Shellfish Aquaculture and Sensor Deployment in the Southeast of Ireland

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Application of Sensors in Precision Aquaculture

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BIM Ireland's Seafood Development Agency

Overview of Presentation

Southeast Shellfish Aquaculture Region

Value of Southeast Aquaculture

Range of Monitoring Work and Equipment Used

Monitoring constraints in each bay

Interesting Findings

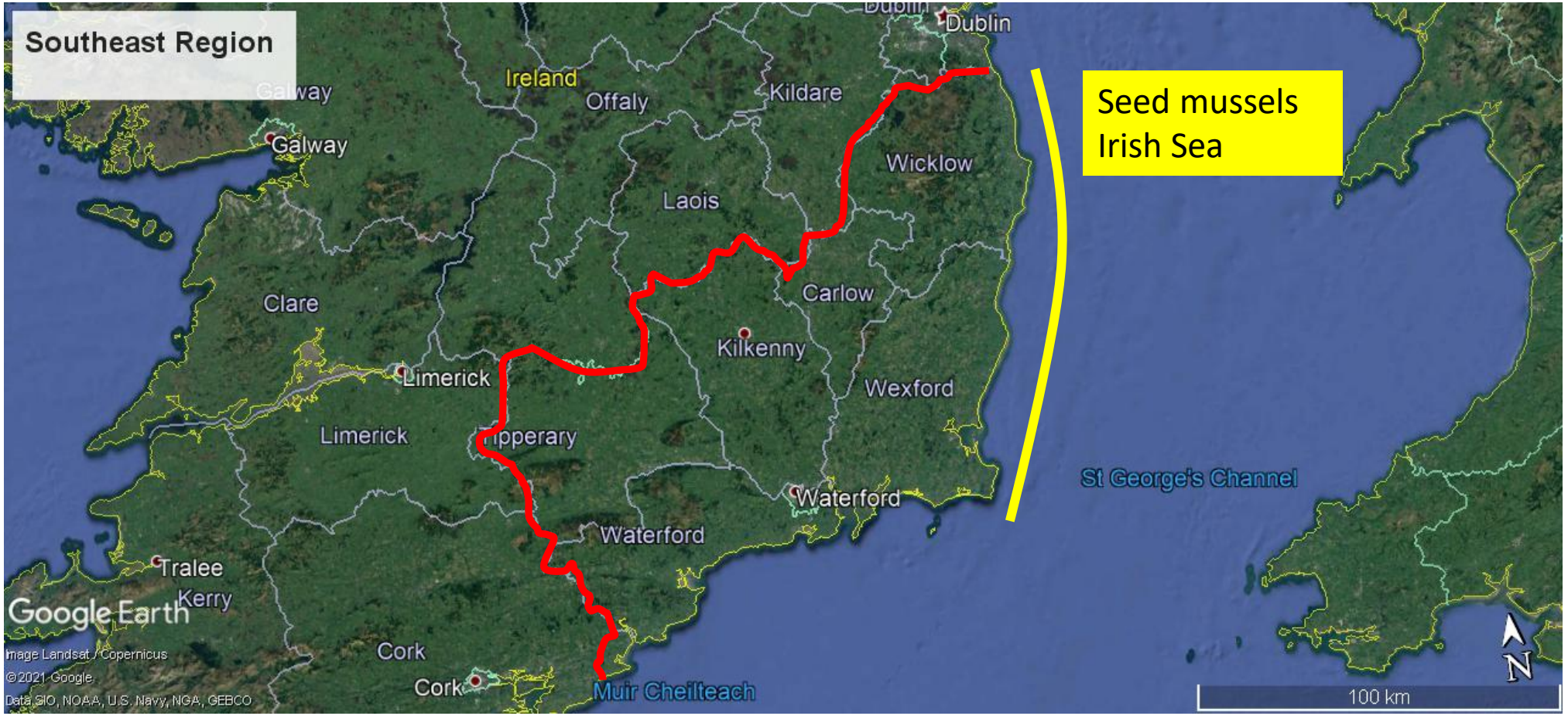
Performance of Monitoring Equipment

SE_Shellfish Industry Pressures and Concerns

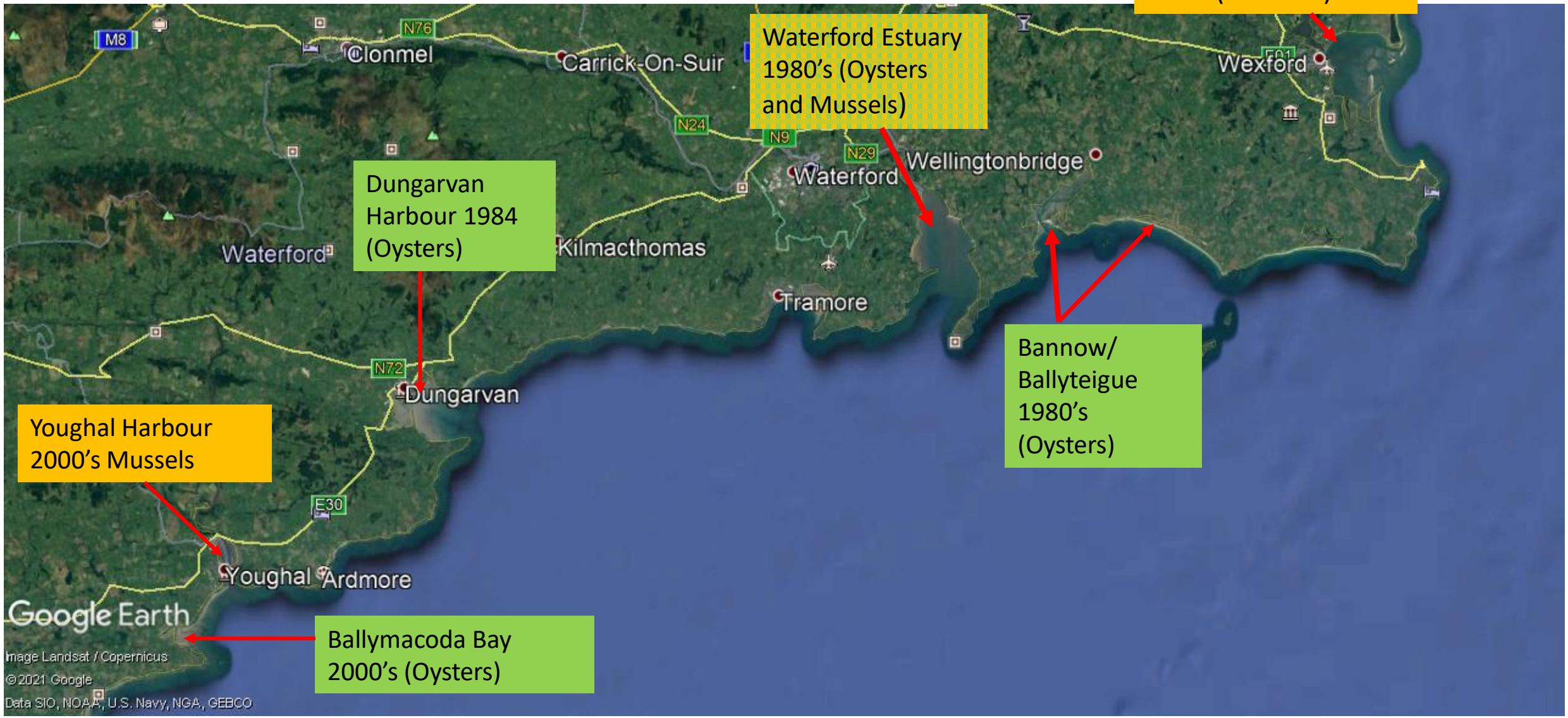
What the Industry (and I) would like in terms of Water Quality Sensors

Take Home Messages

Full Southeast Region



Southeast Shellfish Aquaculture



Wexford Harbour Mussels

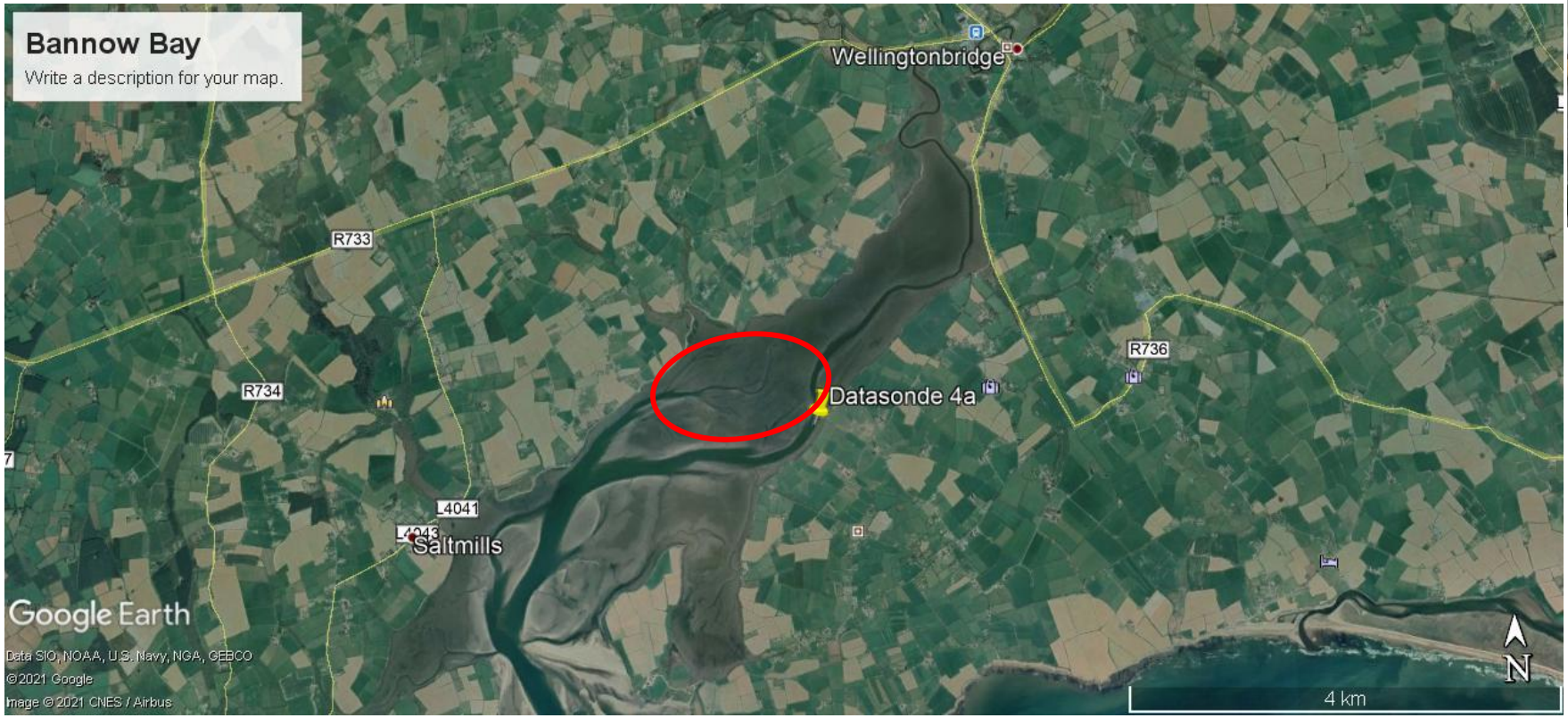
Subtidal Mussel Farming

Shallow/highly dynamic channels and sandbanks

Major town on shore

Major agricultural hinterland around the River Slaney

Bannow Bay (Oysters)



Soft substratum

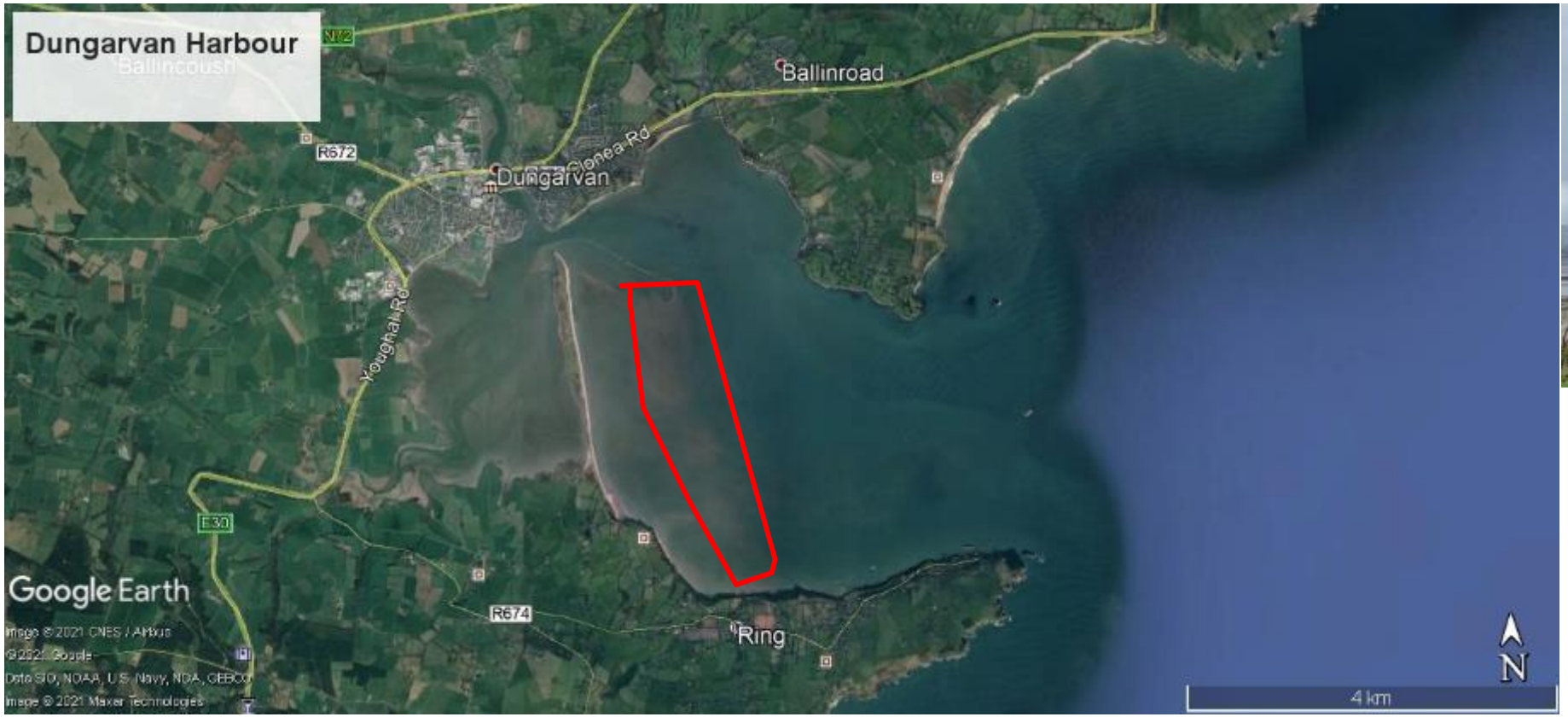
High productivity

Meaty oysters/world class

Flat bottomed Boat and Tractor access

Large agricultural catchment and several rural villages nearshore.

Dungarvan Harbour (Oysters)



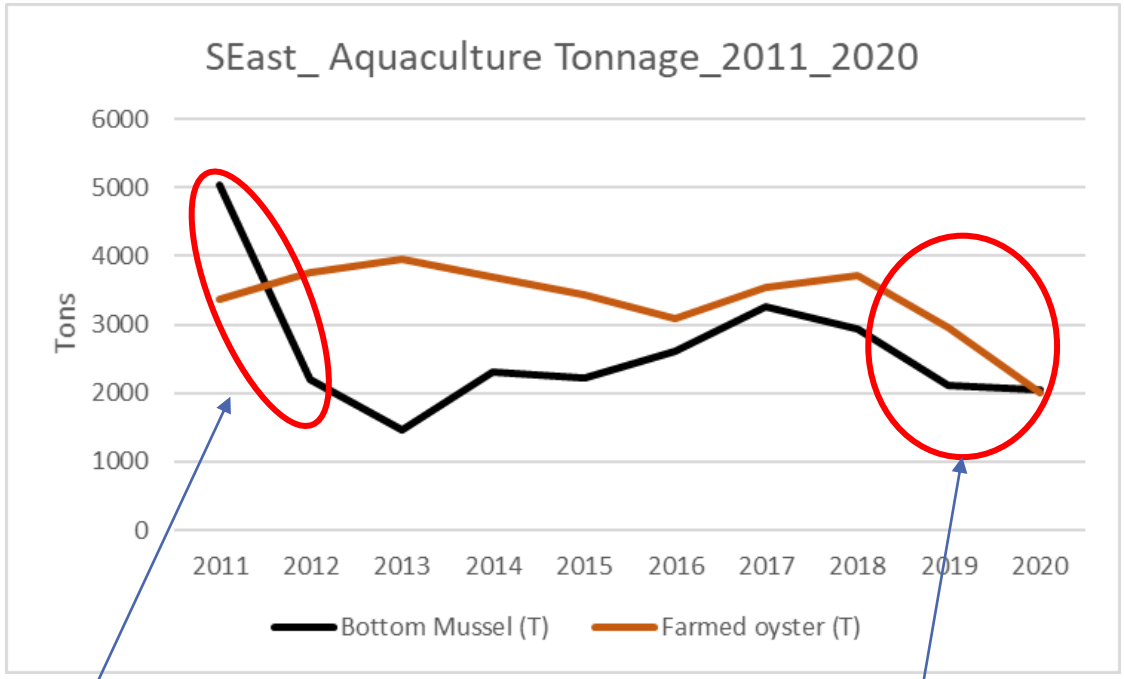
Intertidal Oysters/tractor only

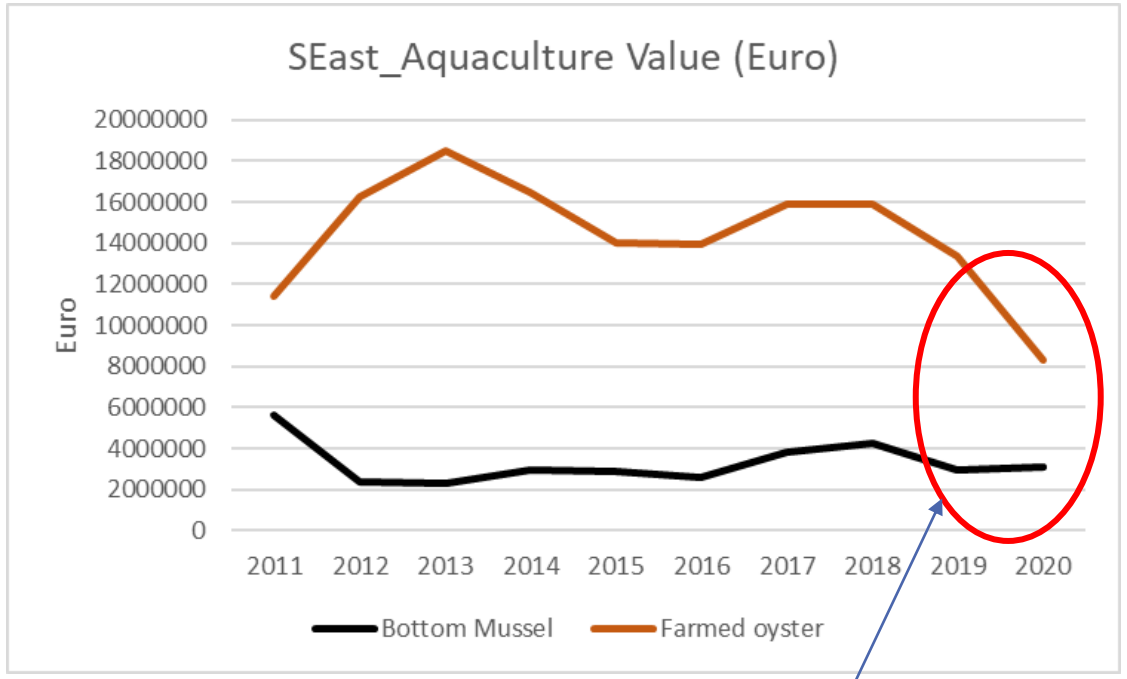
Largest oyster producing bay

Small town

Ideal substratum for oyster farming

Southeast Tonnage and Value (Mussels and Oysters)



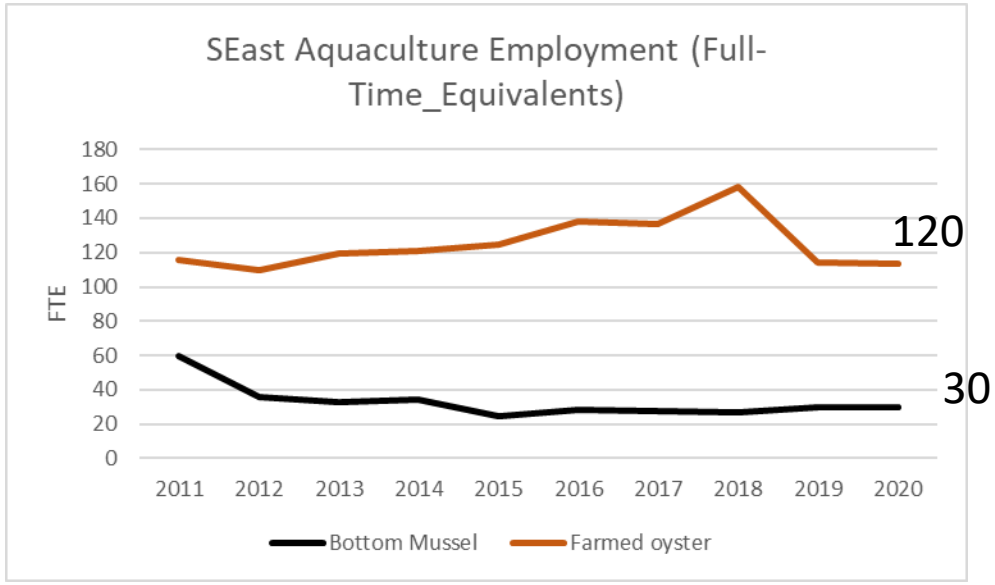


Drop in mussel seed supply from East Coast

Impact of pandemic and also oyster mortalities in some bays

Oysters sales affected more by pandemic than mussels. Also regional drop in oyster output due to mortalities in some bays

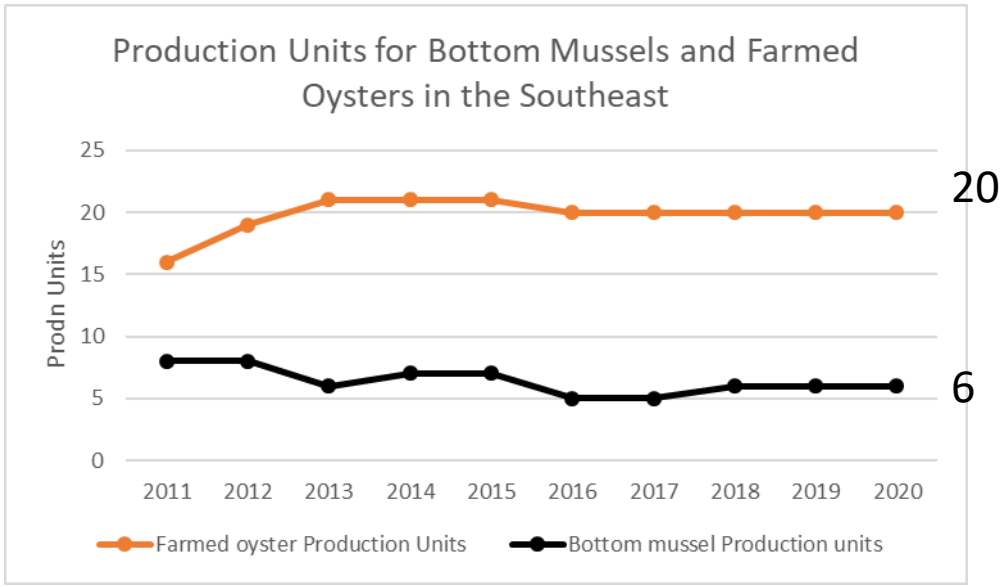
Employment_Full Time Equivalents and Production Units in the Southeast



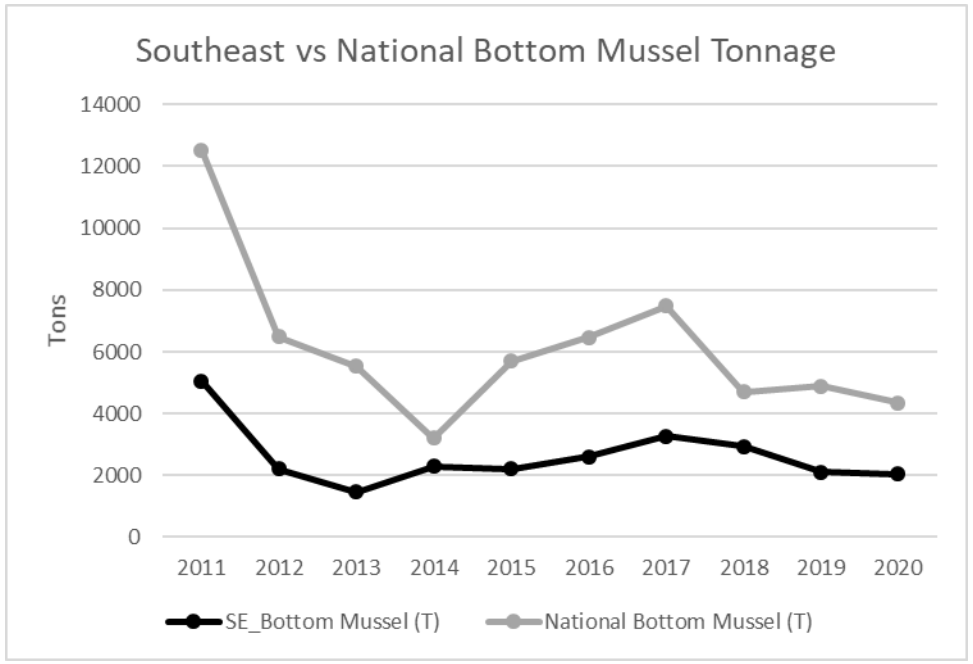
Jobs and production units relatively stable

Currently the bottom mussel job impact is focussed close to Wexford Town.

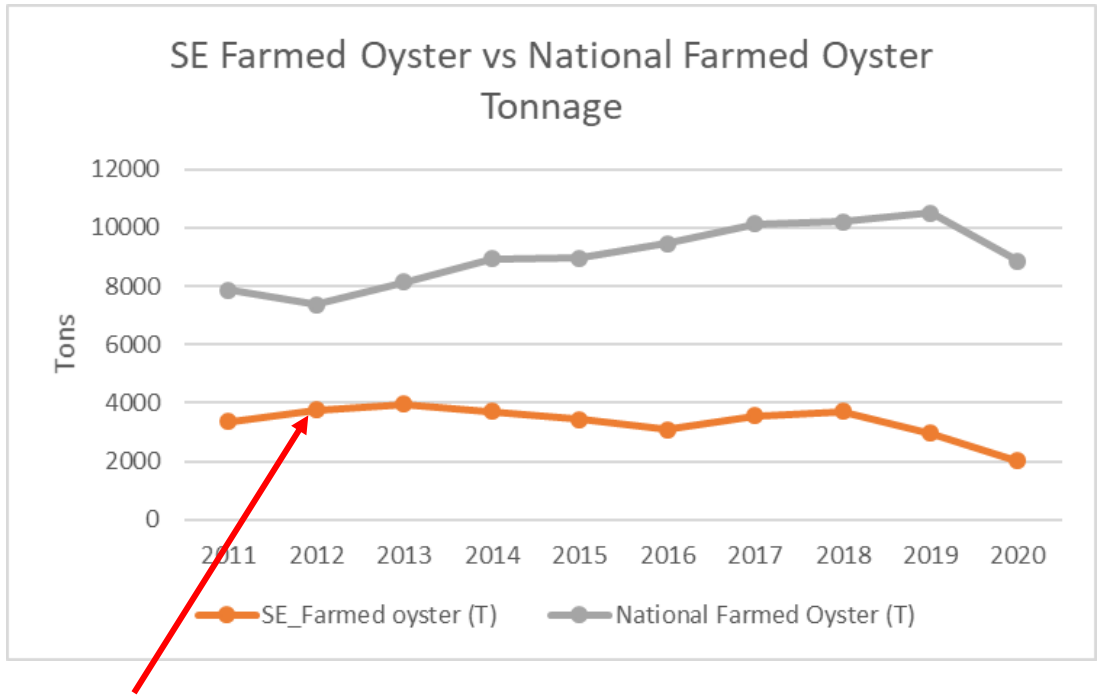
Oyster industry jobs spread across the region.



Southeast Very Important Nationally for Bottom Mussels and Oysters

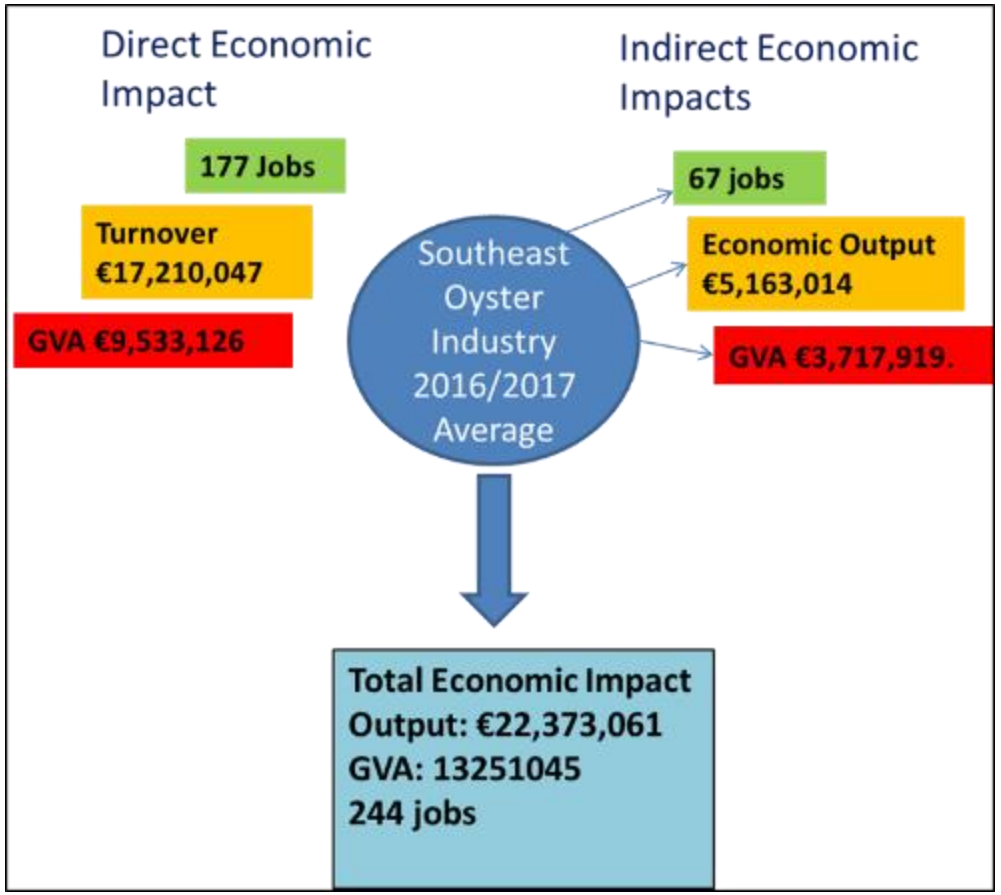


Wexford Harbour is a stalwart in the national bottom mussel industry (40% plus)

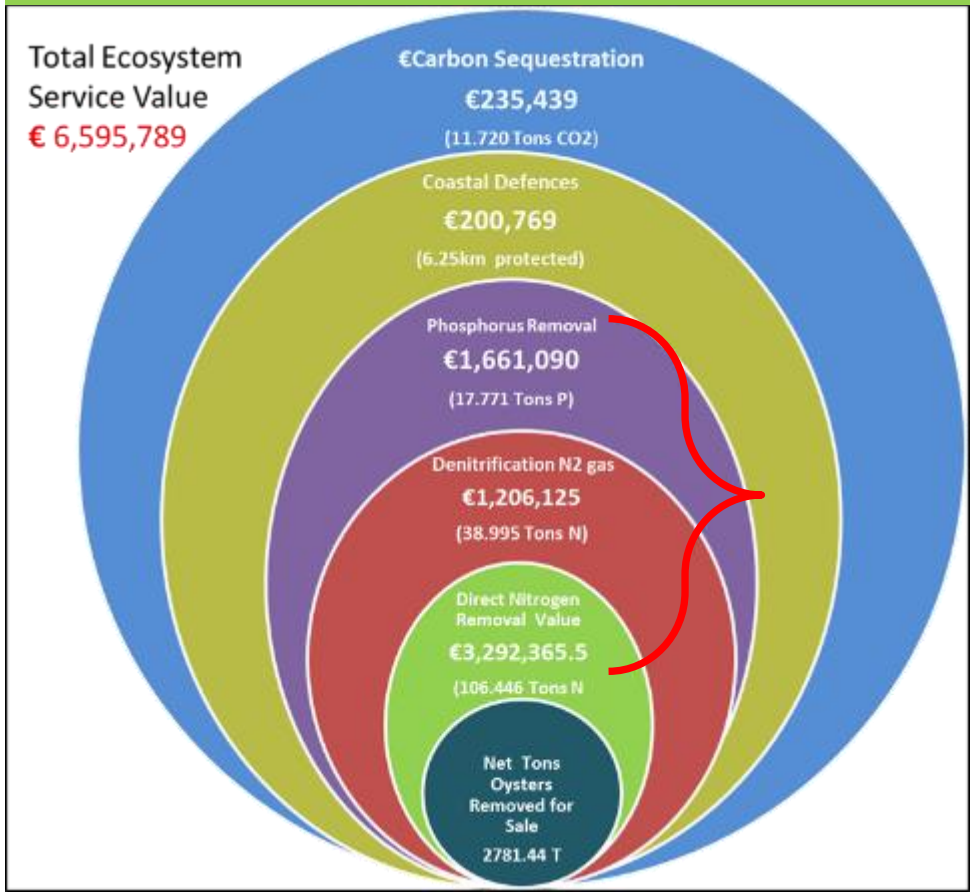


More than 50% at one point. Currently impacted by mortality and pandemic issues. Oyster production growing in other regions.

Additional Economic Value of SE Oyster Industry in 2016/2017
(Thesis for HDip in Aquabusiness)



Ecosystem Service Value



Range of Monitoring work in the region

Small sensor on one producer's farm

Multiple small sensors across oyster farms

Datasonde at one or multiple oyster farms

In farm currents with salinity and temperature.

Spot monitoring from boat (Datasonde or RCM 9 Current meter)

Bay scale hydrographic current meter deployments for hydrographic modelling

2 year full scale sampling and analytical programme with multiple monitoring sensors deployed across three bays and a team of academics! E.g. UISCE Project (Understanding Irish Shellfish Culture Environments)

Mostly summer monitoring at present in oyster areas affected by above average mortalities

UISCE Project Partners

National Oceanic & Atmospheric Administration (USA)
Suzanne Bricker

MarCon Computations International (IRL)
Alan Berry

AquaFact International Services (IRL)
Brendan O'Connor

Plymouth Marine Laboratory (UK)
Anthony Hawkins

Longline Environmental (UK)
Joao Ferreira

Great Eastern Mussels (USA)
Carter Newell

Blue Hill Hydraulics (USA)
John Richardson

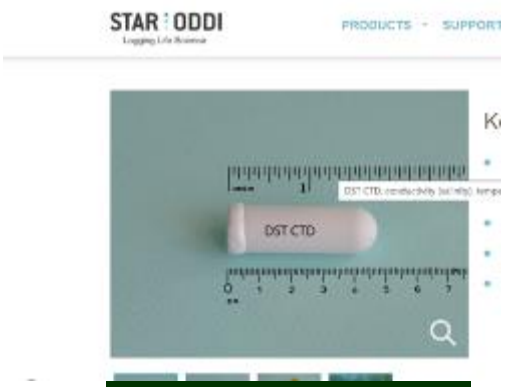
Martin Ryan Institute (IRL)
Michael Hartnett & Declan Clarke

Compass Informatics (IRL)
Gearoid O'Riain

Plus three staff monitoring and sampling in the southeast and three BIM divers when needed.

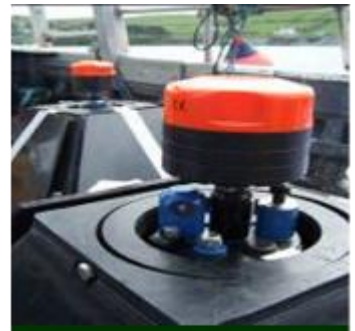
Range of Monitoring Equipment Used

Hobo Water Level & Temp Loggers



Star Oddi CT and CTD's

Hydrolab Datasonde 5X's



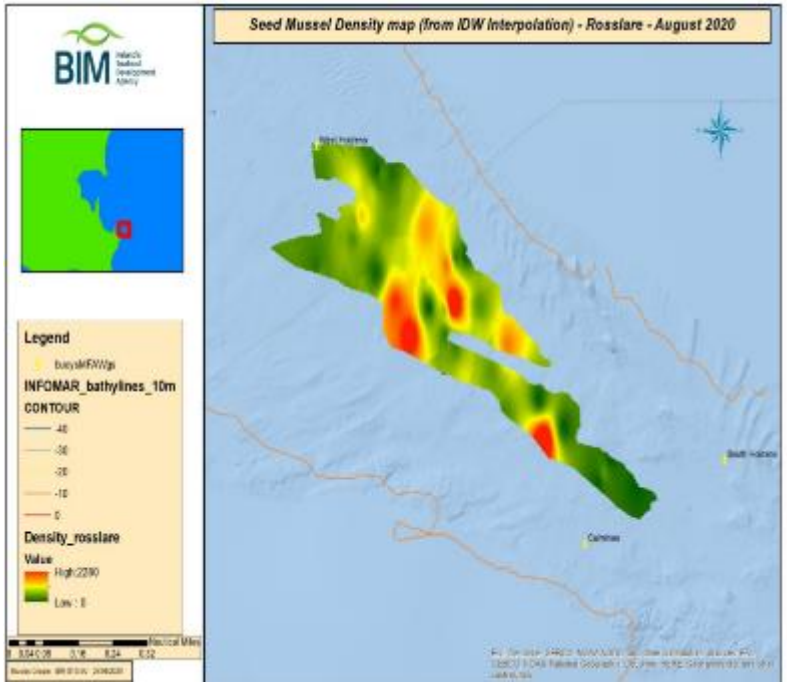
Aanderra RCM9's & Mooring Bases/Frames

Quad and trailer

Custom built filtration systems

GPS

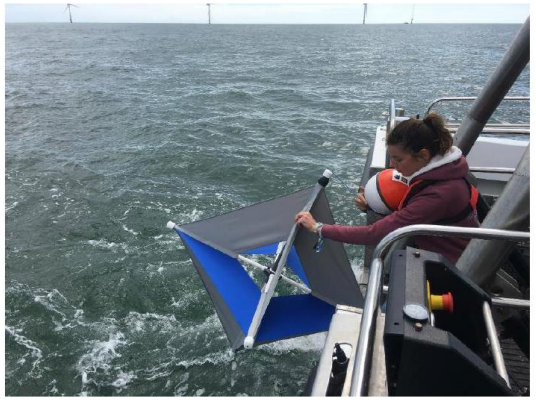
Additional Work in Region:
BIM Mussel Seed Survey/Bluefish Project



Side scan sonar seed mussel bed mapping Irish sea off Wicklow and Wexford Coasts

BIM survey vessel

Figure 29: MS 0007 deployment



Drogue mussel larval tracking

Exosonde and water sampling combined Bannow, Waterford Dungarvan

Monitoring constraints

Subtidal access to subtidal monitoring location. Divers. Health and Safety Red Tape

Anchorage

Exposure to air (pH)

Fouling (Algae, barnacles etc)

Foreshore licence/ Navigational issues

Boats (cost)/ access to shallow subtidal areas

Weather (Rough seas displacing instruments)

Budget

Length of deployment period/power

Limited telemetry options

Exposure of instruments and to accidental or deliberate damage

Size of production areas and widespread location of pressures.

Monitoring constraints







Interesting findings…..

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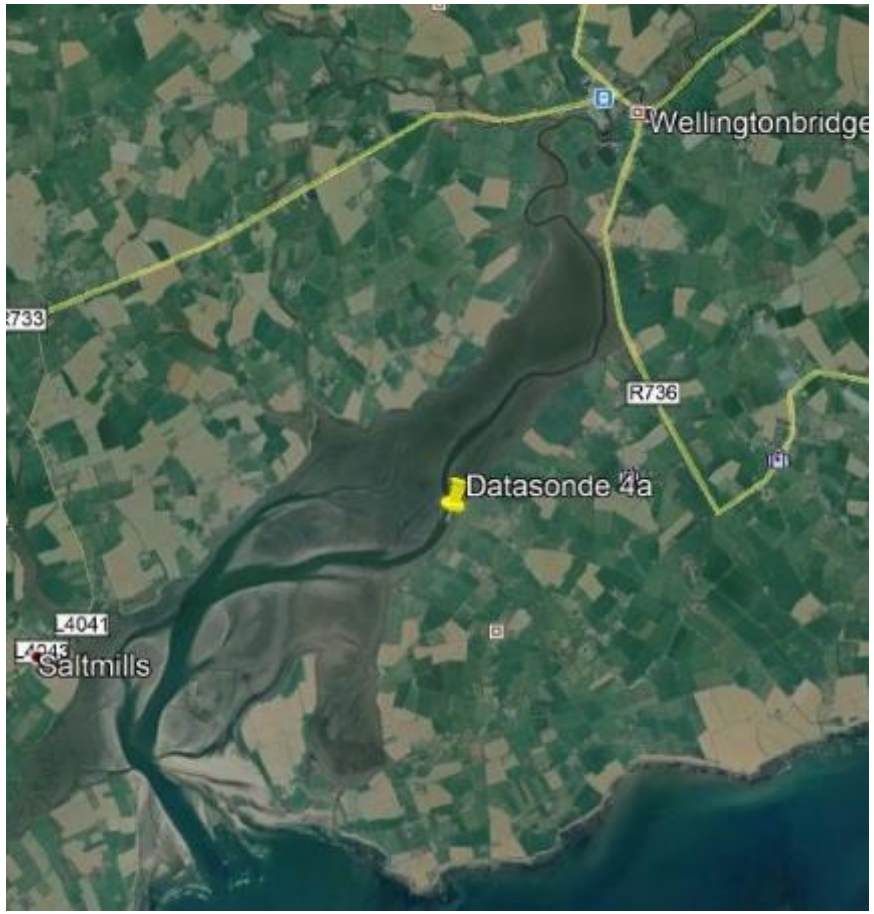
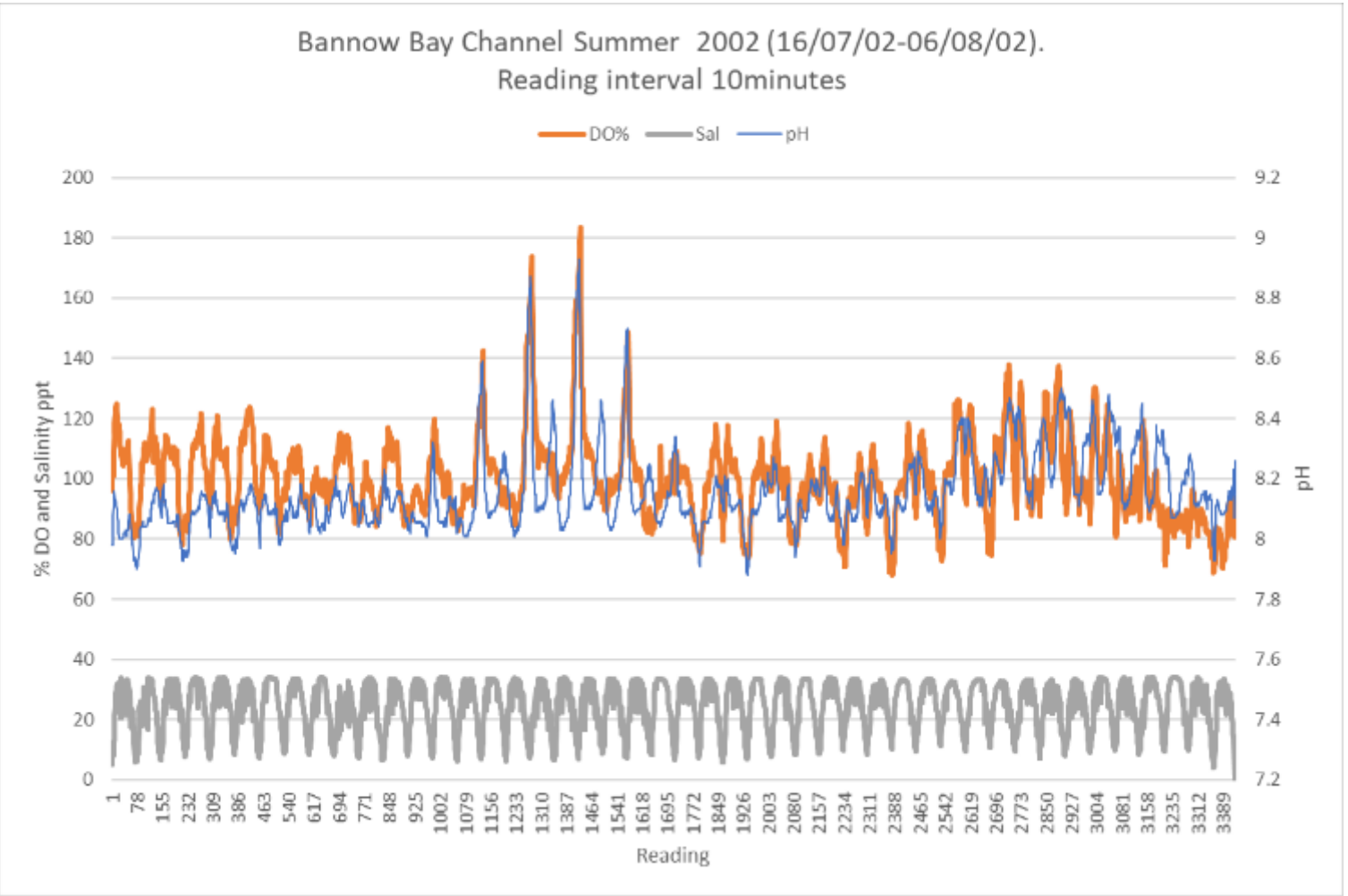
First Sensor Deployment Bannow Bay 2002



Main Findings in Bannow Bay Summer 2002



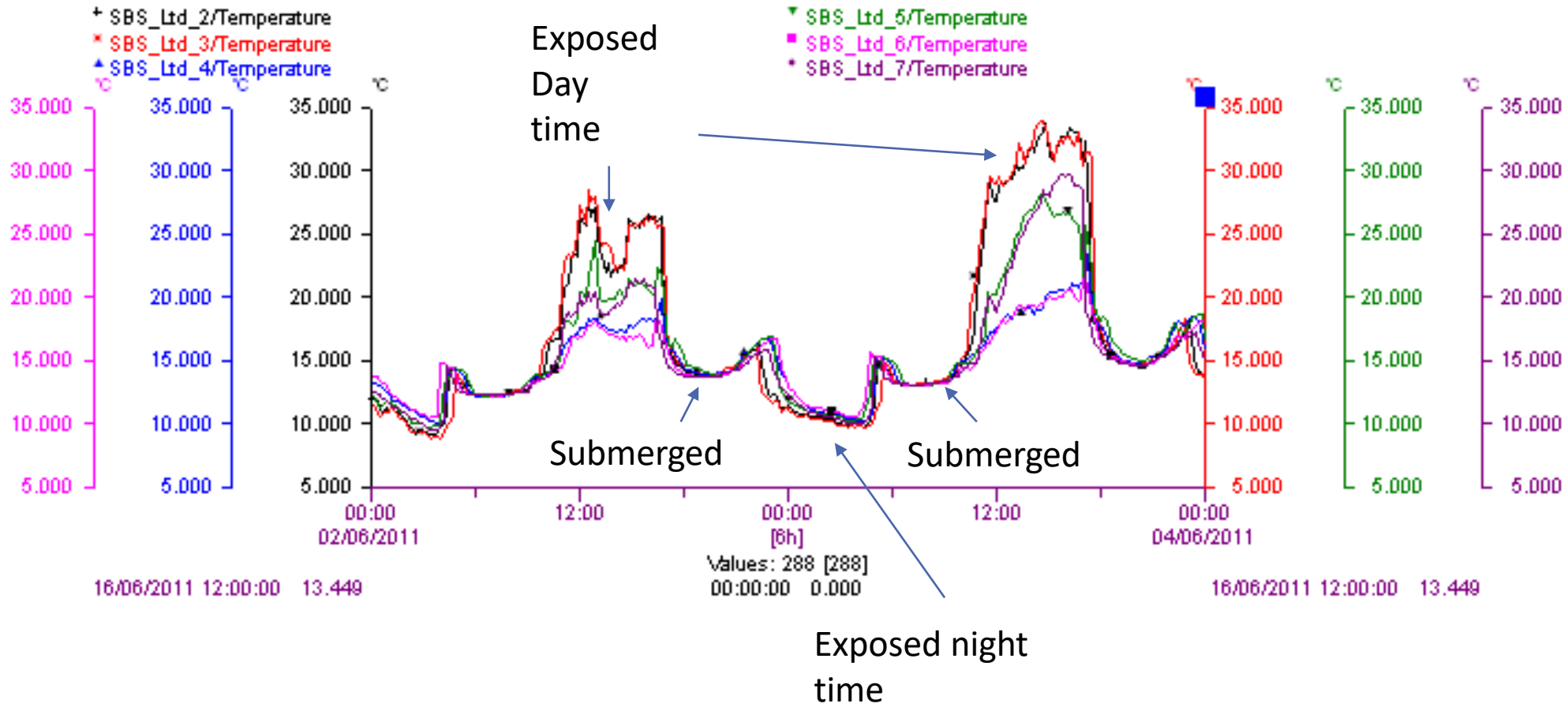
O2 and pH swings

Freshwater influence particularly on neaps

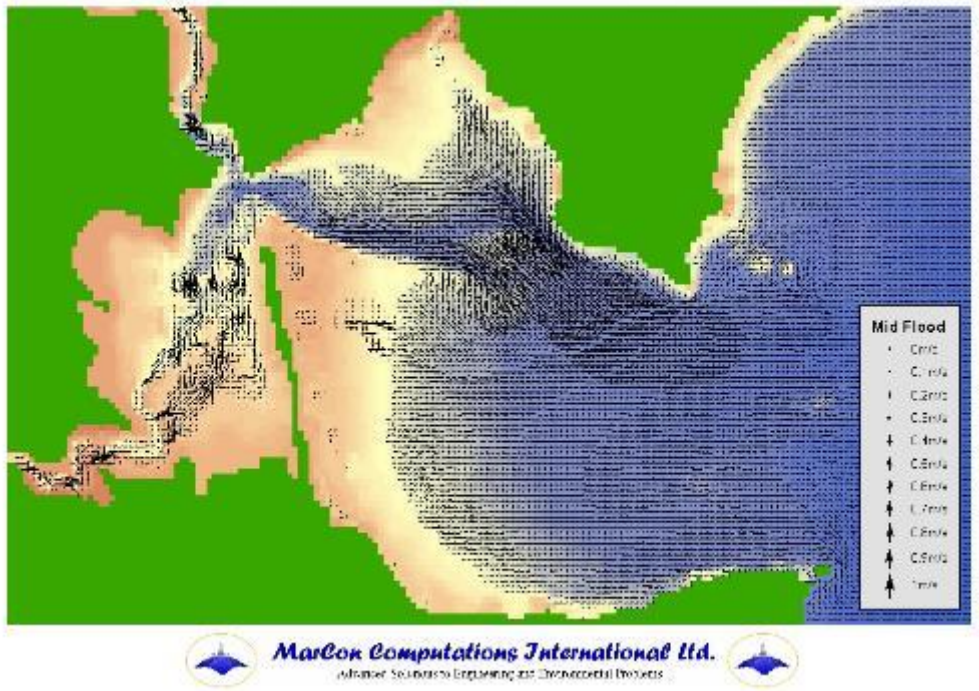
Applied for trial sites away from channel

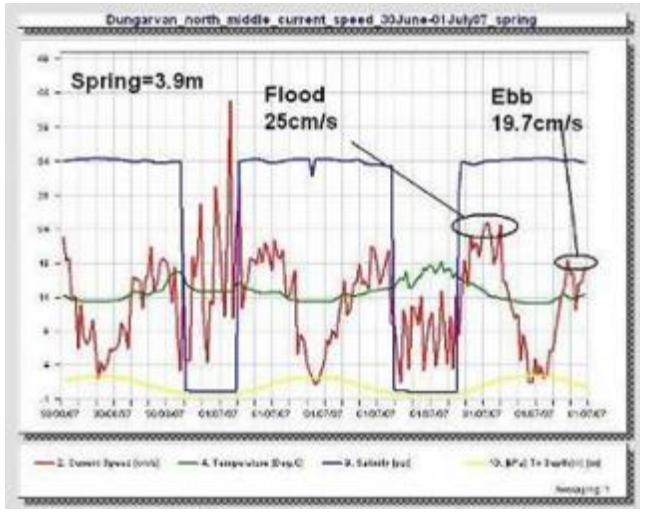
Trial sites successful and move oysters away from channel in summer-less mortality

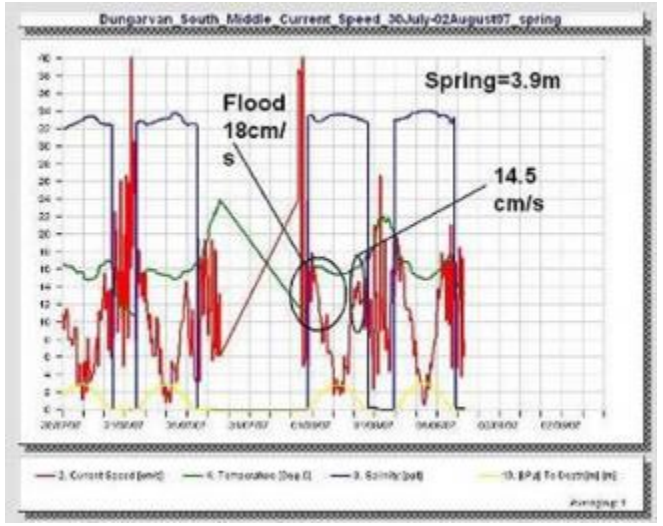
Temperature Data inside Oyster Bags Bannow Oyster Farm (2011)



Some Interesting Findings from UISCE project in Dungarvan Harbour (2008)





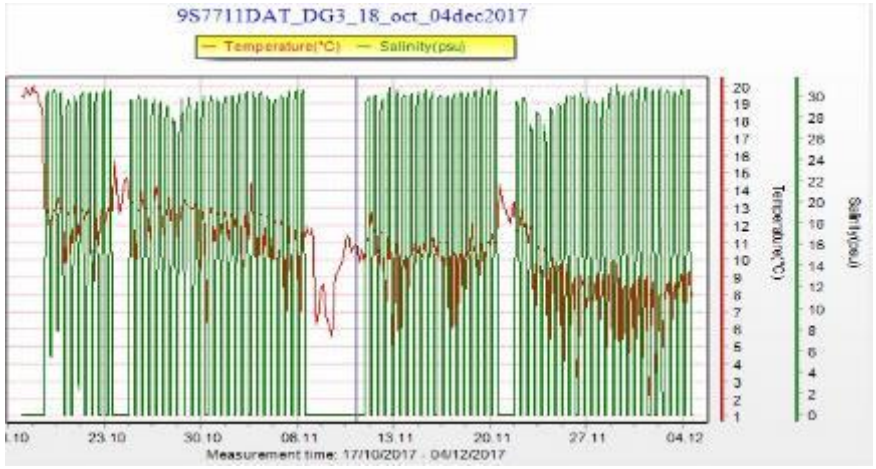


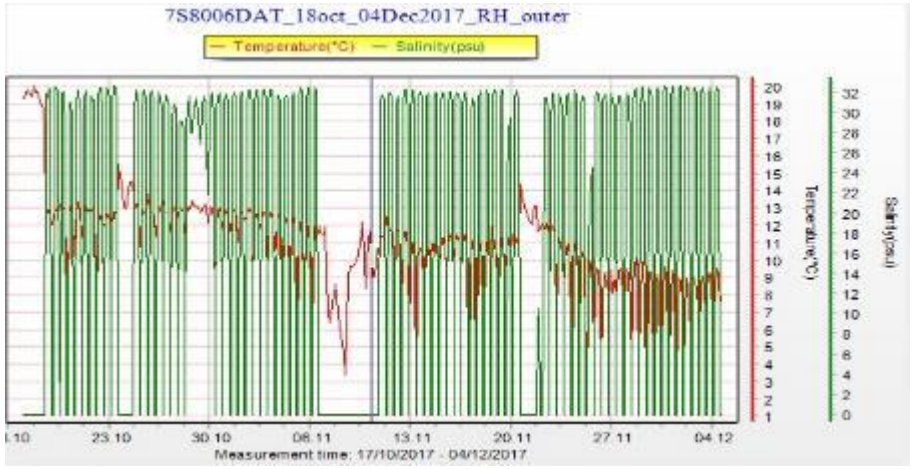
Pulse of chlor a incoming tide- benthic diatoms from sandflats

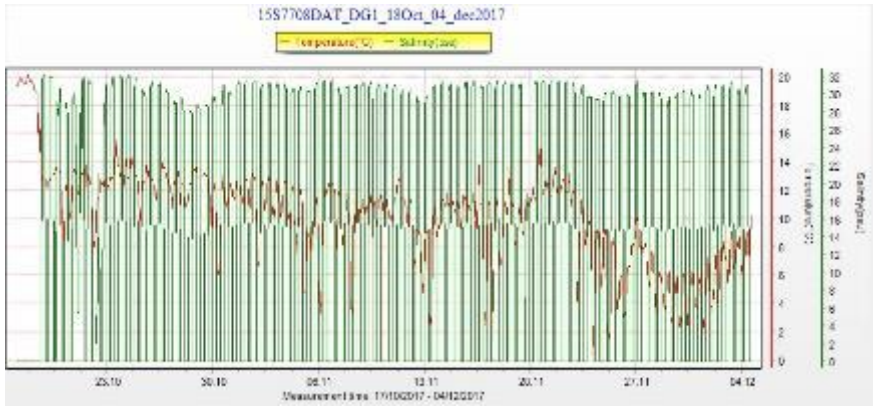
Seed oysters did better in the slower currents in southern sector

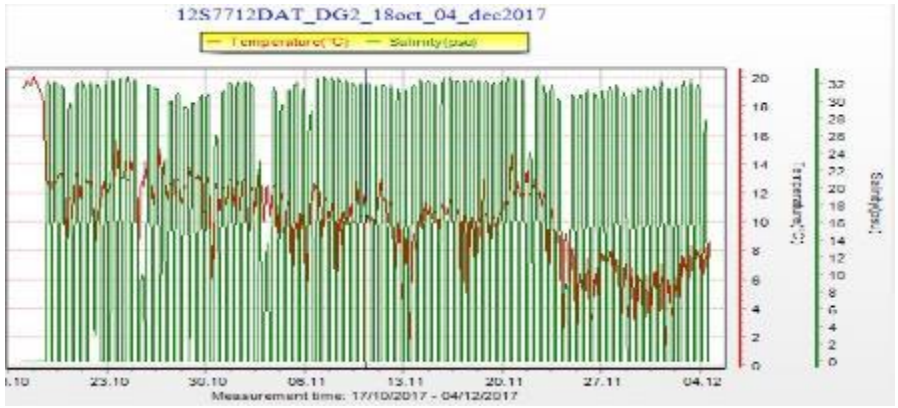
Northern sector better for growout to market size

Zero Salinity Events Northern Edge of Dungarvan Production (Norovirus study 2017)



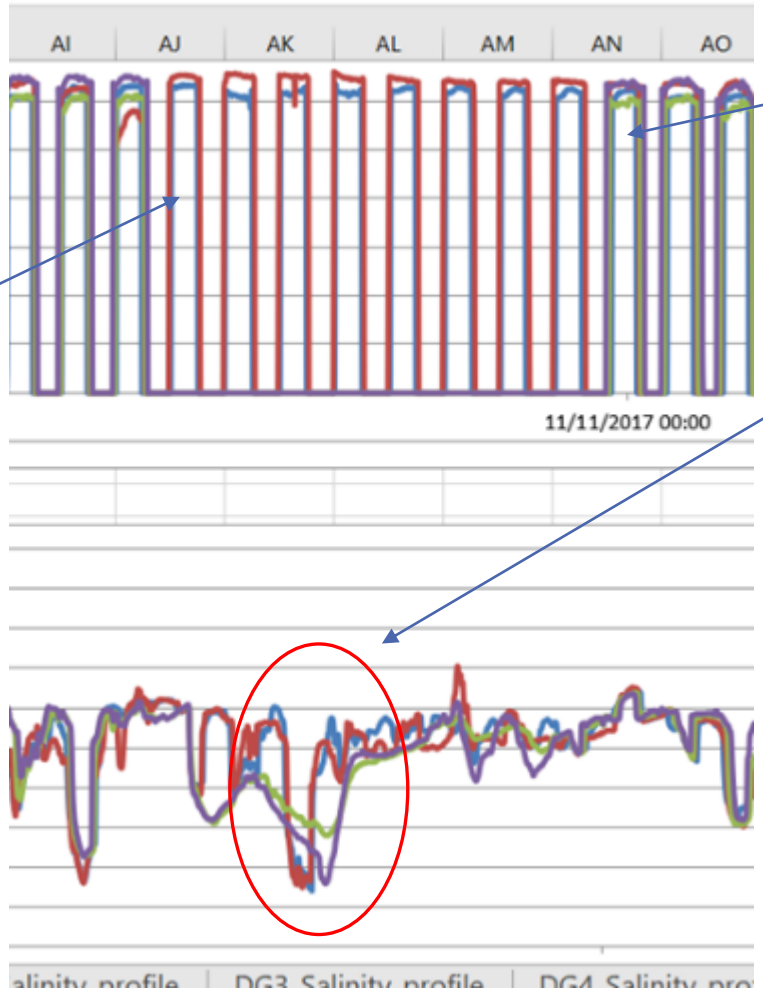






Comparison of Temperature during Zero Salinity event in Dungarvan North vs South

Northern sensors independently (400m apart) both commence recording zero salinity for several days and for similar periods.



Return to normal environmental conditions in northern flank

Both CT loggers in the north (green and purple lines) record temperatures sloping off and no clear exposed/submerged temp profile. Possibility they were covered in cool freshwater from the main channel coming from Dungarvan. Rainfall wasn't particularly heavy.

Performance of monitoring equipment

Tidbits, tide gauges- no issues, long life reliable, low cost- can be lost. Good value for money.

CT/CTD's- give more information, fairly reliable, can suffer from fouling/clogging and can get lost. Good value for money.

Datasondes (4a/5X's). Spikey chlorophyll data/error readings. DO fluorescence excellent. Fouling, critters living in the housing near sensors. Cost of units and calibration is high. Spot reading hand held unit very good. Power drain when sensor fails.

Current meters (Aandera). Extremely reliable data and robust (If only everything in life was as reliable!). Costly. Have had a tractor drive over one and a dredger drag one off its location. Can do spot readings from boat too with inline frame (not live readings).

Not Real Time
Data No alarms!

Pressures/Concerns

E. coli shellfish classification (B classification or better essential for industry) (Mussels and Oysters)

- WWTP's
- Stormwater Overflows
- Pumping Station failures
- Agriculture
- Septic tanks
- The combination of pressures will vary from bay to bay.

Norovirus levels more of a concern for oyster industry

- Human sources (WWTP'S, Stormwater Overflows, Pumping Station Failures), Septic tanks
- Sales to Asian lucrative markets depends on very stringent levels for Norovirus.
- Depuration required but sometimes Norovirus can be too high for depuration to work fully.

Excessive Mortalities

- Microbial Causes (Herpes, Vibrio)
- Algal blooms (Oxygen/Toxins)
- Unknown causes?

What the Shellfish Industry wants

Real Time Monitoring with alarms/notifications.

Year round monitoring but late spring to early autumn essential (I focus on June-September)

Better spread of monitoring locations (production areas are big)

More monitoring close to point pressures eg WWTP/Stormwater Overflows/Industrial Discharges

Different priorities for each bay e.g. Impact of Chlorine Produced Oxidants on ecosystem and turbidity monitoring.

Dissolved Oxygen crucial.

E. coli/Norovirus. Can sensors be developed to detect in the field?

Cheaper sensors.

3 Take home messages:

Requirement for monitoring shifting more towards **protection of shellfish**

Realtime data(preferably with notifications) is strongly desired by industry

Requirement for cheaper sensors and monitoring of new parameters over greater area

Thank you for your attention.

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https://bim.ie

Its time for the next generation of sensors

2002 Bannow

2021 Dungarvan