The secret lives of European green crabs: Habitat utilization as revealed by acoustic telemetry

Curtis Roegner, NOAA Fisheries
Zach Forster, WDFW
David Beugli, Willapa-Grays Harbor Oyster Growers Association

Funding from State of Washington and NOAA Fisheries

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Minimally analyzed results!

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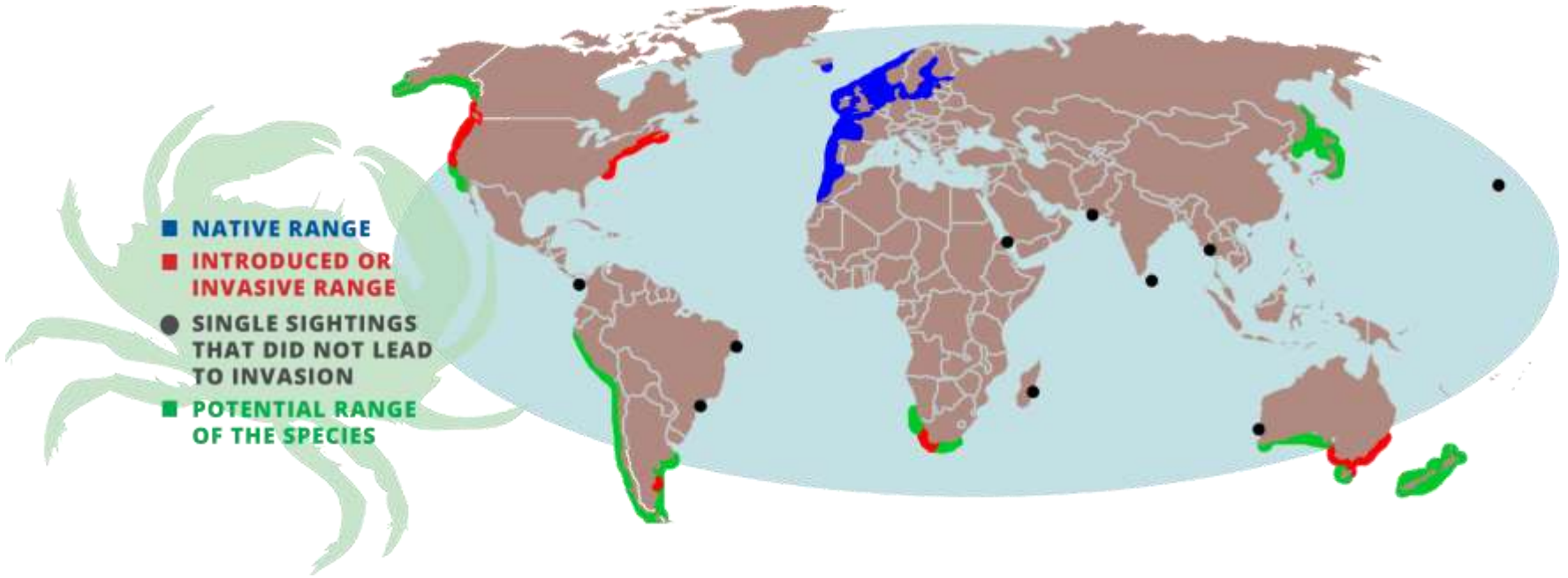
Overview of EGC invasion



PNW

- First detected in SFB in 1989
- First detected in Willapa Bay in 1998
- Populations in coastal estuaries fluctuated – many died out
- Good recruitment from 2015-2022
- Large breeding populations presently extant

Yamada et al. 2022

Objectives: Habitat use of EGC

1. Acoustics in intertidal zone?
2. Compare inter- and subtidal residency and movements of EGC and Dungeness crab
3. Compare habitat use at aquaculture and uncultured sites
4. Identify possible migratory “chokepoints” for eradication actions

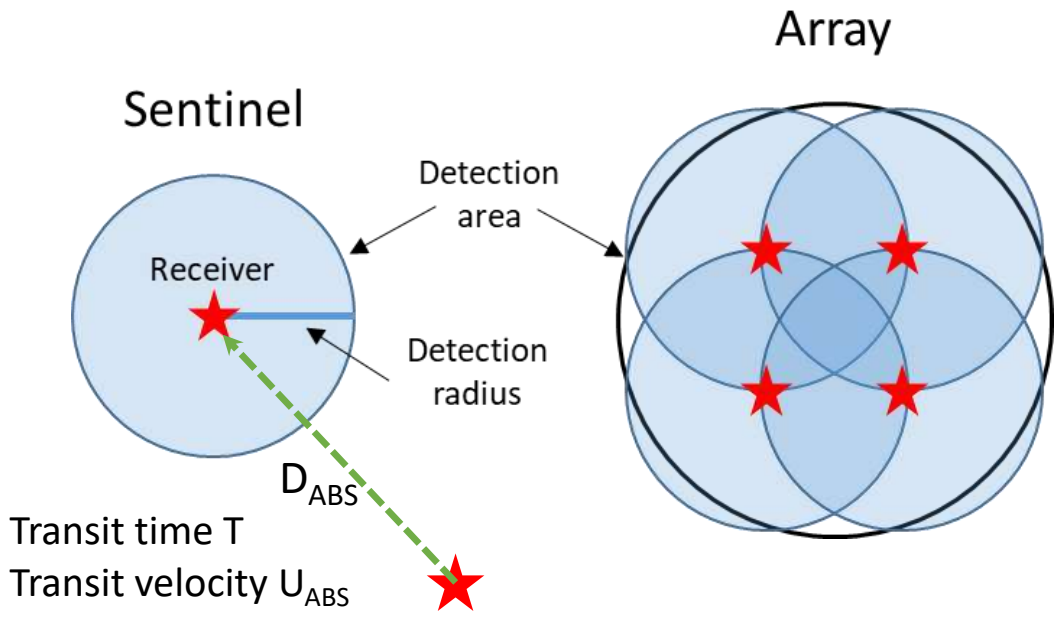
Tags and receivers

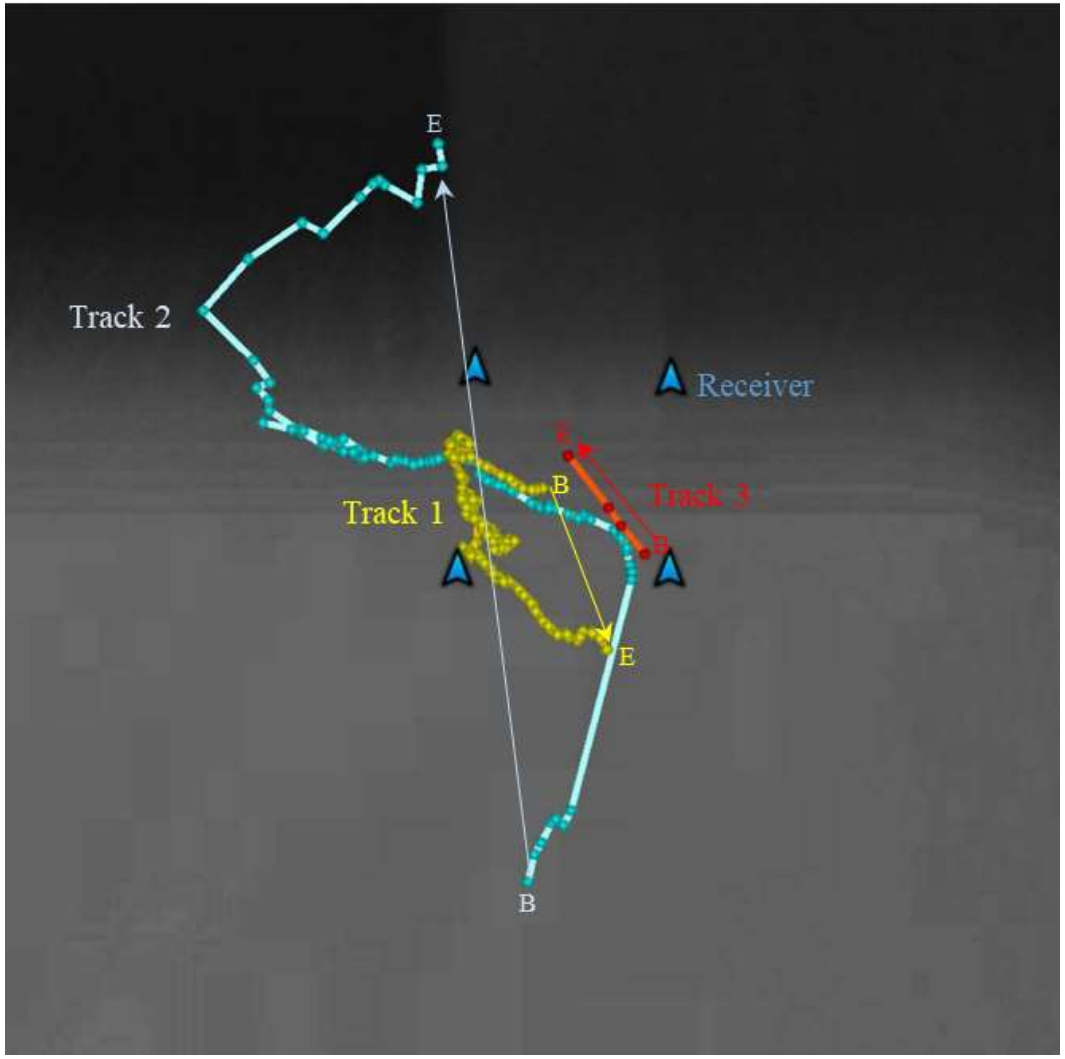
Tagged EGC

Intertidal receiver

Subtidal receiver

Movement metrics





1. Duration (residency vrs dispersal)
2. Activity (U_{AVE}, movement vrs quiescence)
3. Linearity = $D_{ABS} / \sum D$ (directed movement vrs meandering).

Track	Dur	NPOS	ΣD	U_{AVE}	$\%U_{CRIT}$	LI_{AVE}
1	1.61	238	1369	0.019±0.015	36.5	0.31±0.26
2	1.09	110	2488	0.046±0.035	11.8	0.67±0.17
3	0.01	3	186	0.169±0.151	0.0	0.99±0.01

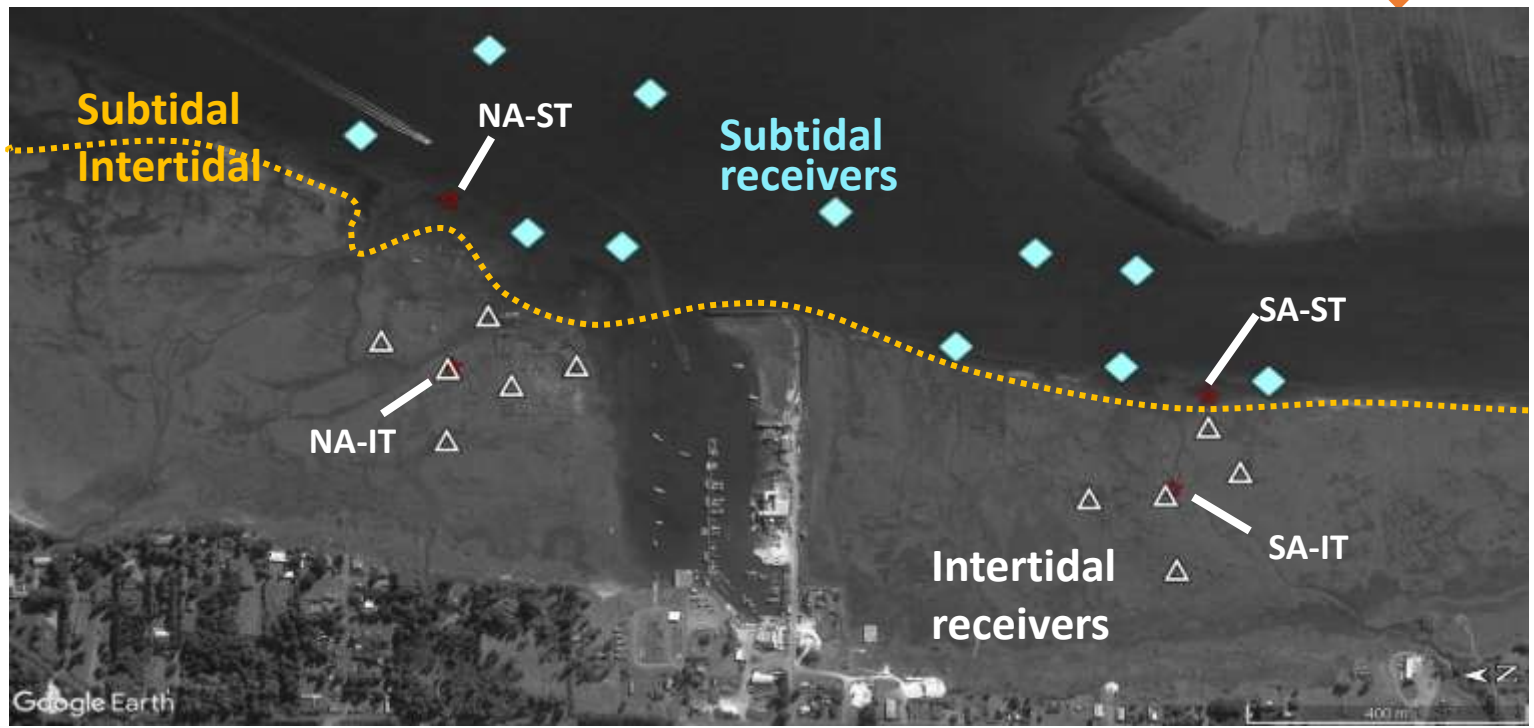
Experimental design

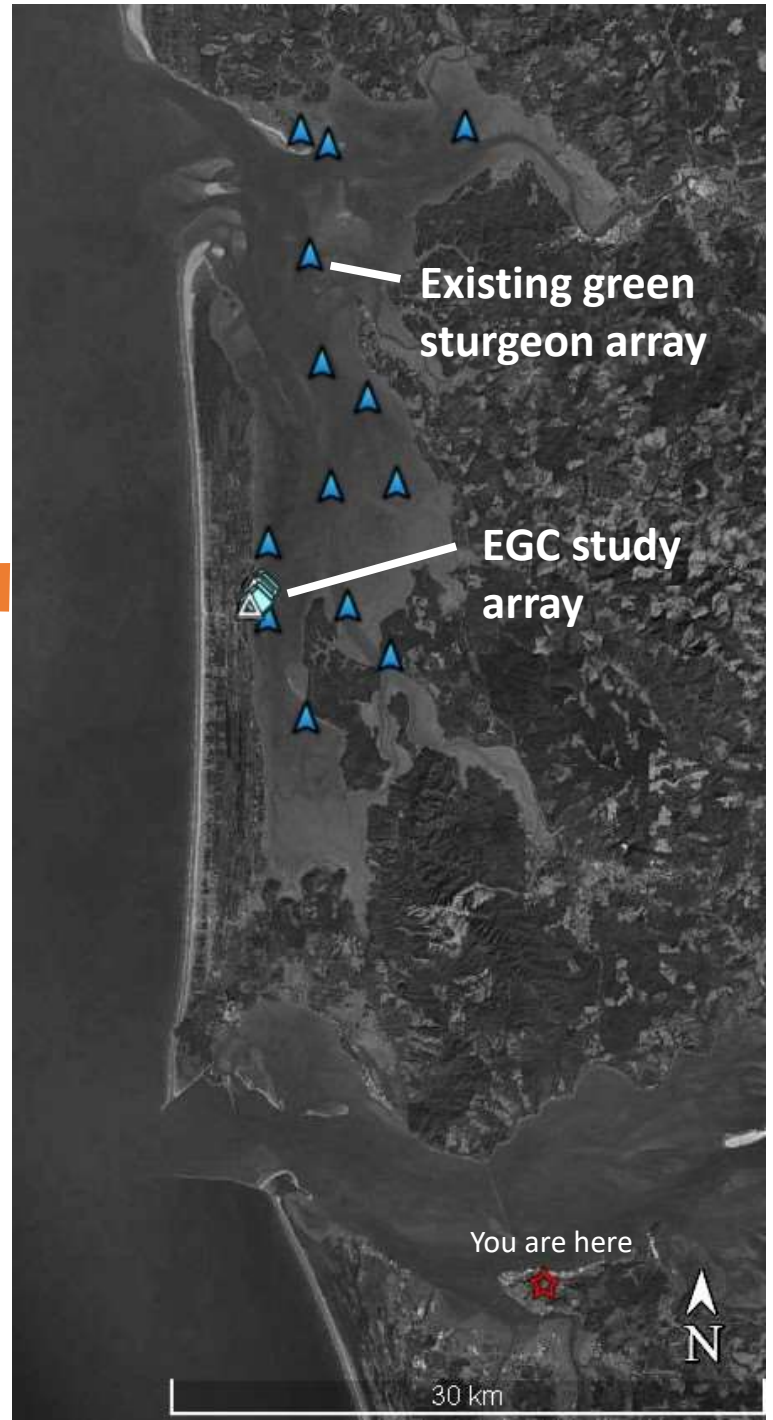
Treatments:

- North Array – intertidal. Working bivalve aquaculture
- South Array – intertidal. Oyster reef, eelgrass, burrowing shrimp
- Subtidal releases Oyster reef, eelgrass, burrowing shrimp

Tagged:

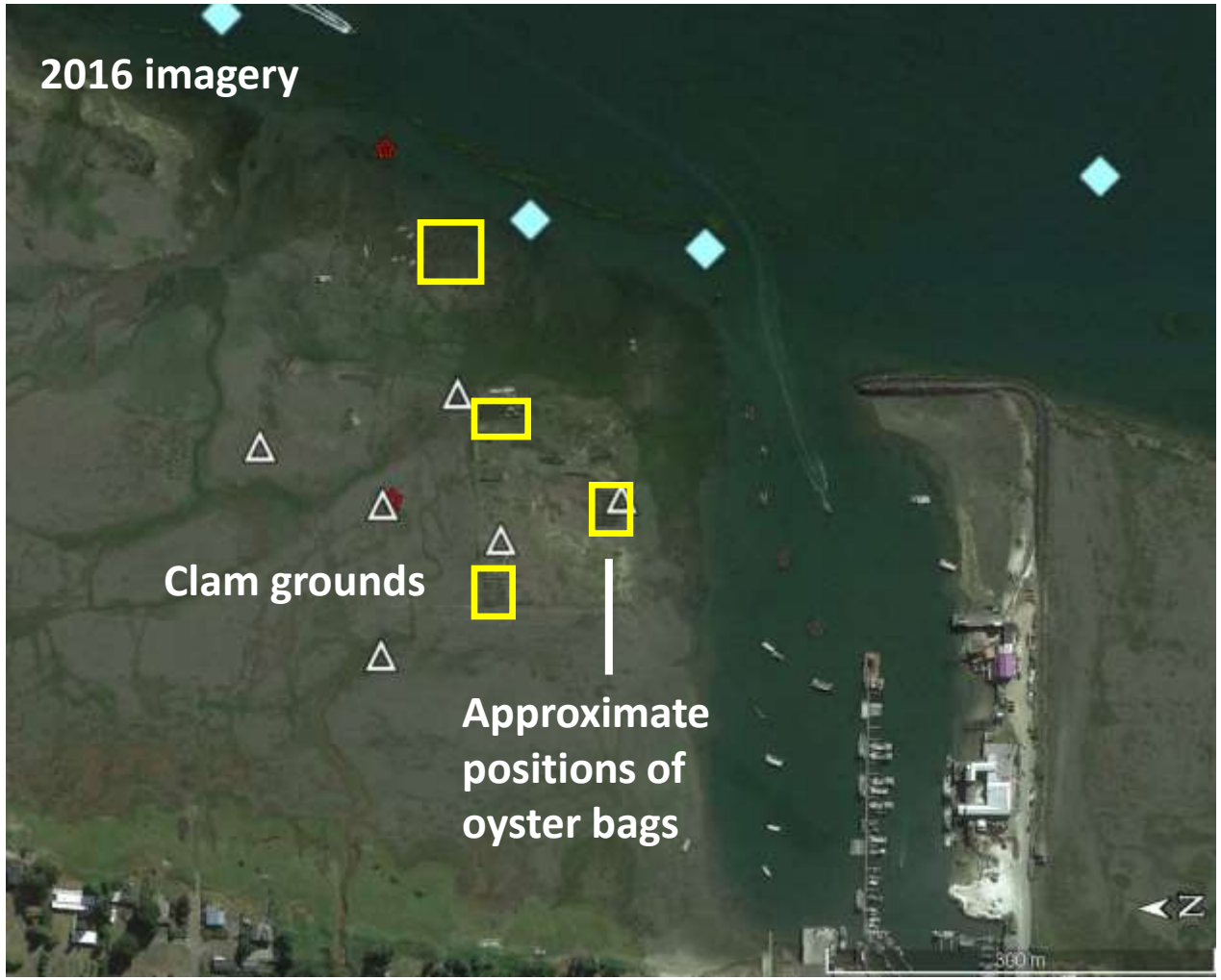
- 40 EGC – 10 at each release site (equal M:F)
- 20 DC – 10 at both subtidal sites (7:3 M:F)
- 1 Red rock crab (F)

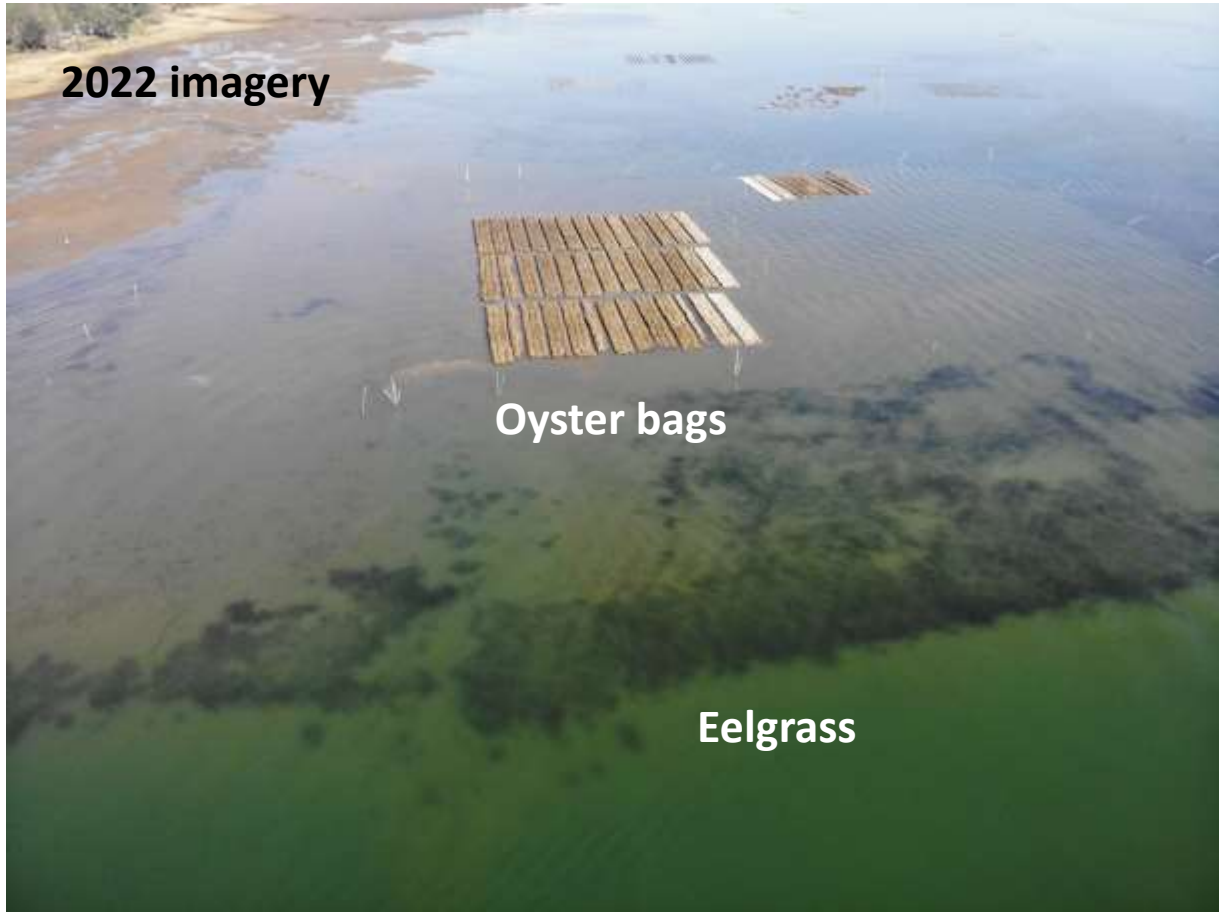




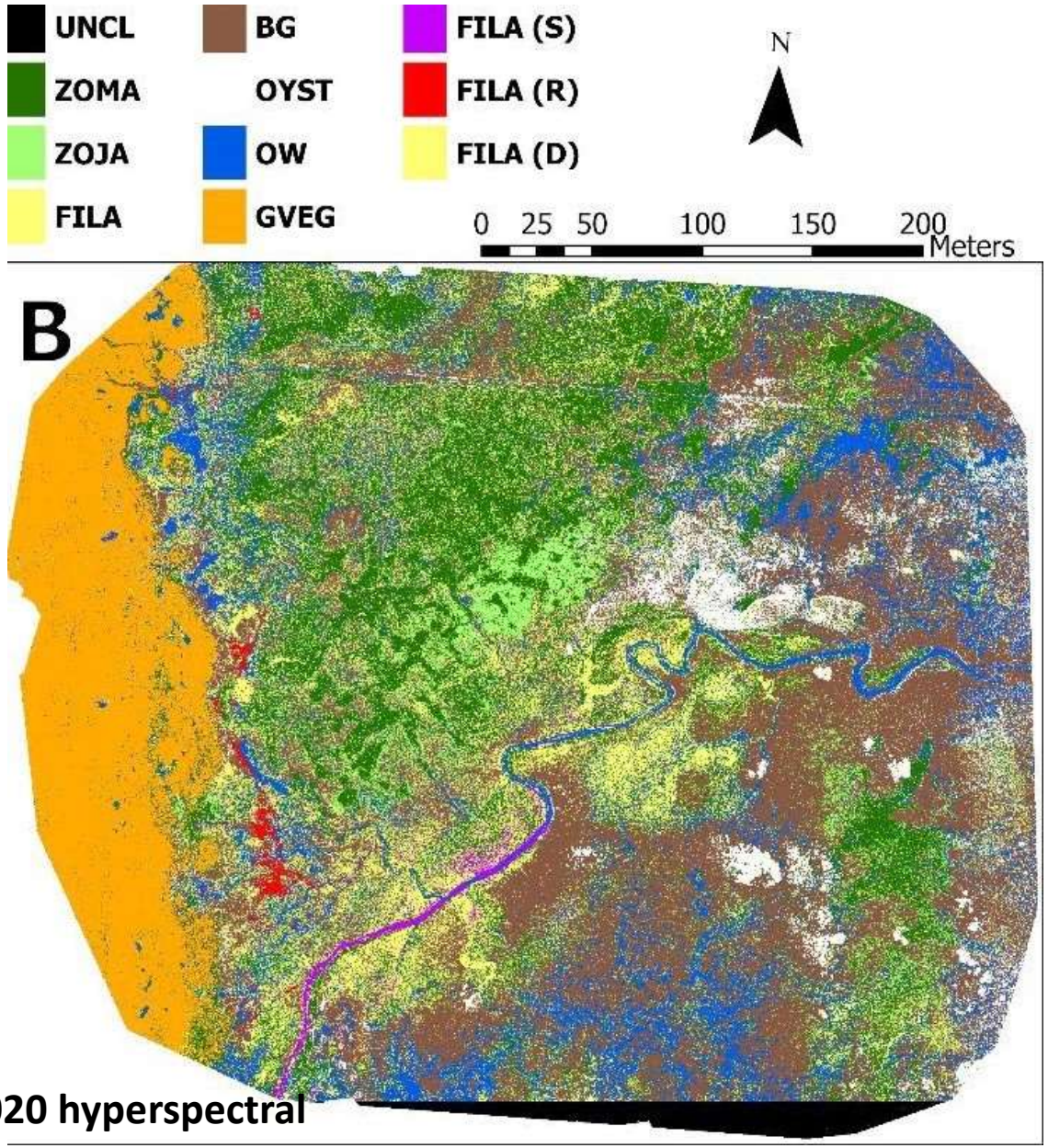
Habitat at the North Array

- Oyster bag culture
- Infaunal Manila clam culture





Habitat at the South Array

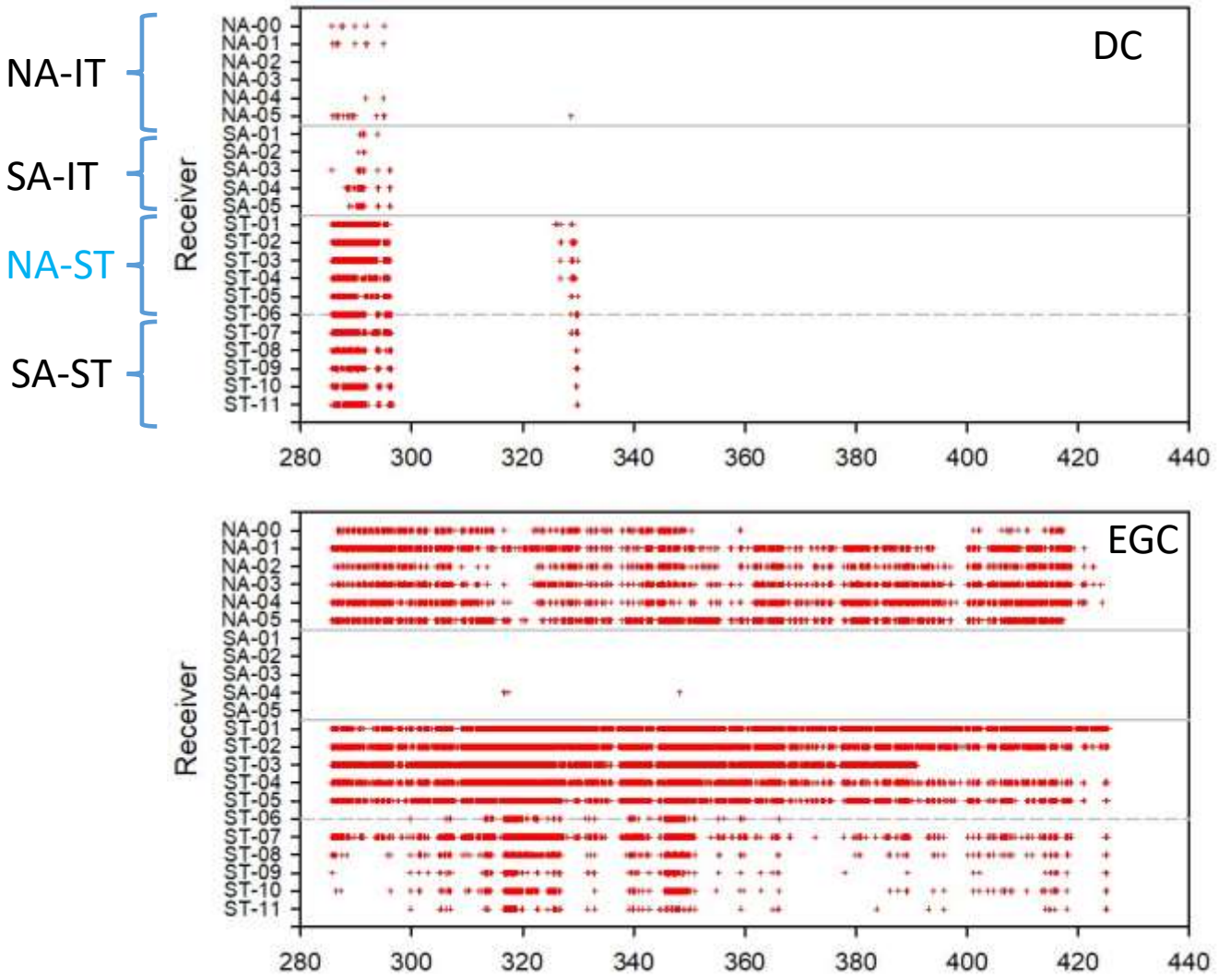


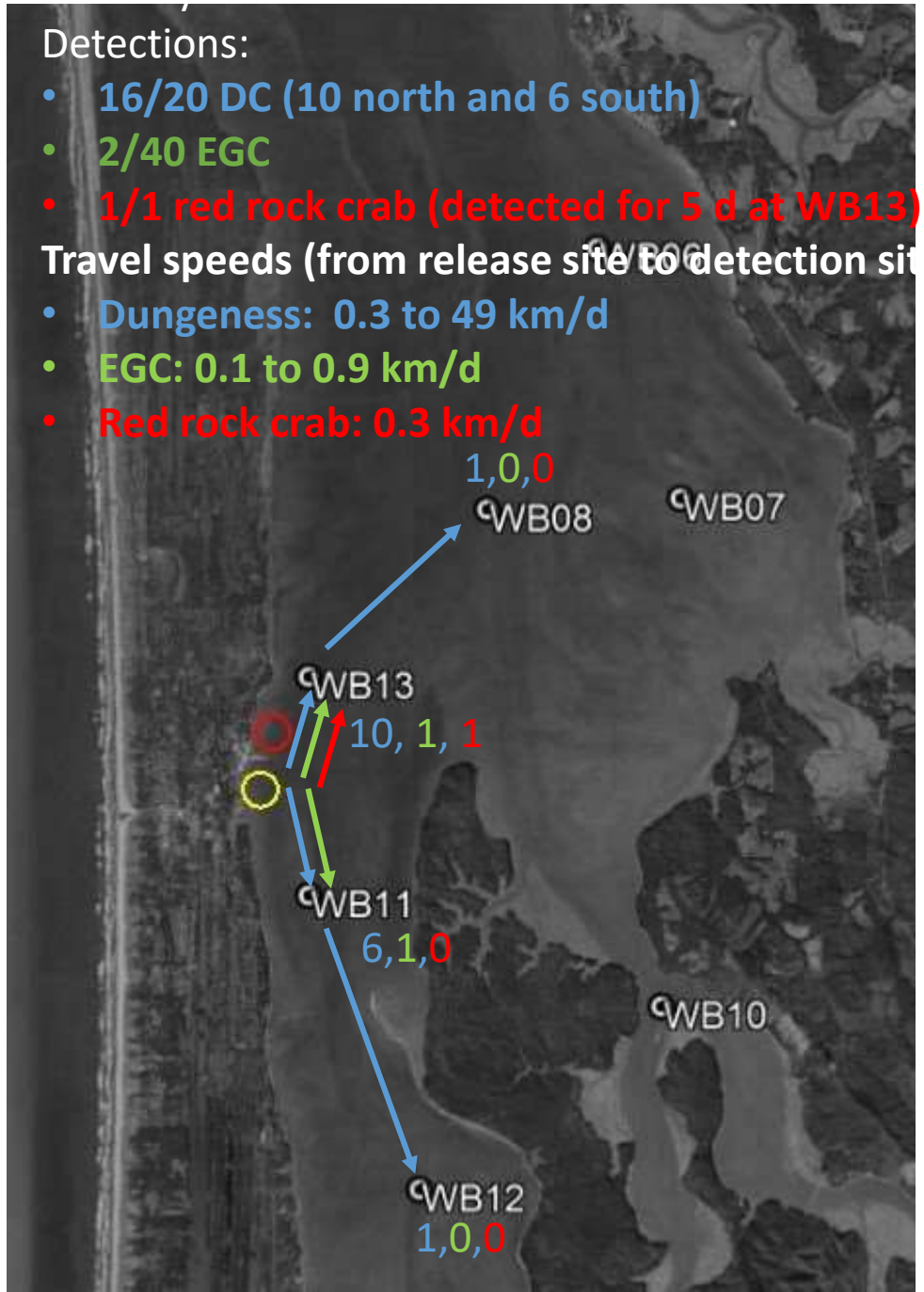
2020 hyperspectral imagery

- Oyster reef
- Eelgrass
- Burrowing shrimp

Results: residency

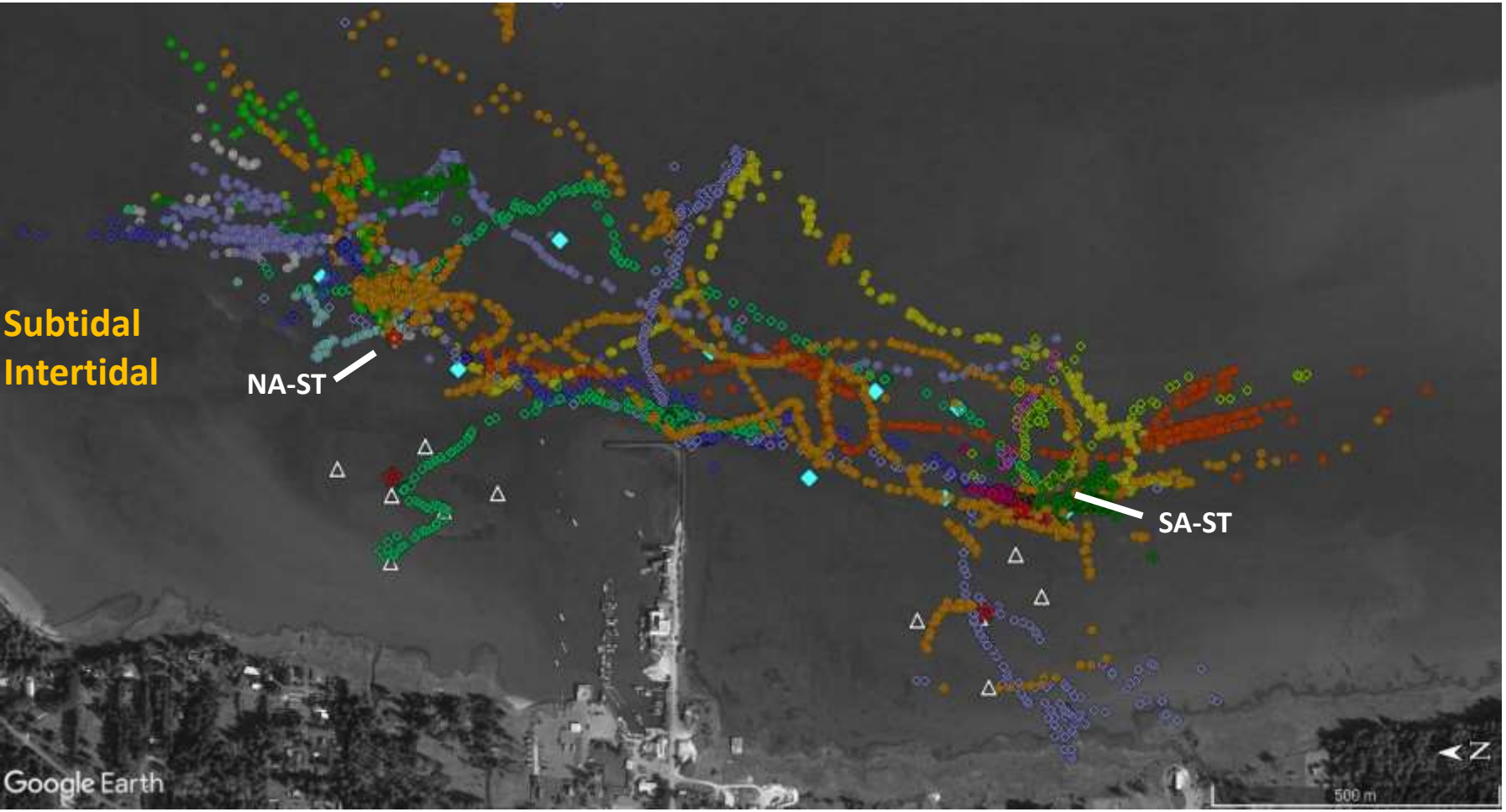
Released at NA-ST





Dungeness crab tracks

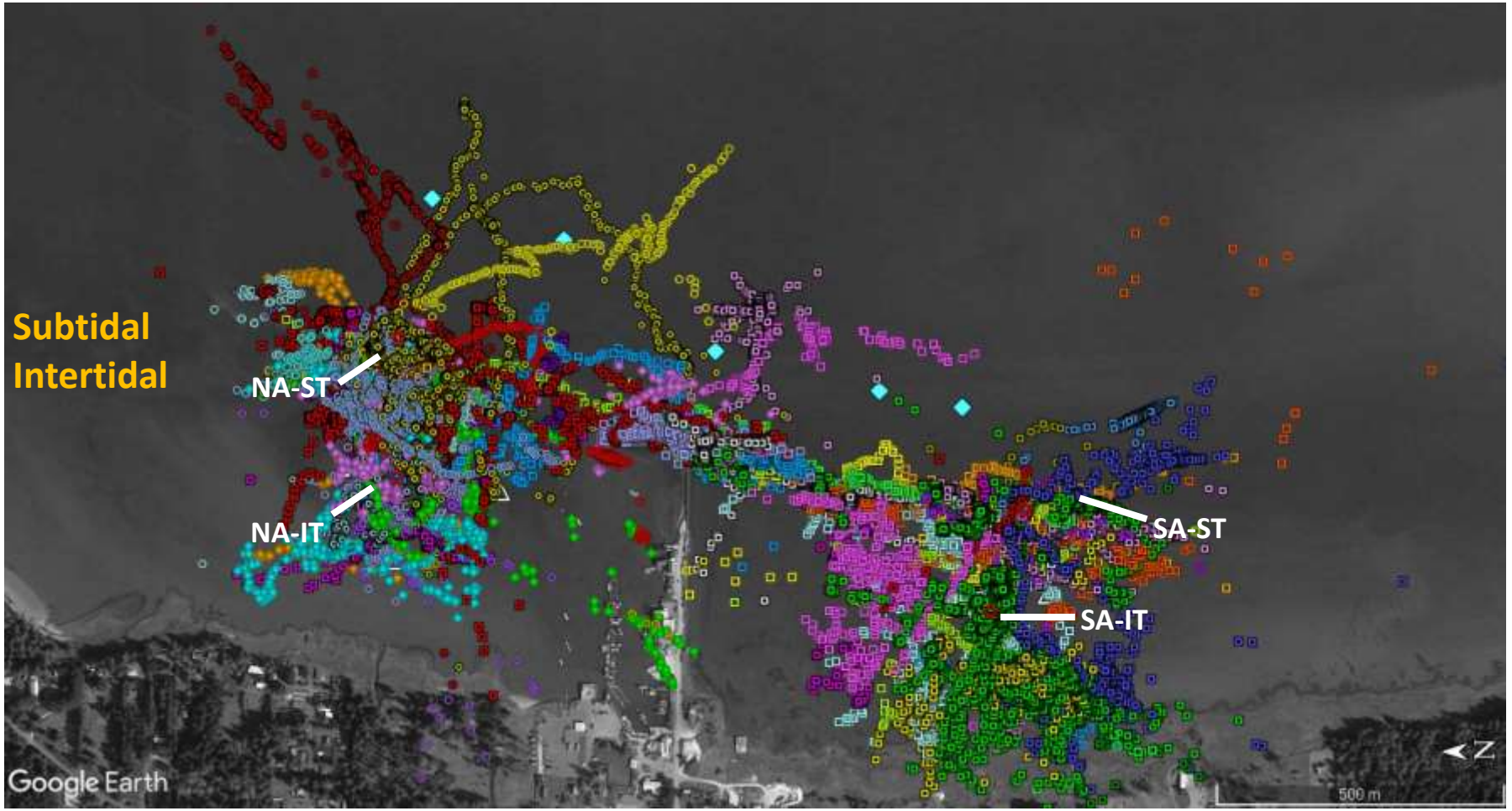
10 Oct 2022-1 Mar 2023



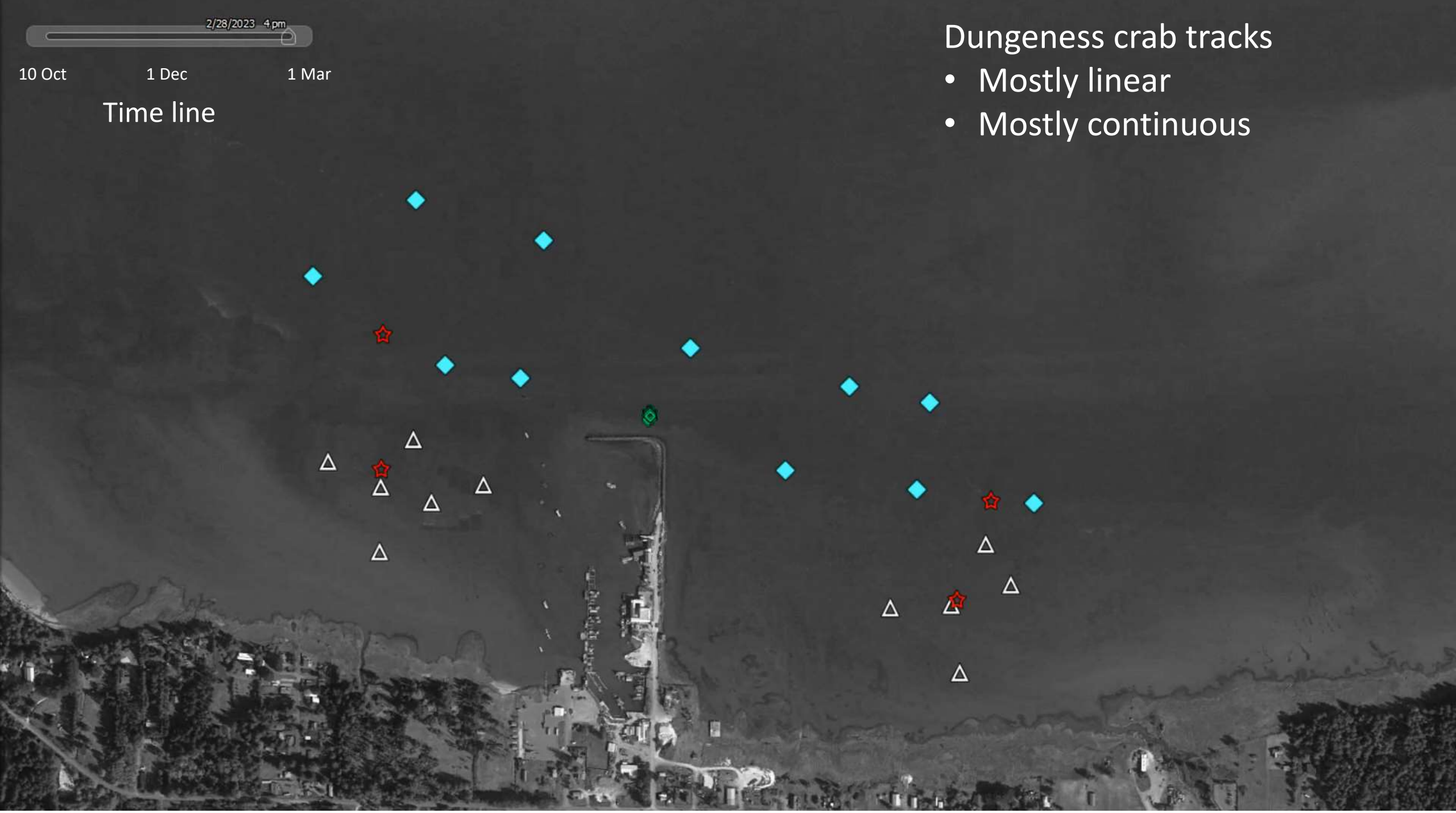
- Mostly subtidal
- Deep and shallow water
- High linearity

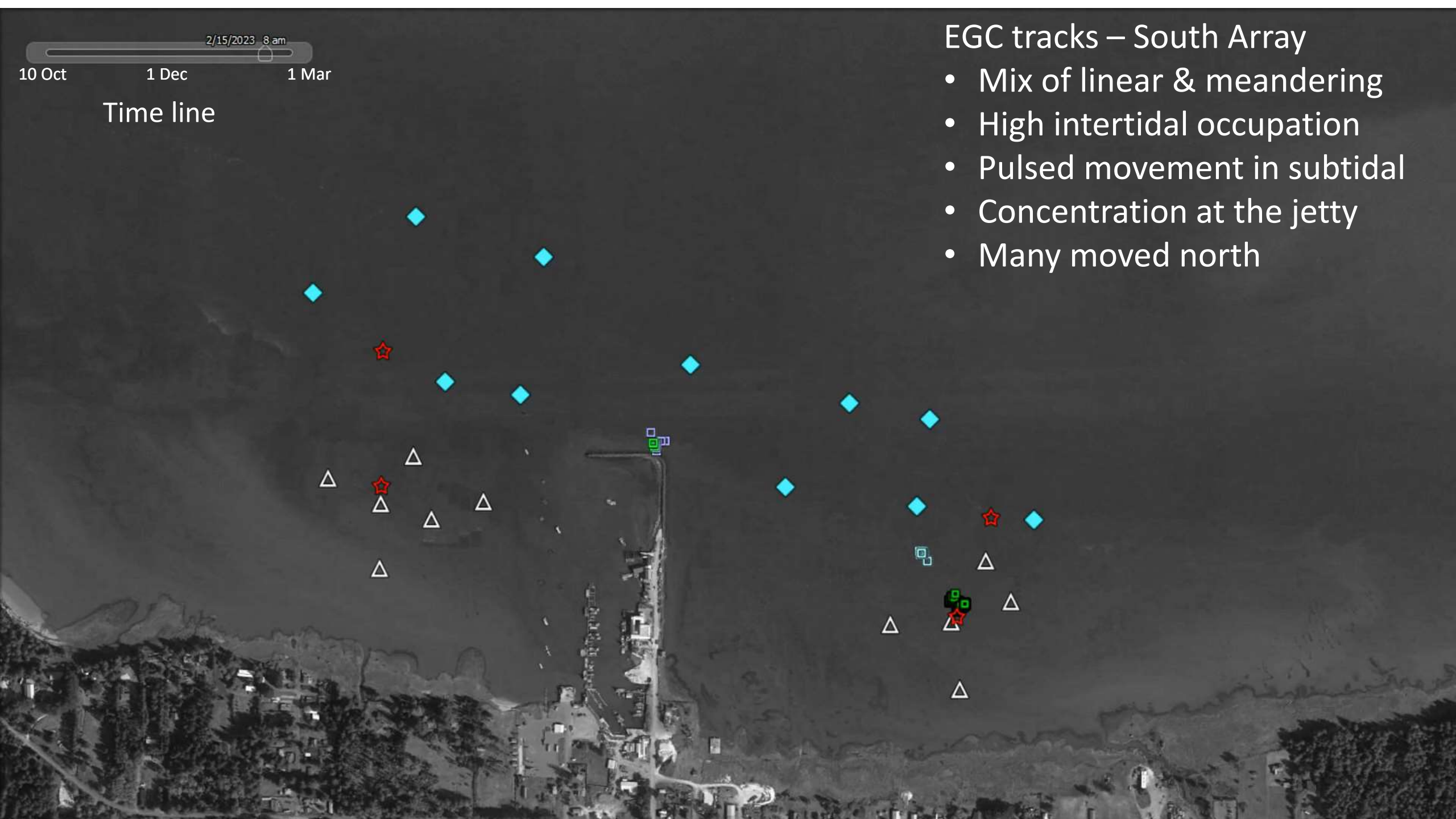
European green crab habitat use

10 Oct 2022-1 Mar 2023



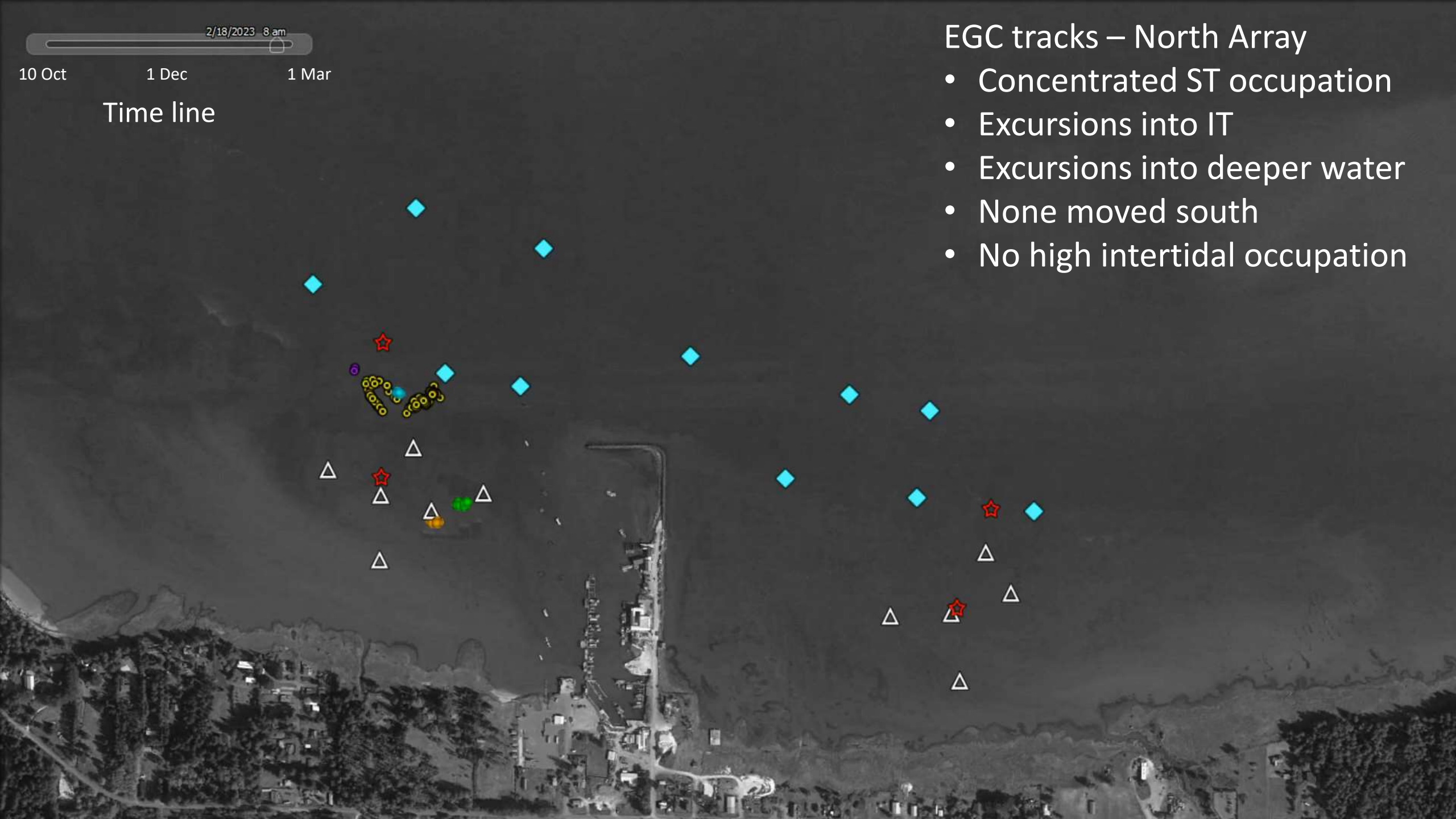
- Extensive use of both sub- and intertidal
- Distributed across detection area
- Subtidal concentration along channel edge


2/28/2023 4 pm
10 Oct
1 Dec
1 Mar
Time line
Dungeness crab tracks
• Mostly linear
• Mostly continuous



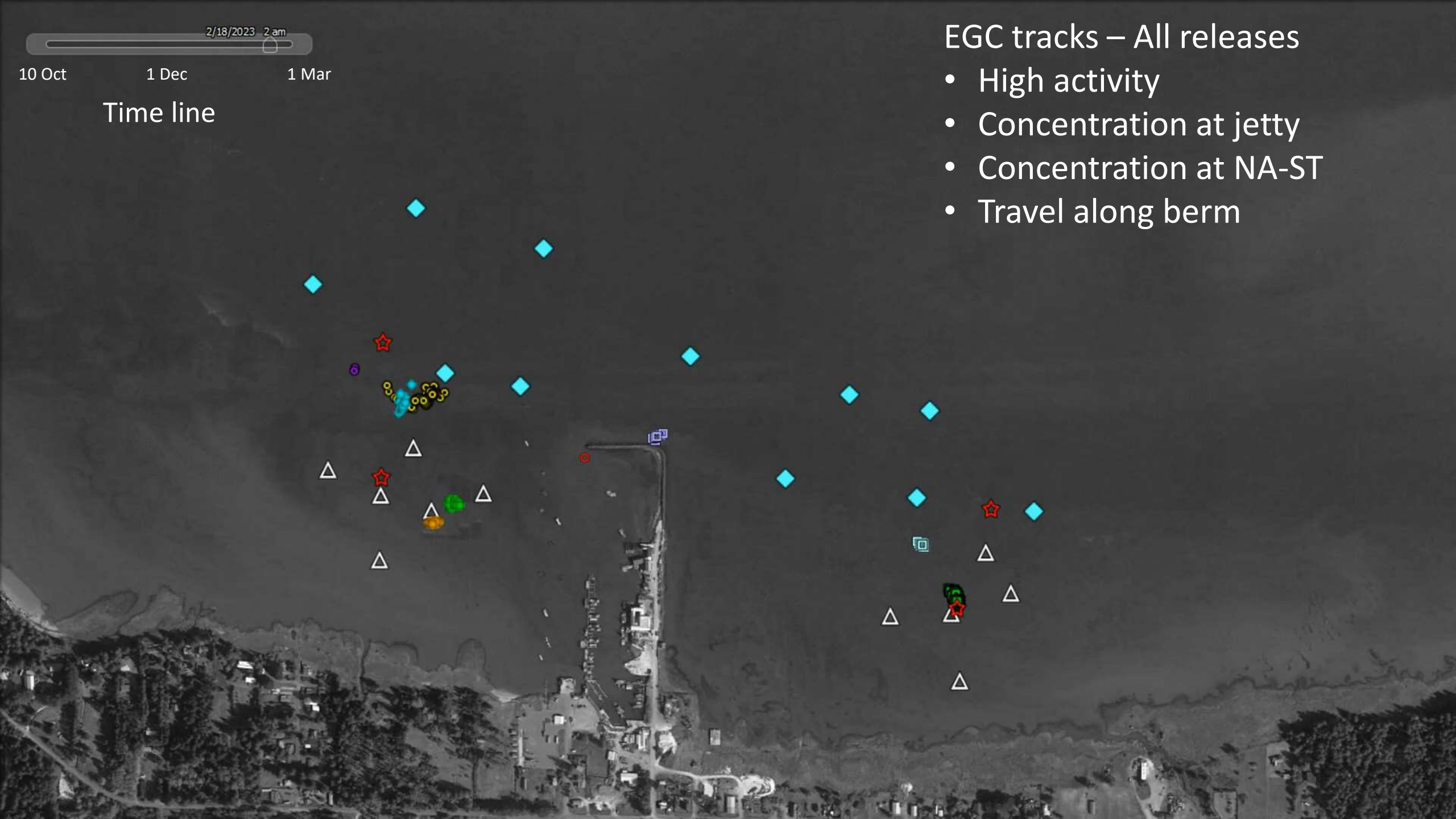
EGC tracks – South Array

- Mix of linear & meandering
- High intertidal occupation
- Pulsed movement in subtidal
- Concentration at the jetty
- Many moved north

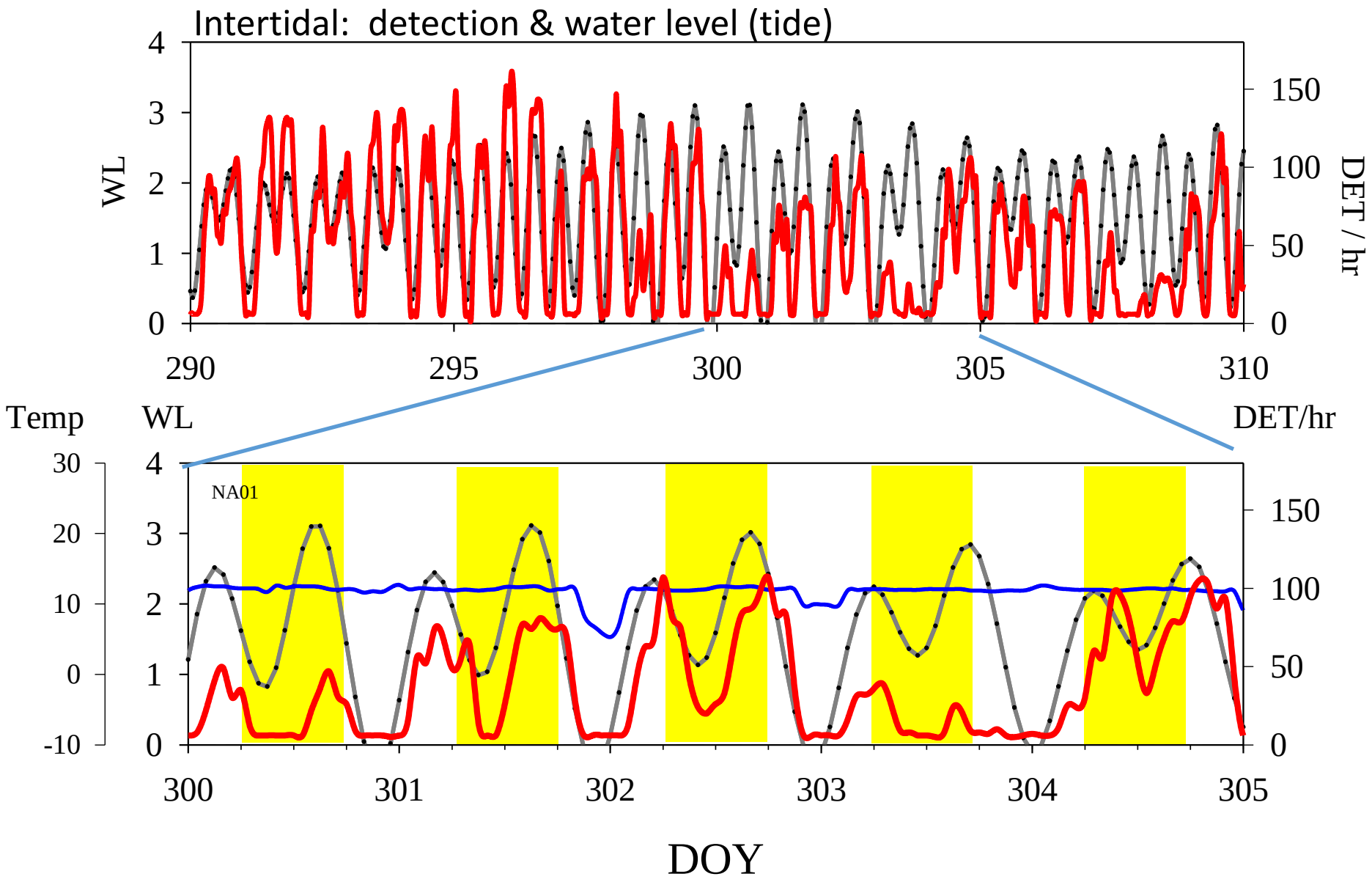


EGC tracks – North Array

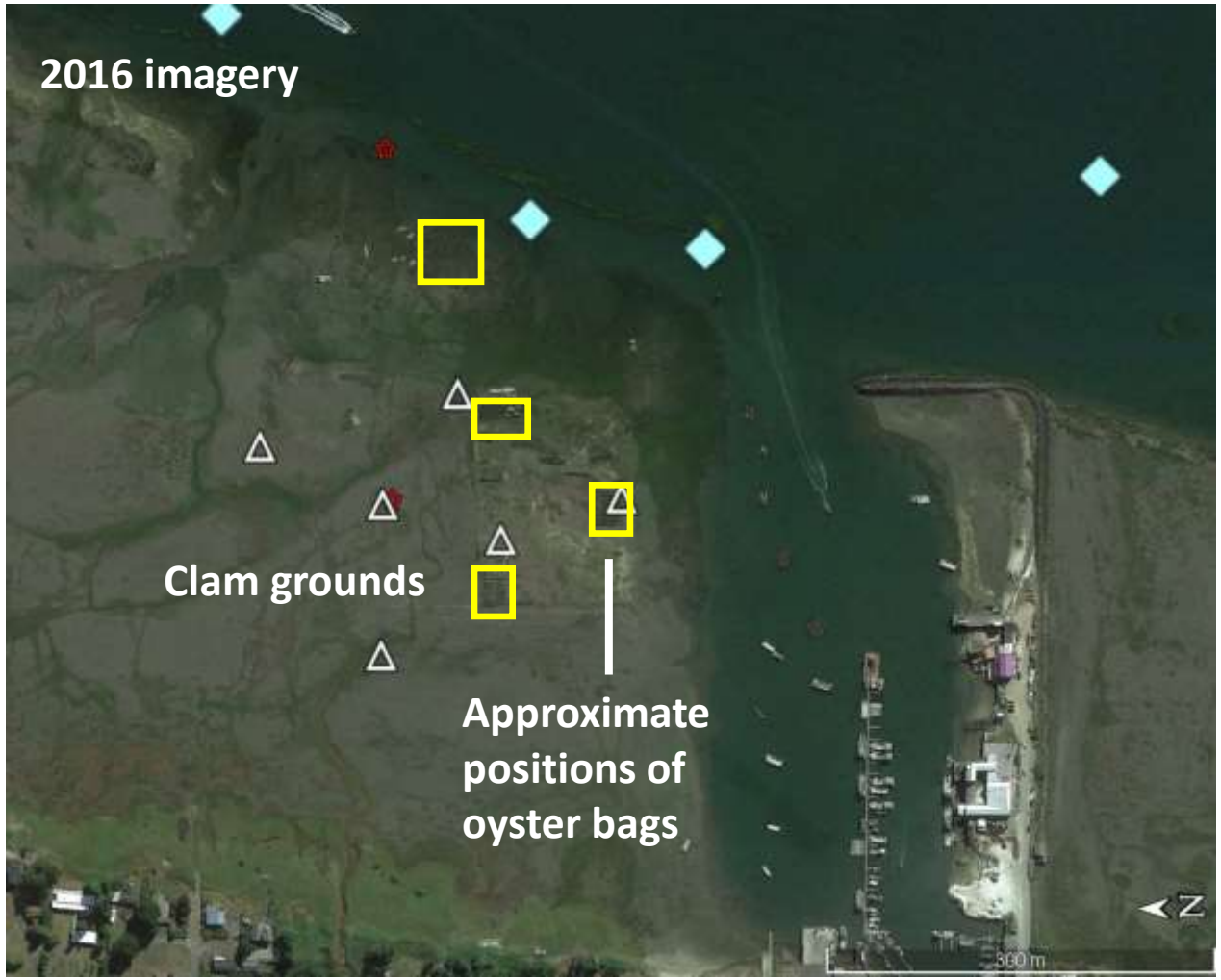
- Concentrated ST occupation
- Excursions into IT
- Excursions into deeper water
- None moved south
- No high intertidal occupation

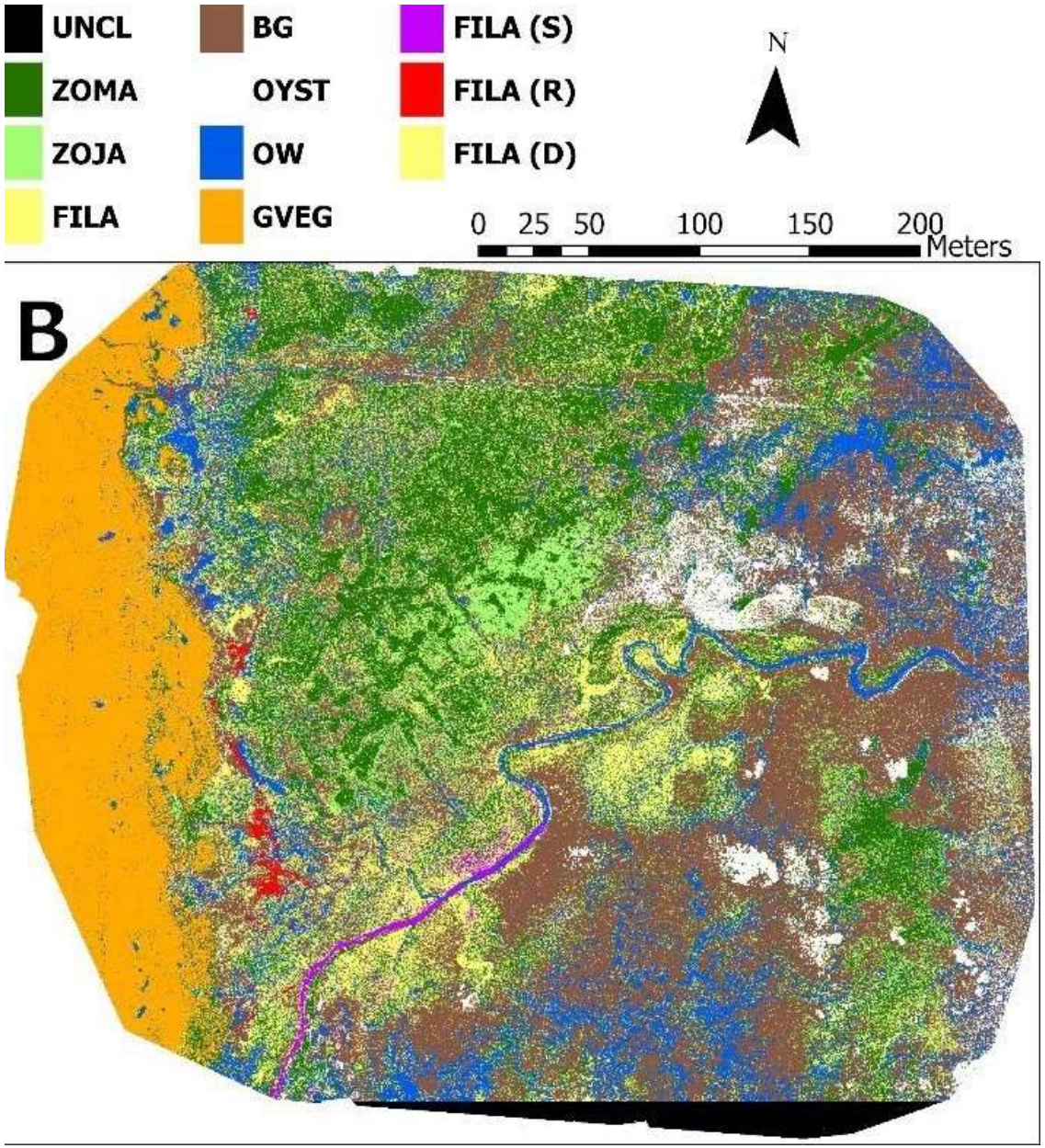

2/18/2023 2 am
10 Oct
1 Dec
1 Mar
Time line
EGC tracks – All releases
• High activity
• Concentration at jetty
• Concentration at NA-ST
• Travel along berm

Environmental correlates



Map crab movement to habitat features





Conclusions

Objectives: Habitat use of EGC

1. Acoustics in intertidal zone?
   - YES, but will need to look at detection efficiencies
2. Compare inter- and subtidal residency and movements of EGC and Dungeness crab
   - DC were mostly subtidal and rapidly left the study site
   - EGC utilized both IT and ST areas and some were present throughout the 5 month study period.
3. Compare habitat use at aquaculture and uncultured sites
   - PRELIMINARY assessment: IT use is higher at the South Array
   - Not strongly associated with oyster bag structure
4. Identify possible migratory “chokepoints” for eradication actions
   - Subtidal berm: travel corridor
   - Jetty: shelter?
   - NA-ST: shallow subtidal eelgrass near tidal channel?