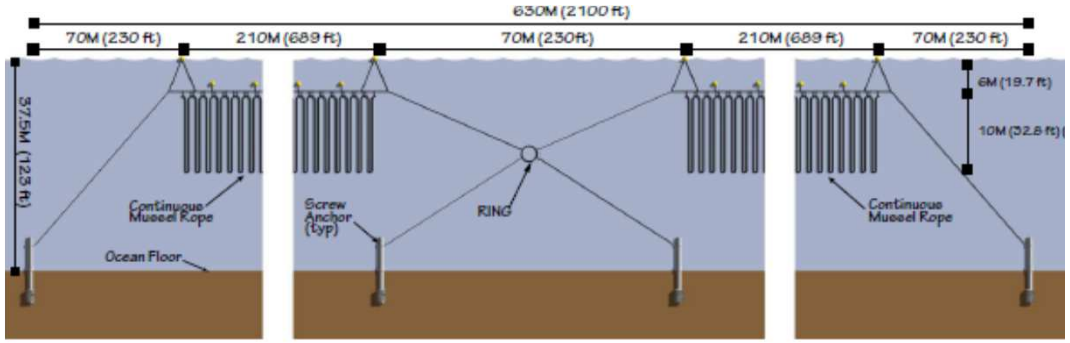
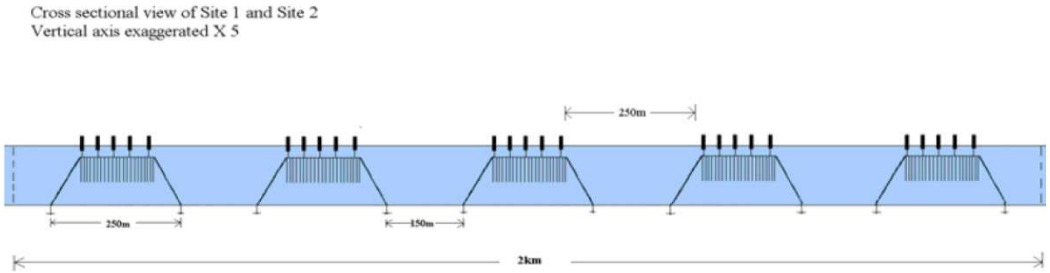
Systems & Kit – Longline Design

KZO 100 Acre Farm – US

(Source: KZO website)

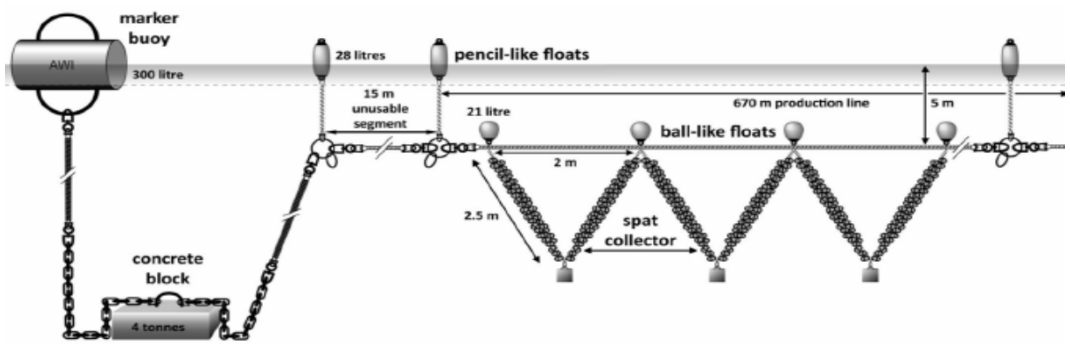


Offshore Shellfish Ltd. - UK



Nordergründe OWF - Germany

(Source: Buck et al. Ref: 2010)



Summary of offshore longline configuration dimensions

Site / Reference	Headline Intervals (Note 1)	Headline Separation (Note 2)	Dropper Length (Note 3)
Offshore Shellfish (Note 4)	250m	50m	10m
KZO (Note 5)	70m	50m	10m
Nordergründe (Note 6)	670m continuous	10m	2m

Scenarios – North Hoyle Trial

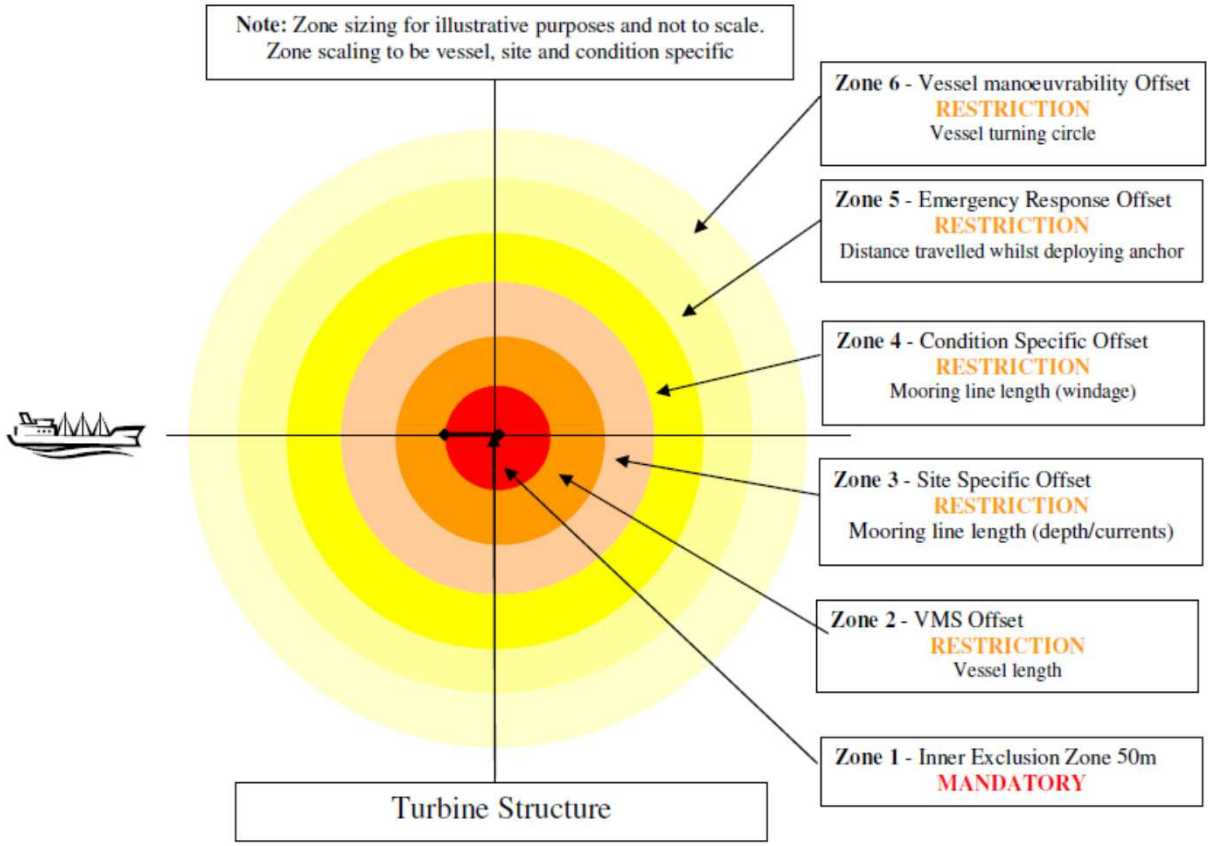
Review of Trial Documentation

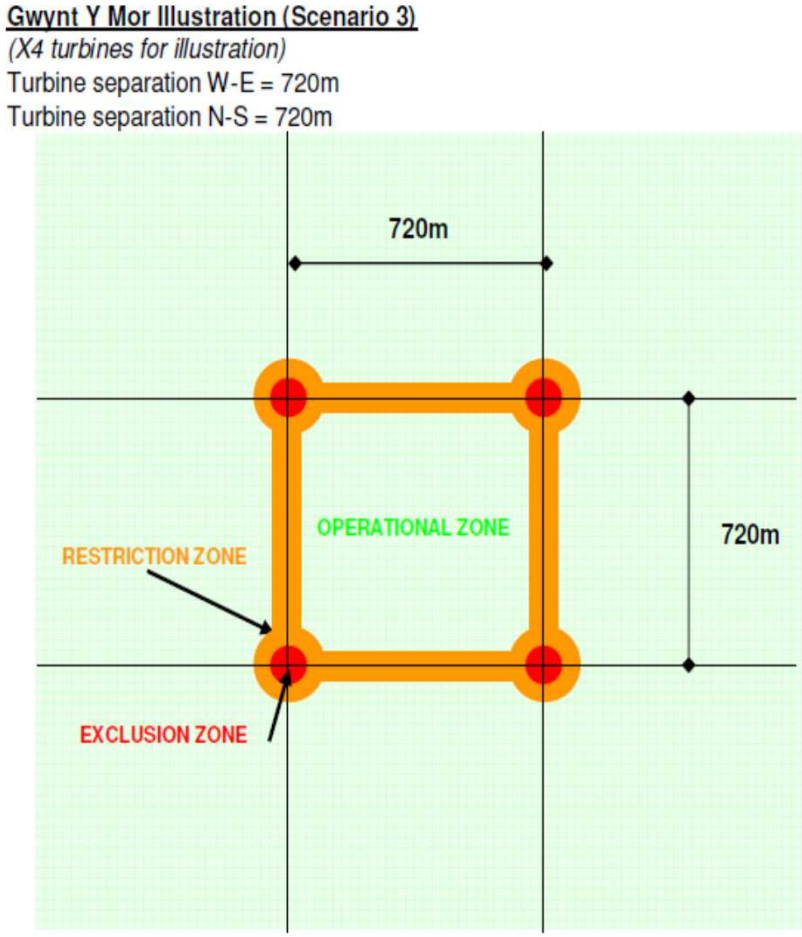
- Project Planning
- *Trial Proposal*
- *Method Statement*
- Communication and Management Protocol
- *Code of Practice*
- *Operational Plan*
- H&S
- *Risk Assessment*
- *Emergency Response Plan*

Mare Gratia - Bow thrusters & dual engines

Scenarios – Proximity Zoning

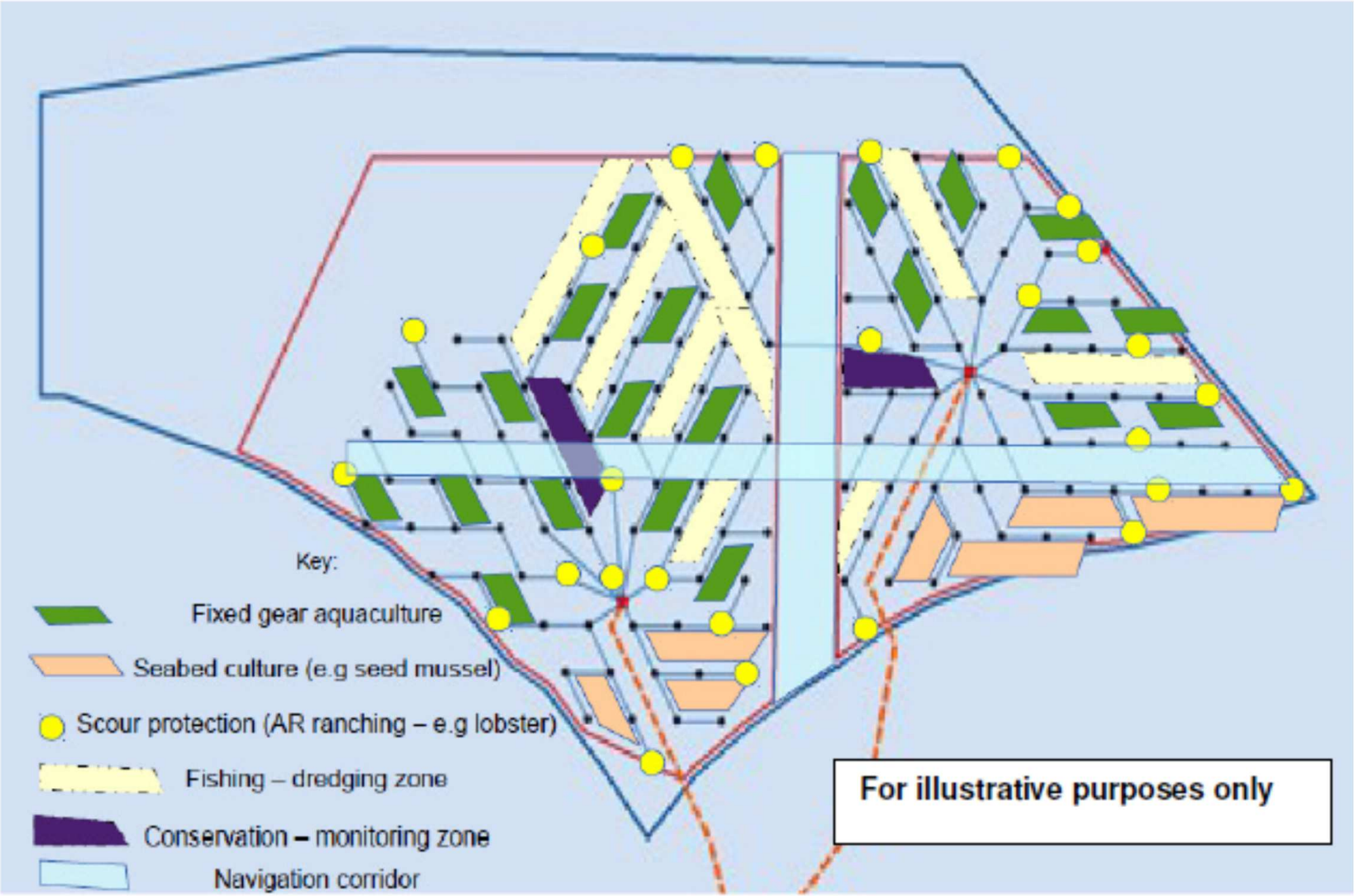
- Generic proximity protocol OK as a broad risk based approach but too vague





- Meeting agreed to use 'real life' scenarios to establish working criteria (e.g. Gwynt-Y-Mor)
- Purpose to develop template NOT an agreed colocation commitment

Scenarios – Illustration of Potential Multi-Zoning



Scenarios – Activity Zoning Risk Profiles

Seabed 'Ranching' (e.g. Lobster seabed culture)
-'INSTALLATION': Deployment of hatchery reared juveniles (by diver or 'tube')

-'OPERATION': Fishing (by standard fixed gear potting)

LOW RISK – EQUIVALENT TO POTTING FISHING

(low frequency periodic cable snag+turbine collision?)

Seabed Dredging (e.g. Mussel seed seabed culture)

-'INSTALLATION': Deployment of mussel seed (obtained from ephemeral beds)

-'OPERATION': Harvesting of part grown mussels (by dredge)
MEDIUM RISK – DREDGING

(low frequency visits targeted to optimal 'low risk' conditions)

Fixed Aquaculture (e.g. Mussel longlines culture)
-'INSTALLATION': Deployment of longlines (insertion of screw anchors)

-'OPERATION': Servicing and harvesting of mussels (by support vessel)
HIGH RISK – GEAR FOULING, DRAGGING ANCHORS, OBSTRUCTION

(Installation of screw anchors 'one off' under optimal conditions

Operational service visits with multiple returns to mend storm damage, grade stock etc.)

Scenarios - Criteria for Fixed Aquaculture Location:

-Not crossing cable routes & cable boundaries to aquaculture cells
-270 degree access to turbines (i.e. alternate 'rows' and 'columns' fallow)
-Avoid export cable route, sub-station & central corridor (as navigation corridor)
-Within bounds of the OWF & cell margins in line-of-sight of turbines
-Strive for regular cell shapes in regular clusters

Based broadly on:

(Source: Buck, B. H. , Ebeling, M. and Michler-Cieluch, T. (2010). Mussel Cultivation as a Co-Use in Offshore Wind Farms: Potentials and Economic Feasibility, Aquaculture Economics and Management 14(4):, pp. 1365-7305)

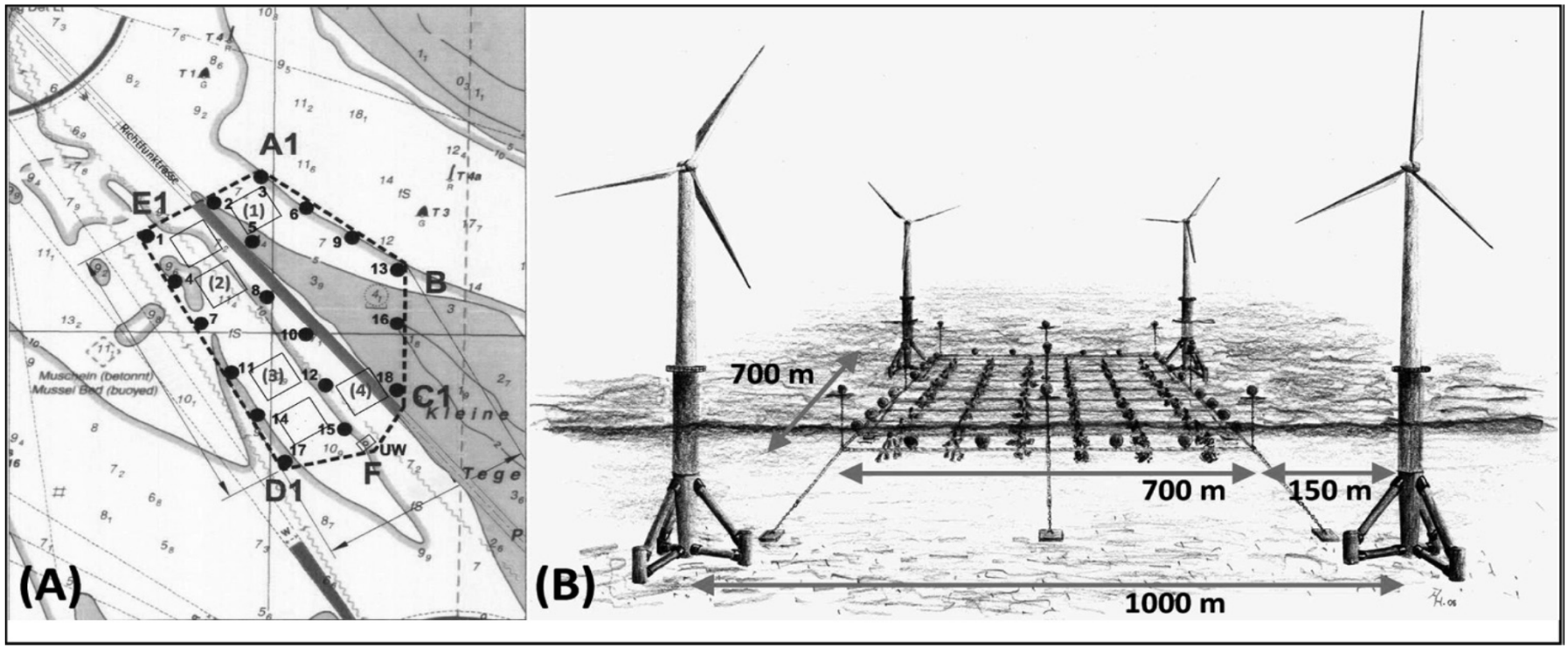


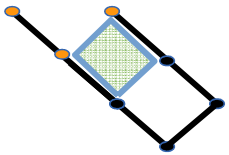
Figure (A) shows map of the area displaying18 offshore wind turbines & 6 single mussel plots designated by wind farm company
Figure (B) presents a design of a single mussel plot within a group of four wind turbines (not to scale)

Scenarios – Cable Sensitivity

Impact of Distal and Terminal Aquaculture Location ***The 'Christmas Tree Lights' Effect***

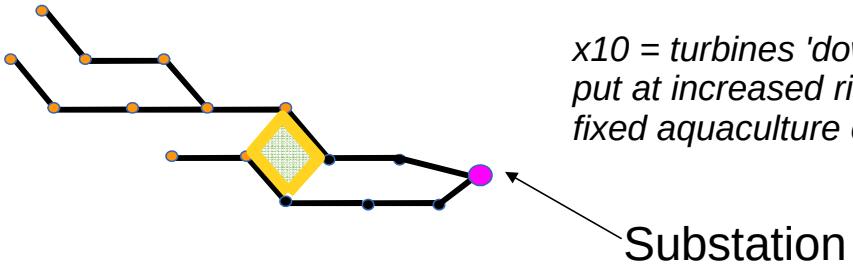
Cell 1 (Near Distal End)

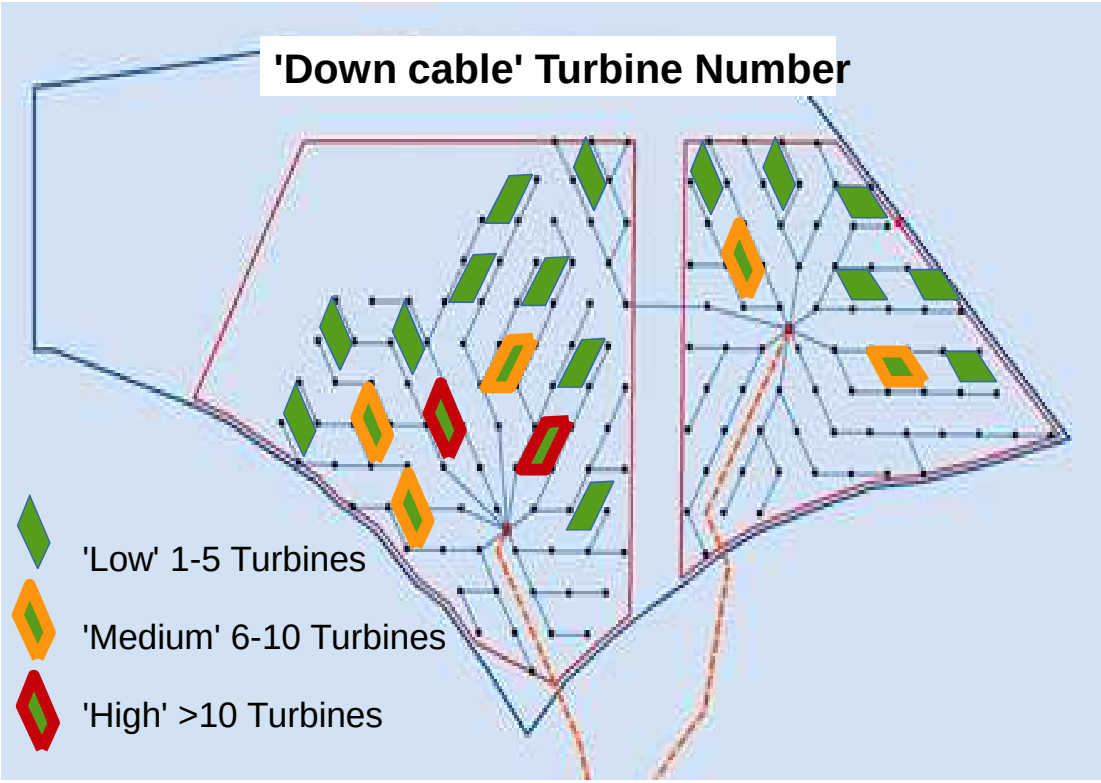
x3 = turbines 'down cable' put at increased risk by fixed aquaculture cell



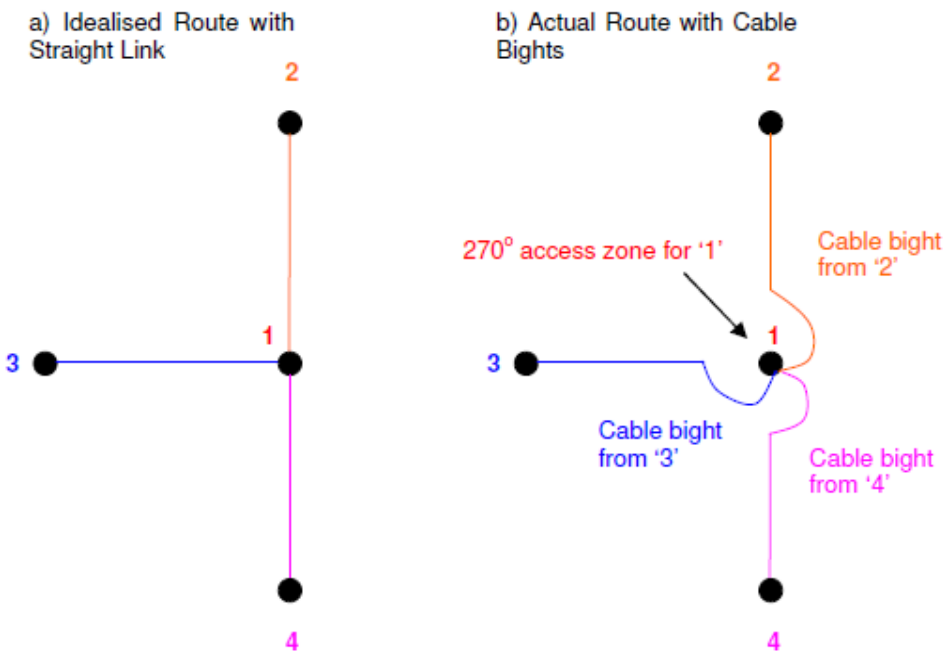
Cell 22 (Near Terminal Substation)

x10 = turbines 'down cable' put at increased risk by fixed aquaculture cell





OWF cable bights and turbine connections



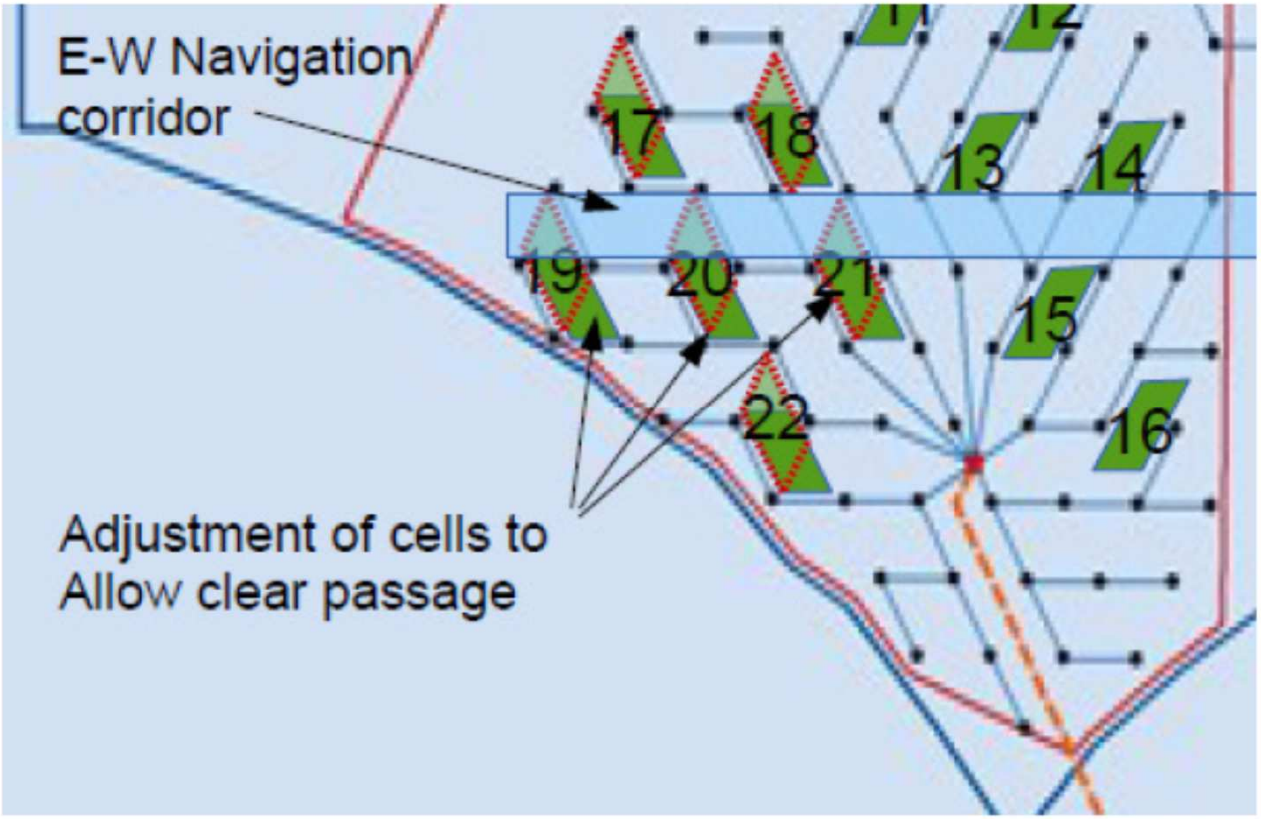
Scenarios – Navigation Corridors and Access Protocol

Potential navigation corridors:

N-S
(along gas pipeline route)

E-W
(along principal AtoNs)

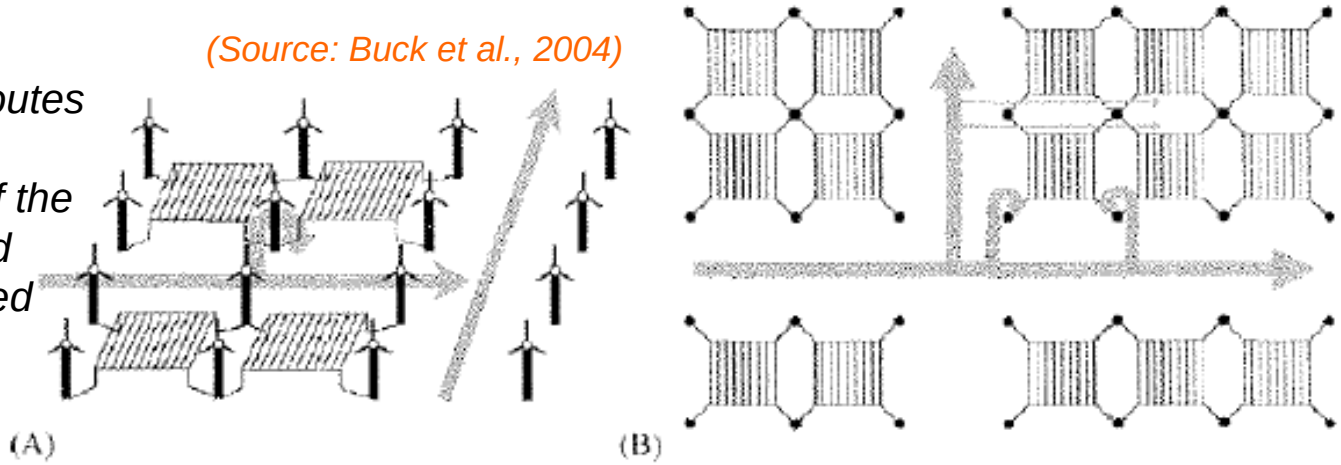
Broadly based upon:



Potential multifunctional maritime traffic zones in offshore wind farms

(Source: Buck et al., 2004)

Arrows mark access and servicing routes to each wind turbine.
Gridded boxes in the inner section of the wind farm represent parallel attached longline systems, which are separated from the major waterways.
(A) shows a side view and
(B) a bird's eye view.



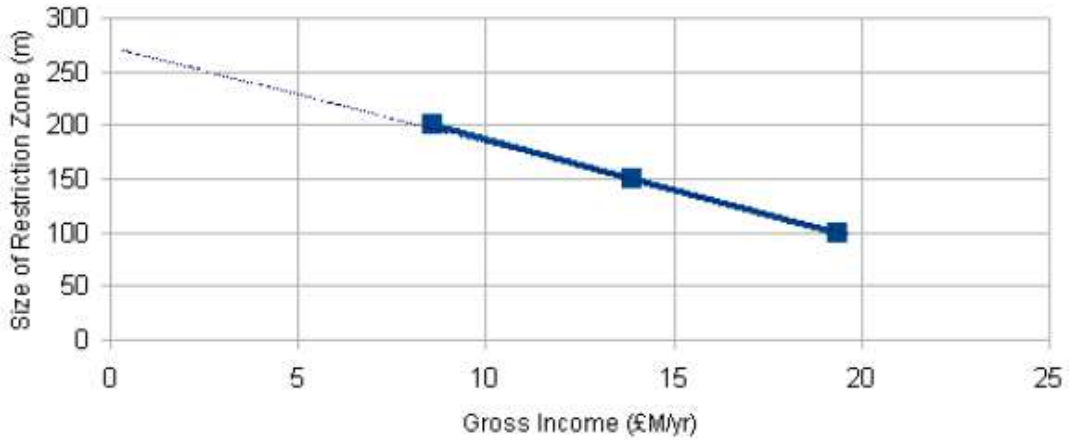
Scenarios – Production Tool Illustration

Aquaculture Production

Exclusion Zone	Seabed Culture		Fixed Culture		Total	
m	T/yr.	£M/yr.	T/yr.	£M/yr.	T/yr.	£M/yr.
200	9438	4.7	4558	3.9	13996	8.6
150	13968	7.0	8149	6.9	22117	13.9
100	18648	9.3	11812	10.0	30460	19.4

NB based on following cells production (see accompanying map)

No Cells =	Seabed Culture	Fixed gear culture
No 'end' limits	13	19
x1 'end' limit	4	3



Production Area (ha)

Exclusion Zone	Seabed Culture	Fixed Culture	Total
m			
200	252	188	439
150	372	335	708
100	497	486	983

Proportion of OWF

Exclusion Zone	Seabed Culture		Fixed Culture		Total	
m	% Intra-array	% Whole OWF	% Intra-array	% Whole OWF	% Intra-array	% Whole OWF
200	4.2%	3.1%	3.1%	2.3%	7.3%	5.5%
150	6.2%	4.7%	5.6%	4.2%	11.8%	8.8%
100	8.3%	6.2%	8.1%	6.1%	16.4%	12.3%

In particular, does what you have heard convince you that the potential described merits further effort?
Why / why not?

Session 2 – Articulating & exploring options for follow-on work

Identifying risk factors for commercial co-location projects, & options for minimisation / management

Follow-on Work

Seabed Cultivation Trials:

- Current Project grew from original trials in North Hoyle
- Further North Wales trials by Deepdock Ltd.

Commercial-scale Offshore Trials:

- Still many unknowns e.g. risk assessments
- Required in order to test the theories, models, environ. impact, ecosystem services and economic realities
- South West offshore trials will inform but further work required in OWFs as well
- CEFAS & TCE South West offshore finfish trials may act as a model
- International co-operation & funding

Socio-economic Study:

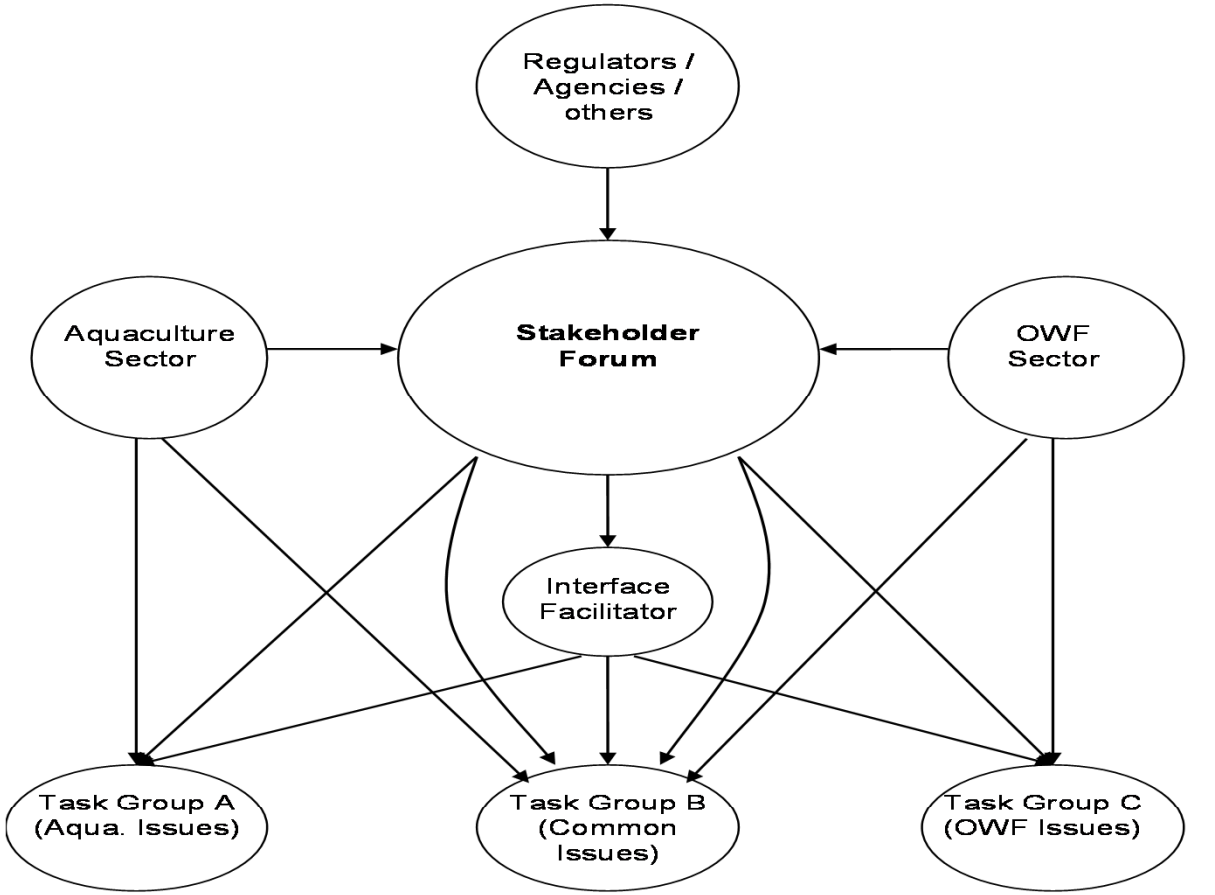
- To highlight & quantify potential wider benefits of co-location

- Provides encouragement rather than just a requirement through legislation or Policy Drivers

- Scoping document for Socio-economic Study drafted and submitted to WG for consideration

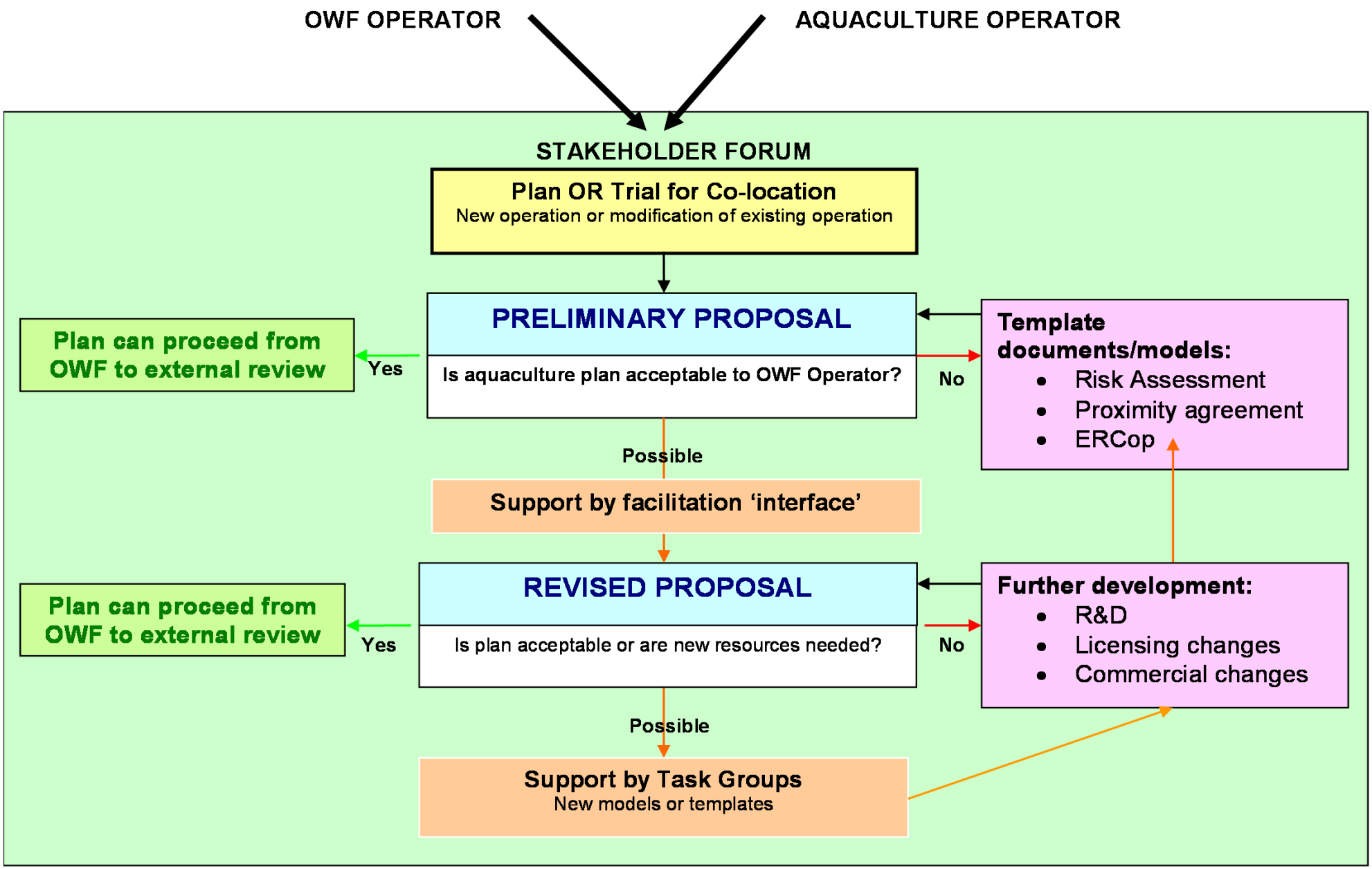
Aquaculture & OWF Co-location Stakeholder Forum

- Seafish to form initial Secretariat
- Support from CEFAS
- Support from other Project Partners & Stakeholders?



Examples include: *a) Technical:* -Assess offshore aquaculture gear reliability -Assess suitability of SC2 systems for aquaculture *b) Safety:* -Develop aquaculture activity specific risk profiles	Examples include: *a) Financial:* -Seek resource -Socioeconomic study *b) Safety:* -Risk Assessments -Proximity Agreements -Navigation implications -SAR implications *c) Legislative* -licensing	Examples include: *a) Technical:* -Assess cable severing risk from towed gear -Assess suitability of SC2 systems for OWF *b) Safety:* -Review ERCop

Protocol Development



Study recommendations & next steps

Aquaculture Options for Offshore Wind Farms – Shellfish Species

It is recommended that the blue mussel (*Mytilus edulis*) should be prioritised for commercial-scale aquaculture trials within Welsh offshore wind farms.

Shellfish Mariculture Permissions and Licensing

- It is recommended that The Crown Estate be approached to review and provide an opinion on the various issues and areas of uncertainty that are raised with respect to marine aquaculture licensing beyond 12nm for fixed gear aquaculture.

- It is recommended that The Crown Estate be asked to provide an opinion on the legal status, in terms of licensing, or multi-functional use of a leased area within either an existing or proposed offshore wind farm.

- It is recommended that an investigation is carried out to ascertain if a Fishery Order can be granted for an area within an existing offshore wind farm.

Shellfish Mariculture Permissions and Licensing

- It is recommended that a Co-location Stakeholder Forum should be tasked with leading the discussion regarding the potential for co-operation between Wind Farm Operators and the Welsh aquaculture industry.

Policy Drivers

- It is recommended that Welsh Government be asked to consider the policy or legislative changes that would be needed for Welsh waters in order to implement a requirement for developers of new offshore wind farm sites to carry out and evidence that an investigation of the potential for co-location or multi-functional use of offshore wind farm sites has been undertaken.

Operational Issues

- ***Technology Developments*:**
  - Cable Impact
  - Vessel management

- ***Offshore Aquaculture Trials*:**
  - Conservation Issues (Bird Impacts)
  - Multi-user Compatibility

- ***Development of North Hoyle Trial Documentation*:**
  - Project Planning documentation
  - Code of Conduct and Operational Protocol
  - Risk Assessment
  - Emergency Response Plan

Operational Issues *contd.*

- ***Proximity Agreements*:**
  - The Proximity Zoning

- ***Scenario Development Tools:***
  - Risk Profiles
  - Phase Development
  - Navigation Corridors
  - Socio-Economic Studies

Closing Session

Actions to Close of Project

Report Finalisation:

- Feedback to be submitted if possible by the **31st July 2013**
- Contact ASL in the first instance
- Final report to be made available via Seafish website (Resources Section) – e-mail notification will be sent
- Anticipated date of availability is **mid-August**

Any Other Business?