

Preliminary investigations of current flow through mussel rafts at an Integrated Multi-Trophic Aquaculture site

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Introduction

- Integrated Multi-Trophic Aquaculture (IMTA) is a practice where the wastes of one species are recycled into inputs for another
- Atlantic salmon, blue mussels and kelp



IMTA Mussel Raft (Polar Circle)

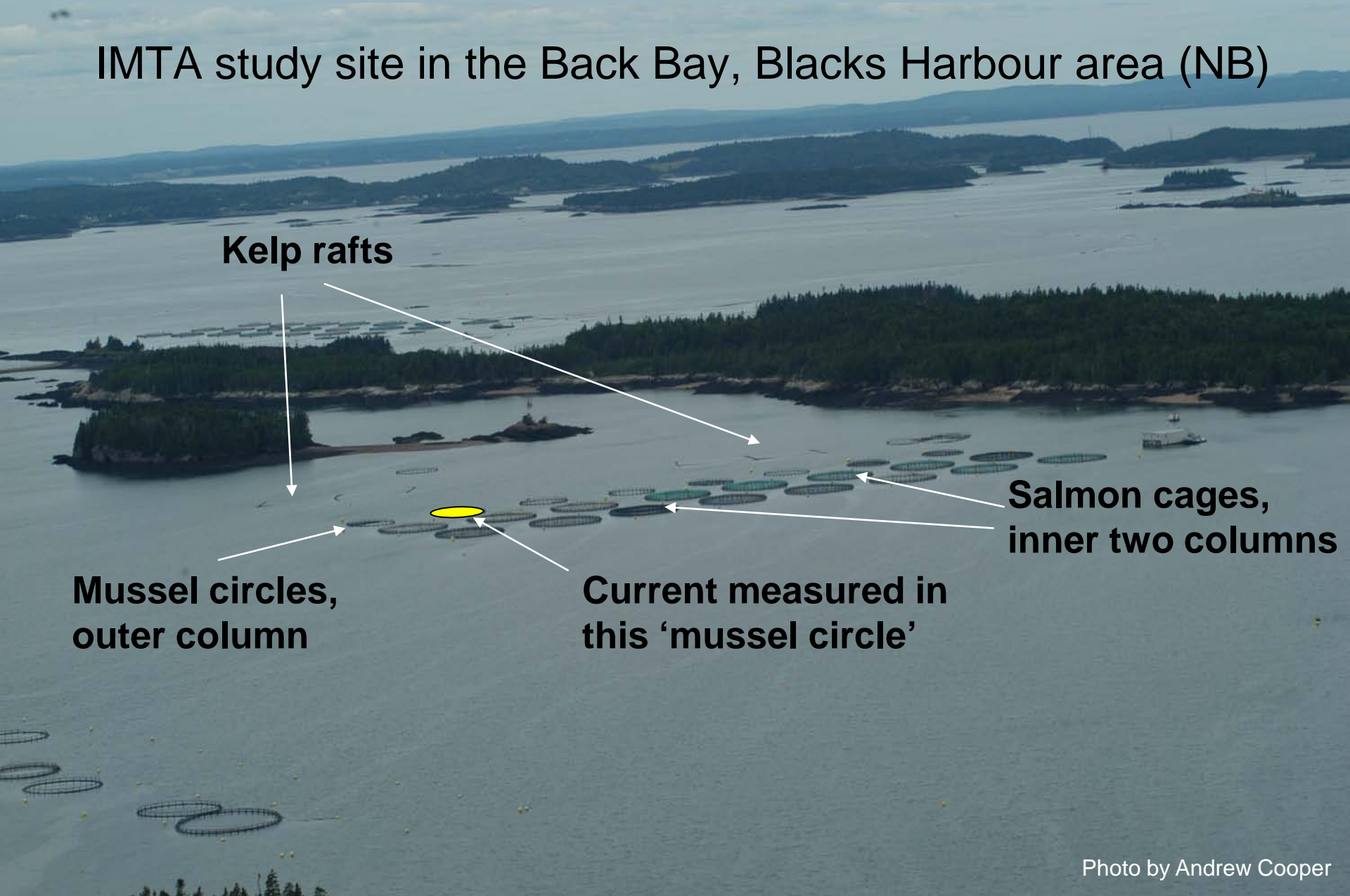


Introduction cont.

- Polar circles are atypical of traditional mussel culture
- Currents within a raft require investigation
- To improve:
 - Raft Design
 - Socking Densities
 - Placement within the site grid

Methods

IMTA study site in the Back Bay, Blacks Harbour area (NB)



Kelp rafts

**Salmon cages,
inner two columns**

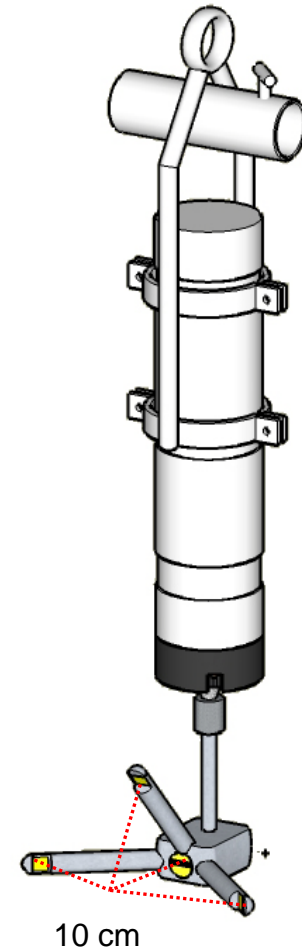
**Mussel circles,
outer column**

**Current measured in
this 'mussel circle'**

Methods cont.

- Three current meters were deployed, at a depth of 5m, in a mussel circle for two days
 - The current meters are Acoustic Doppler Velocimeters (ADV)
- Samples were recorded every 10 minutes with a 10s averaging interval
- Current speed measures were pooled into hourly means

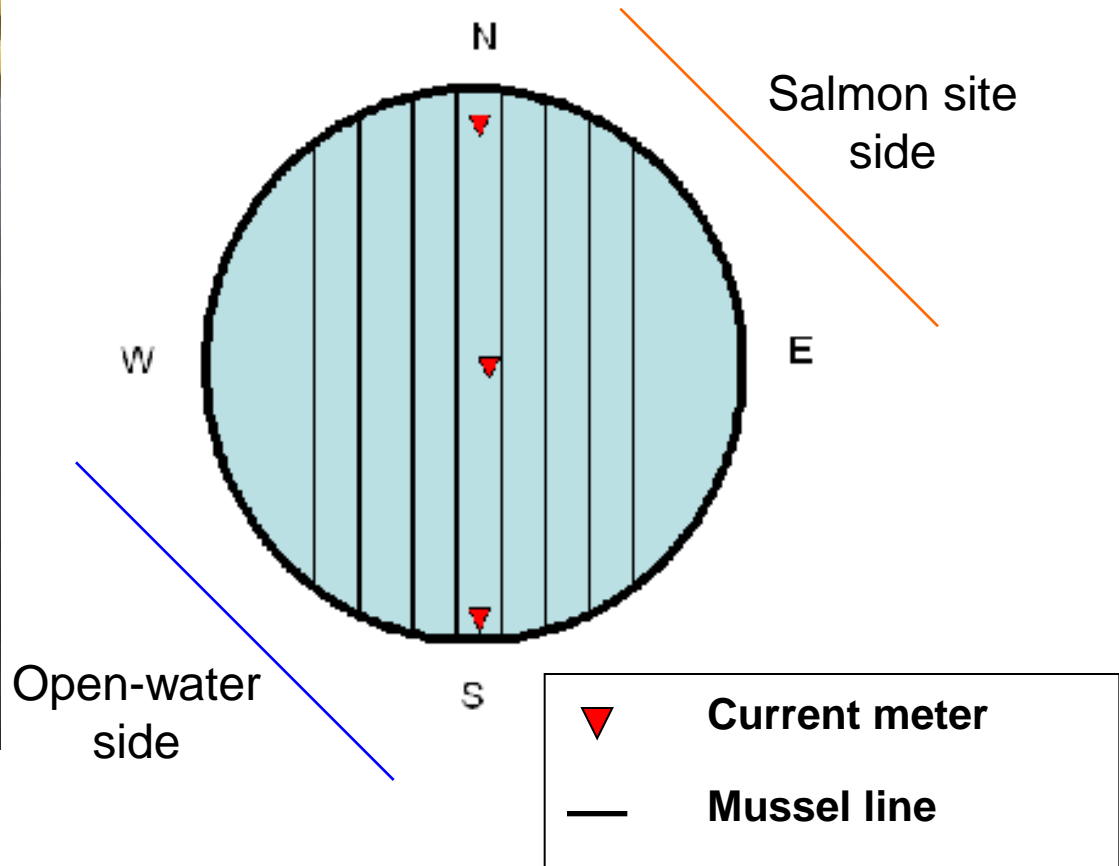
Side looking unit



Current meter deployment



- The current meters were attached to individual buoys and positioned between mussel lines



SE

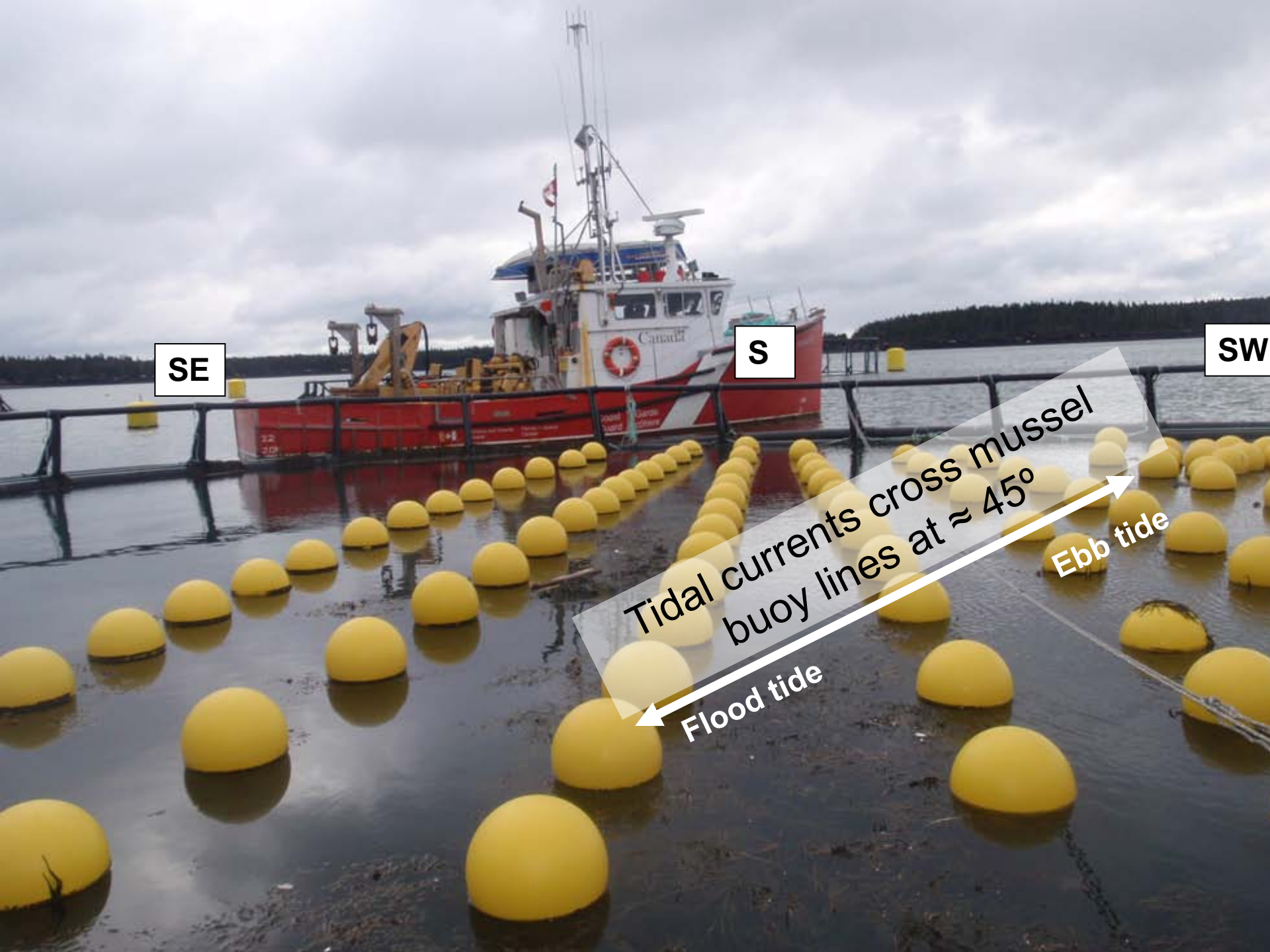
S

SW

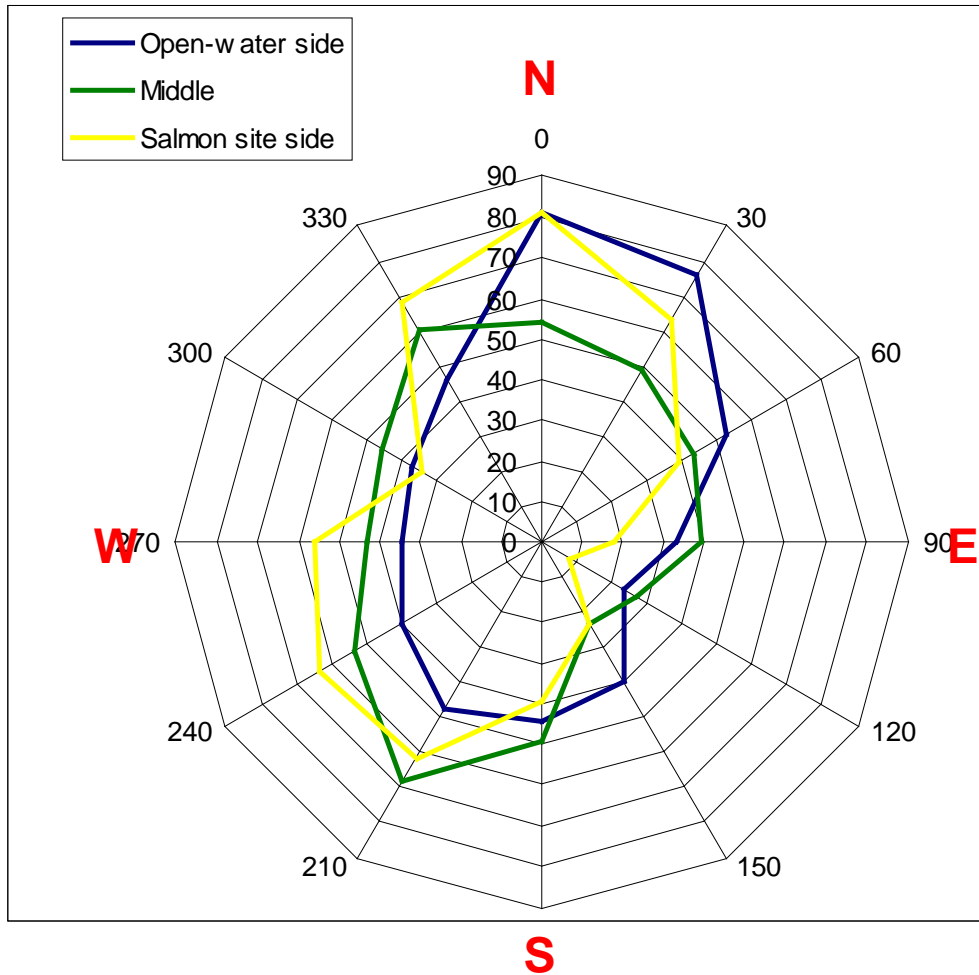
Tidal currents cross mussel
buoy lines at $\approx 45^\circ$

Flood tide

Ebb tide



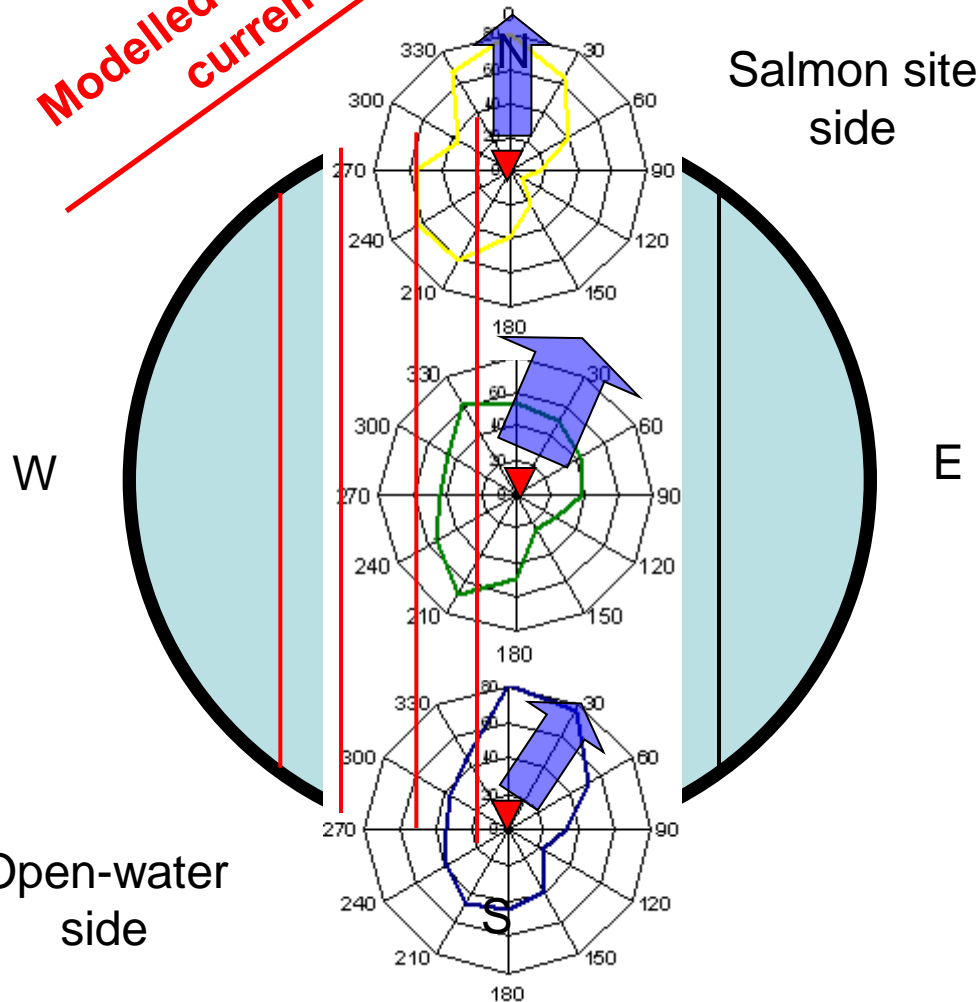
Mean Current Direction



While there were current measures in all directions, the predominant flow directions were with estimated tidal currents, running SW and NE

Results: Flood Tide

Modelled flood tide
current



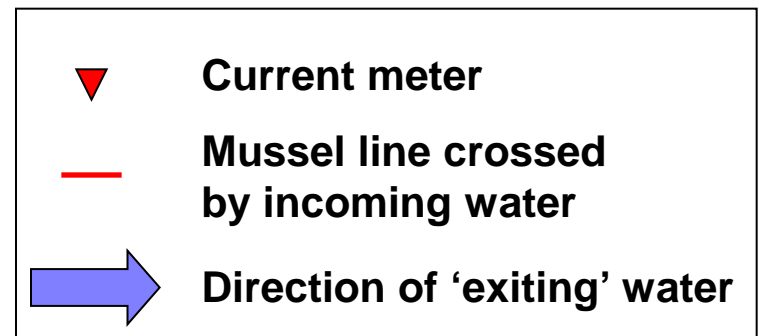
- **Open Water Side:**

Consistent with expected flood tide direction

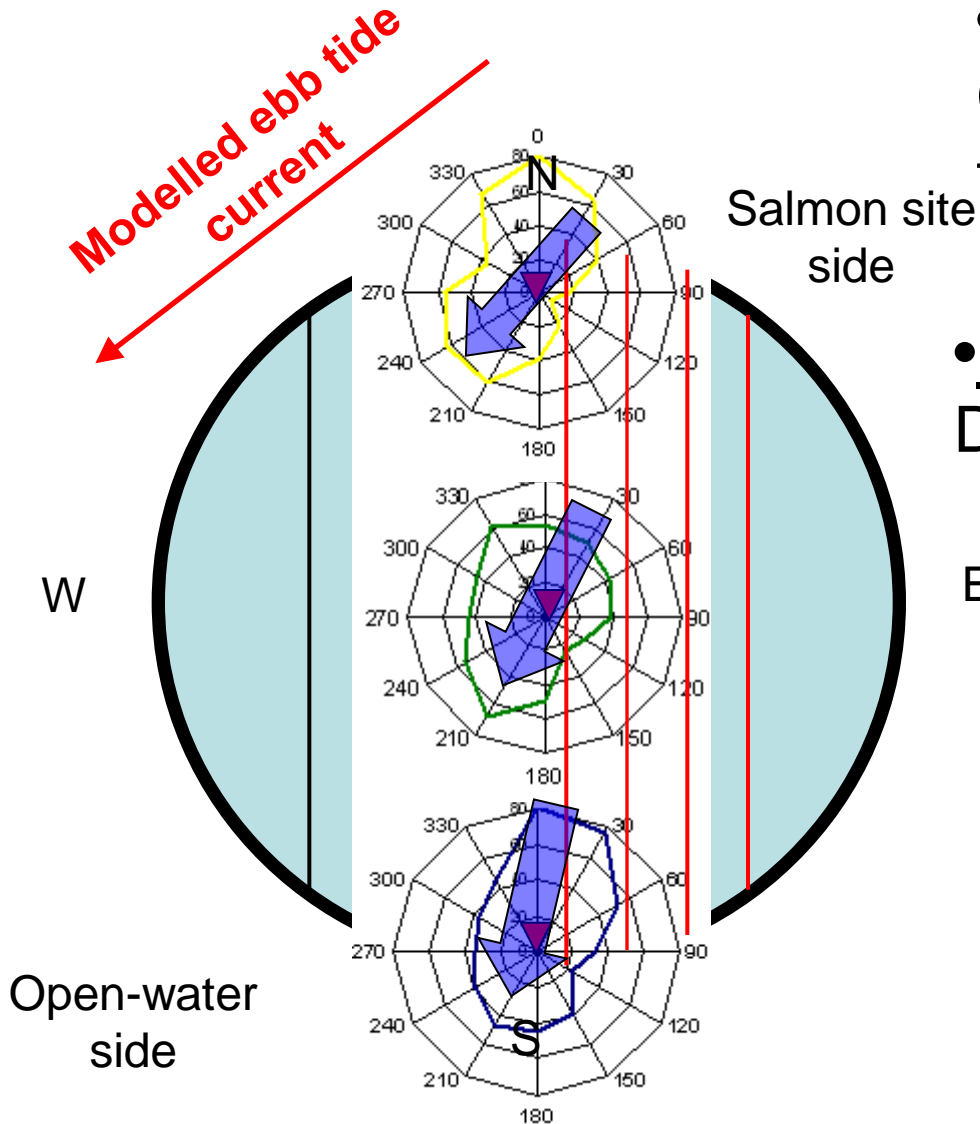
- **Middle:** More variable; frequency of 90° to 330° similar

- **Salmon Site Side:**

Majority of measures are North



Results: Ebb Tide



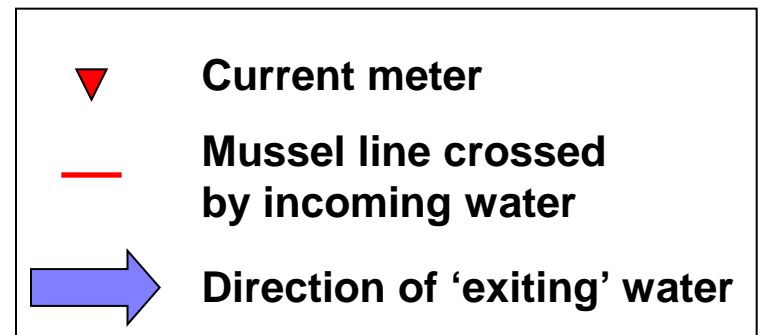
•Salmon Site Side:

Consistent with expected ebb tide direction

•Middle and Open-Water Side:

Direction moves towards south

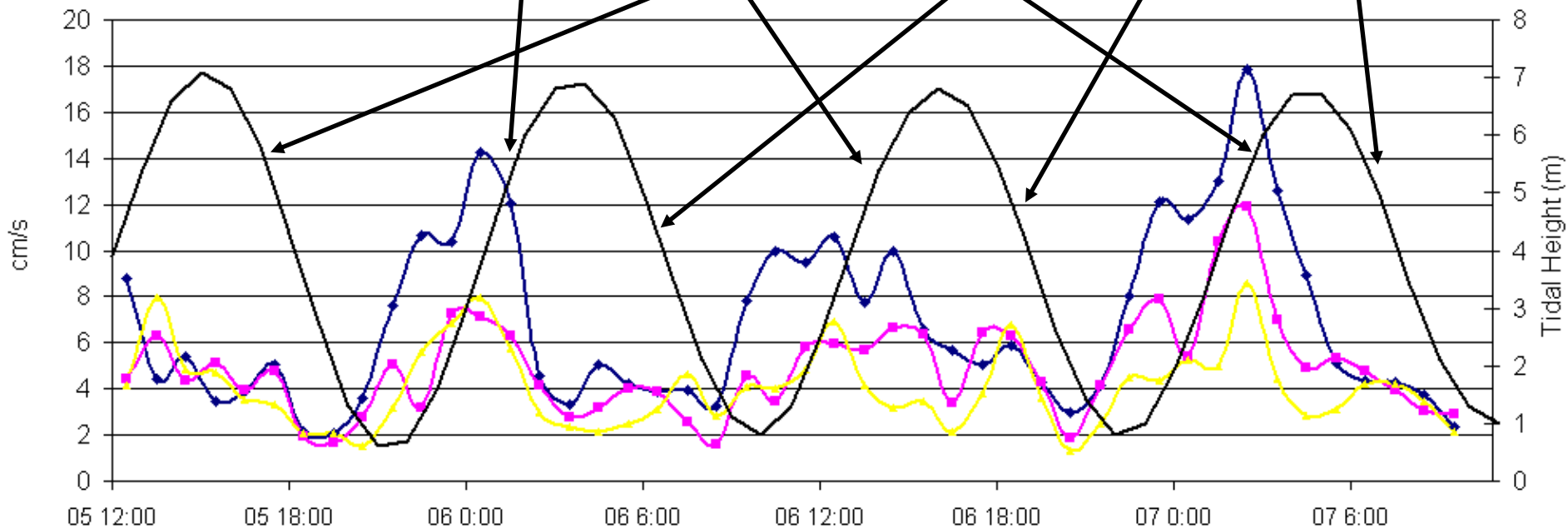
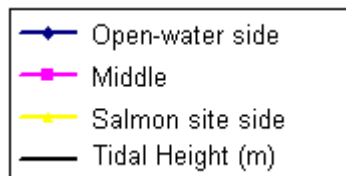
E •**Reverse effect seen on flood tide**



Mean hourly current speed vs. tidal height

Flood tides

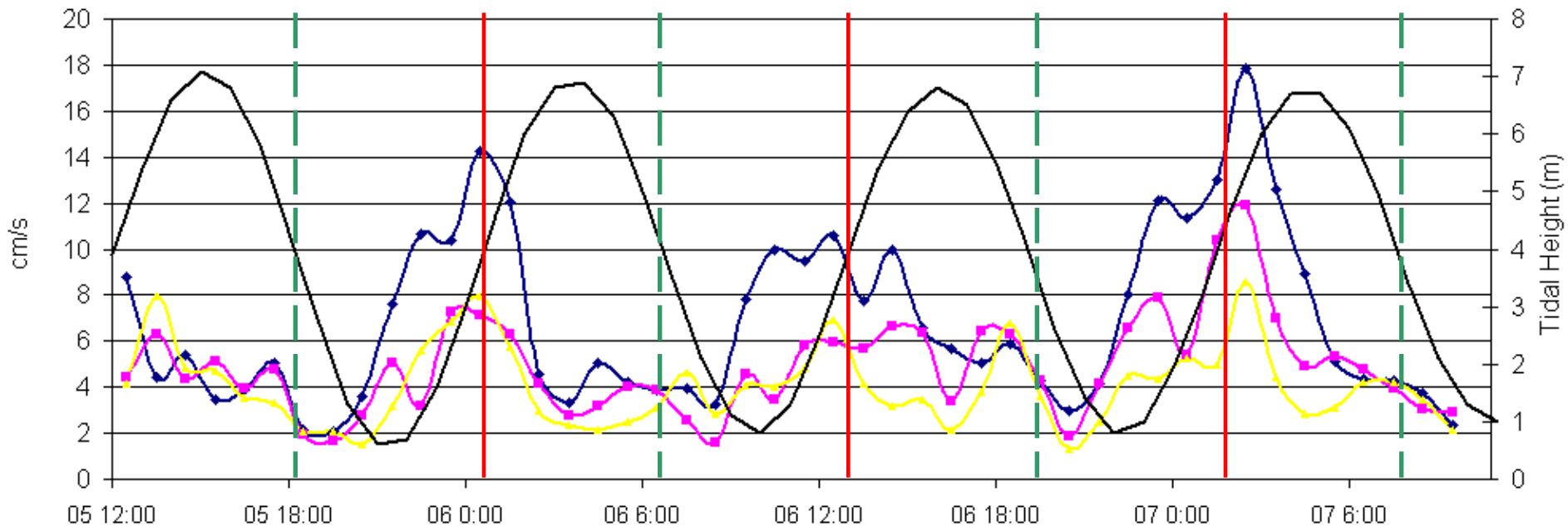
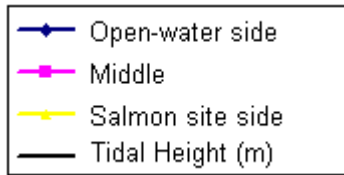
Ebb tides



Mean hourly current speed vs. tidal height

- Currents usually fastest during mid-flood tide and at the open water side —

- Currents slower and similar at all locations during mid ebb tide - - -



Ebb tides cross the salmon cages



Ebb tide currents

Conclusions

- Orientation of Mussel Lines impact the direction of flow through the mussel raft
- Flow velocity can change within a raft but appears to be related to initial flow speeds and number of mussel lines crossed
- Appears to be a dampening effect of salmon cages but can't 'tease' this effect out from the natural reduction in ebb tide in this study.
- Particles coming from salmon cages likely arrive at a slower, less variable rate than natural seston from open-water side
- This has implications for modelling and feeding at low particle concentrations, as well as raft and site design.

Challenges and Limitations



- Difficult to control:
 - socking densities
 - design
 - location of Mussel rafts
 - harvest dates
 - weather
- Sampling is opportunistic
- Current moves mussel lines causing lines to ‘bunch up’

Other sampling approaches

- Connecting current meters between mussel socks, using divers
 - Better placement choice within circle
 - Logistically taxing and requires specialized personnel

- Using 'arms' that suspend current meters just outside the 'mussel circles', to better measure incoming and exiting water



Questions?



Thanks to our partners



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Canadian Food
Inspection Agency

Agence canadienne
d'inspection des aliments



