

Balancing  
the provision of  
infrastructure  
enhancements  
against their  
environmental  
cost

Muffy Seiderer

Marine Ecological  
Surveys Limited



- Provided there is a good understanding of the environmental resources and their sensitivity to disturbance, it is possible to devise a construction and/or compensation plan that more than offsets the immediate environmental impacts of construction
- **Two** very different infrastructure development projects with different environmental constraints
- **Thanet Offshore Wind Limited**
  - The EU Directive on renewable energy targets - 20% of energy from renewable sources by 2020
  - Annex I Habitats within the development site
- **London Gateway Port Limited**
  - Provision of a world class port facility in the Thames estuary
  - Special Protection Area SPA designated for the presence of internationally significant populations of over-wintering wading birds
- **Two** great solutions

# Thanet Offshore Windfarm

100 Turbines

The site covers an area of 35 km<sup>2</sup>

Turbines installed on monopile foundations

Approximately 500m apart along rows and 800m between rows

300 Mega Watts of Power

Provides 200,000 homes with clean energy

Operational since September 2010

# Offshore Windfarms

- Turbine installations and cable laying associated with offshore windfarm construction involves a physical disturbance to the seabed
- Accurate mapping of sensitive habitats plays a critical role in the planning of these developments

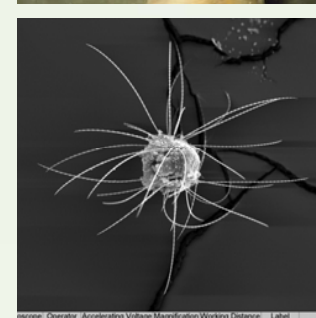


**YES – It is windy!**

# *Sabellaria spinulosa*

Online Marine Macrofauna Genus Trait Handbook [www.genustrait handbook.org.uk](http://www.genustrait handbook.org.uk)

- The Ross worm, *Sabellaria spinulosa*, is a small tube-dwelling polychaete worm that filters particulate matter from the water column
- Forms dense aggregations that develop into reef-like structures forming a complex habitat providing shelter for a variety of invertebrates which in turn provide ecosystem services to other invertebrates & fish
- Biogenic reefs formed by *Sabellaria* communities are classified as Annex I habitats under the EU Habitats Directive
- The long breeding period, long larval phase & relatively rapid initial growth in the first year after settlement results in a genus that has high recoverability
- The reef structures are spatially & temporally variable



# Side-scan Sonar signature



- SSS acquired to inform the engineering
- Textured signature typical of *Sabellaria* aggregations
- Leads to further investigation involving seabed imagery and grab sampling



Ground truthing revealed *Sabellaria spinulosa* reef

# Patchiness

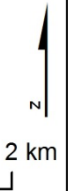
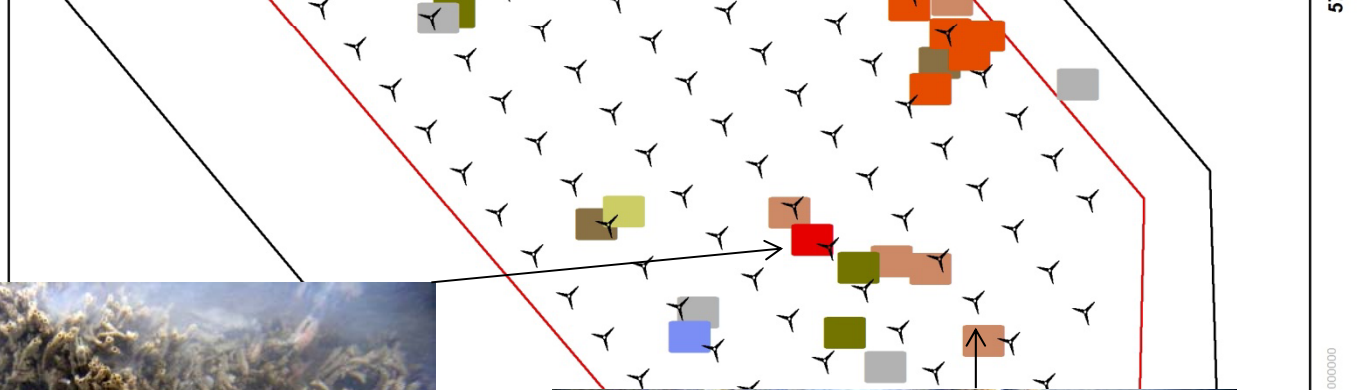
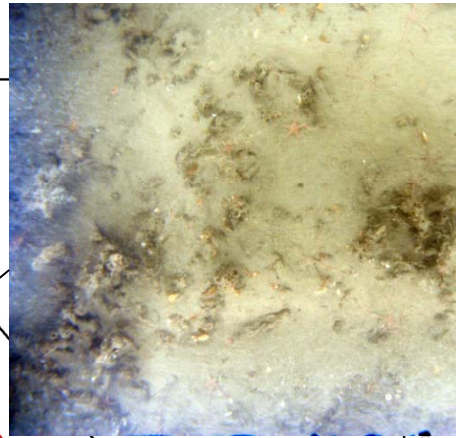
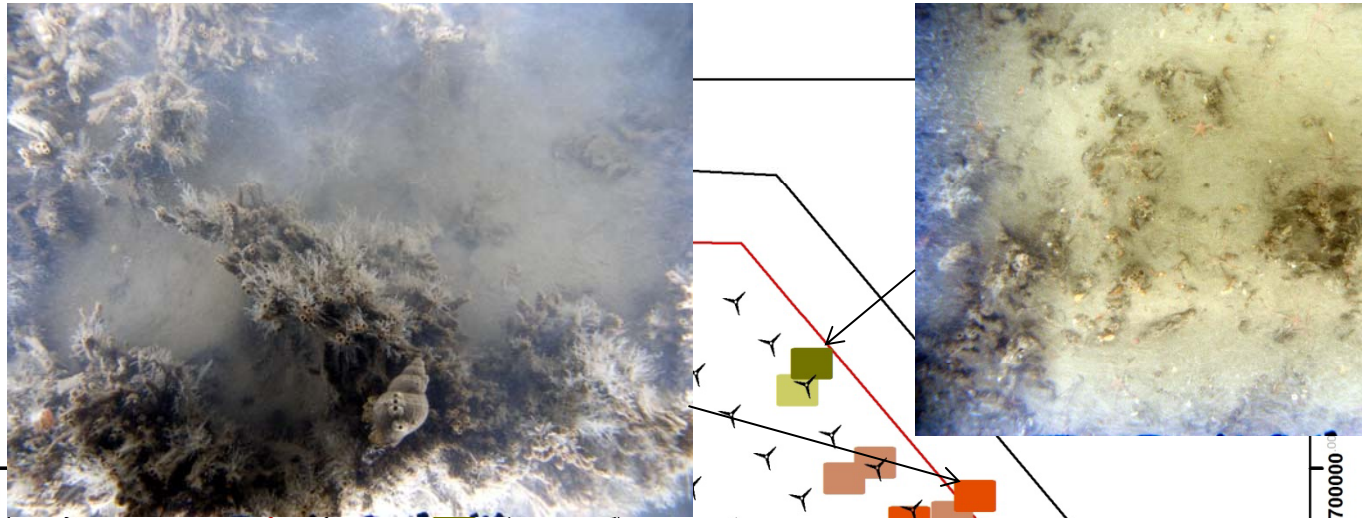
- The sequential results of these 3 interlinked disciplines demonstrated the spatial and temporal variability of the *Sabellaria* aggregations
- The seabed imagery showed that the occurrence of *Sabellaria* could be classified into the following groups:-
  - ❖ Patchy
  - ❖ Moderate
  - ❖ Dense
- Detailed mapping of the extent and quality of the Annex I Habitats enabled the construction to go ahead with individual turbines being positioned in such a way that damage to the most important parts of the reef was avoided

# Thanet Wind Farm

## 2012 *Sabellaria* Assessment

### Legend

-  Turbine Location
- Sabellaria GT Interpretation**
-  Dense *Sabellaria* region
-  Moderate to dense *Sabellaria* region
-  Moderate *Sabellaria* region
-  Moderate patchy *Sabellaria*
-  Sparse to moderate *Sabellaria* region
-  Sparse *Sabellaria* region
-  *Sabellaria* rubble
-  Low percentage of *Sabellaria* rubble
-  No *Sabellaria*
-  Side Scan Sonar Coverage
-  Thanet Offshore Wind Farm Boundary

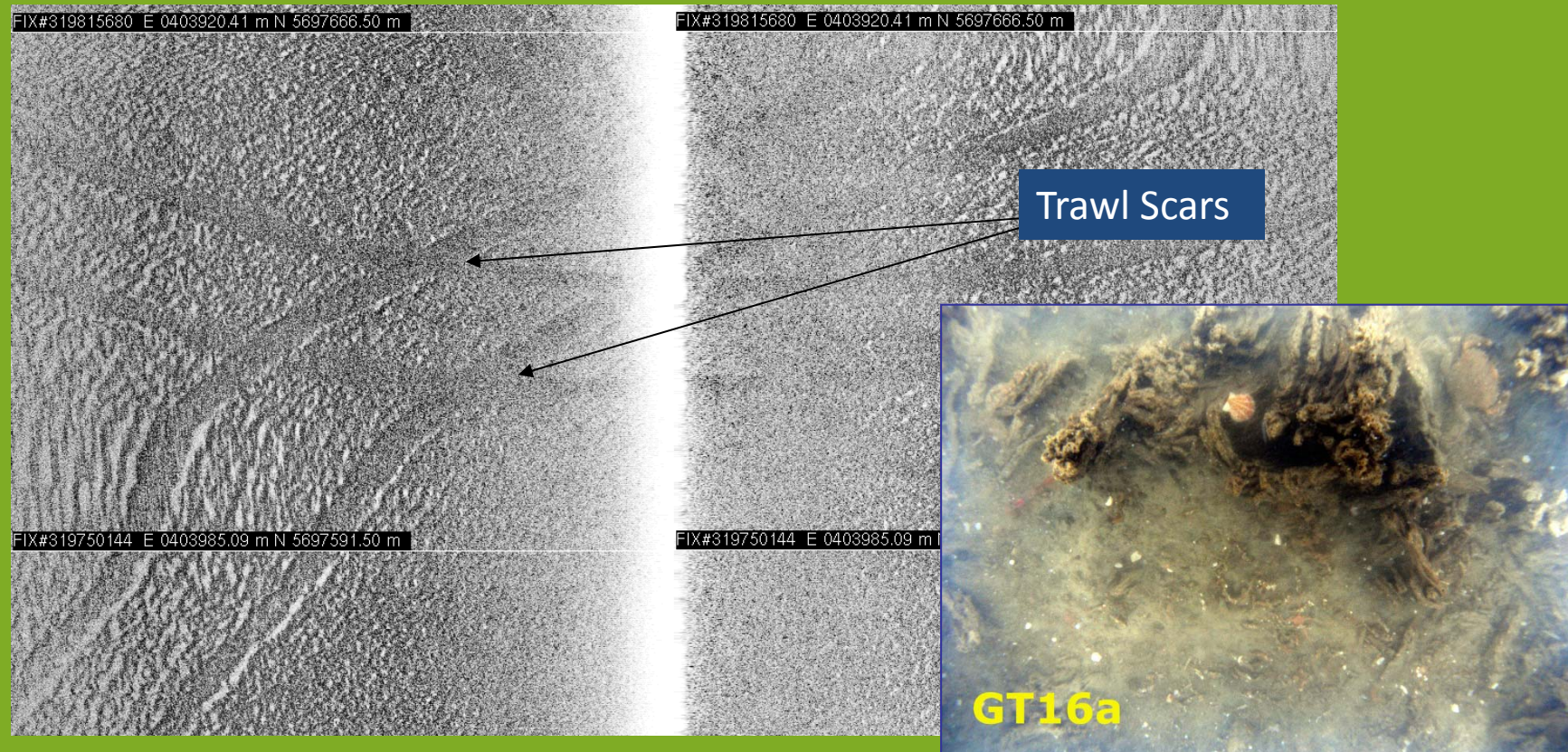


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Co-ordinate System: UTM31N

Version A  
 Comments  
 Author JP

# Trawl Damage of *Sabellaria* reef



# TOWF as a Refuge for *Sabellaria spinulosa* aggregations

- TOWL has no restrictions on fishing activities within the site although it is likely that the fishing effort was reduced during the construction phase due to the nature of the works and presence of construction vessels
- Post-construction acoustic data from TOWF has, amongst other observations, demonstrated that recent trawl scars are limited to the area outside of the turbine array
- Further observations show that the high quality reef area has expanded within the array in terms of:-
  - ❖ elevation
  - ❖ growth
  - ❖ colonisation

# Summary of Mutual Benefits

- Development was allowed to continue, despite being located in a region containing potential Annex I Habitats
- As a result of the micro-positioning exercise, a Public Inquiry was not triggered
- A compensation package was not required
- Annex I Habitats were minimally affected by the construction
- Benefits for conservation and for ecosystem services
- I have not included the socio-economic benefits of the development

# London Gateway Port Project

- Now let's turn to a very different infrastructure project and one that did require compensation for inevitable losses under the 'footprint' of the dredging and reclamation works involved in the construction of a major international container port in the lower Thames estuary.



**DP WORLD**

**London**  
Gateway

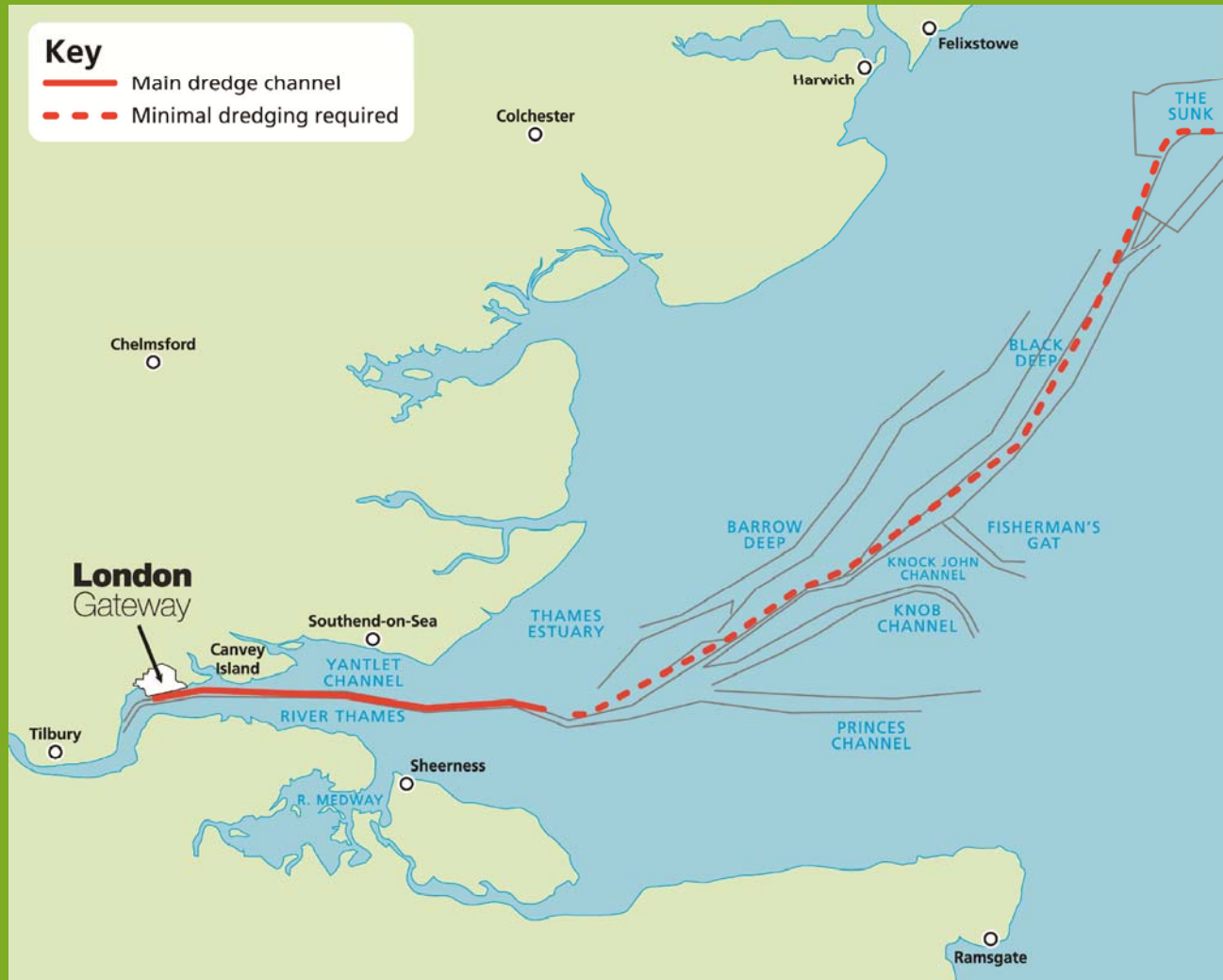




# Port Development

- Dredging and reclamation involve physical disturbance to the seabed
- Accurate mapping of sensitive habitats plays a critical role in the planning of these developments
- Proximity to designated conservation areas is very likely
- During the Public Inquiry, significant conditions were imposed to mitigate impacts of the development - before, during and after construction of the port
- **A commitment was made to offset unavoidable environmental losses**

# The Dredge Plan



- ~100 km east to west
- Reclamation



# The Biological Environment

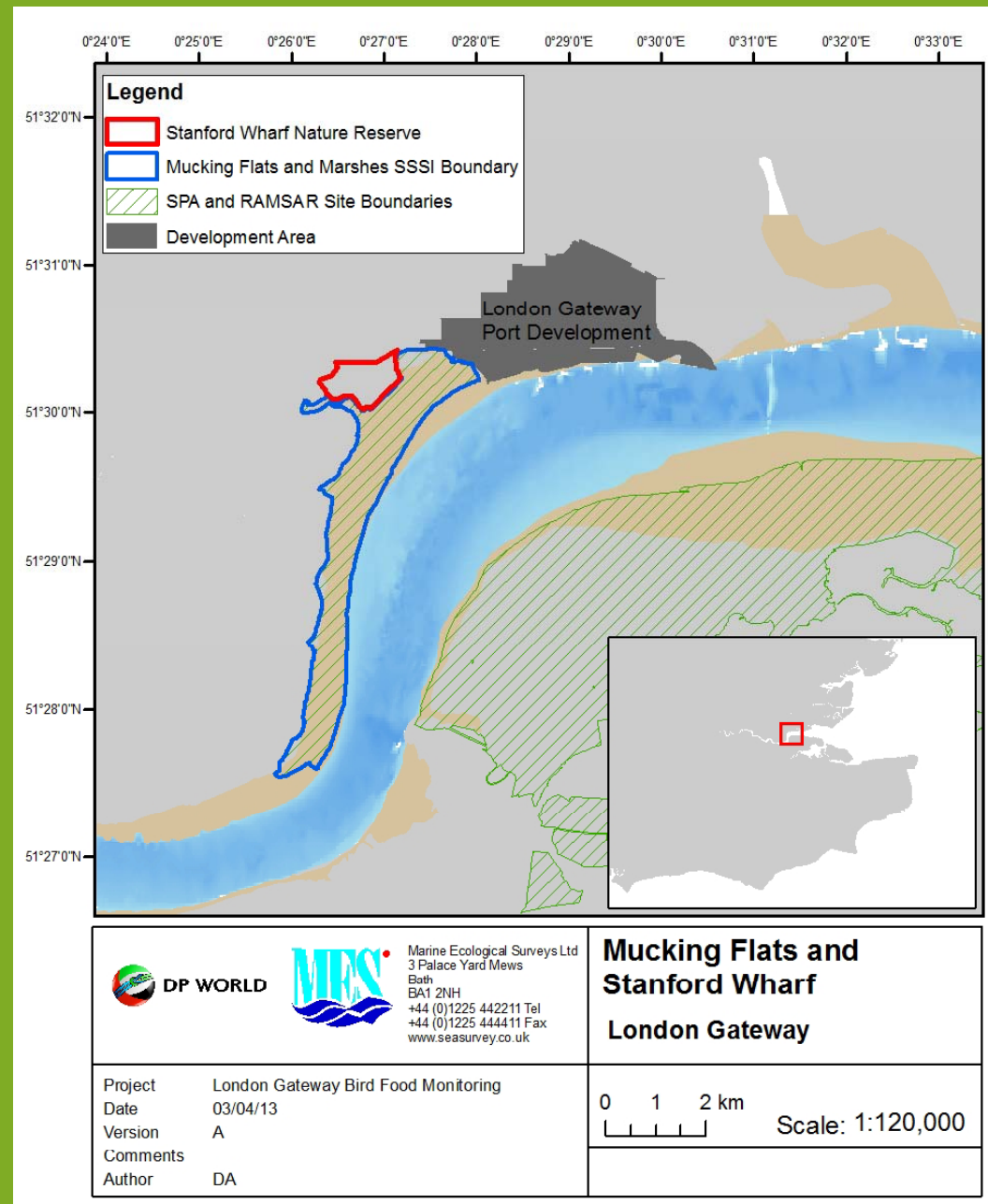
# Conservation areas –

designated for internationally significant populations of over-wintering wading birds

- Seasonal monitoring of bird food resources to assess:-

- ❖ the carrying capacity of the mudflats

- ❖ the extent to which these resources are depleted at the point at which the over-wintering wildfowl depart



# Bird Food



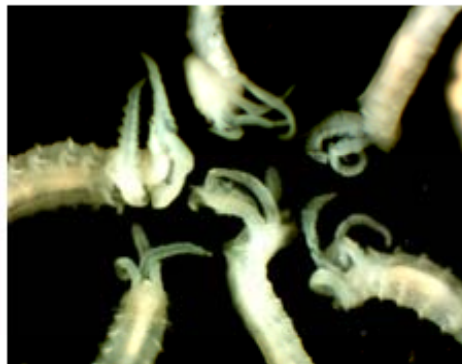
**Corophiidae**



**Oligochaeta (*Tubificoides* sp.)**



***Aphelochaeta* sp.**



***Streblospio shrubsolii***



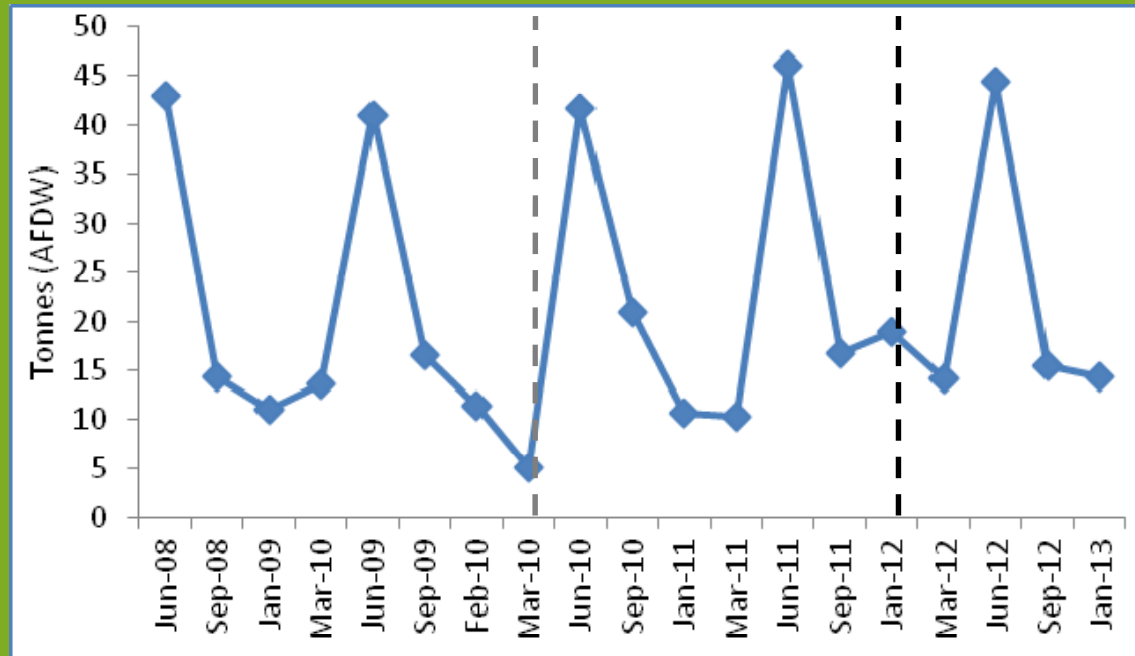
***Macoma balthica***



***Hediste diversicolor***

# Mucking Flats – tonnes of bird food

- Carrying capacity depleted by 80% as the birds leave
- Were this reduction in carrying capacity to be exacerbated by accretion or erosion then the bird population may be food-stressed at the end of the winter feeding period



- It is for this reason that a compensation proposal was made
- Note that the seasonal trend in biomass of bird food has not been affected by the dredging & reclamation programme

# Managed Realignment Areas

- To compensate for potential losses of bird feeding areas
- The first of these is known as Stanford Wharf Nature Reserve
- Ahead of and following the breach of Stanford Wharf, the following assessments were carried out:-
  - ❖ Inter-annual and seasonal variability of ecosystem services provided to the birds by the Flats
  - ❖ Bird counts during the over-wintering period
  - ❖ Comparative statistics to assess the potential alterations as a result of the dredging & reclamation programme

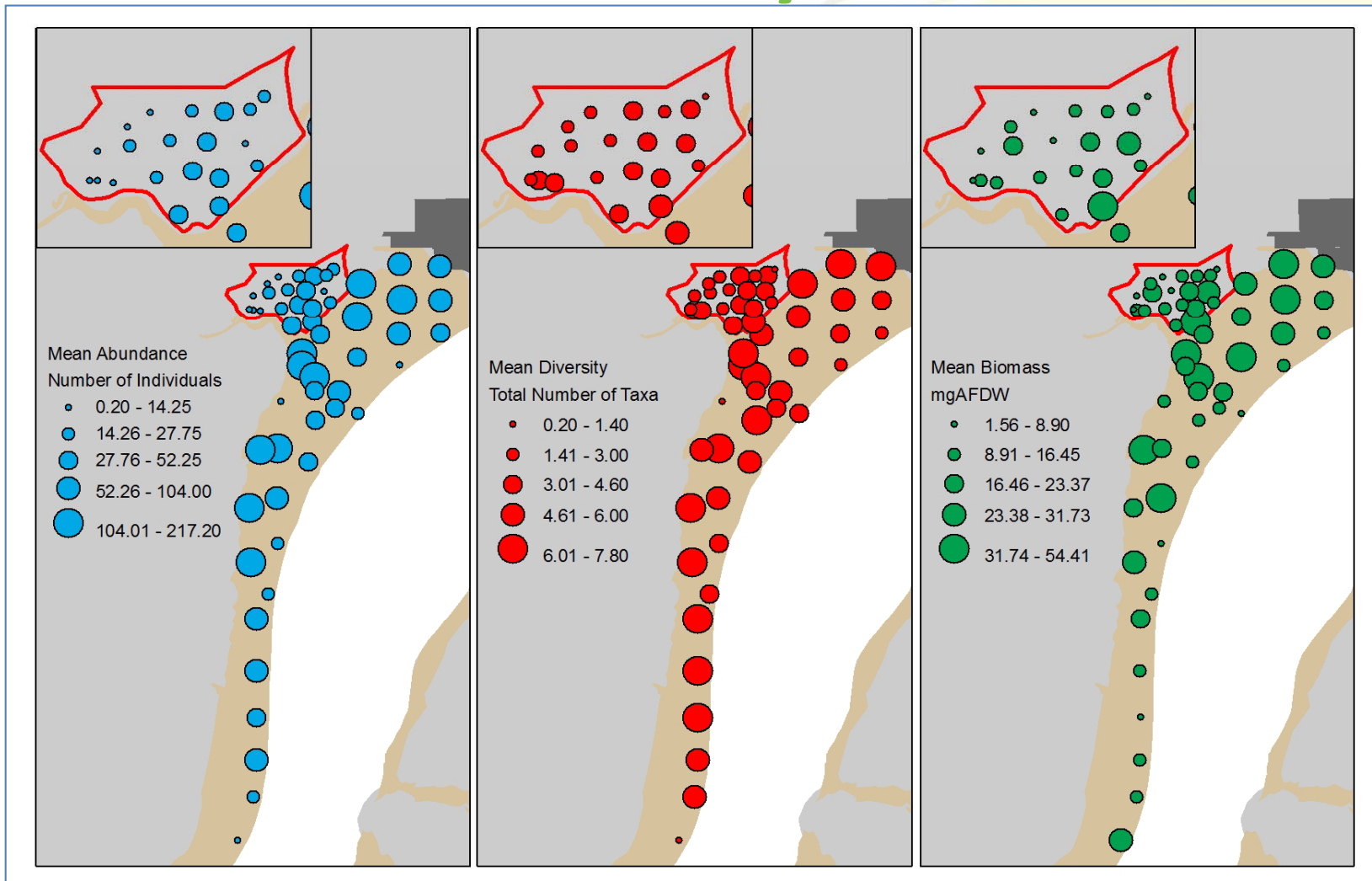
# Stanford Wharf Nature Reserve

- There has been a relatively rapid colonisation of the surface deposits by a variety of invertebrates that are significant as bird food
- There are likely to be long-term changes in the invertebrate population of Stanford Wharf:-
  - ❖ natural 'ecological succession'
  - ❖ probable changes in accretion and erosion within the compensation site



# Abundance Diversity

# Biomass



- The combined biomass values for Mucking Flats and the newly colonised deposits at Stanford Wharf significantly exceed the biomass required for compensation of the predicted loss of intertidal habitat
- The bird feeding resources within the compensation area provide additional carrying capacity
- Studies on the use of the whole area by wading birds suggest that both sites are important feeding areas
- Stanford Wharf supports a wide variety of juvenile fish species of economic and conservation significance
- Engaged in dialogue with Natural England to assess the extent to which Stanford Wharf may be added to the SPA

# Summary of Mutual Benefits

- Development was allowed to continue, with a commitment to offsetting unavoidable environmental losses, despite being located in a designated conservation area
- Reputational enhancement of the developer as a result of :-
  - ❖ An increase in the provision of ecosystem services leading up the food chain to both birds and fish
  - ❖ A possible adjunct to a designated conservation area
  - ❖ A demonstration of Best Practice in environmental management leading to prestigious Awards
- I have not included the socio-economic benefits of the development

# Thank You



MESL is part of the Gardline Group of Companies

