

How do man-made structures affect Pacific Sea Nettle larval settlement and swimming behavior?



Oregon Institute of Marine Biology

Pre-settlement swimming behavior and substrate selection by *Chrysaora fuscescens* planula larvae

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Global concern surrounds apparent increases in jellyfish blooms



Photo credit: Sam Zeman

- Adult jellyfish congregate in seasonal “blooms”
- Patchy blooms costly for fishing operations (1)
- Increasing blooms suggest ecological shifts

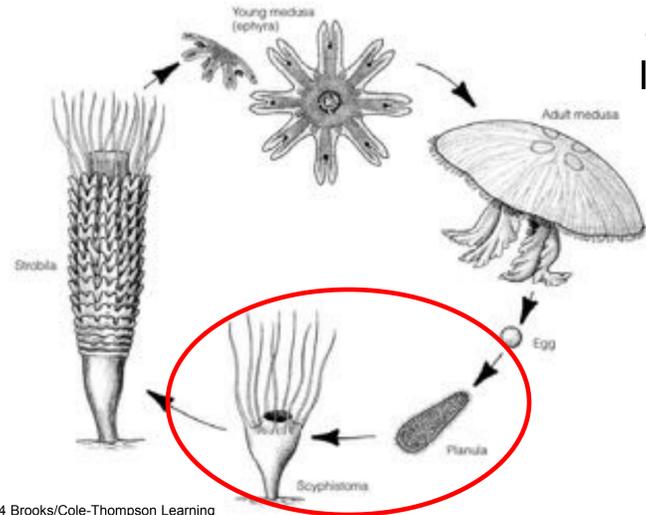
Man-made stressors, including overfishing, eutrophication, climate change, **marine sprawl**, may contribute to blooms (2)

Marine sprawl:



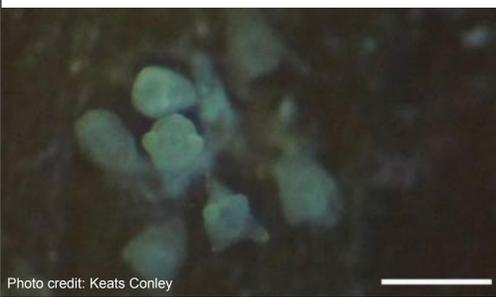
Docks and rigs near the mouth of the Coos Estuary, OR.

Jellyfish larvae settle on hard surfaces



Jellyfish life cycle

© 2004 Brooks/Cole-Thompson Learning



- Polyp distribution directly related to adult distribution
- Planulae preferentially settle on man-made surfaces instead of natural surfaces (2)

Pacific Sea Nettle polyps. Scale bar = 0.5 mm

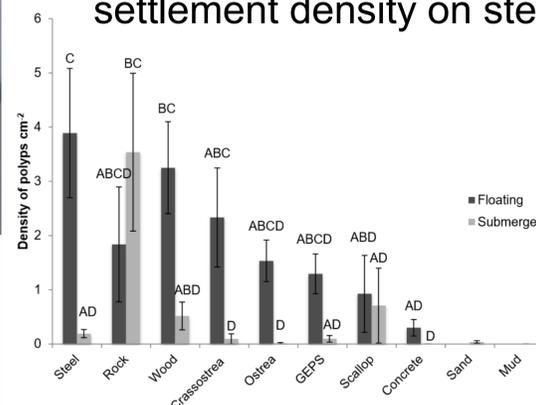
Pacific Sea Nettle (*Chrysaora fuscescens*)

- **Most abundant jellyfish in the California Current System**
- Blooms pose nuisance to rockfish, groundfish, salmon, and tuna fishing operations (1)
- No field observations of polyp distributions exist, so we aim to study larval settlement in the lab



Approach #1: Test larval settlement preference

Preliminary experiment showed highest polyp settlement density on steel, rock, and wood



Mean density of polyps settled on different materials in the laboratory. Bars indicate standard error. Common letters indicate groups that did not have significantly different polyp settlement densities.

New settlement plate approach: individual planula



Left: Experimental settlement plate. Right: Experimental containers with floating plates.

Settlement plates with six natural and artificial substrates: **steel, wood, concrete, shell, quartzite rock, and polystyrene foam**

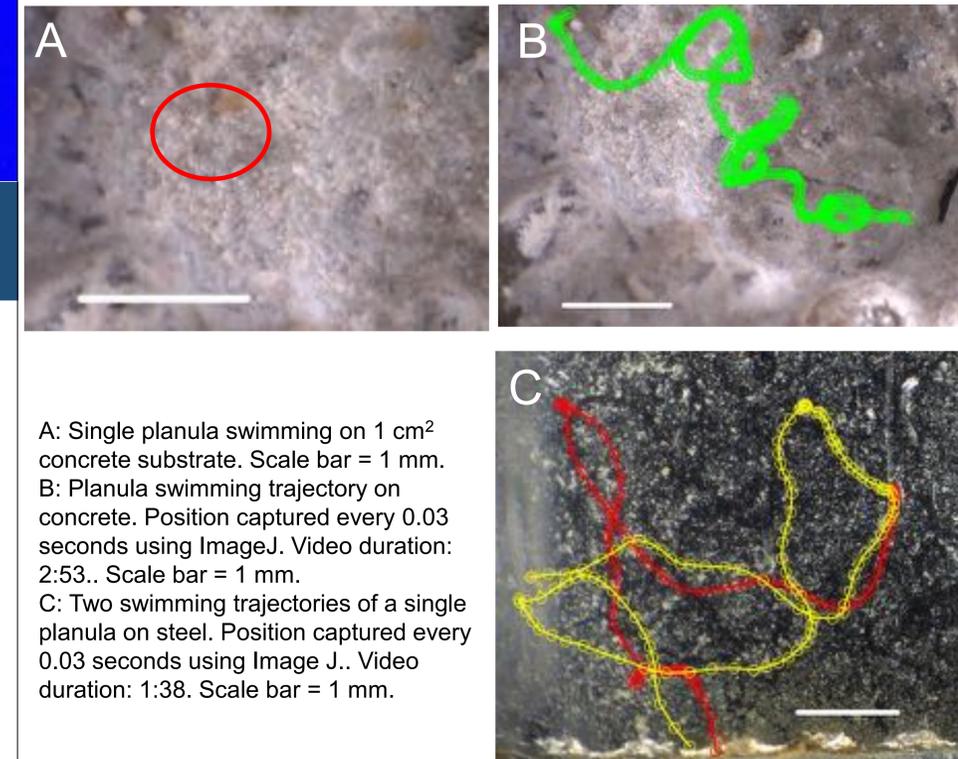
Goal: Eliminate influence of gregarious settlement behavior on observed planula settlement

References:

- (1) Conley KR, Sutherland KR (2015) Commercial fishers' perceptions of jellyfish interference in the Northern California Current. ICES Journal of Marine Science. doi:10.1093
- (2) Duarte CM, Pitt CA, Lucas CH, Purcell JE, Uye S, Robinson KL, Brotz L, Decker MB, Sutherland KR, Malej A, Madin LM, Mianzan H, Gili, J-M, Fuentes V, Atienza D, Pages F, Breitburg D, Malek J, Graham M, and Condon R (2012) Is global ocean sprawl a cause of jellyfish blooms? Frontiers in Ecology and the Environment 11: 91 - 97.

Approach #2: Observe larval pre-settlement swimming behavior

Film videos of planulae interacting with substrates



A: Single planula swimming on 1 cm² concrete substrate. Scale bar = 1 mm.
B: Planula swimming trajectory on concrete. Position captured every 0.03 seconds using ImageJ. Video duration: 2:53. Scale bar = 1 mm.
C: Two swimming trajectories of a single planula on steel. Position captured every 0.03 seconds using Image J. Video duration: 1:38. Scale bar = 1 mm.

Swimming metrics observed for comparison across substrates:

- **Swimming path, velocity, acceleration, tortuosity**

Goal: Compare planula swimming metrics on steel, wood, concrete, shell, rock, and foam substrates

Novel approach aims to help predict larval habitat selection in the field

First experimental study of Pacific Sea Nettle planulae

Results will help inform:

- Ecological impacts of coastal infrastructure
- Ecological consequences of planulae behavior
- Jellyfish bloom distribution

Next research steps:

- With more planulae, film additional videos and run new settlement preference experiment

Acknowledgements:

We thank the staff of the Oregon Coast Aquarium, particularly Evonne Mochon-Collura and Jim Burke, for their assistance in collecting adult jellyfish for use in these experiments. In addition, we greatly appreciate Oregon SeaGrant and the State of the Coast planning committee for providing an opportunity to share our research with the greater Oregon Coast community.