PREDATOR DENSITY AND WATER-LEVEL MEDIATE PREY UTILIZATION OF AN INTERTIDAL ESTUARINE HIGHWAY

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Connectivity and movement controlled by physical and biological factors; varies across temporal and spatial scales

(Kneib 2000; Gillanders et al 2003; Litvin and Weinstein 2003; Bretsch and Allen 2006; Allen et al. 2013)

function of water level, physiological constraints, predation pressure, foraging opportunities

To date little is known about fine-scale movement and use among habitats within the mosaic

Role of individuals on structure/function of ecosystems (Allen et al 2013):

- Trophic dynamics
- 2° production
- Energy transfer
- Biogeochemical cycling

Improve understanding of scales of processes and effectiveness of restoration efforts

Examine tidally induced patterns of fish movement and behavior between subtidal and intertidal habitats

Subtidal waters

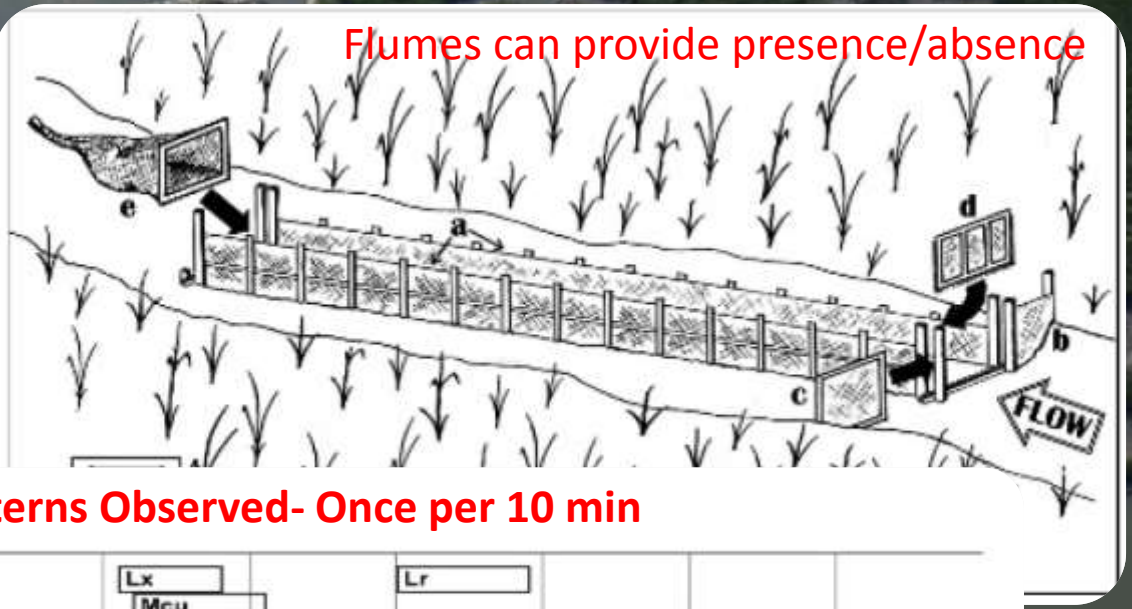
- Always inundated
- Foraging and reproduction grounds
- Risky habitats

Intertidal habitats

- Isolated pools at low tide
- Refuges for many small nektonic species
- Energetically costly
- Refugee fish vulnerable to avian predation

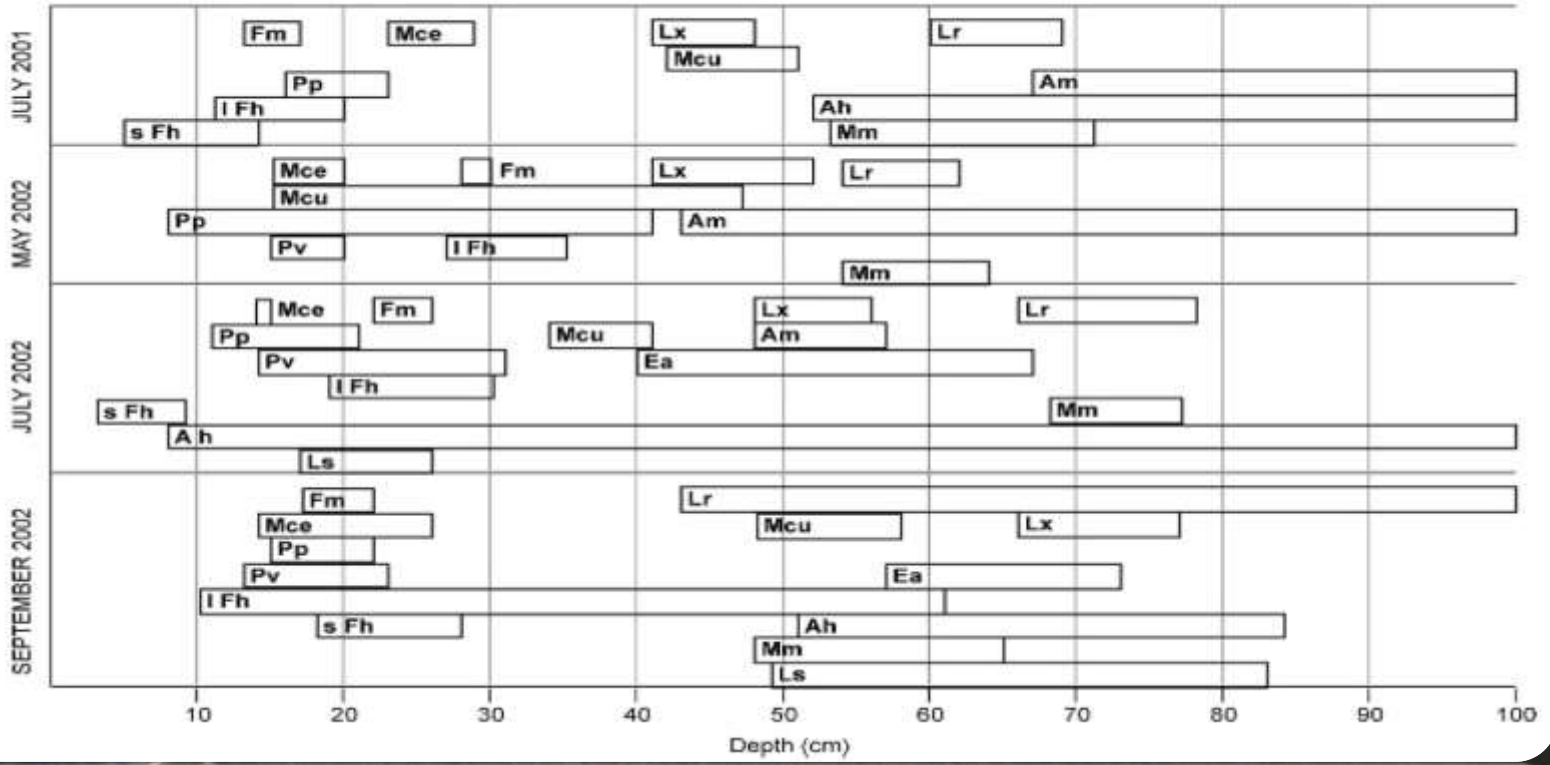
Very dynamic and turbid system!

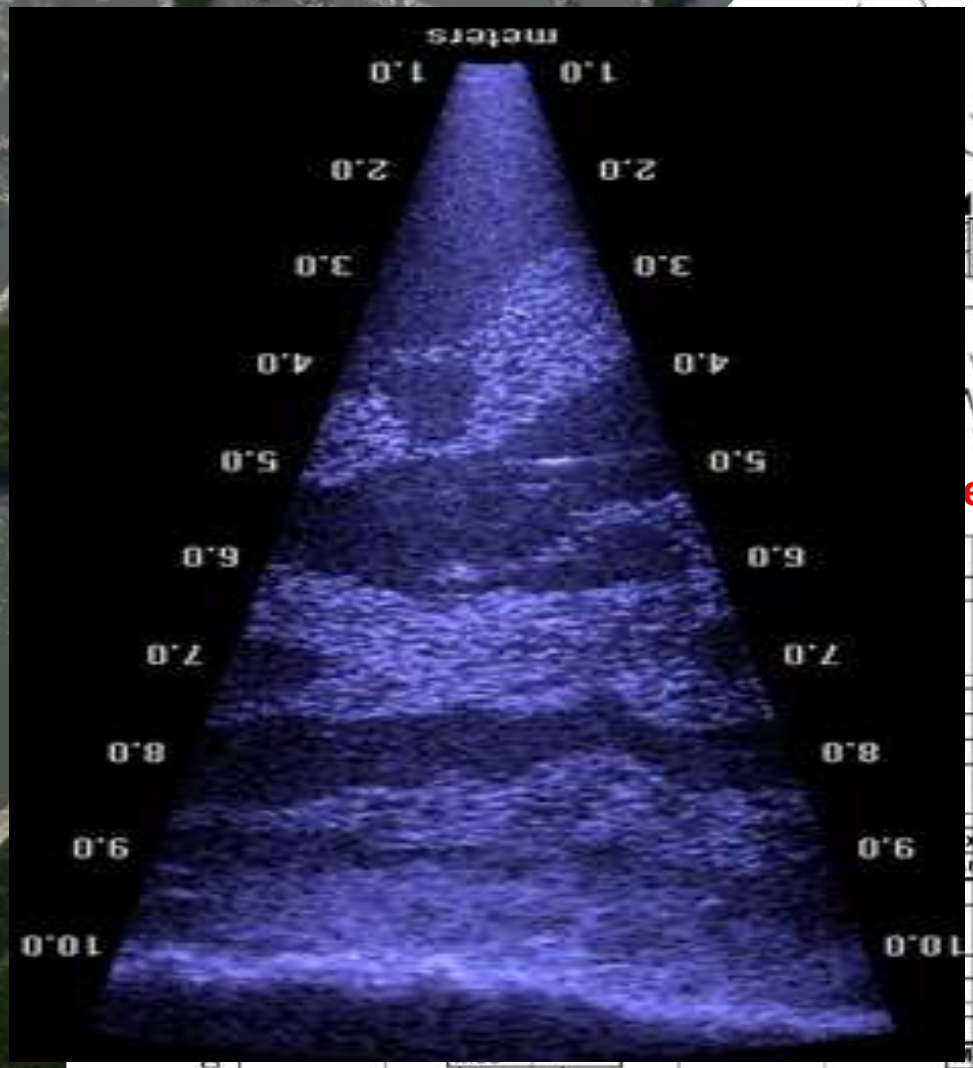
Flumes can provide presence/absence



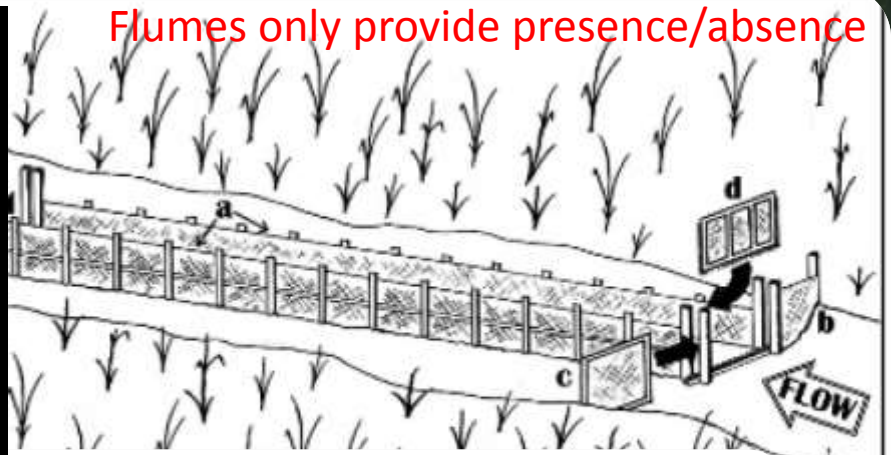
K. Bretsch and D. M. Allen

Daytime Patterns Observed- Once per 10 min

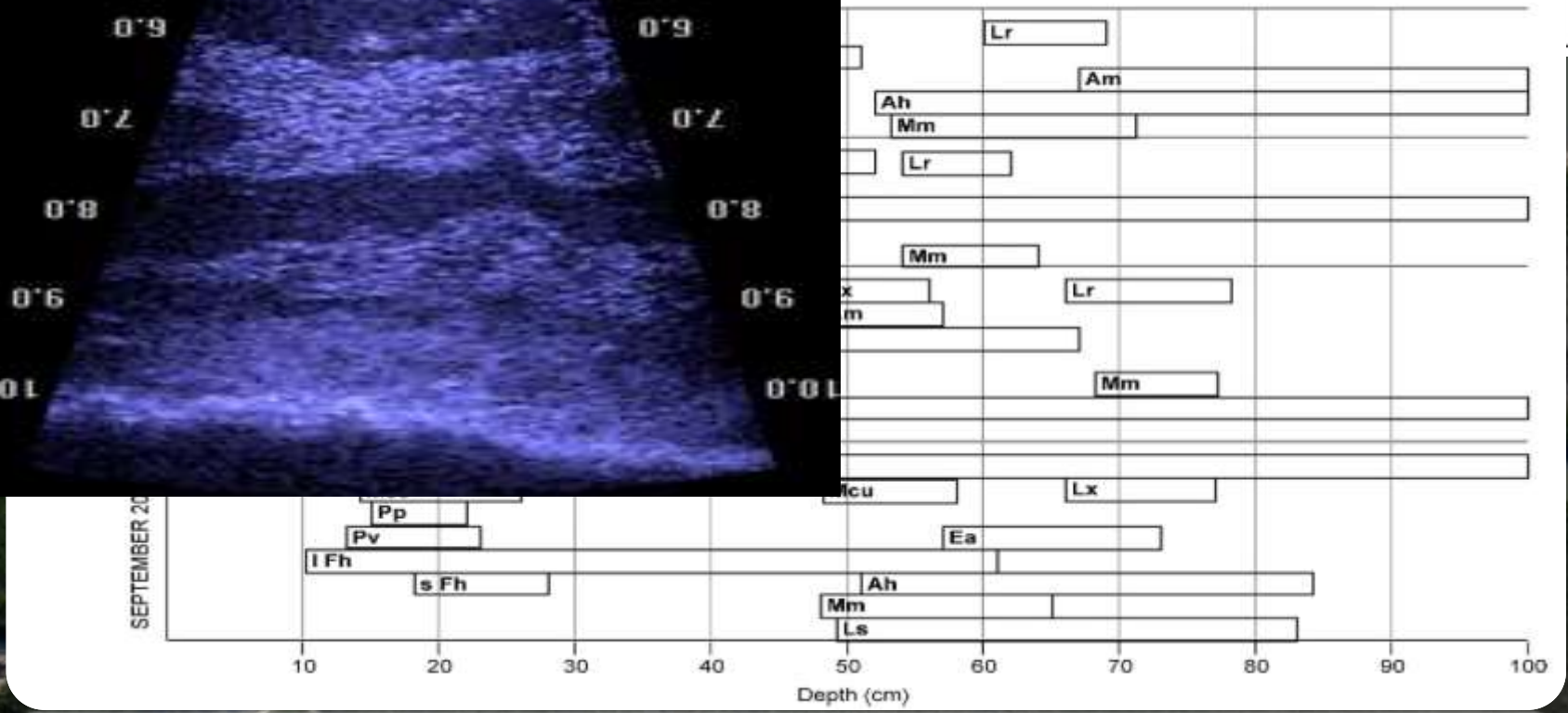




Flumes only provide presence/absence



ed- Once per 10 min



Use patterns are coupled with low water levels

ELSEVIER

Journal of Experimental Marine Biology and Ecology 346 (2007) 87–101

Journal of EXPERIMENTAL MARINE BIOLOGY AND ECOLOGY

Nekton utilization of intertidal salt marsh creeks: Tidal influences in natural *Spartina*, invasive *Phragmites*, and marshes treated for *Phragmites* removal

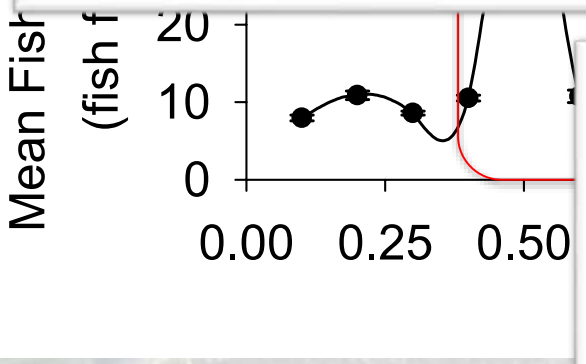
Matthew E. Kimball[a,b,*], Kenneth W. Able[a]

Estuaries and Coasts Vol. 29, No. 3, p. 474–486 June 2006

Tidal Migrations of Nekton in Salt Marsh Intertidal Creeks

KURT BRETSCH[1,*] and DENNIS M. ALLEN[1]

[1] *Belle W. Baruch Institute for Marine and Coastal Sciences, University of South Carolina, P. O. Box 1630, Georgetown, South Carolina 29442*

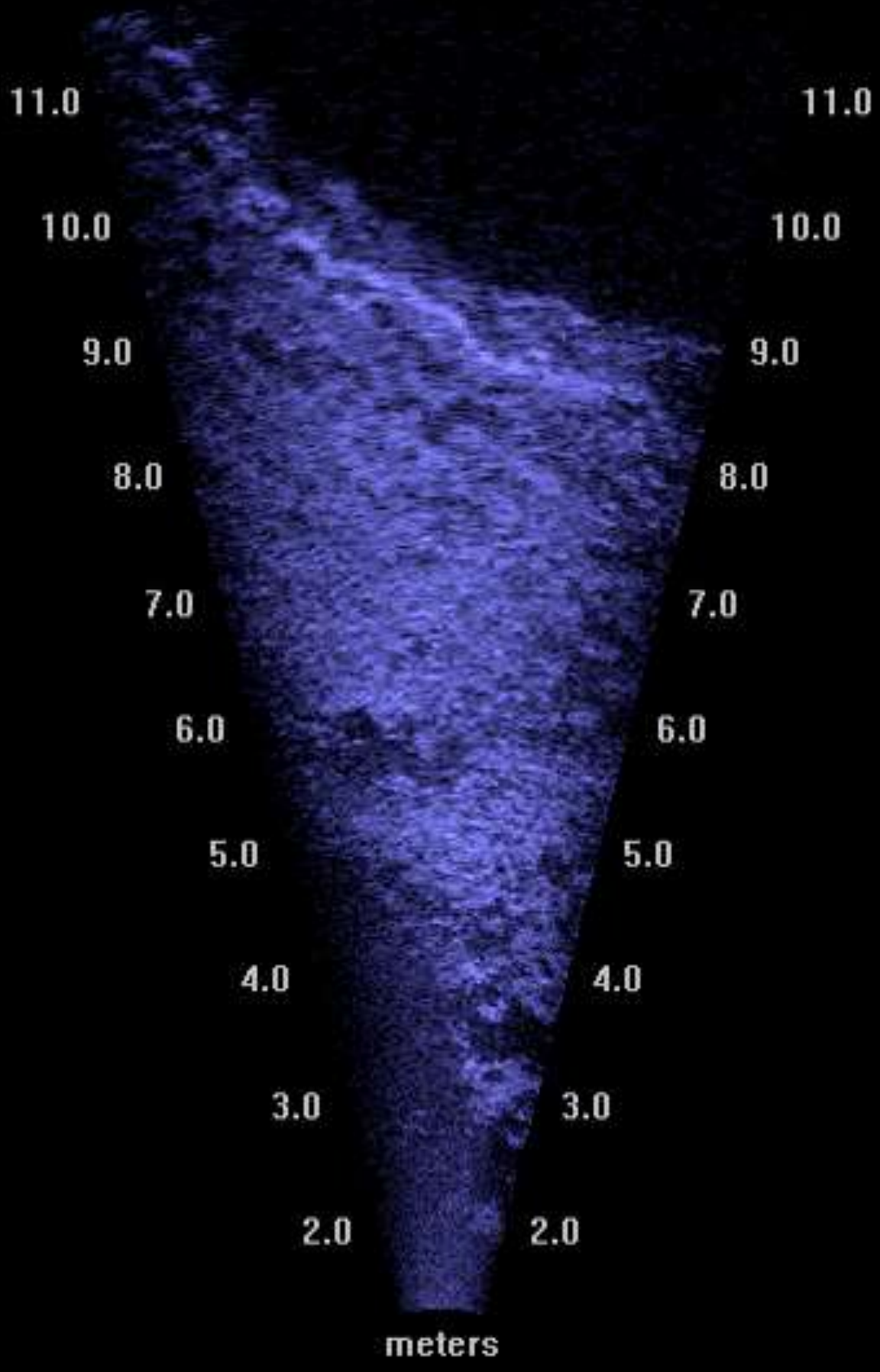


Environmental Biology of Fishes **67**: 231–240, 2003.

Site fidelity, home range, and tidal migrations of juvenile pinfish, *Lagodon rhomboides*, in salt marsh creeks

Michael T. Potthoff[a,b] & Dennis M. Allen[b]
[a]*Marine Science Department, Coastal Carolina University, Conway, SC 29562, U.S.A.*
[b]*Baruch Marine Field Laboratory, University of South Carolina, Georgetown, SC 29440, U.S.A.*

Boswell et al. In review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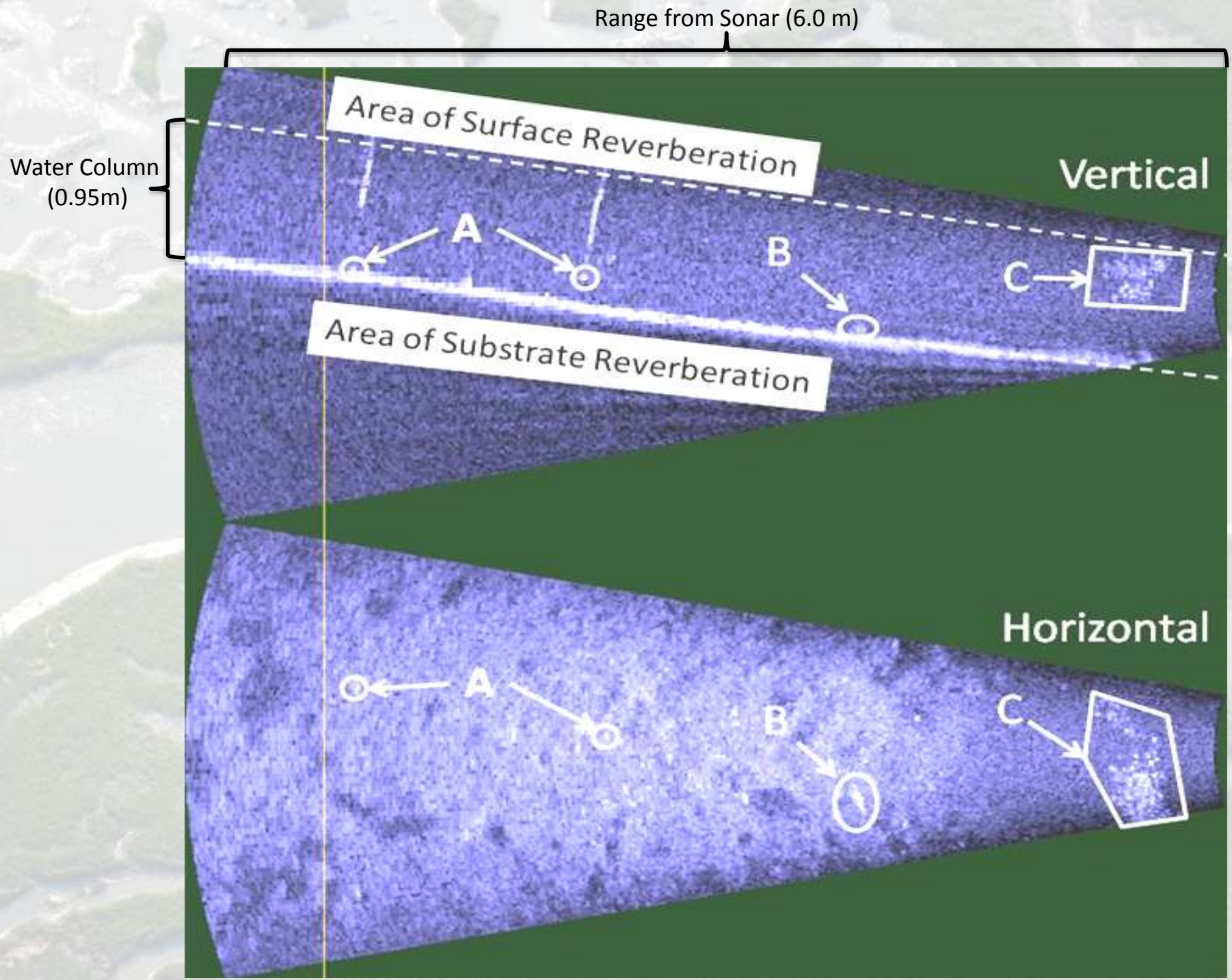
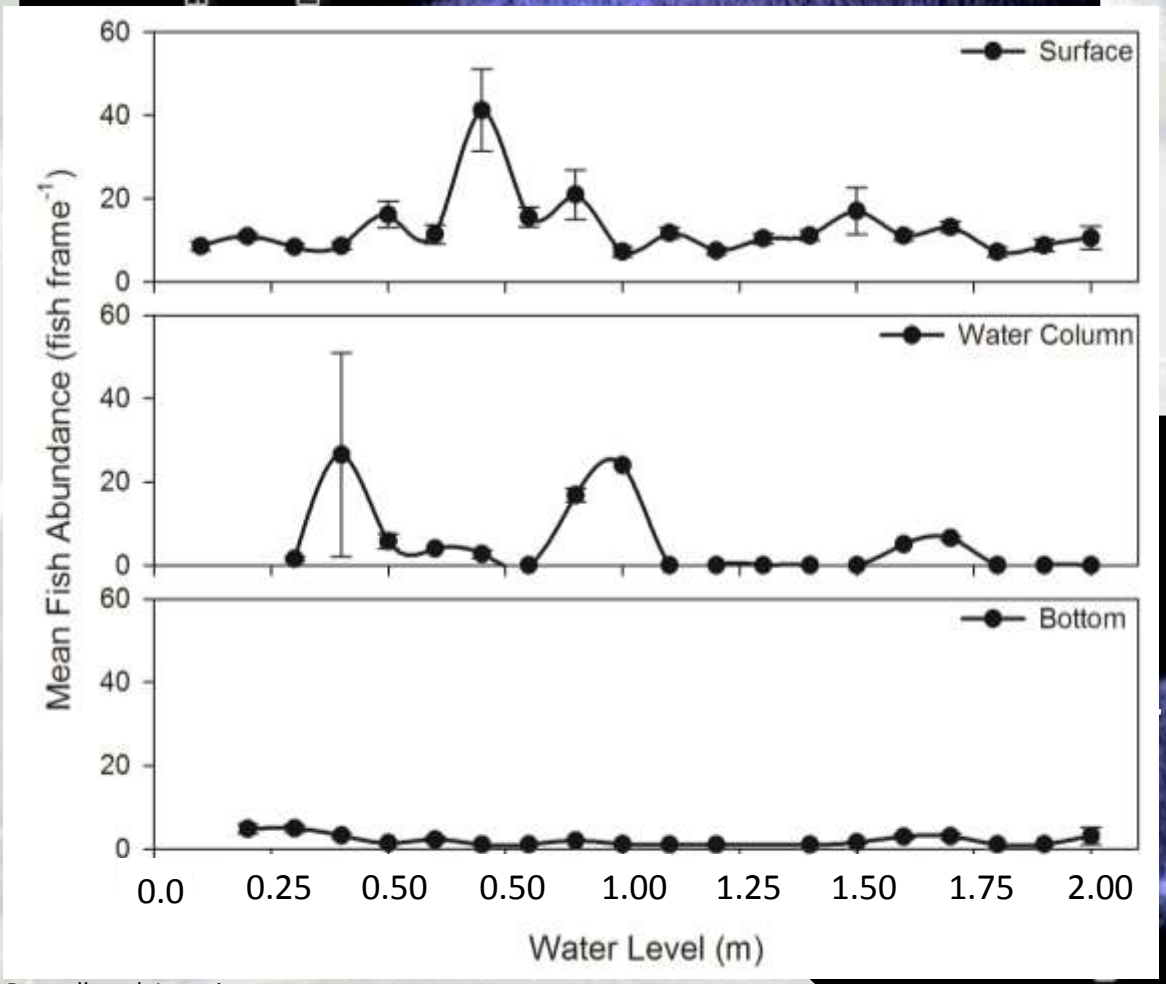
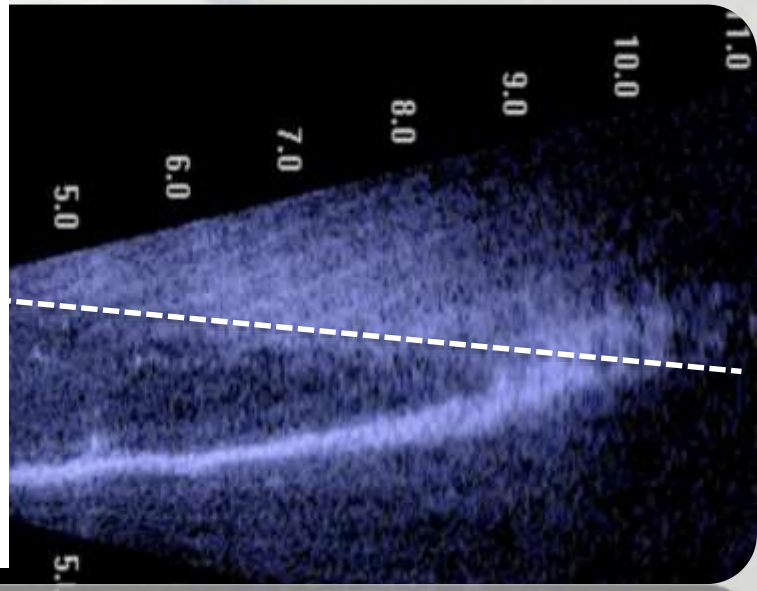

Range from Sonar (6.0 m)
Water Column
(0.95m)
Area of Surface Reverberation
Vertical
A
B
C
Area of Substrate Reverberation
Horizontal
A
B
C

Going vertical!

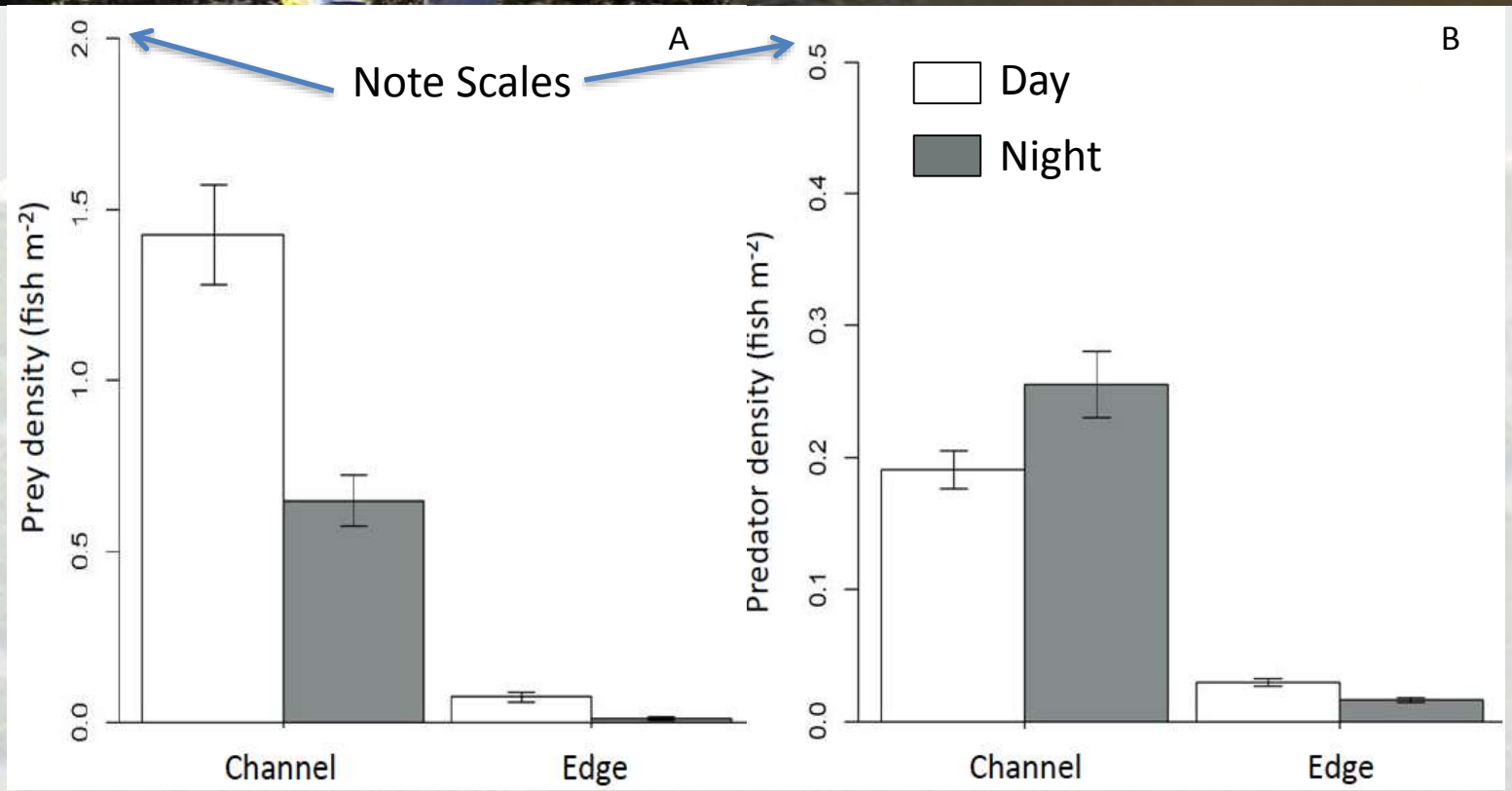
Novel Application for Shallow Estuarine Ecosystems





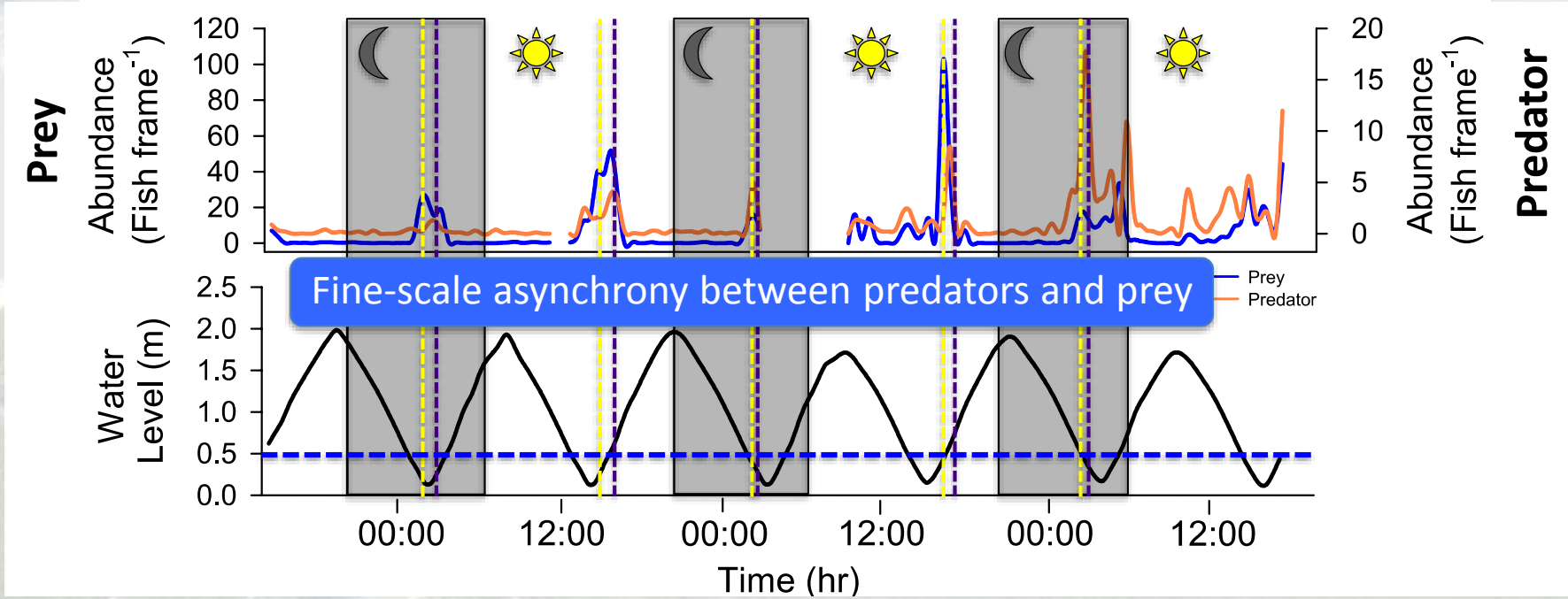
Boswell et al. In review

Do predators and prey differentially use estuarine habitats during tidal migrations?



Boswell et al. In review

Functional groups respond to water level



Greatest densities associated with low water levels

Patterns preserved irrespective of TOD

Lowest densities associated with slack high-tide

Boswell et al. In review

Are predators and prey synchronous in movement between subtidal/intertidal habitats?

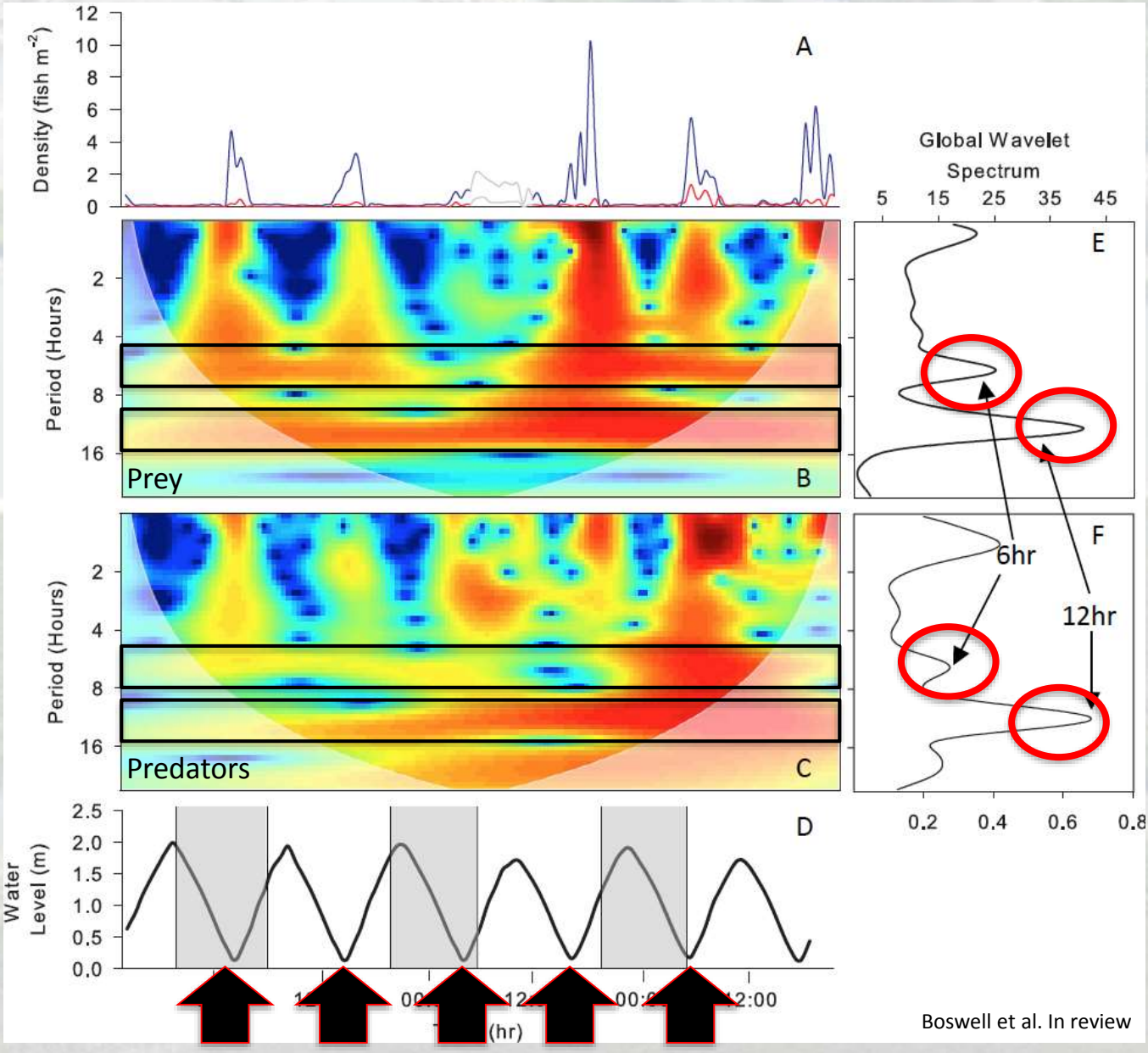
Temporal scales of variation→ Wavelets

Dominant Scales of Forcing/Processes:

6 hr – Tidal

12 hr- Diel

Greatest variation occurs at low water, irrespective of TOD



Boswell et al. In review

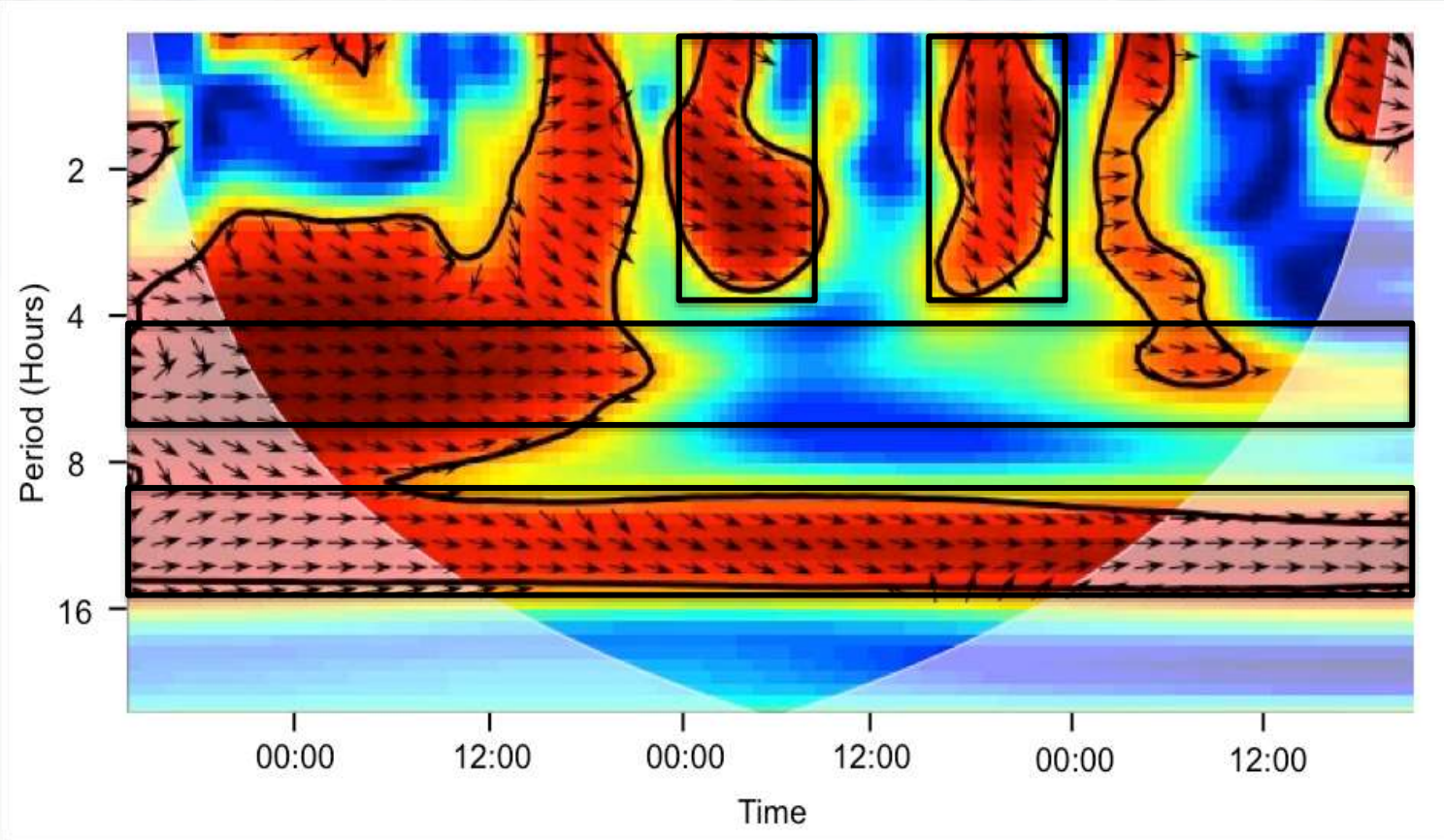
Are predators and prey synchronous in movement between subtidal/intertidal habitats?

→ Inphase

← Antiphase

↓ Prey lead pred.

↑ Pred. lead prey



Predators and prey vary in unison at scale of dominant forces

Dynamics of prey lead dynamics of predators at small <2hr scale

Density dependent at these scales

Boswell et al. In review

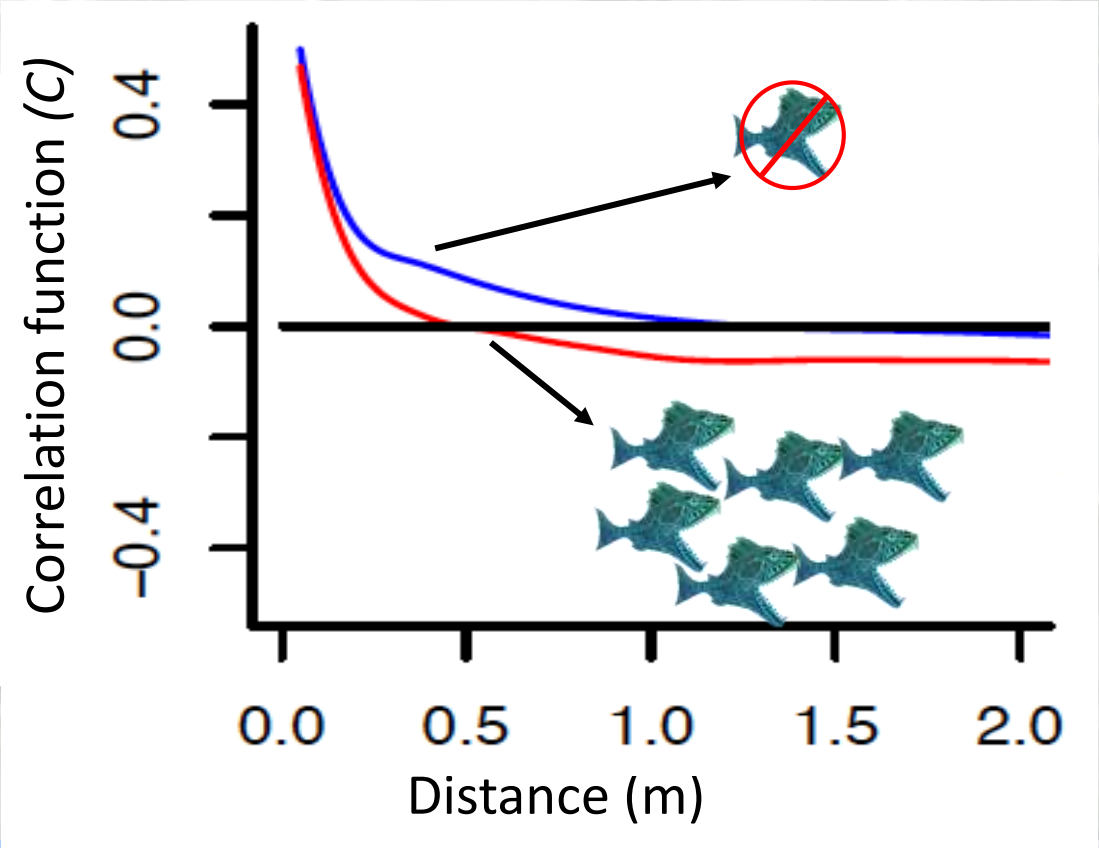
Coordinated prey behavior helps maintain information transfer

Risk remains constant in schools >4 m^2

- Predator satiation points with finite consumption

- Schooling reduces overall risk to the individual

- Risk may be abated by dilution



Handegard et al. 2012. Curr. Biol.

Conclusions

Results support similar patterns as previous work while acquiring much finer resolution in movement and use

Non-invasive approach with continuous record, facilitates examination of effects of tide and diel cycles on temporal and spatial relationships among individuals/schools

Need to better understand behavior at a finer resolution to gain insights into:

- how nekton use habitat
- competing nekton partition use of co-occupied habitat
- inform decisions on habitat protection, restoration, etc

Challenges

Dynamic systems impose special considerations for use in shallow systems

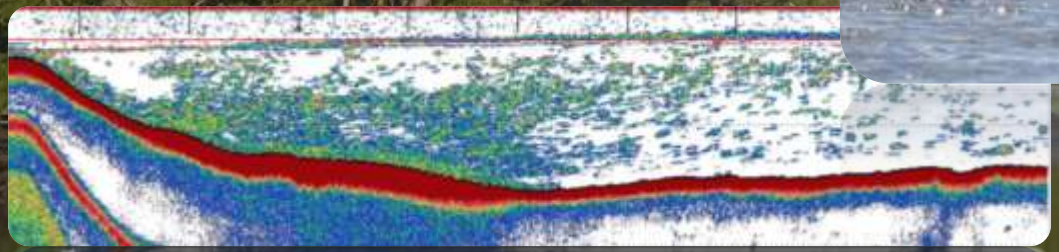
Data are voluminous and can be difficult to automate analysis

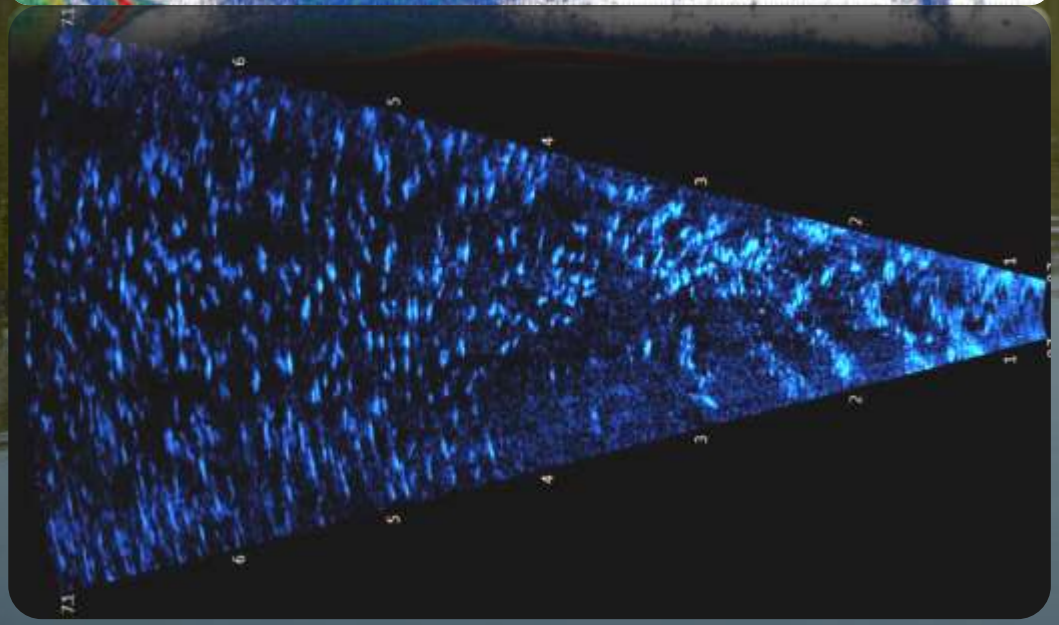
Analyzing and representing data remain a challenge

Similar concerns as with video data- what's the correct way?

Schools are complex and require special attention

Roving into the Everglades





- Opportunities available for linking multiple scales
- Non-invasive autonomous platform
- Configurable to accommodate multiple sensors