Edible Seaweed Workshop

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https://sites.une.edu/byronlab/seaweed-project/

FDA U.S. FOOD & DRUG ADMINISTRATION

- 48 mil foodborne illnesses
- Food Safety Modernization Act (FSMA)
- Hazards Analysis Critical Control Points (HACCP)
- National Shellfish Sanitation Program (NSSP)

UNIVERSITY OF NEW ENGLAND

INNOVATION FOR A HEALTHIER PLANET

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Assessment of bacterial pathogens on edible macroalgae in coastal waters

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MAINE EPSCoR

SEANET

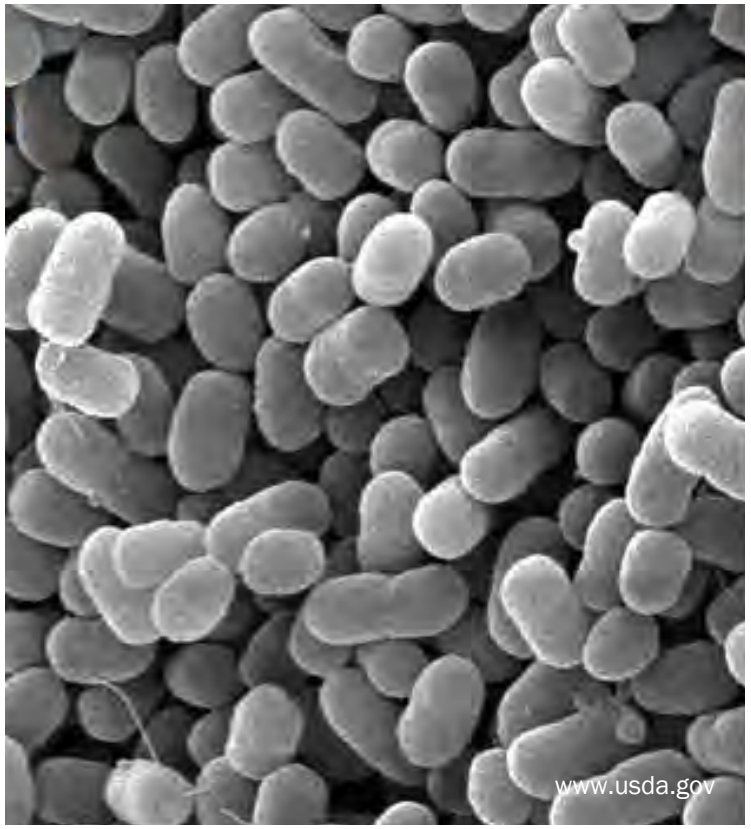
Research Objective

- **To assess pathogenic bacteria present at kelp aquaculture sites**

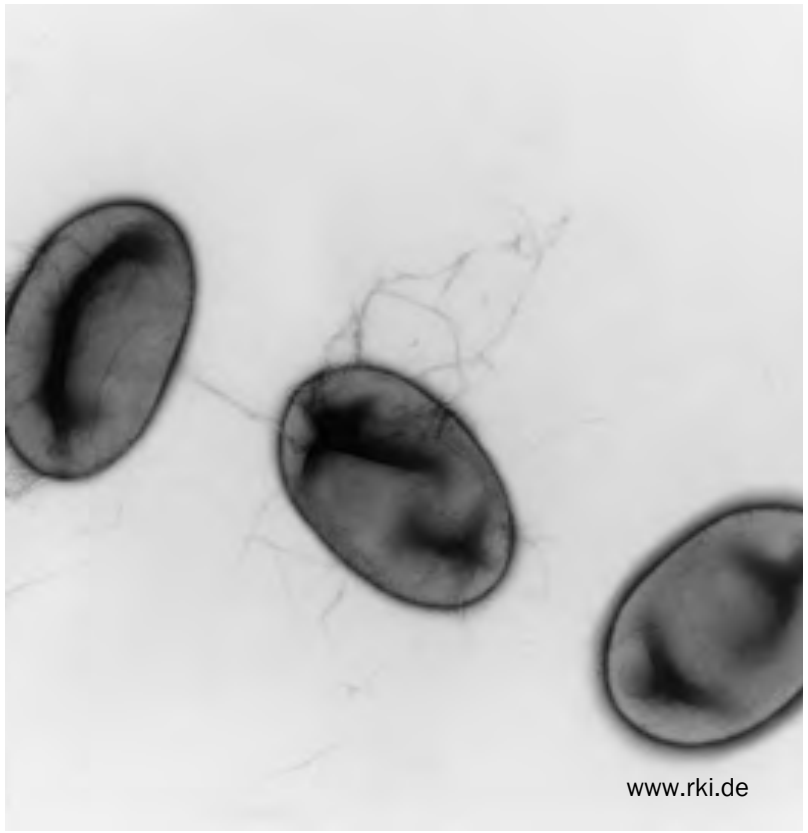
Research questions

1. Are there harmful bacteria present on farmed kelp?
2. Should kelp aquaculture follow the same siting guidelines used for shellfish?
3. Does bacterial presence differ between kelp and water?

Foodborne bacterial pathogens



Enterohemorrhagic *Escherichia coli* (EHEC)



Salmonella enterica Typhimurium

Vibrio parahaemolyticus

Sampling

- Casco Bay: 2 farms
  - CB I (6 sampling events)
  - CB II (4 events)
- Saco Bay: UNE farm (8 events)

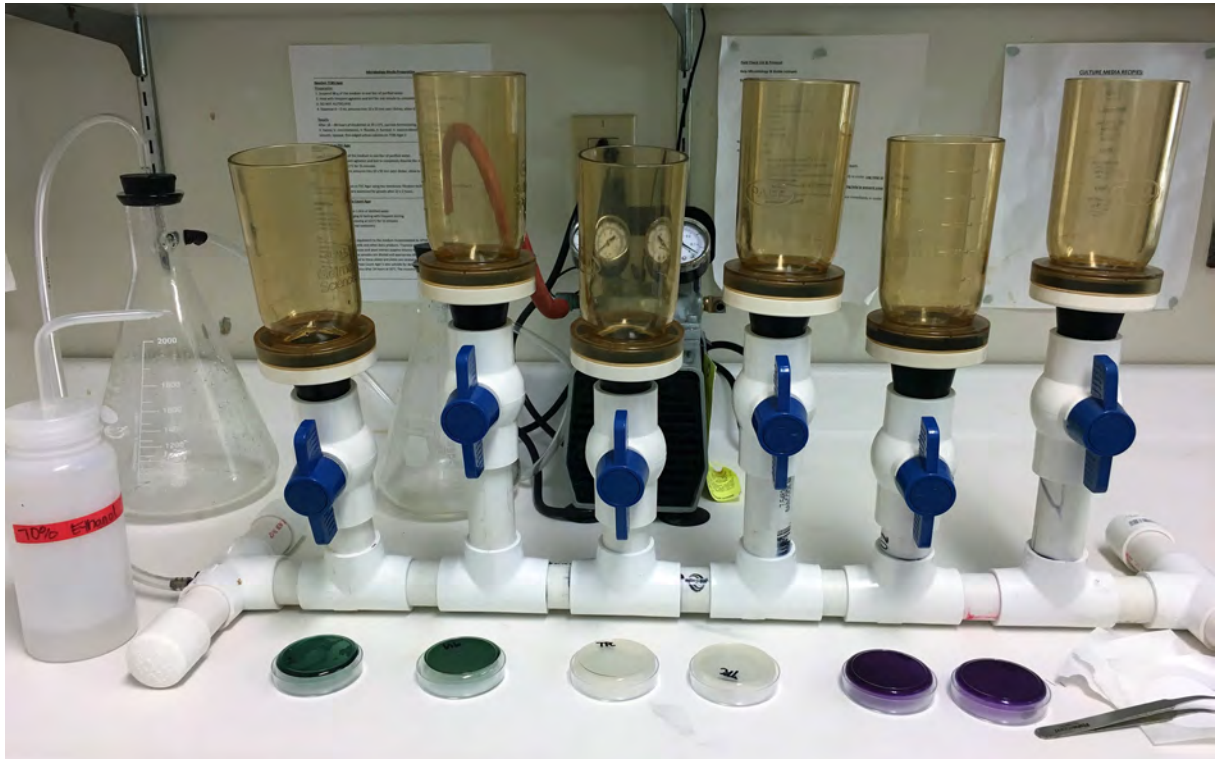
- February – May 2018

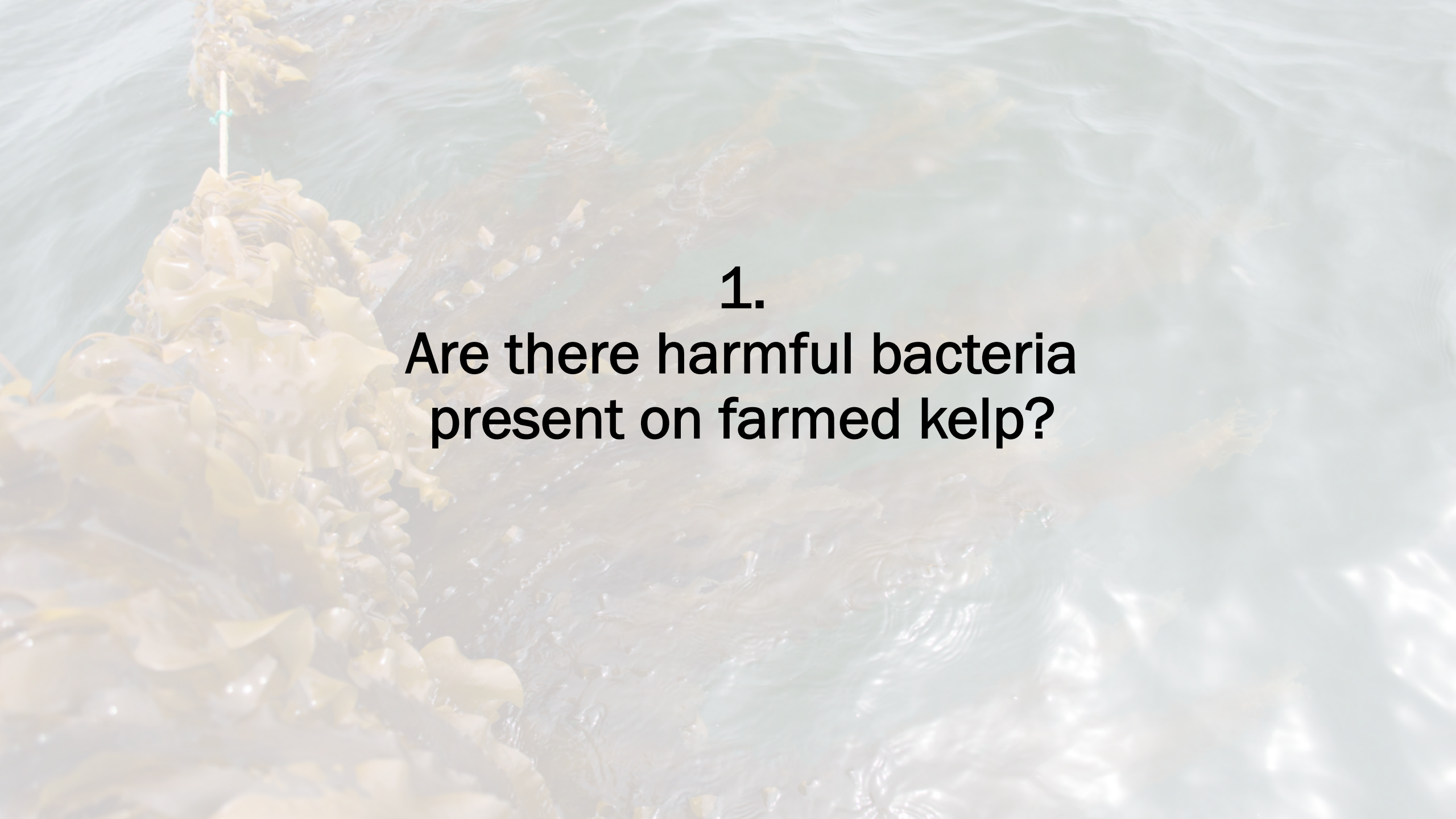
- Kelp collected from 3-4 points on longline
- Paired with water

- Samples transported at <2°C and processed within 3 h of return

Kelp processing

- Blades cut horizontally
- Strips from several blades/sample combined
- Bunches agitated in sterile, filtered seawater
- Seawater then surveyed for bacterial pathogens

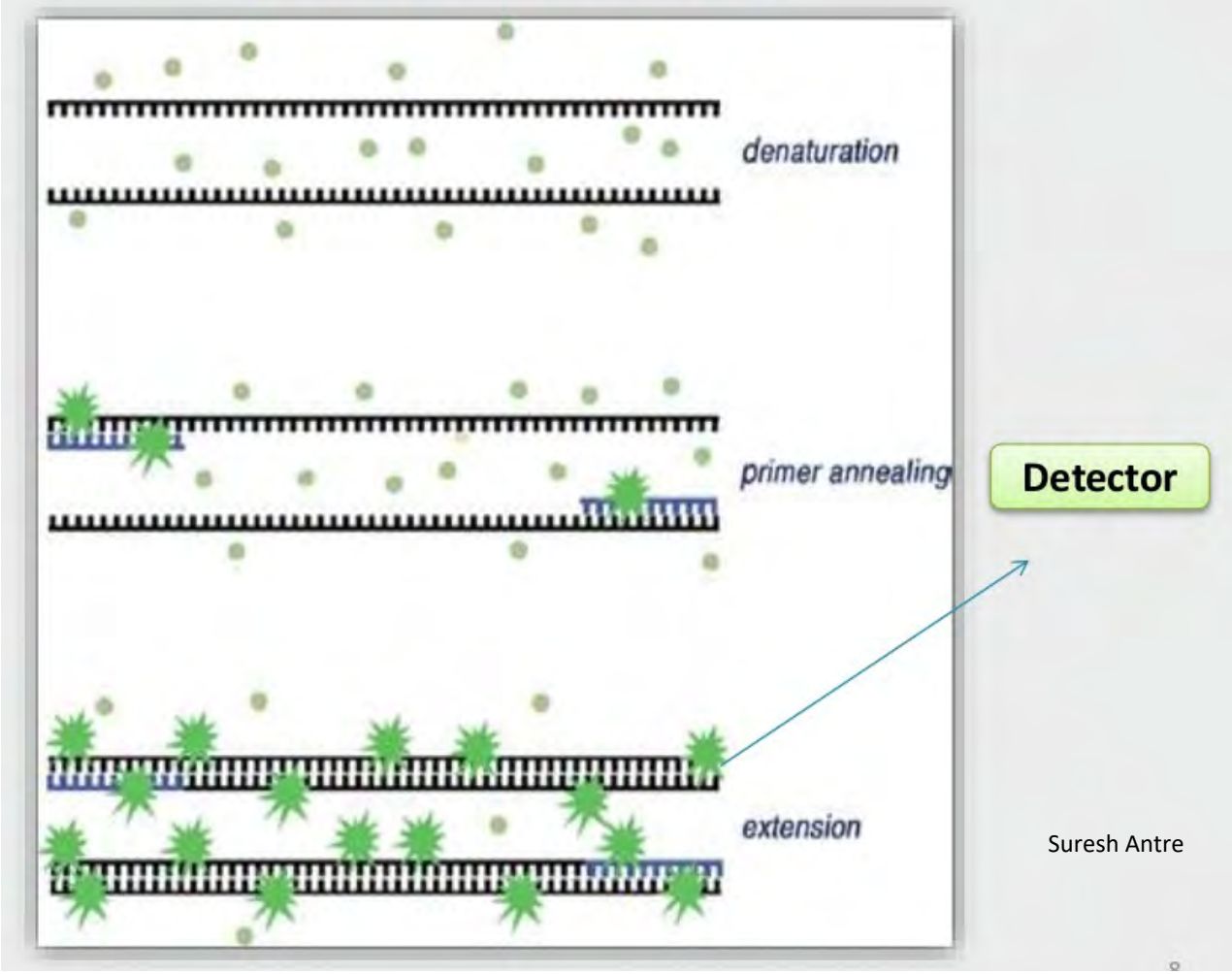




1.
Are there harmful bacteria present on farmed kelp?

Detection with qPCR

- Amplifies a target DNA sequence
  - *V. parahaemolyticus* (*trh*)
  - EHEC (*eaeA*)
  - *S. enterica* Typhimurium (*iroB*)
- Sensitive
- Rapid detection
- Enrichment enhances ability to detect low concentrations

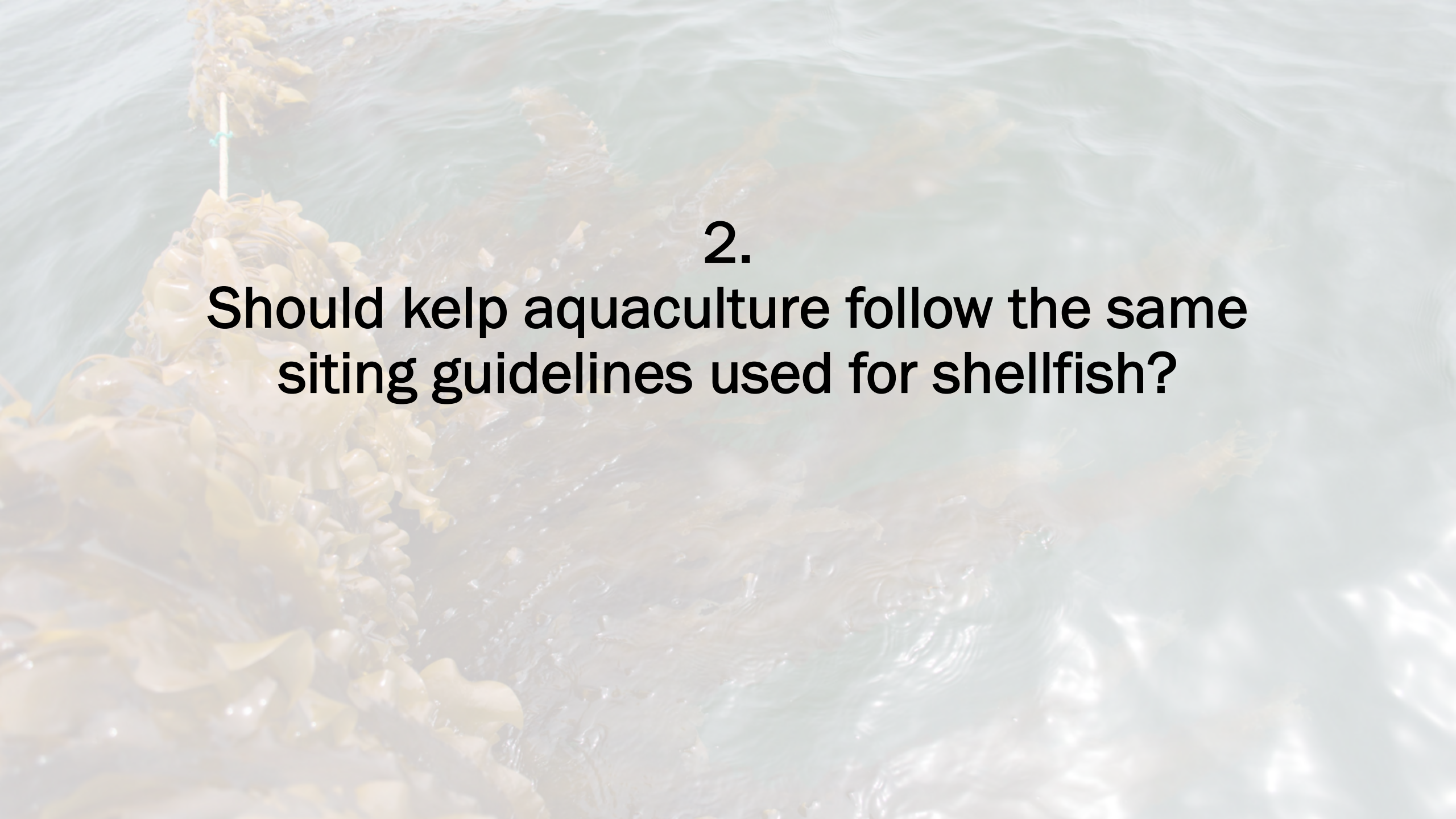


qPCR detection at all sites

Bacterium	% of + events (n=18)	% of + replicates (n=50)
V. parahaemolyticus	78%	52%
S. Typhimurium	83%	60%
EHEC	56%	46%

Are there harmful bacteria present on farmed kelp?

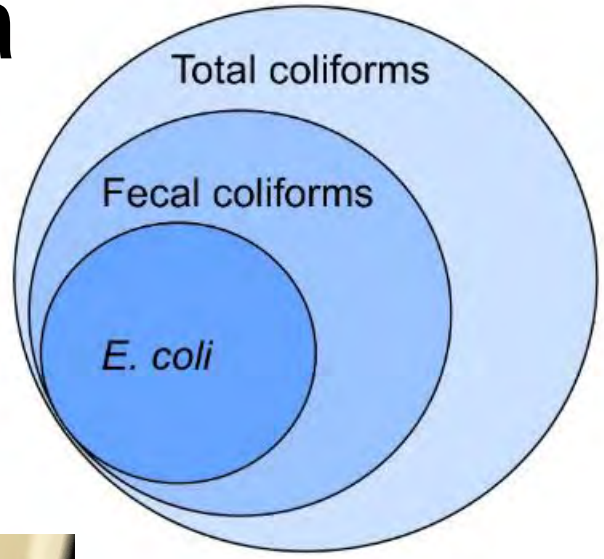
- Yes, frequent detection of 3 pathogens
- At least 2 pathogens per event
- But in low quantity
- May create risk after harvest



2.
Should kelp aquaculture follow the same siting guidelines used for shellfish?

Plating for fecal bacteria

Closed shellfish growing waters
NSSP



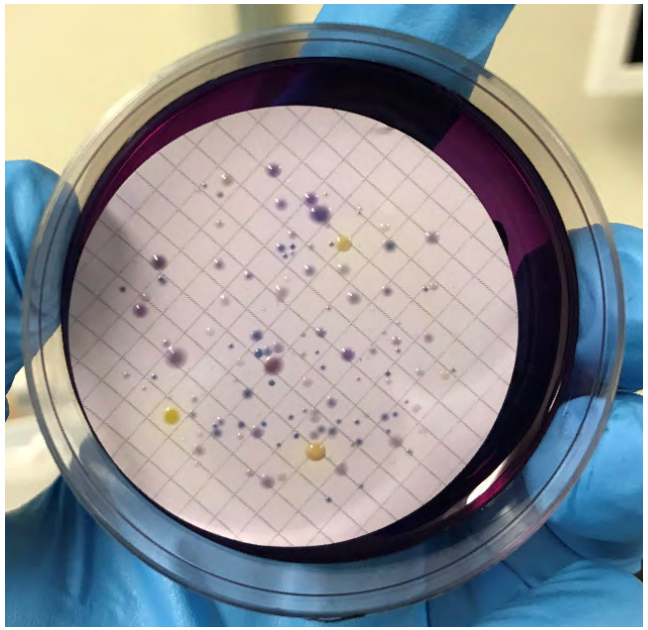
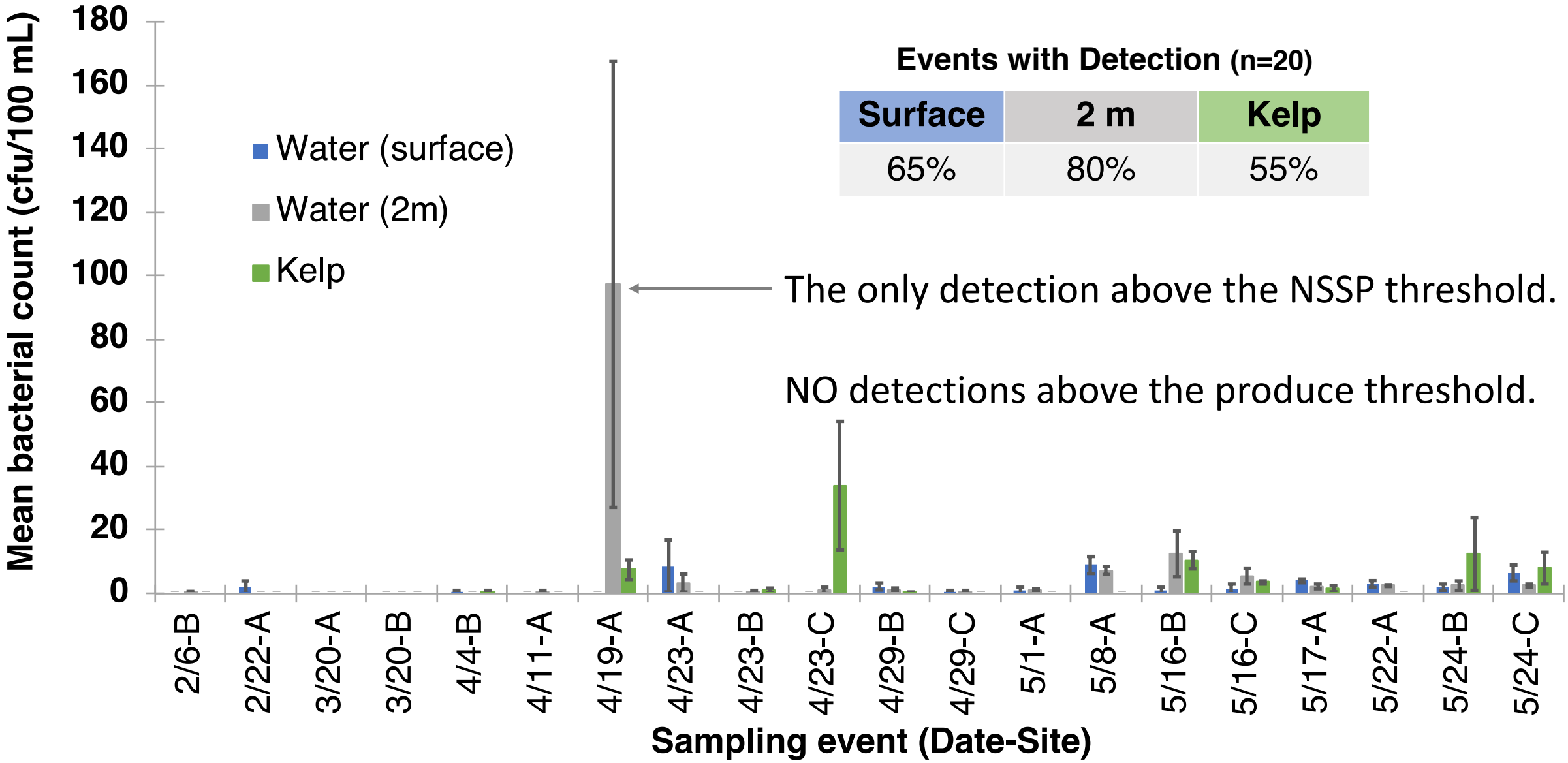


Plate counts: *E. coli*



Events with Detection (n=20)

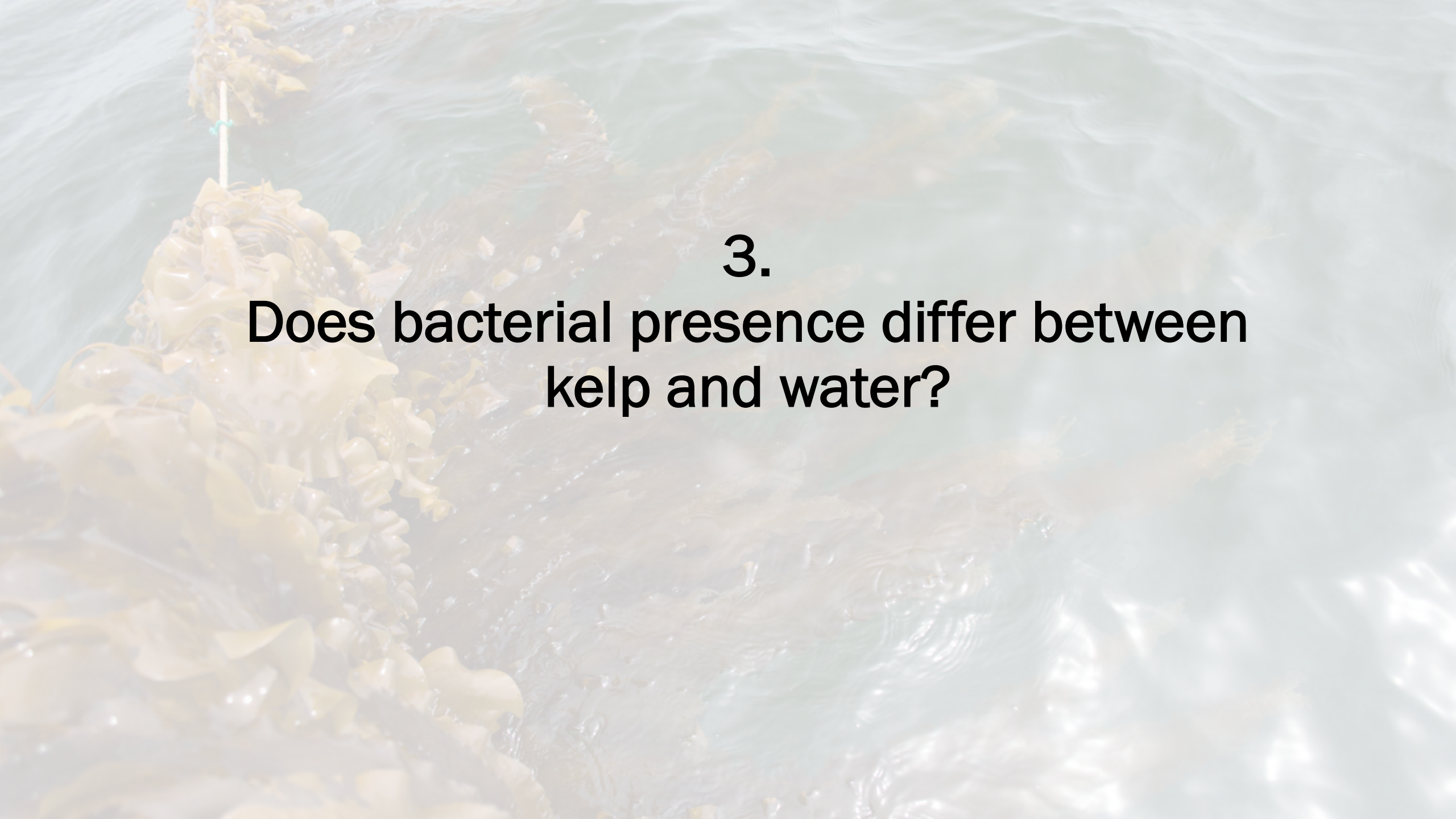
Surface	2 m	Kelp
65%	80%	55%

The only detection above the NSSP threshold.

NO detections above the produce threshold.

Should kelp aquaculture follow the same siting guidelines used for shellfish?

- Shellfish guidelines likely too restrictive for kelp
- Sample kelp directly
- No change in risk throughout season

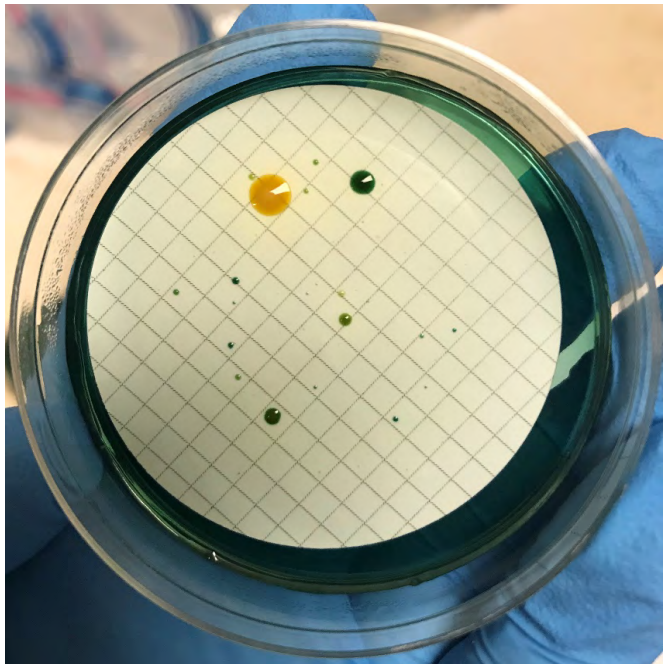


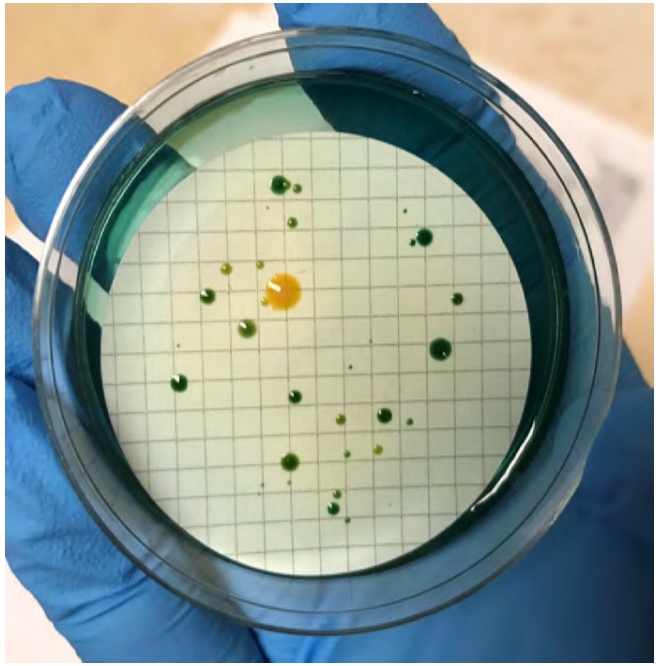
3.

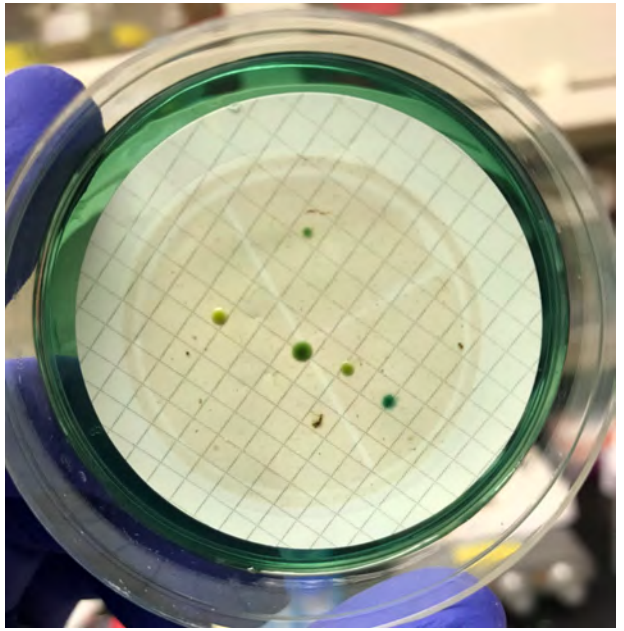
Does bacterial presence differ between kelp and water?

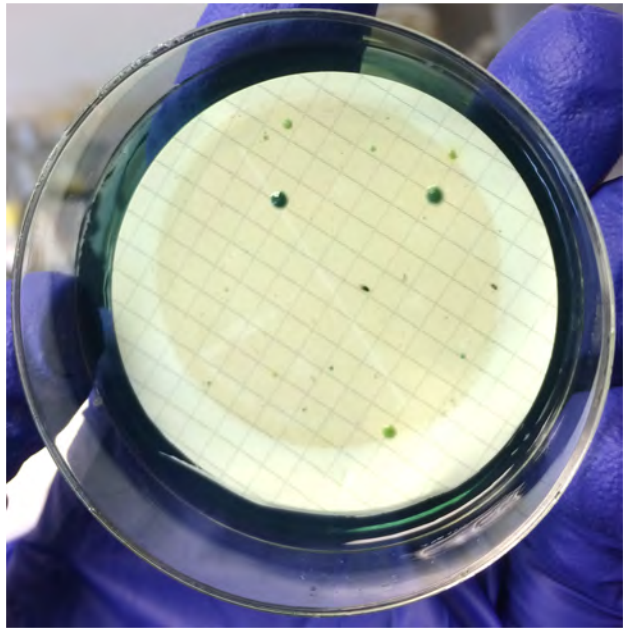
Enumeration of Vibrio

- TCBS agar
- Blue-green identified as *V. parahaemolyticus*
- Yellow as *V. alginolyticus*









Kelp vs Water

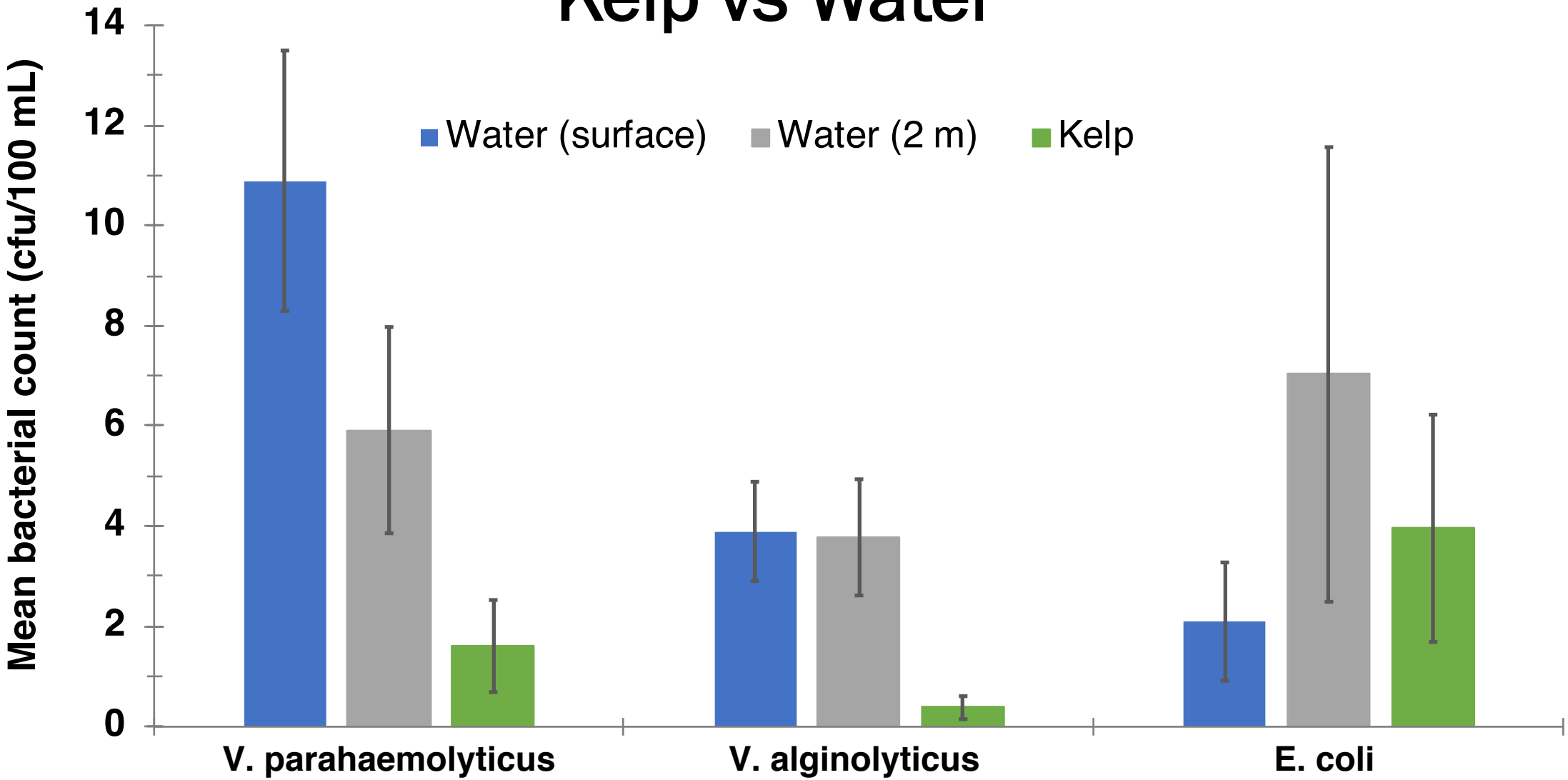
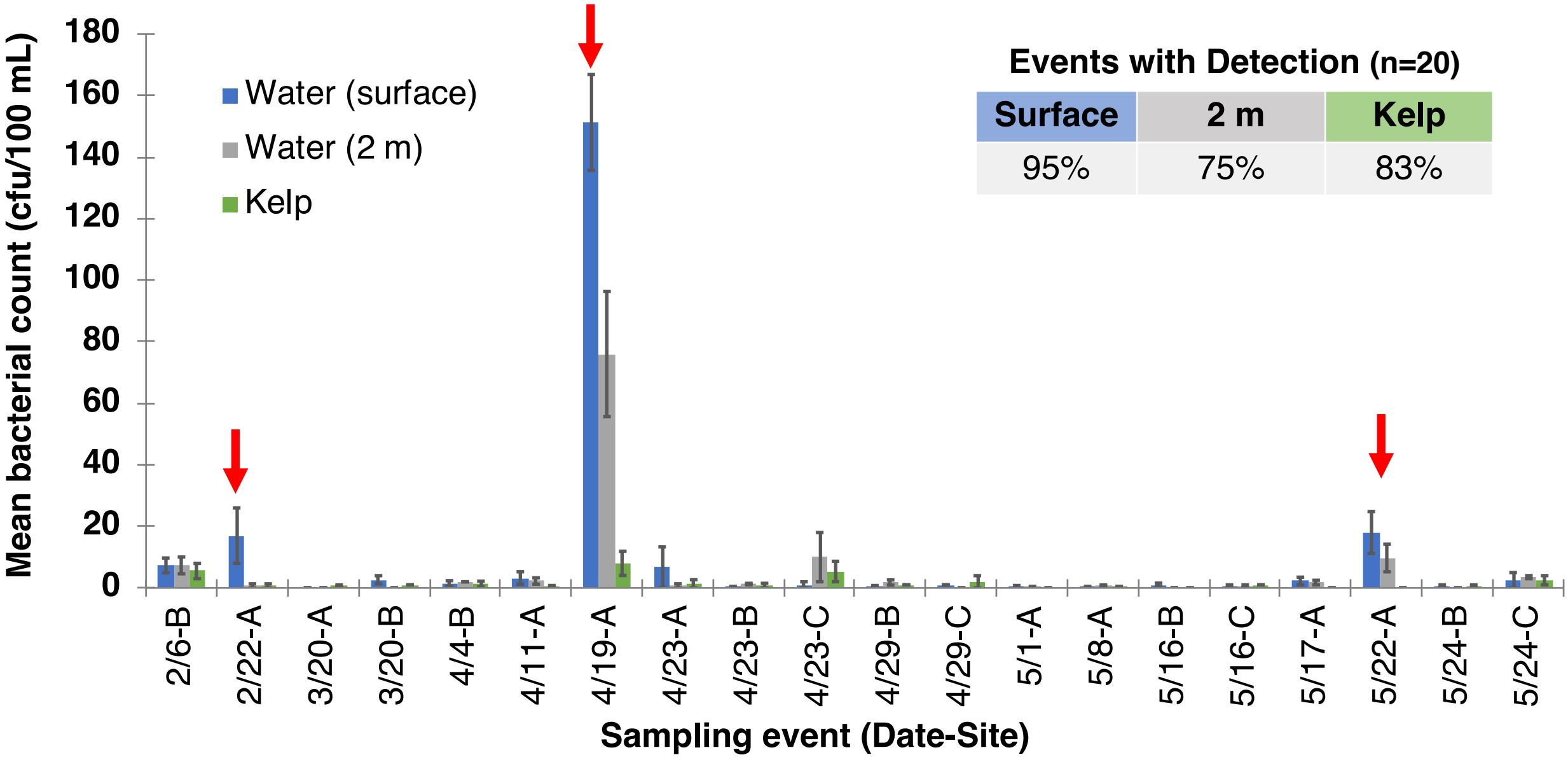


Plate counts: *V. parahaemolyticus*



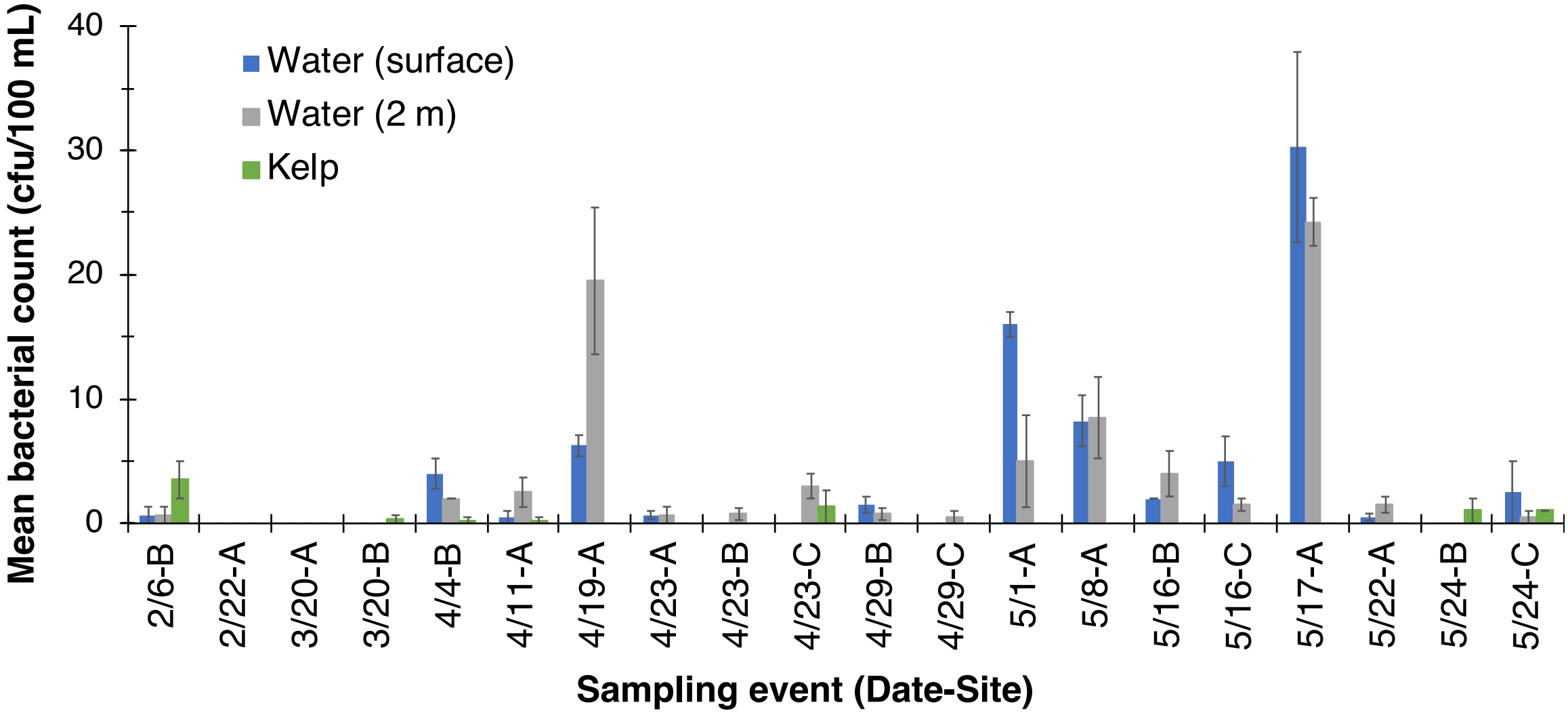
Events with Detection (n=20)

Surface	2 m	Kelp
95%	75%	83%

Plate counts: *V. alginolyticus*

Events with Detection (n=20)

Surface	2 m	Kelp
65%	80%	37%



Does bacterial presence differ between kelp and water?

- Variation in kelp-seawater relationship
- *E. coli* associates with kelp
- Vibrio less frequently associates

Conclusions

1. Risk of pathogens confirmed by frequent qPCR detection

2. Low abundance on kelp; need siting guidelines specific to kelp

3. Variation in bacterial abundance between kelp and water