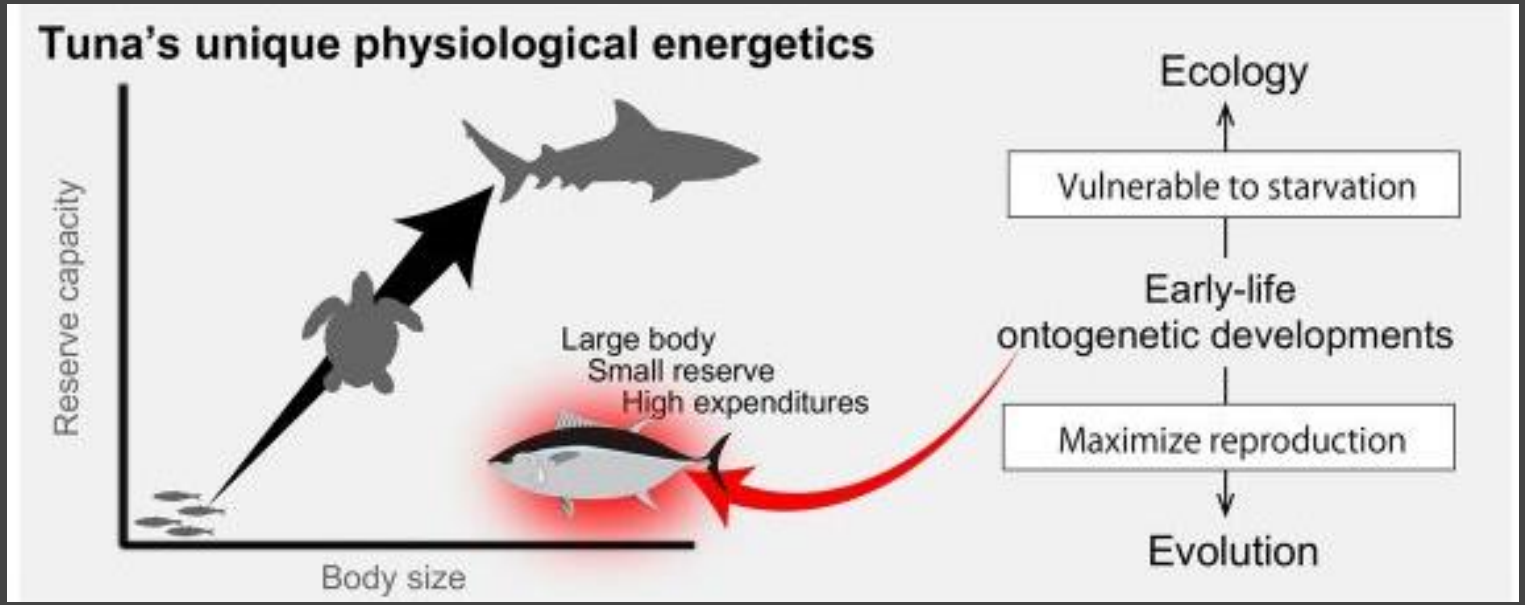
DOI: 10.1080/01431161.2019.1707903

Cradle to Grave



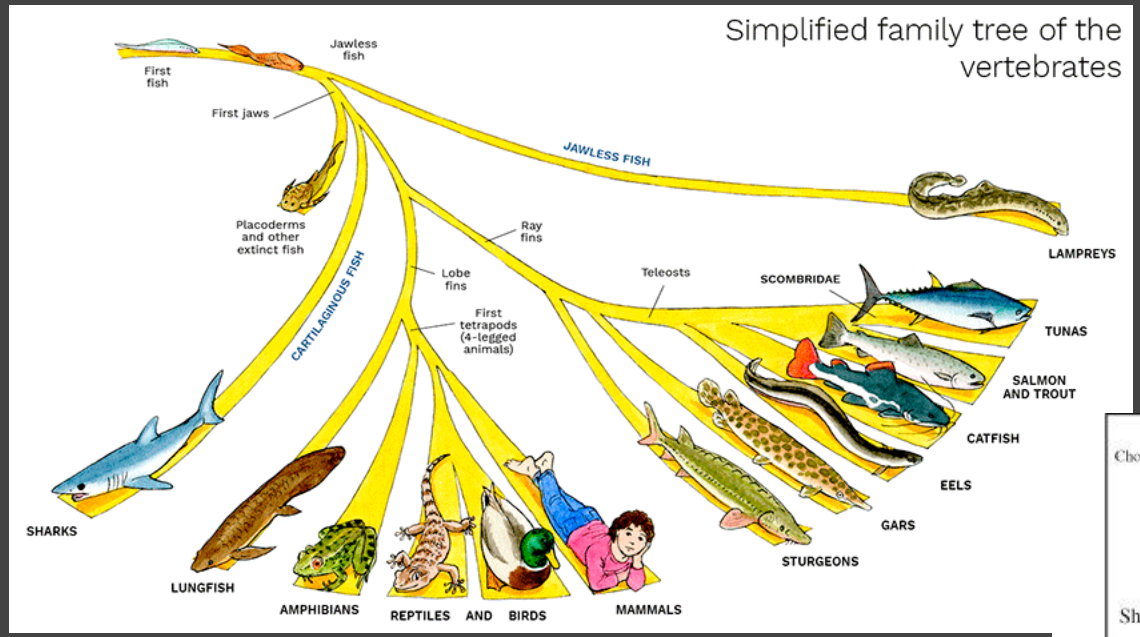
Courtesy: Wikimedia commons

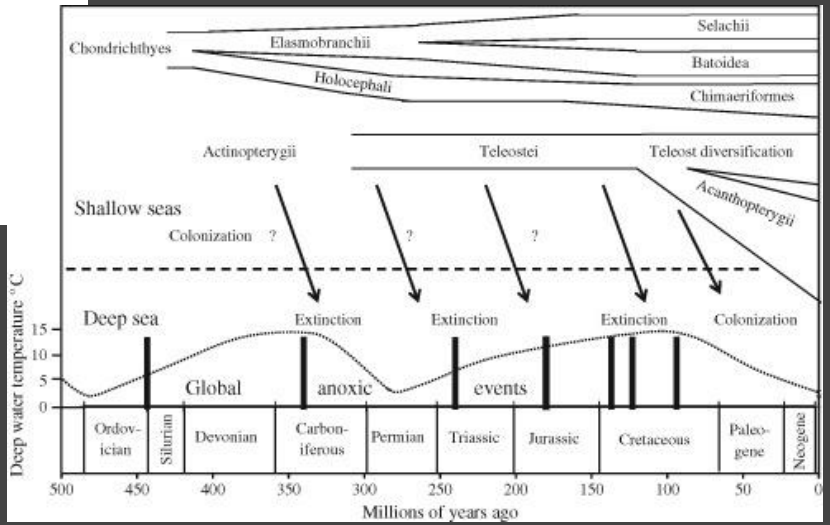
Unique



DOI: 10.1016/j.jmarsys.2020.103307

Evolution





Courtesy: PlanetTuna, Wikimedia Commons

A fish like a mammal?

- Endothermic traits
- Countercurrent heat-exchange
- Artery reserves
- Larger gills (speed attack!)

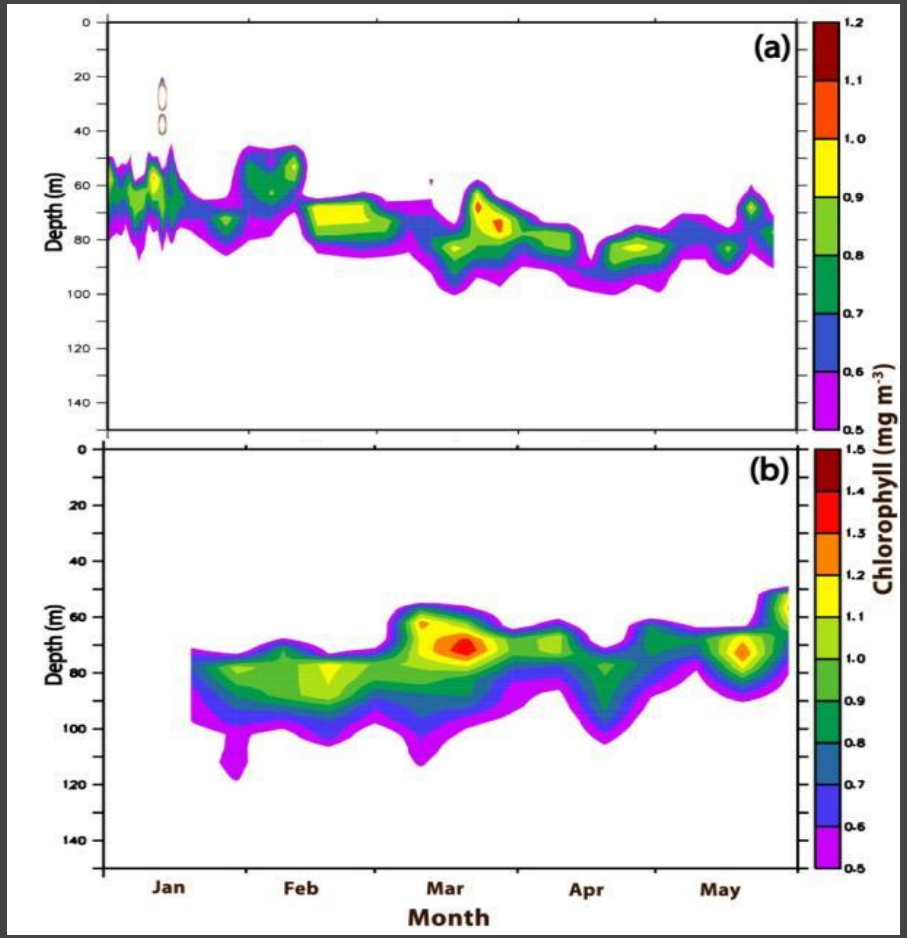
- Randall et al.,2014.

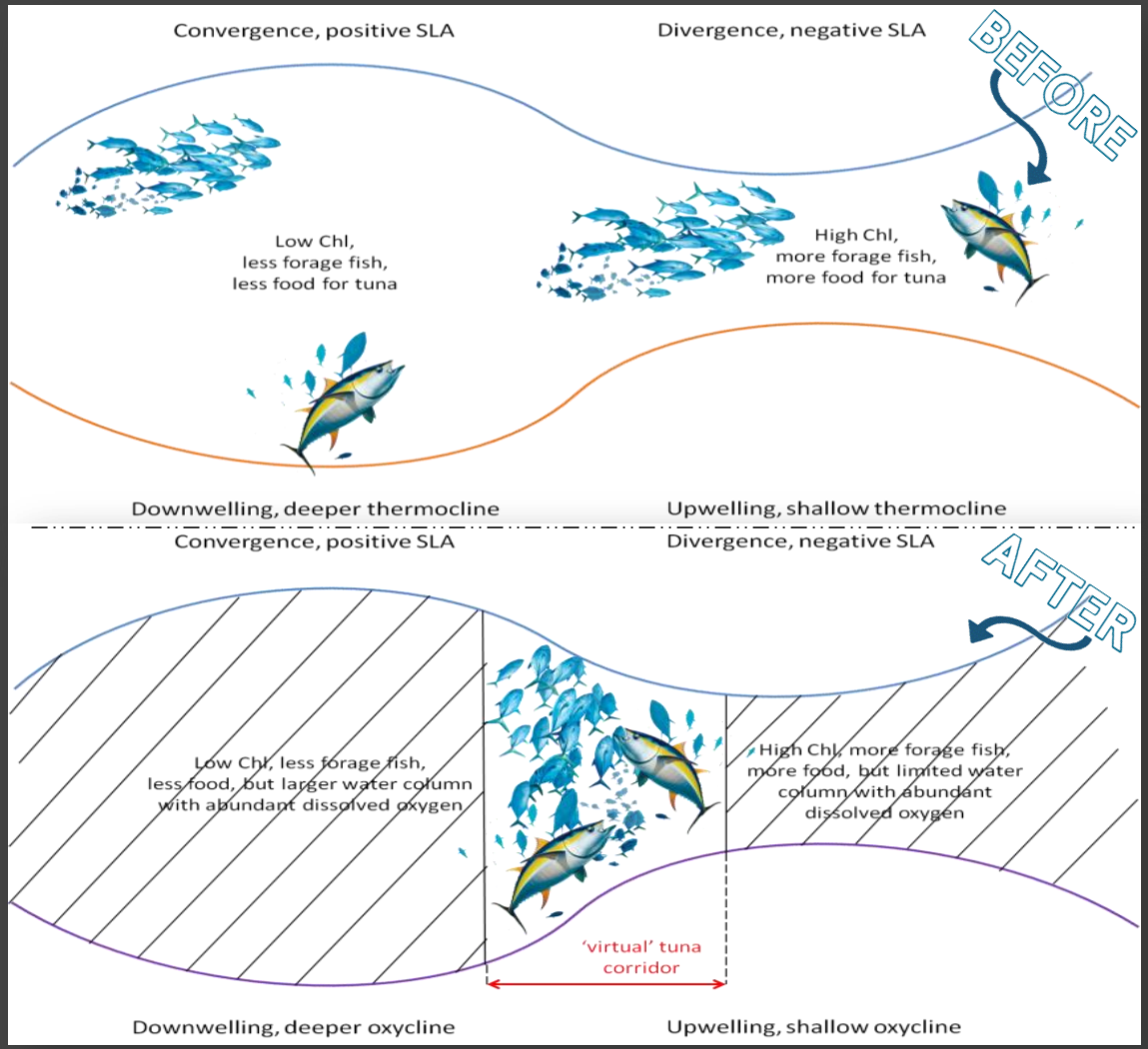
What about Gasps?

- ‘Virtual swimming’ tanks
- Resilience
- Sensitivity
- Implications

- Bushnell, Brill, and Bourke, 1990.

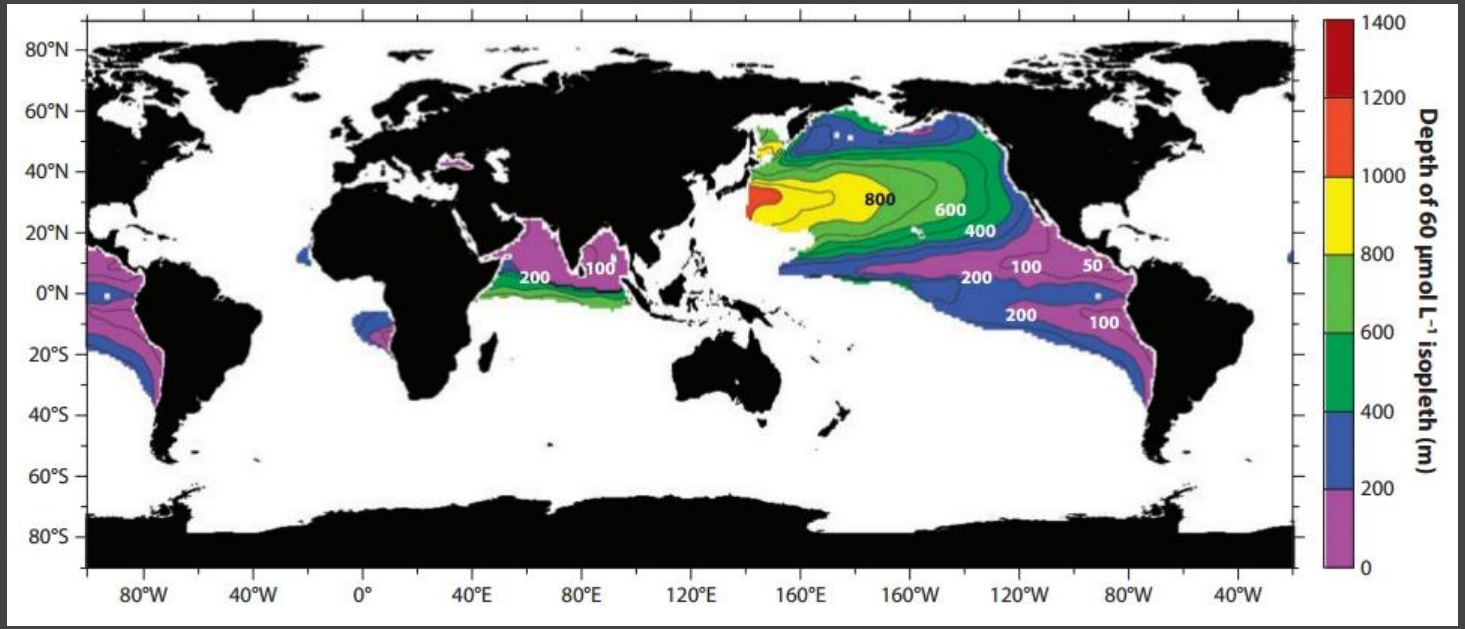
The food





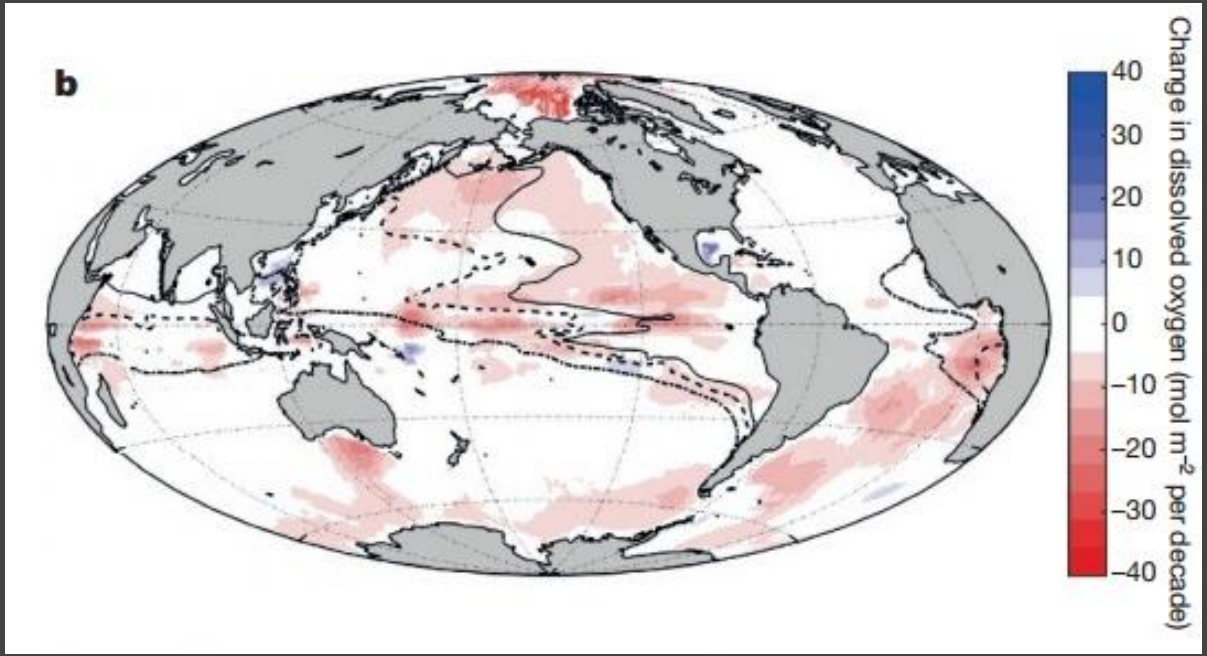
What SATTUNA found?

Natural laboratory (or time-machine?)



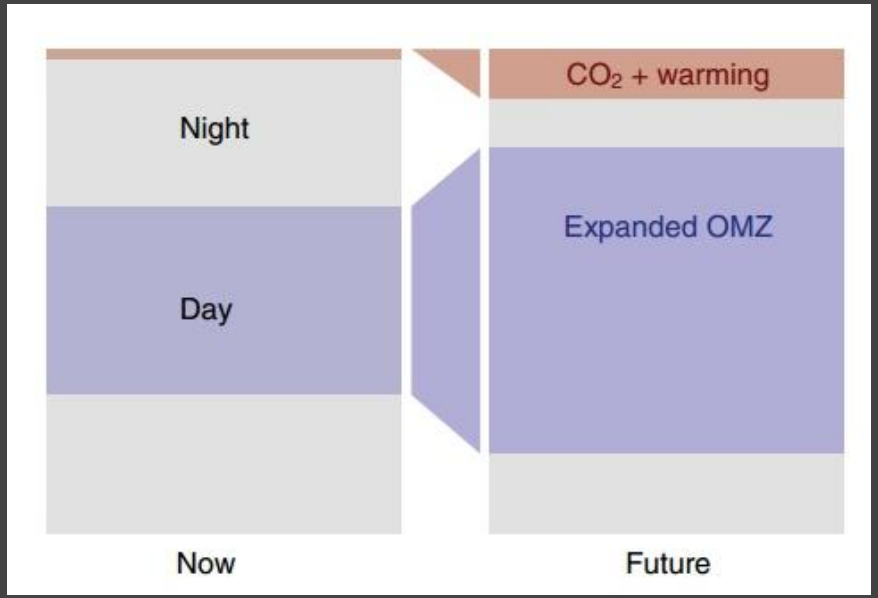
DOI:10.1146/annurev.marine.010908.163855

Continual loss



DOI:10.1038/nature21399

Future implications



nature climate change
LETTERS
PUBLISHED ONLINE: 4 DECEMBER 2011 | DOI: 10.1038/NCLIMATE1304

Expansion of oxygen minimum zones may reduce available habitat for tropical pelagic fishes

Lothar Stramma[1], Eric D. Prince[2]*, Sunke Schmidtko[3†], Jiangang Luo[4], John P. Hoolihan[5], Martin Visbeck[1], Douglas W. R. Wallace[1,6], Peter Brandt[1] and Arne Körtzinger[1]

doi:10.1242/jeb.049171

Q & A

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