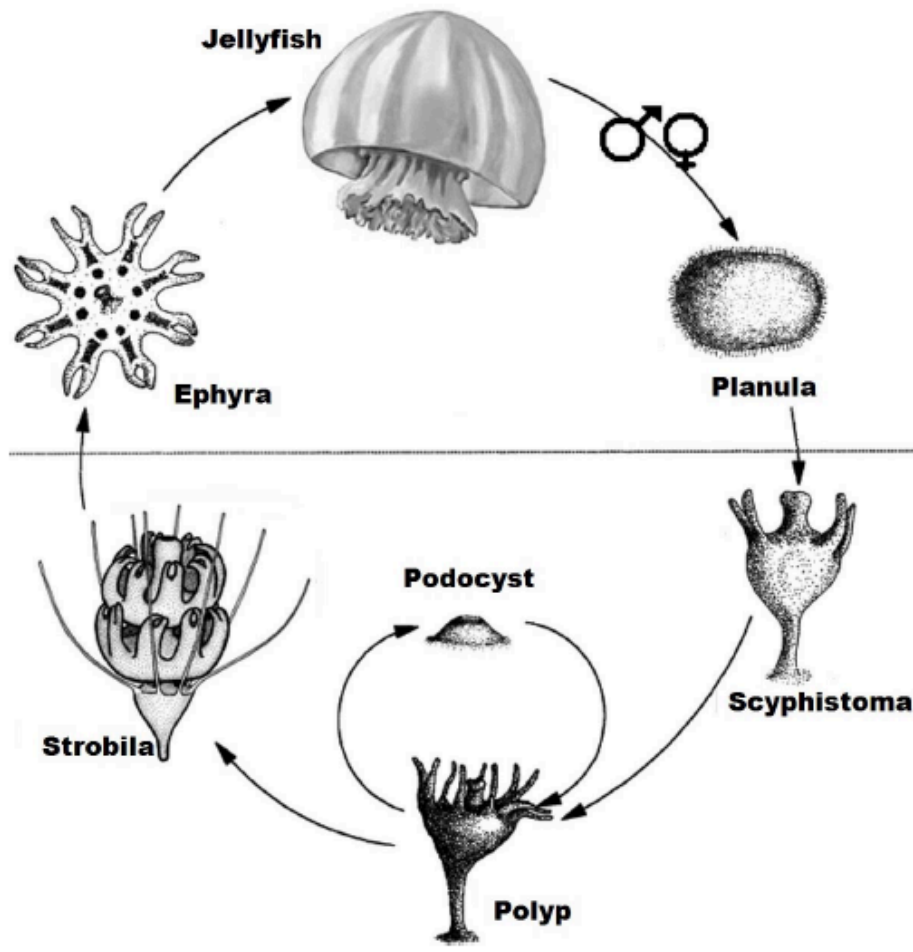
An aerial photograph showing a vast expanse of the ocean covered with a dense, multi-colored bloom of jellyfish. The water is a mix of light blue, green, and white, with the jellyfish appearing as numerous small, translucent, bell-shaped organisms floating on the surface. The bloom extends across the entire visible area of the water.

**Are our oceans turning into jelly?
The effect of climate change on gelatinous
zooplankton**

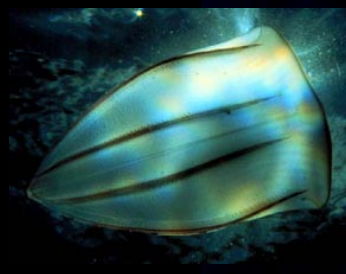
**Natasha Henschke
Princeton University**

Future work with Nereus

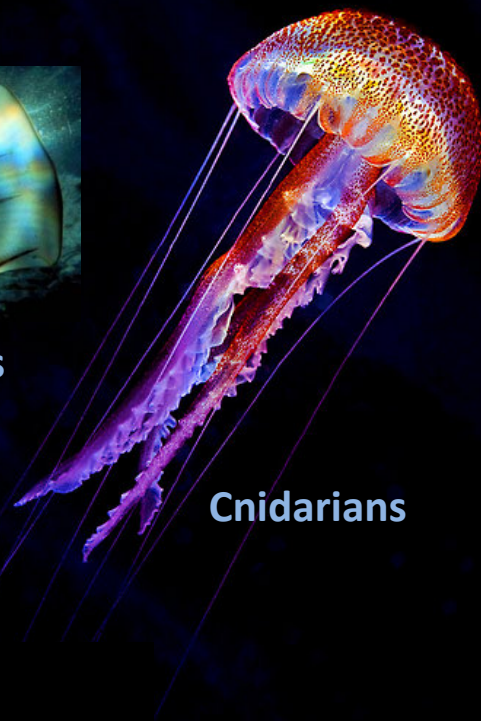
- Examine and model global relationships between climate and jellyfish blooms
- Explore the global role of gelatinous zooplankton within planktonic food webs



Swarming species



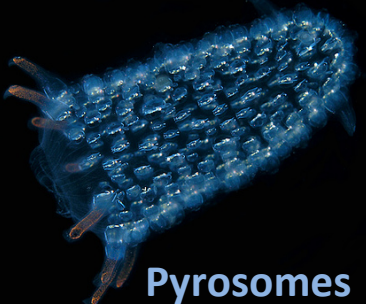
Ctenophores



Cnidarians



Salps



Pyrosomes





エチゼンクラゲが日本に流れつくルート

エチゼンクラゲの
本来の生息域



Potential impact of climate change

(b)

Eutrophication

Phytoplankton flagellate blooms
might favour jellyfish

Nutrient run-off (high N and P, low Si)

Phytoplankton
bloom

Climate change

Warming enhances stratification
and promotes flagellates and jellyfish.
Tropical jellyfish could
expand to temperate latitudes

Warming



Stratified conditions
Warm, nutrient
- poor water

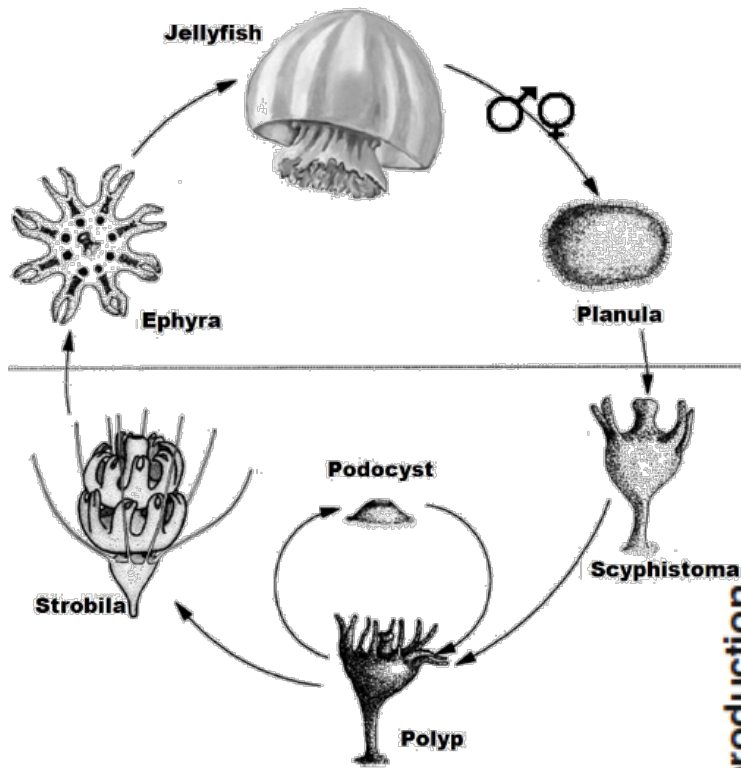
Sinking phytoplankton

Low O₂ levels

Jellyfish
tolerate
low O₂
conditions

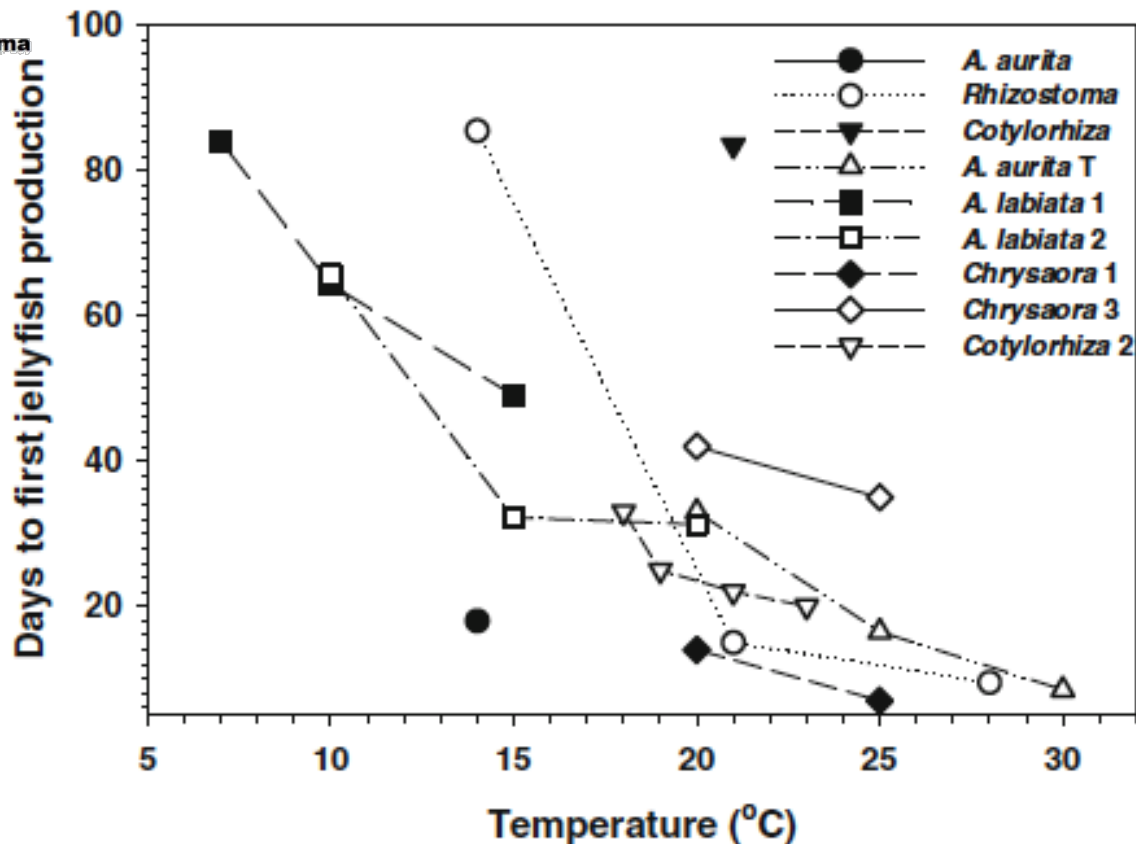
Bacteria decomposing on
dead phytoplankton

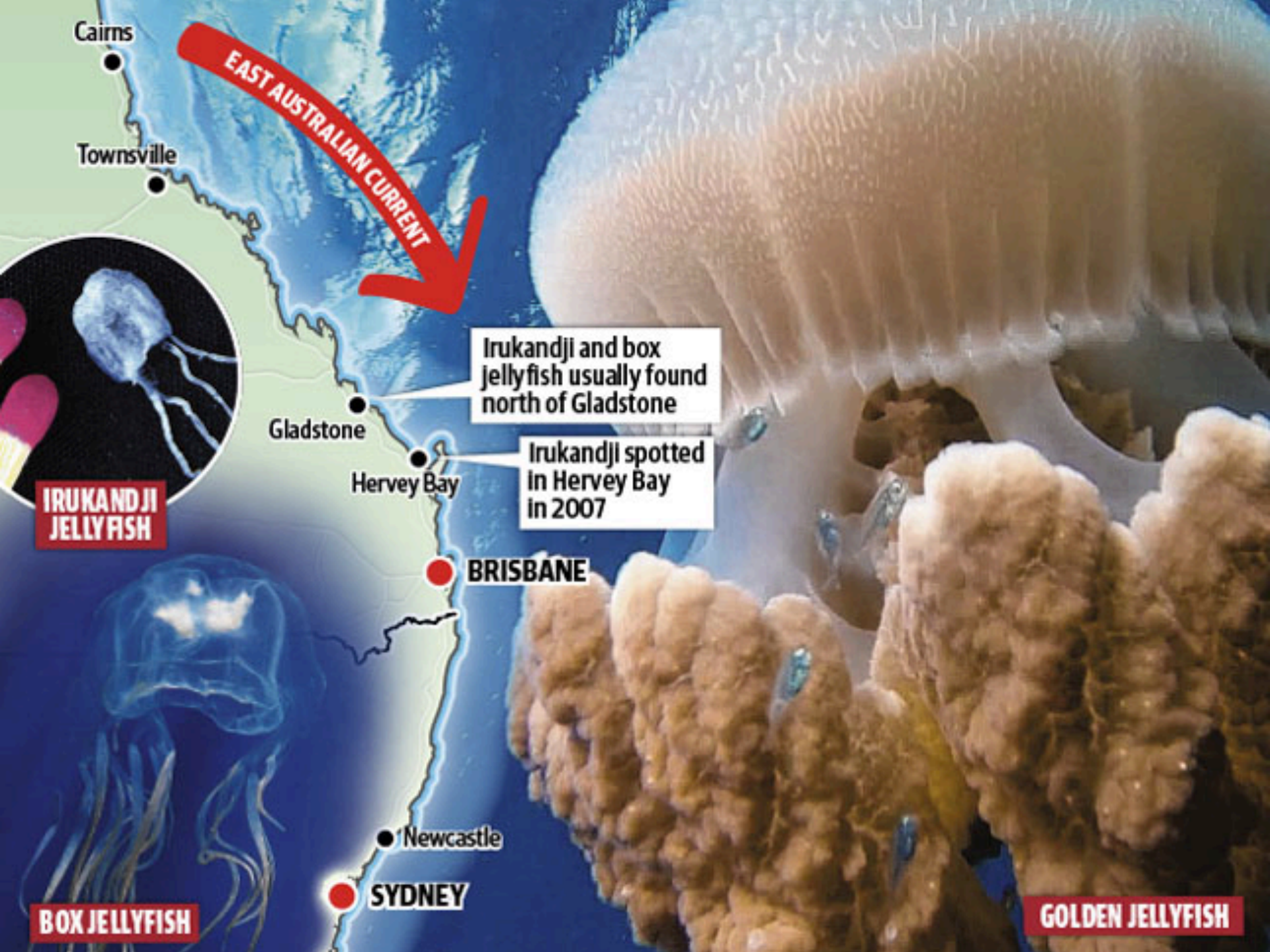
Cool, nutrient
- rich water



Increasing temperature will:

- Accelerate medusae growth
- Accelerate ephyrae production
- Lengthen reproductive season





Cairns

Townsville

EAST AUSTRALIAN CURRENT

Gladstone

Hervey Bay

Irukandji and box jellyfish usually found north of Gladstone

Irukandji spotted in Hervey Bay in 2007

BRISBANE

Newcastle

SYDNEY

IRUKANDJI JELLYFISH

BOX JELLYFISH

GOLDEN JELLYFISH

Potential impact of climate change

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Bacteria decomposing on
dead phytoplankton

Cool, nutrient
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Are gelatinous zooplankton increasing?

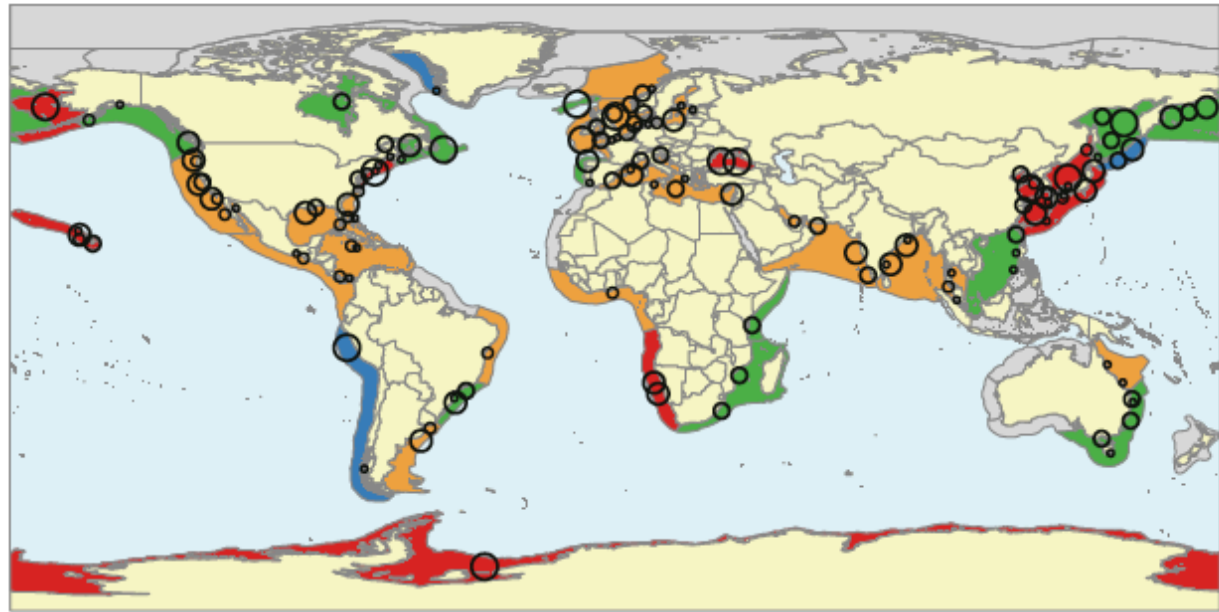
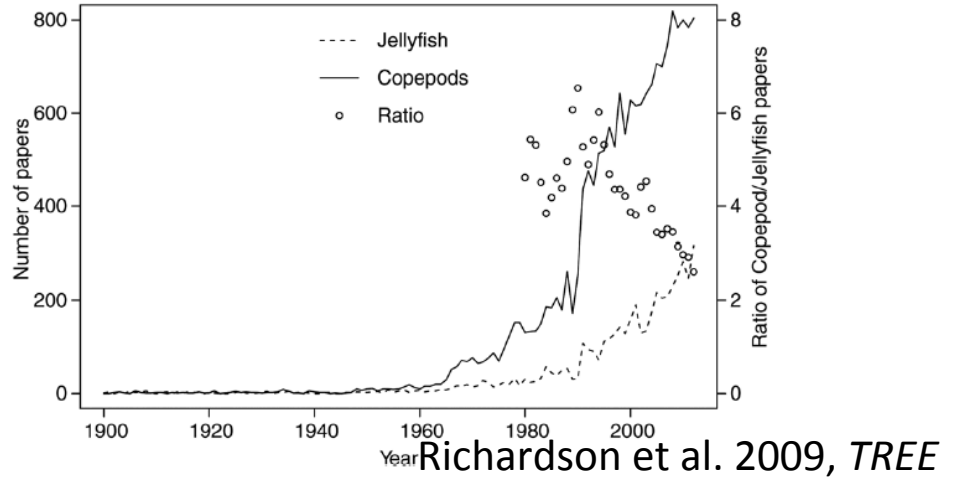
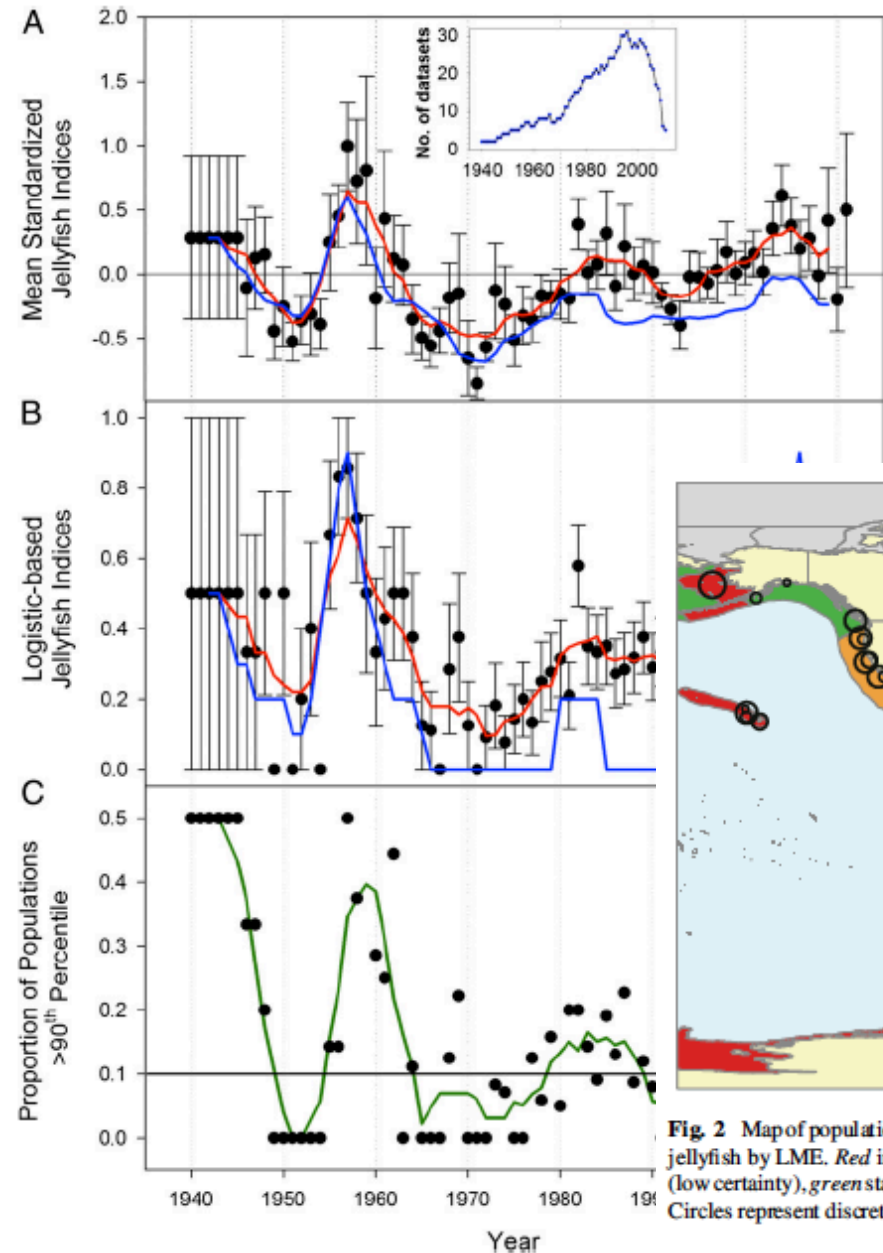
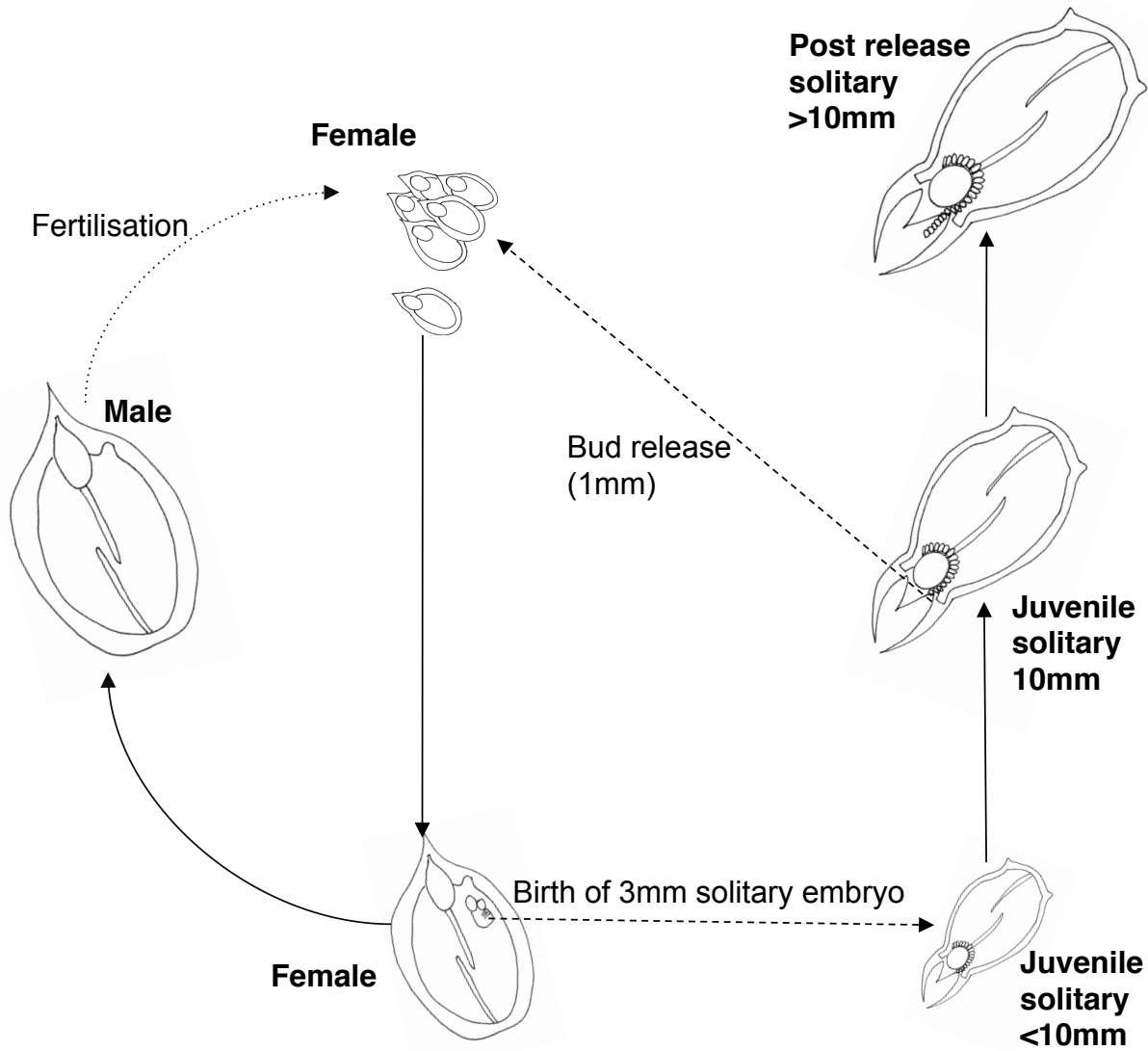


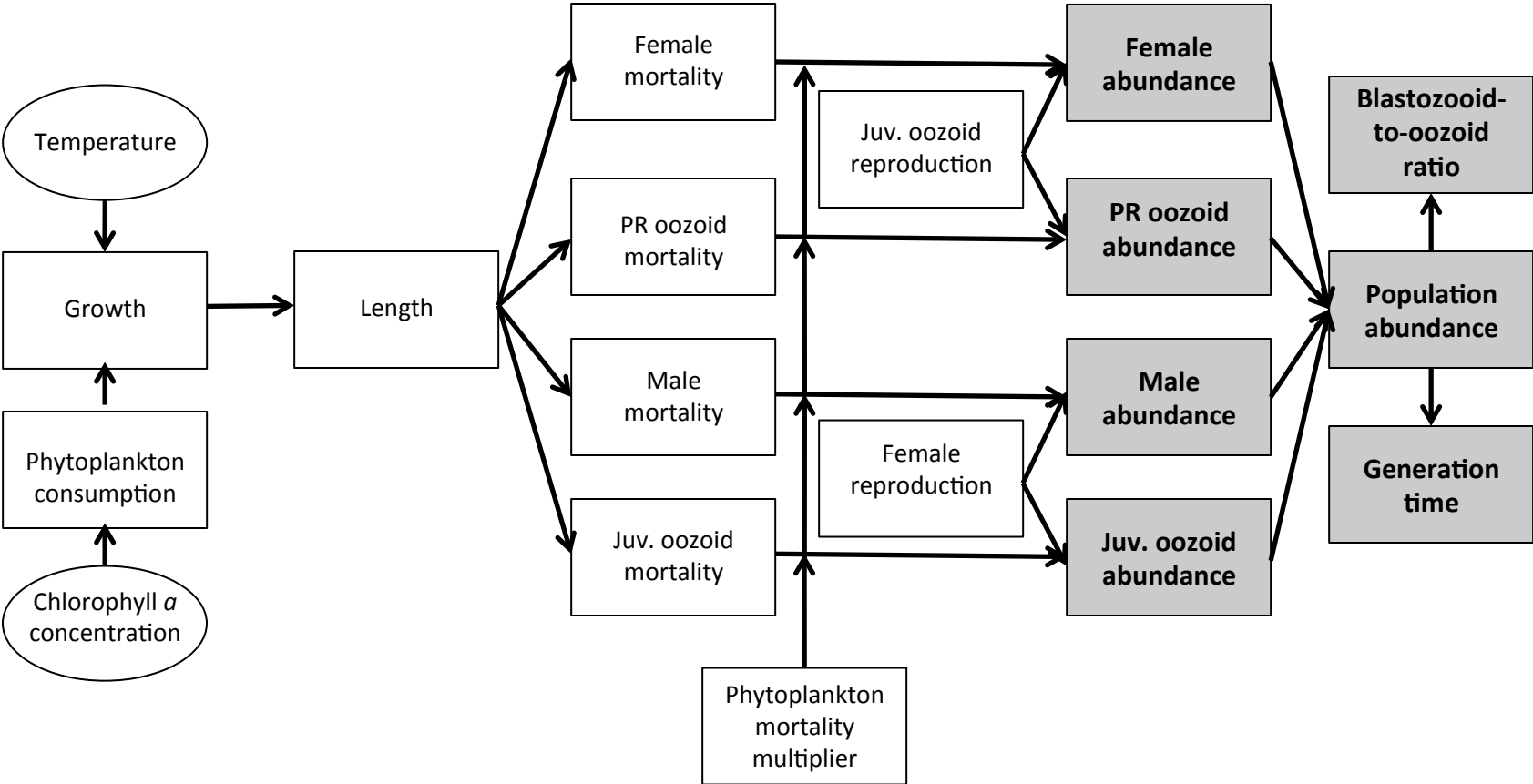
Fig. 2 Map of population trends of native and invasive species of jellyfish by LME. *Red* increase (high certainty), *orange* increase (low certainty), *green* stable/variable, *blue* decrease, *grey* no data. Circles represent discrete chronicles with relative sizes reflecting

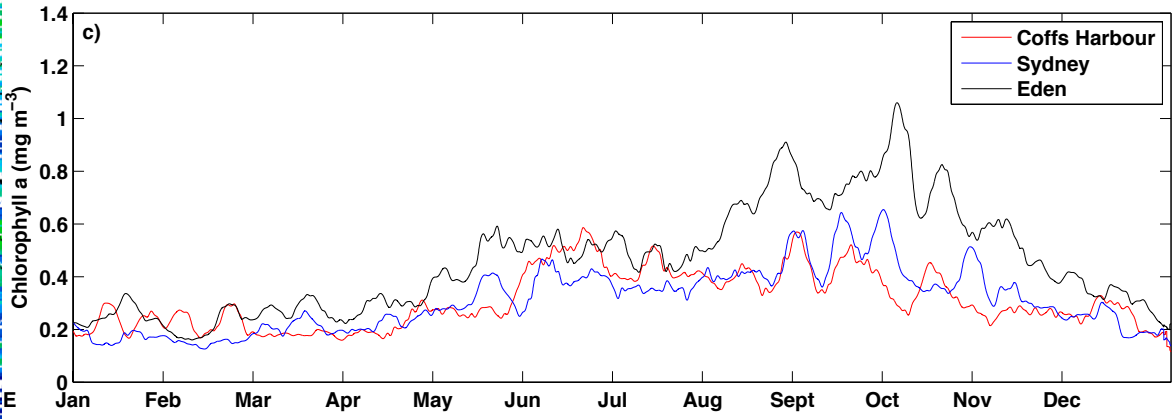
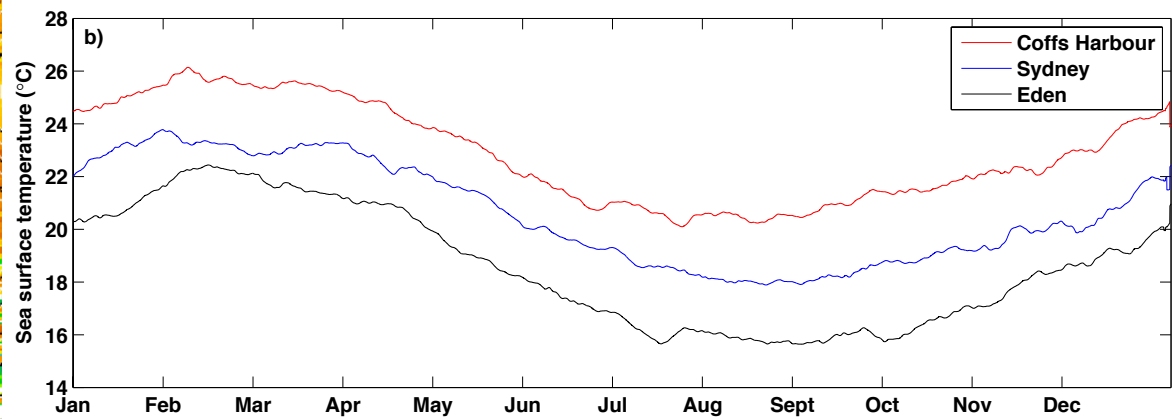
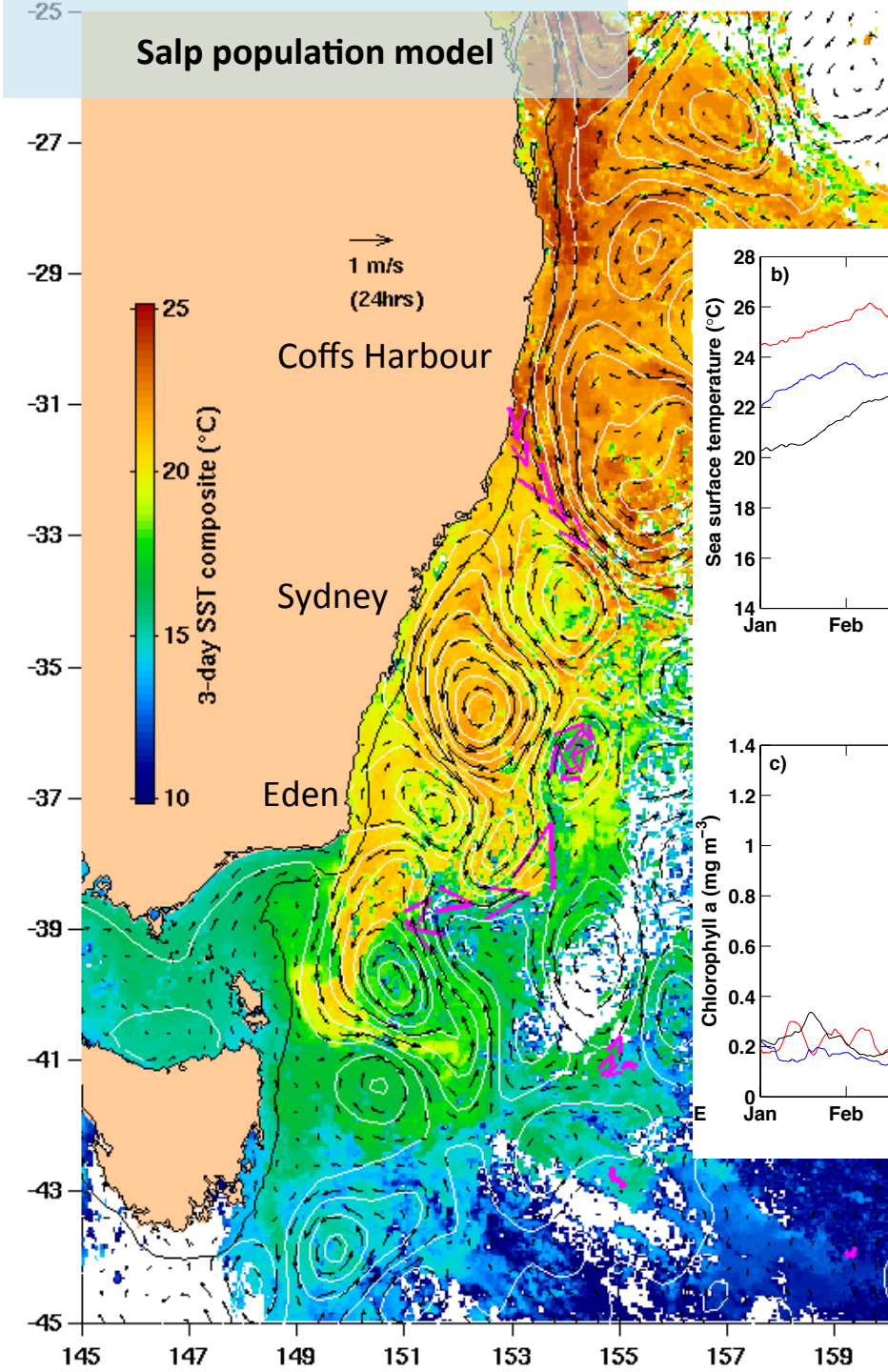
the Confidence Index. Circle locations are approximate, as some were shifted to avoid overlap; the circle for the Antarctic LME summarizes circumpolar observations

Salp population model

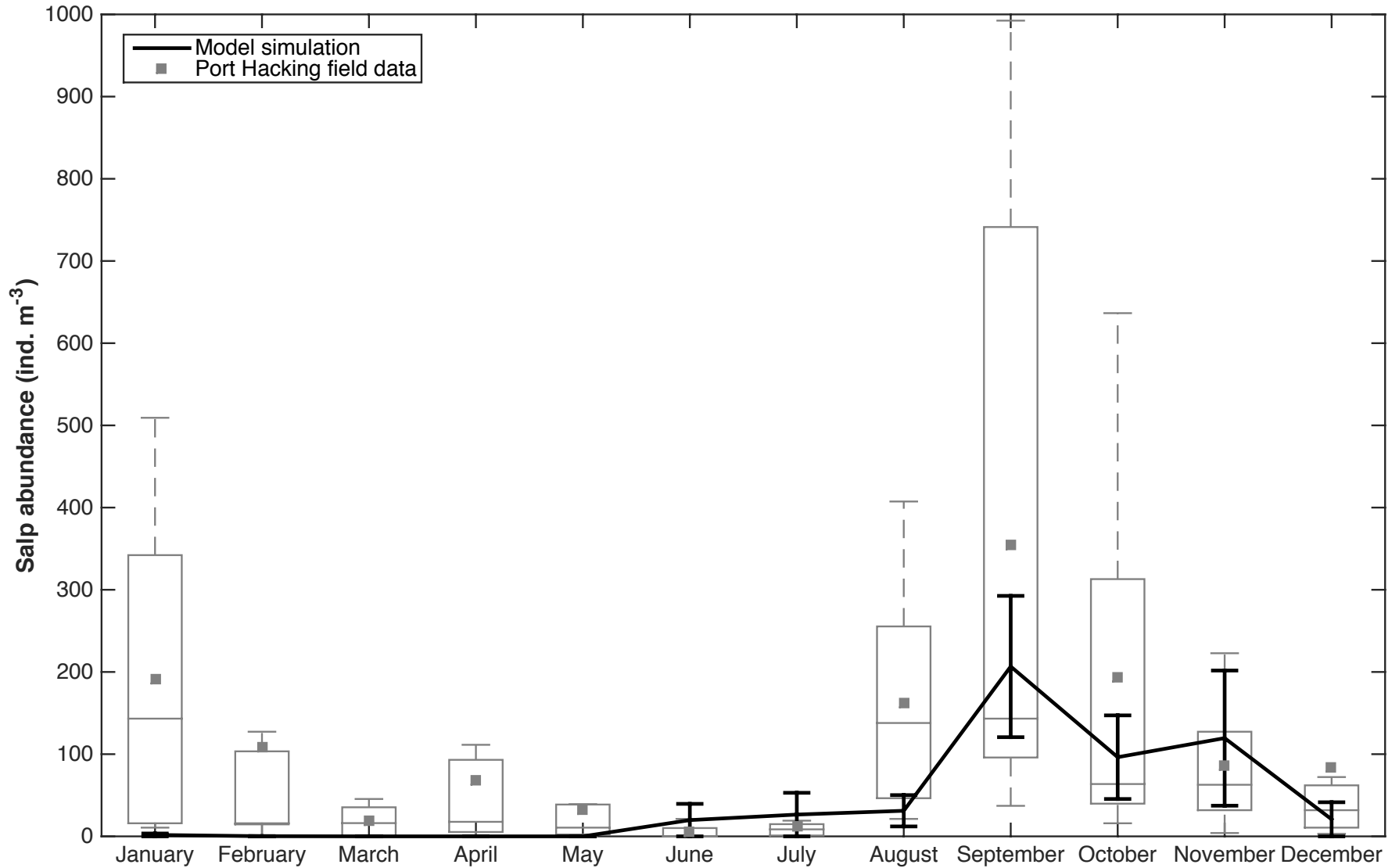


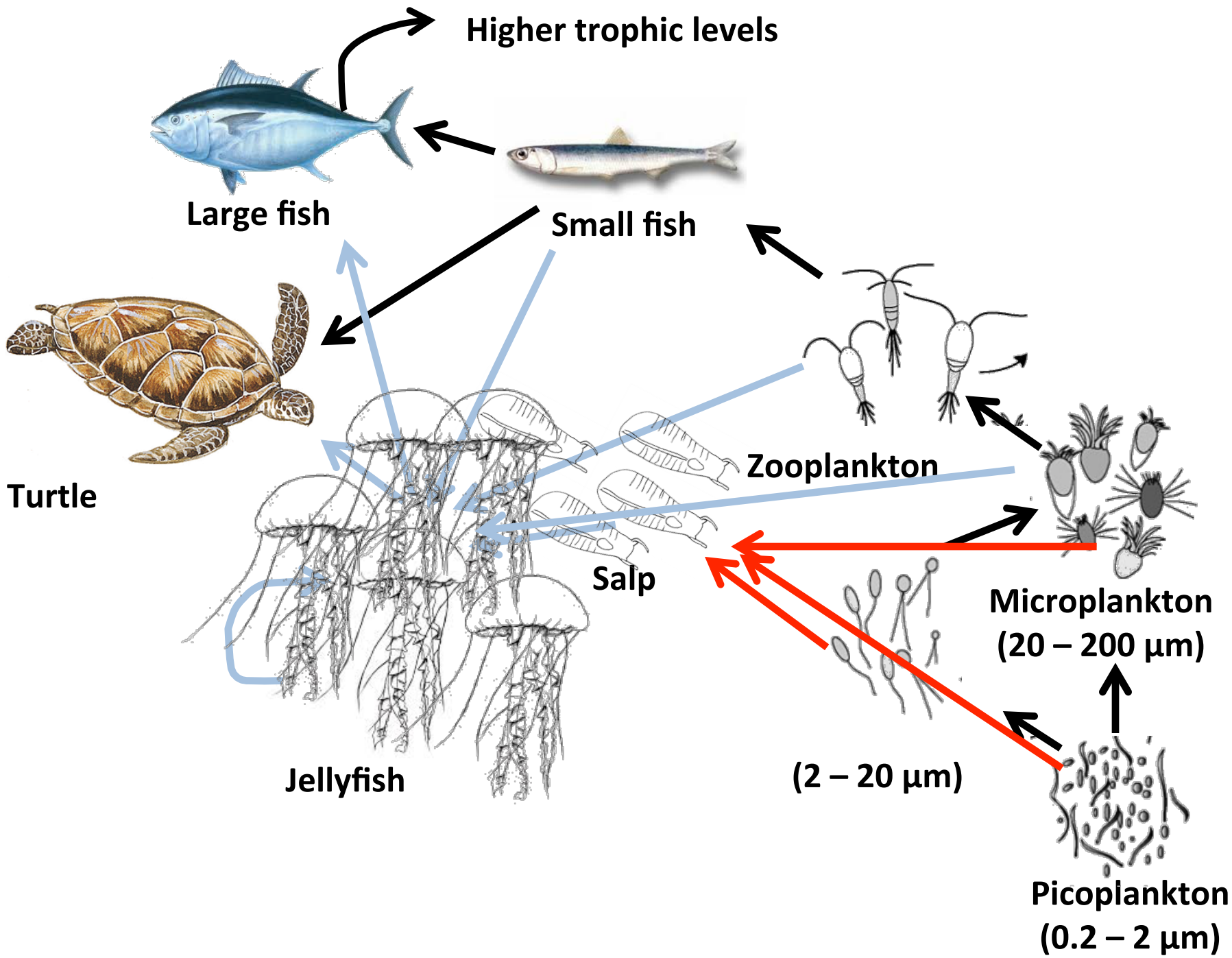
Salp population model



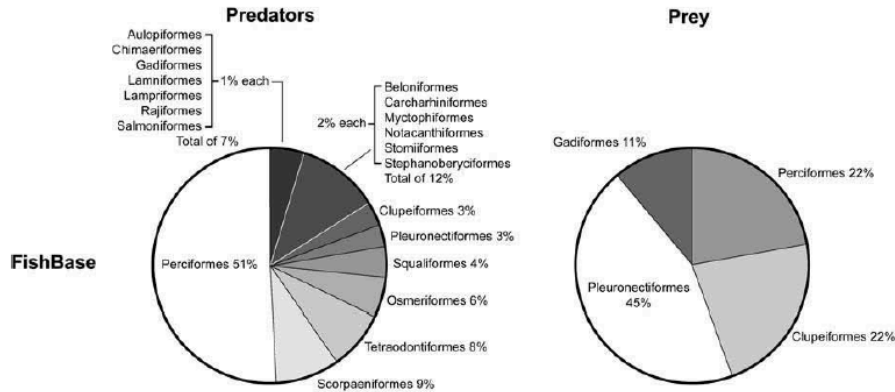


Salp population model

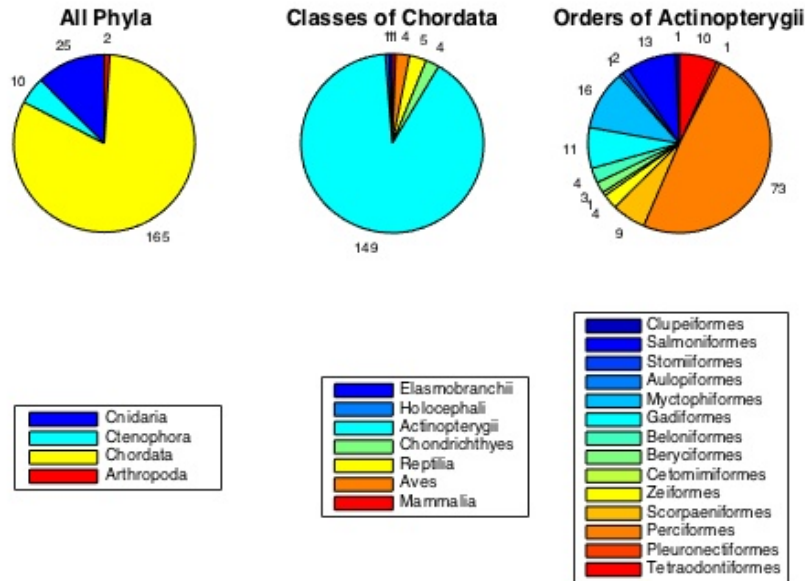
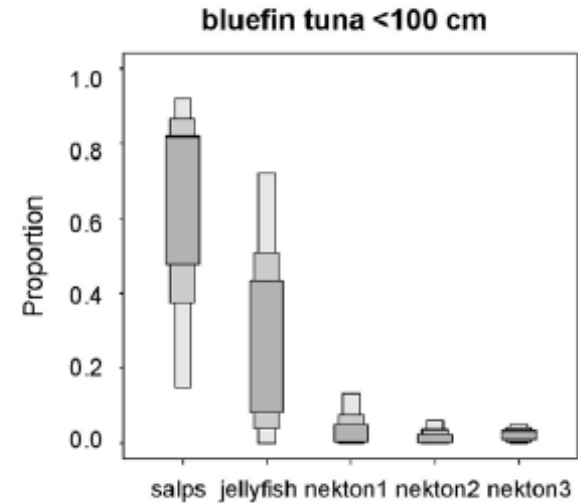




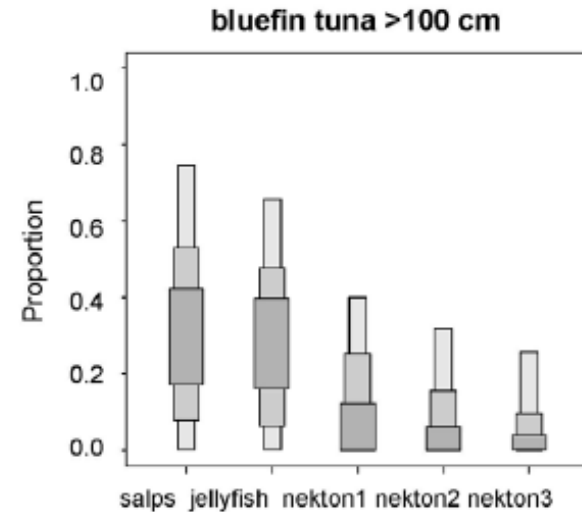
Predators of gelatinous zooplankton



Pauly et al., 2009, *Hydrobiologia*



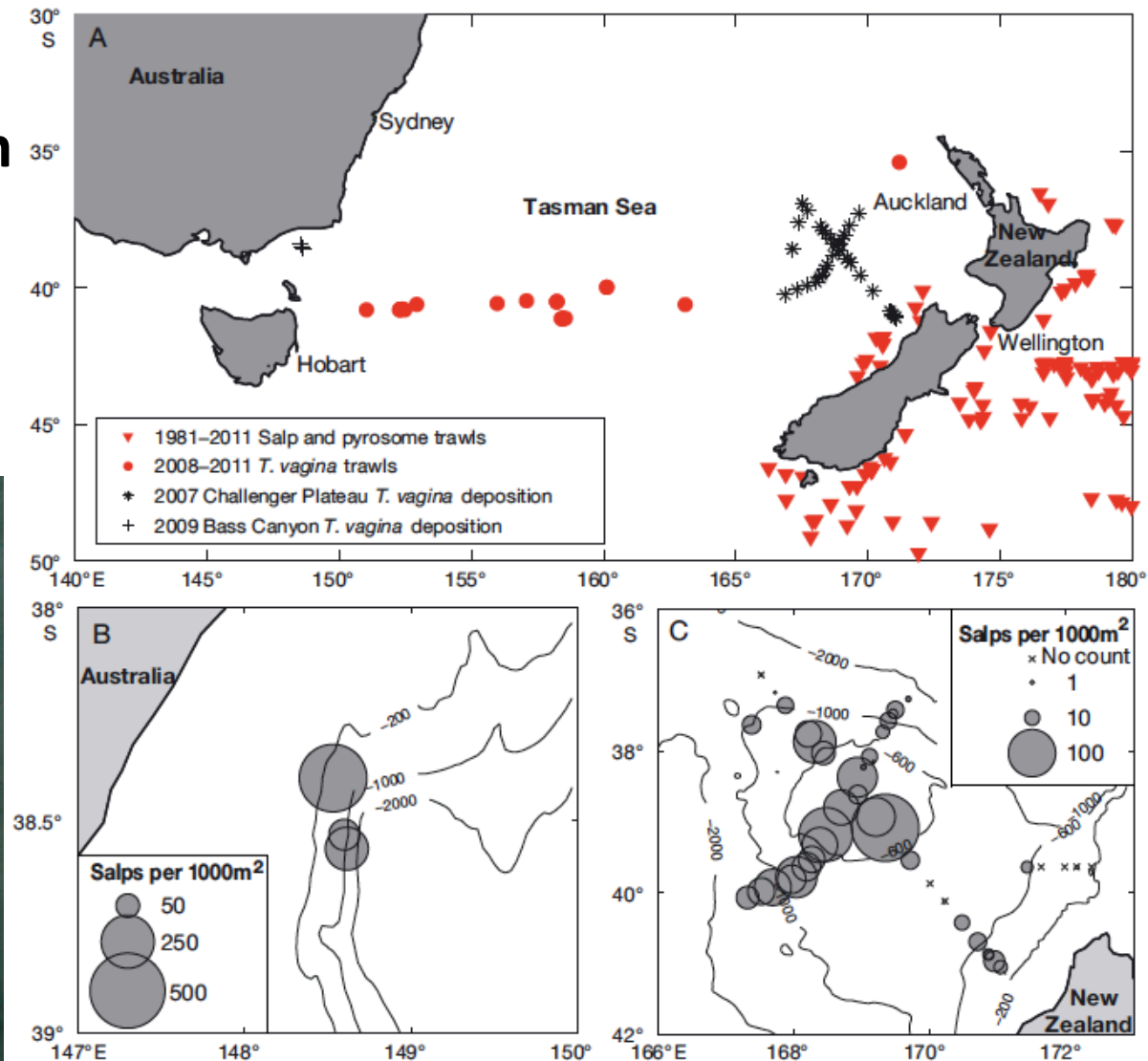
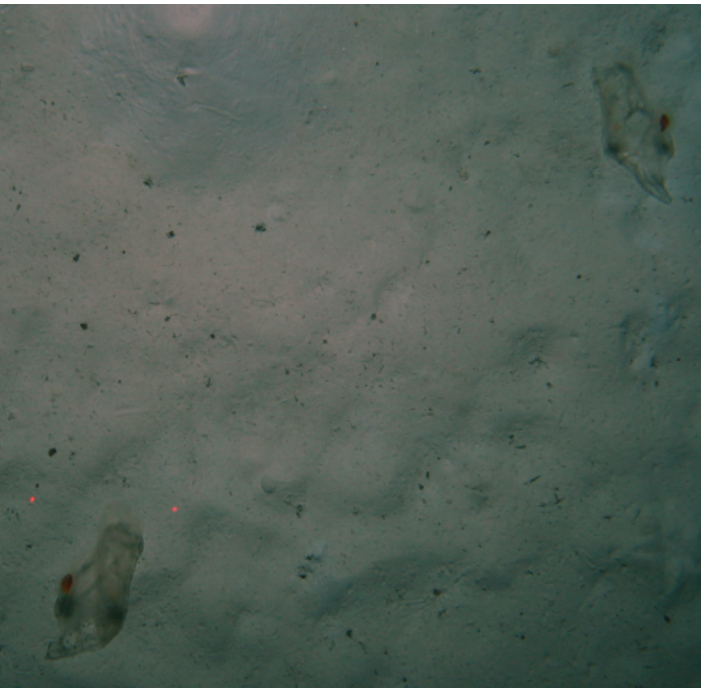
Henschke et al., in prep



Cardona et al., 2012, *PLoS One*

Mass deposition of salp carcasses in the Tasman Sea

- 1768 individuals
- Sinking rates of 1700 m day⁻¹
- 32% decomposition after 30 days



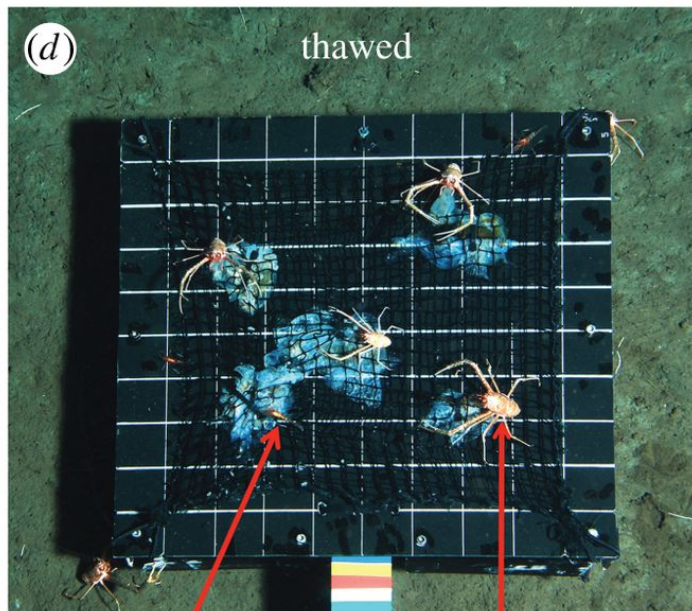
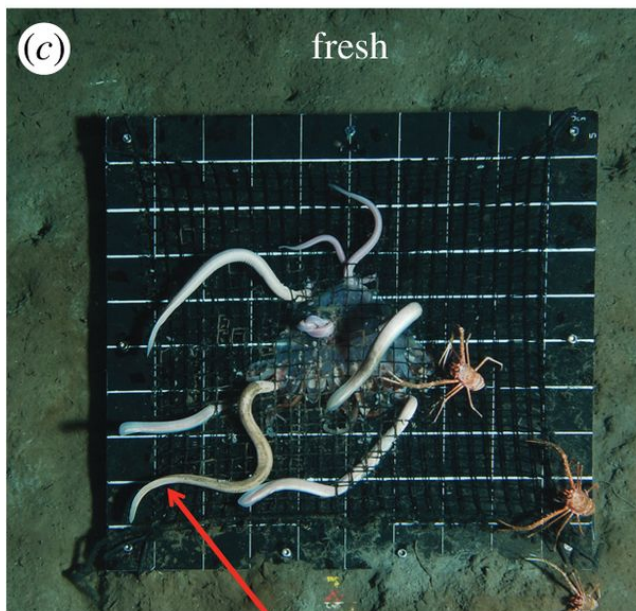
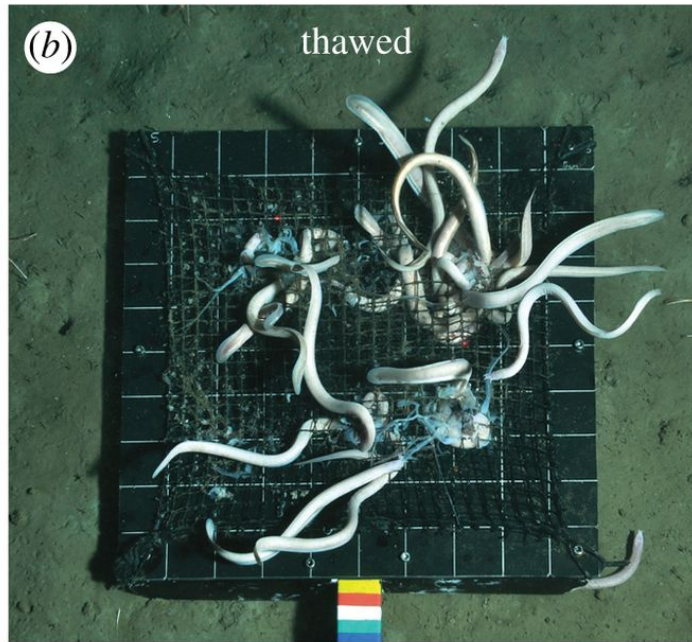
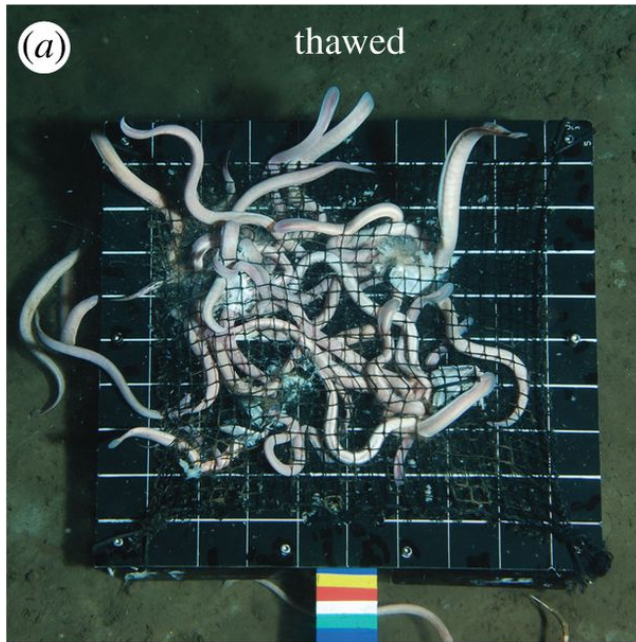
Thetys vagina



Platymaia maoria

482 m

Henschke et al 2013, MEPS



M. glutinosa

decapod shrimp

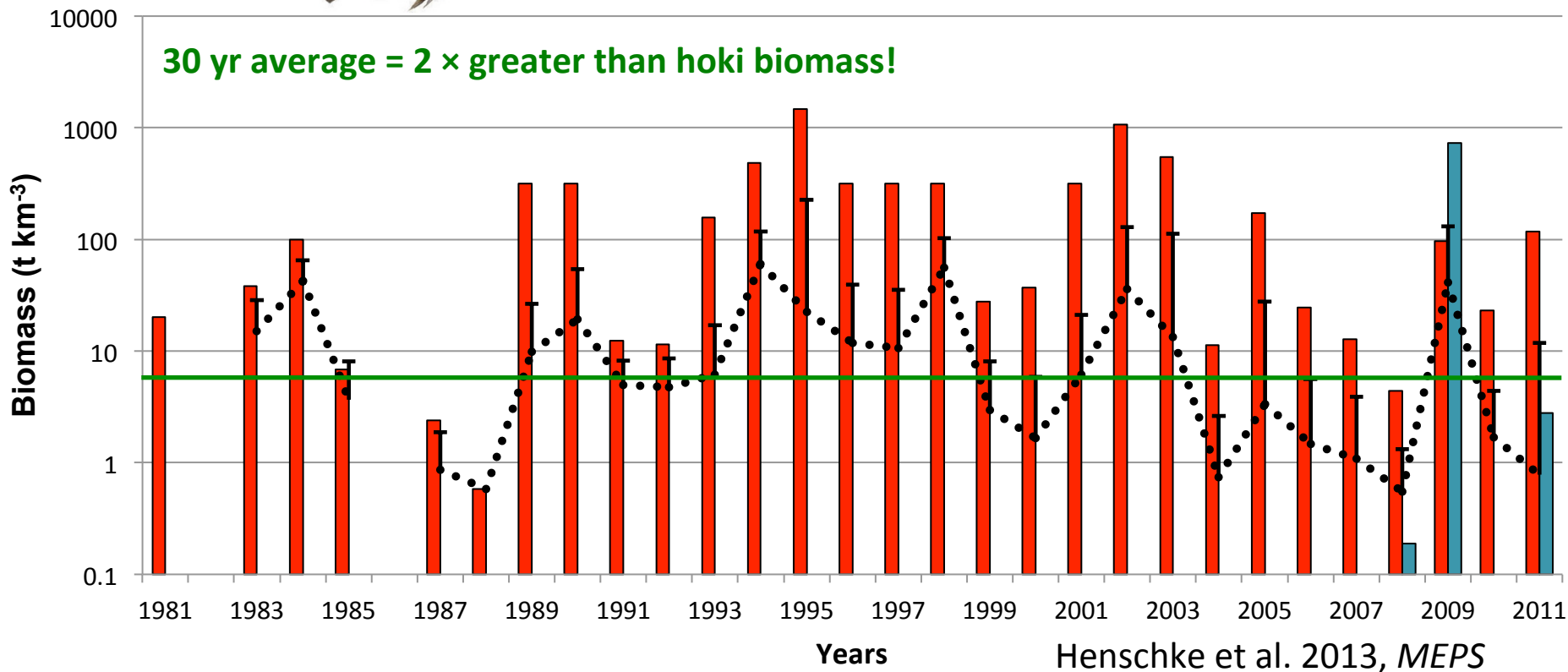
M. tenuimana

New Zealand's #1 fisheries species



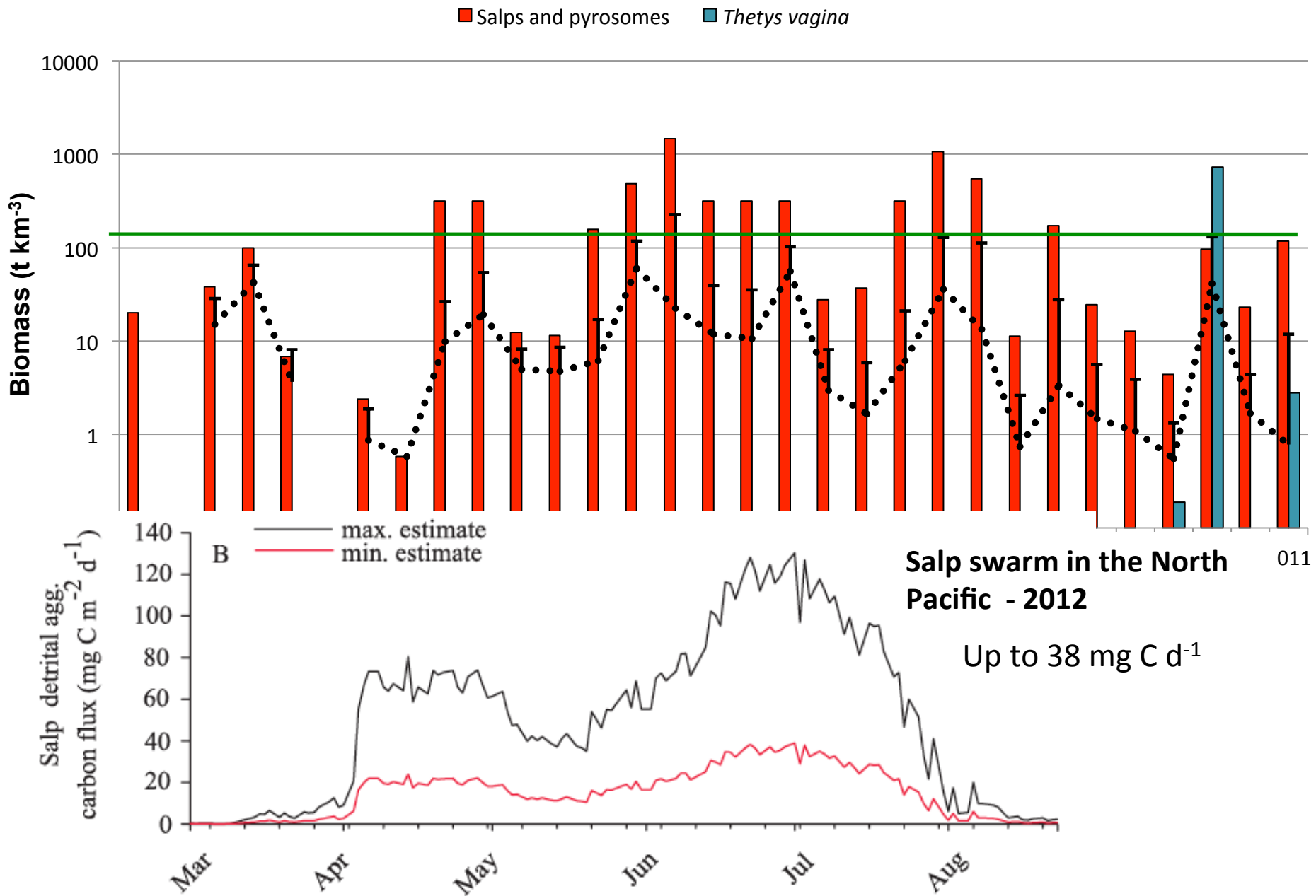
Salps and pyrosomes *Thetys vagina*

30 yr average = 2 × greater than hoki biomass!



Using 100 t km⁻³...

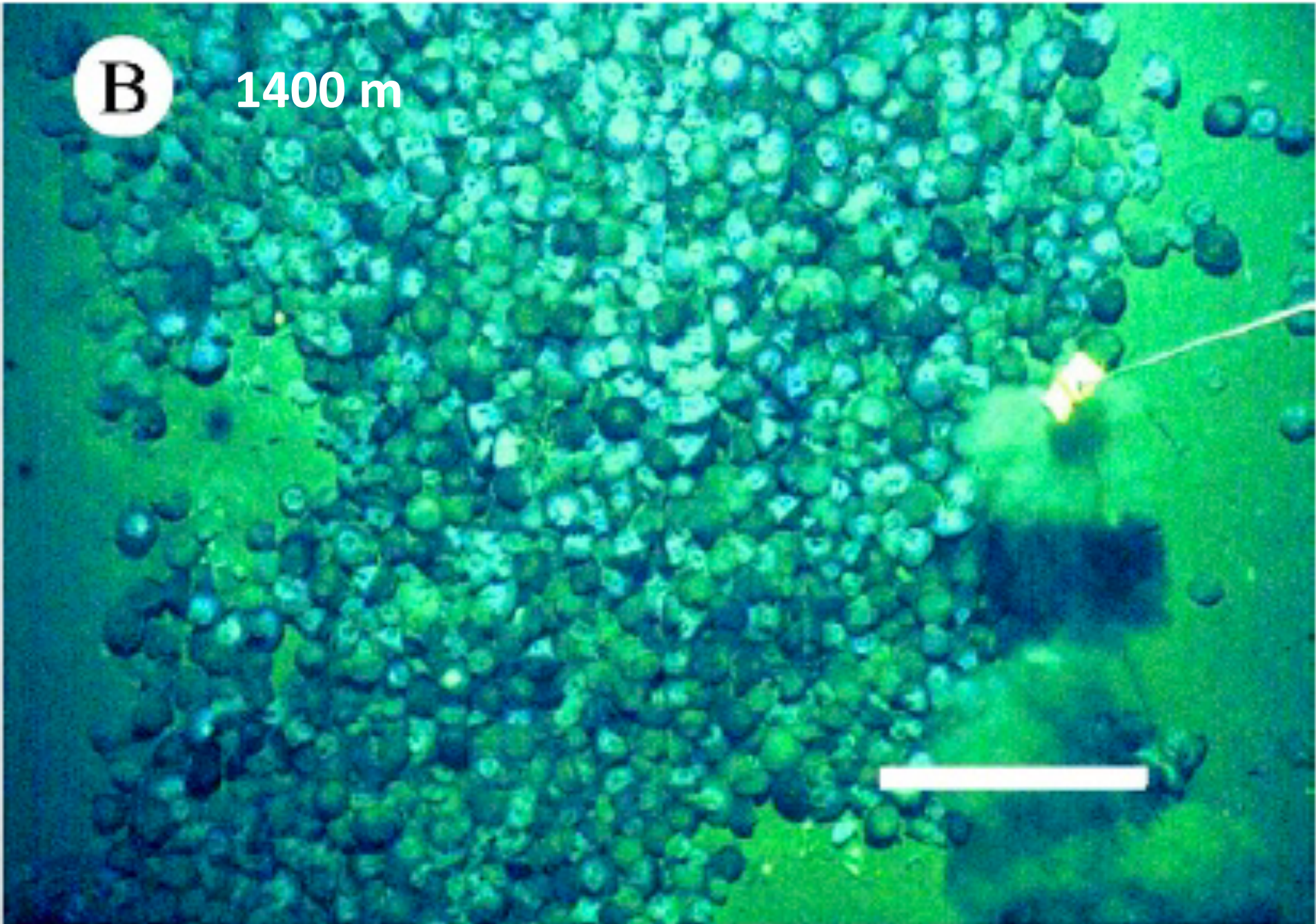
16 t C km⁻² = 10 x annual flux



Crambionella orsini in the Arabian Sea (Billett et al, 2006)

B

1400 m



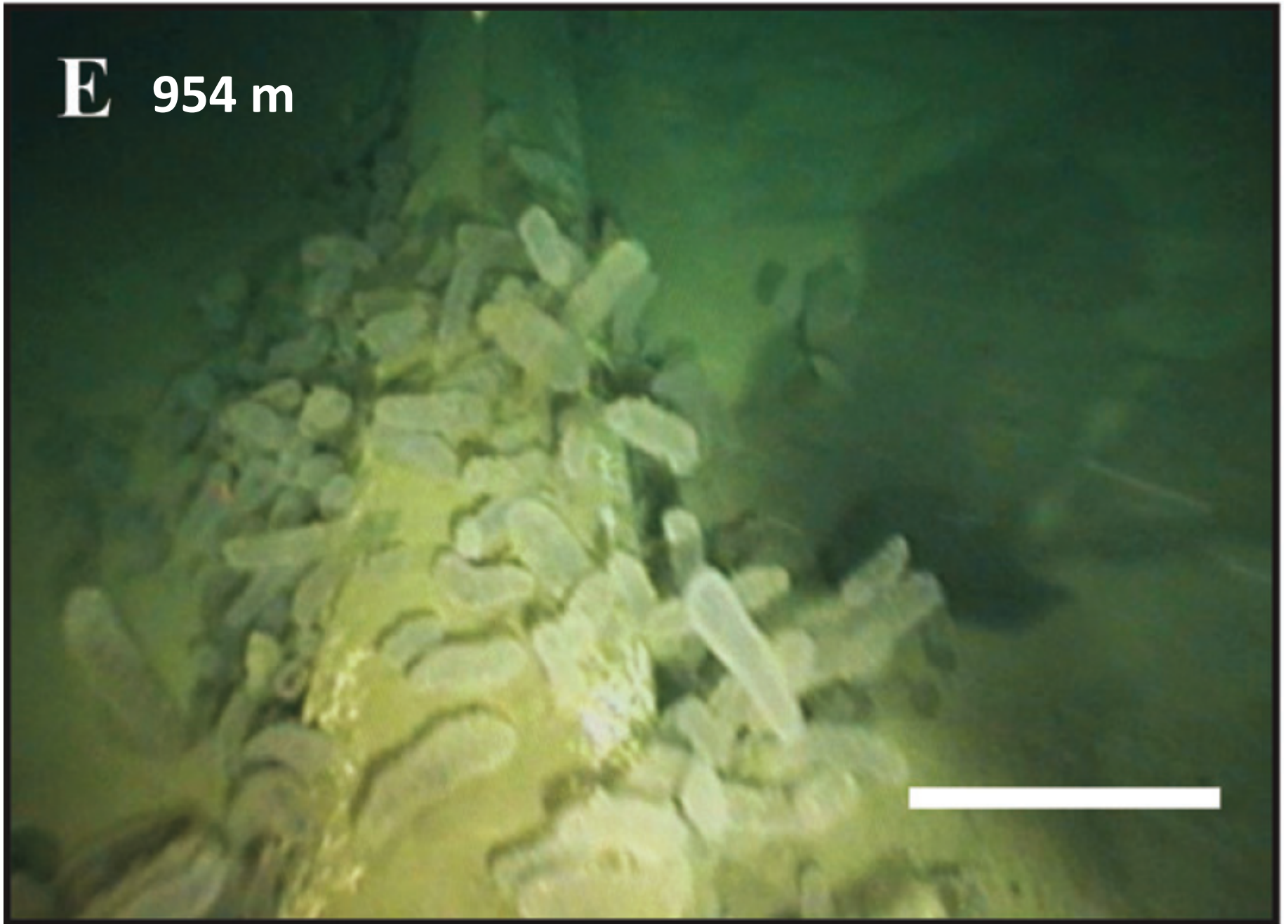
Nemopilema nomurai in the Sea of Japan (Yamamoto et al, 2008)

354 m



Pyrosoma atlanticum off Ivory Coast (Lebrato and Jones, 2009)

E 954 m



Future work with Nereus

- Examine and model global relationships between climate and jellyfish blooms
- Explore the global role of gelatinous zooplankton within planktonic food webs

A large number of colorful jellyfish, including white, yellow, orange, and blue ones, are floating in the water. The jellyfish are densely packed, creating a vibrant, multi-colored sea. The water is a deep greenish-blue. A semi-transparent white rectangular box is overlaid in the center of the image, containing the text "Thank you!".

Thank you!