

A photograph of two dolphins swimming underwater against a deep blue background. The dolphins are captured in a dynamic pose, with their bodies arched and fins visible. The lighting highlights the sleek, wet skin of the dolphins.

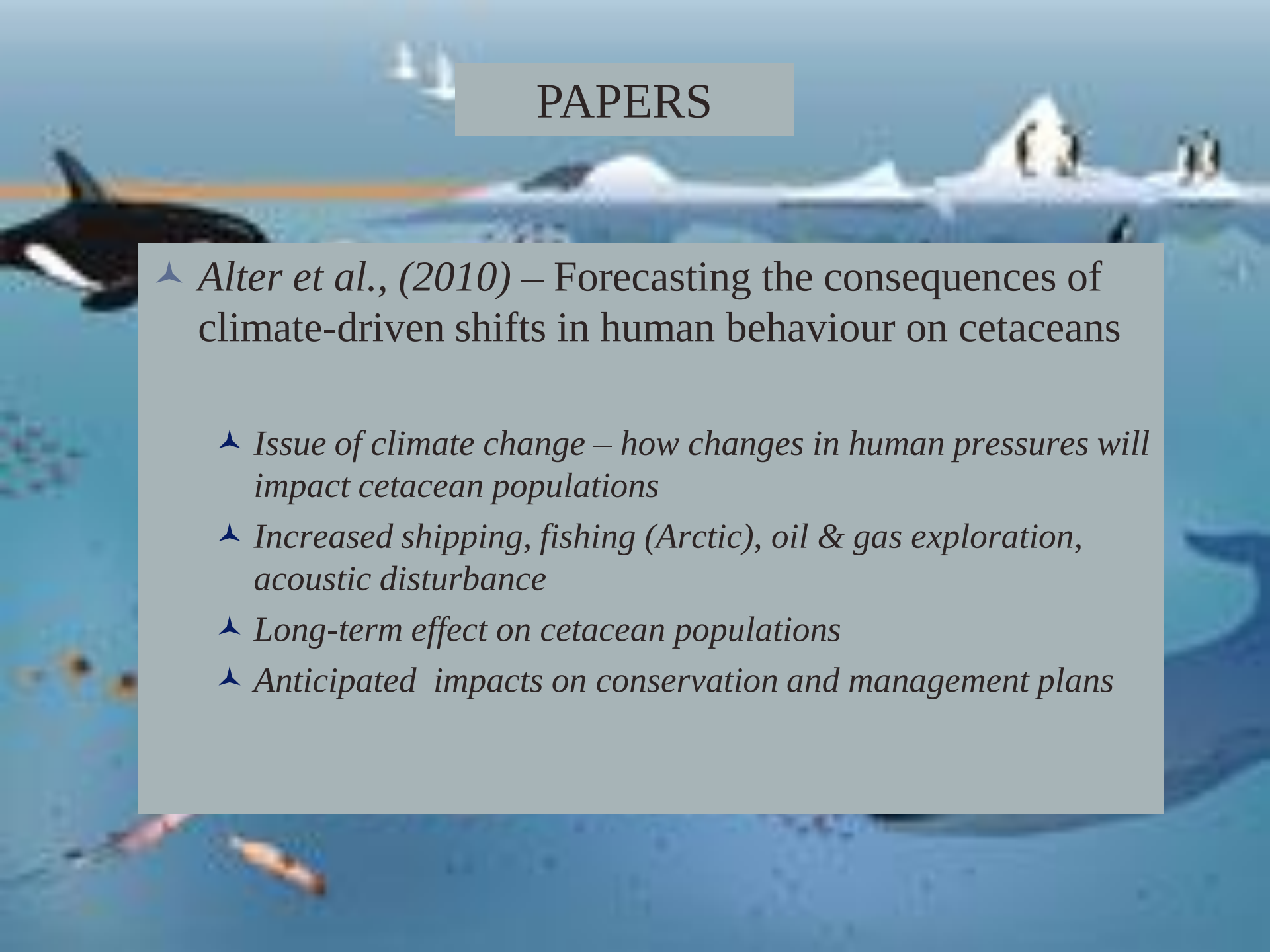
Coastal & Marine Conservation
Tuesday 14.00 – 16.30 MG306

Coastal & Marine Conservation

▲ *Lectures:*

- ▲ *Bycatch*
 - ▲ *Maritime noise/pollution*
 - ▲ *Marine tourism*
 - ▲ *Marine Spatial Planning*
- ## ▲ *Self study – background research chosen paper*





PAPERS

- ▶ *Alter et al., (2010) – Forecasting the consequences of climate-driven shifts in human behaviour on cetaceans*
 - ▶ *Issue of climate change – how changes in human pressures will impact cetacean populations*
 - ▶ *Increased shipping, fishing (Arctic), oil & gas exploration, acoustic disturbance*
 - ▶ *Long-term effect on cetacean populations*
 - ▶ *Anticipated impacts on conservation and management plans*



Papers

- ▲ Avery-Gomm et al. (2012). Northern fulmars as biological monitors of trends in plastic pollution in the north eastern Pacific
 - ▲ *Need for internationally accepted methods of plastic pollution monitoring*
 - ▲ *Lack of baseline data*
 - ▲ *Stomach contents of fulmars in eastern north Pacific – quantities of plastic highest recorded*
 - ▲ *Revealed an increasing trend over last 40 years*

Papers

- ▲ ***Banks et al., (2008) – Effects on Common Scoter in Carmarthen Bay and status ten years later***
 - ▲ **Recounting disaster of 1996 spill and its effect on scoters in Carmarthen Bay**
 - ▲ **Direct mortality and pollution of key food resources**
 - ▲ **Changes in bird distribution as well as major decline in population**
 - ▲ **Monitoring & distribution as indicators of ecological recovery**

Papers

- ▶ *Calado et al., (2010). Marine Spatial Planning: Lessons learned from the Portuguese debate*
 - ▶ *Legal, methodological and political frameworks - MSP*
 - ▶ *Horizontal/cross-cutting planning tools – joined up policy making*
 - ▶ *Conflict reduction – access to good quality data challenging*
 - ▶ *Should be designed on a case by case basis*

Papers

- ▶ *Embling et al., (2010)* – Using habitat models to identify suitable sites for marine protected areas for harbour porpoises
 - ▶ **Selection of MPAs for HP conservation**
 - ▶ **Nursery ground – high young to adult ratio**
 - ▶ **Significance of current strength – use of bathymetric and hydrographical variables to identify density hotspots – conservation measures**

Papers

- ▲ Crawford *et al.*(2011). Effectiveness of bycatch-reduction devices in roller-frame trawls used in the Florida shrimp fishery:
 - ▲ *High rates of fish discards*
 - ▲ *Gear used in seagrass beds to harvest shrimp*
 - ▲ *No BRD required even though bycatch can be high*
 - ▲ *Effectiveness of two new devices tested*

Doyle et al., (2007) – Broad-scale distribution of five jellyfish species across a temperate coastal environment



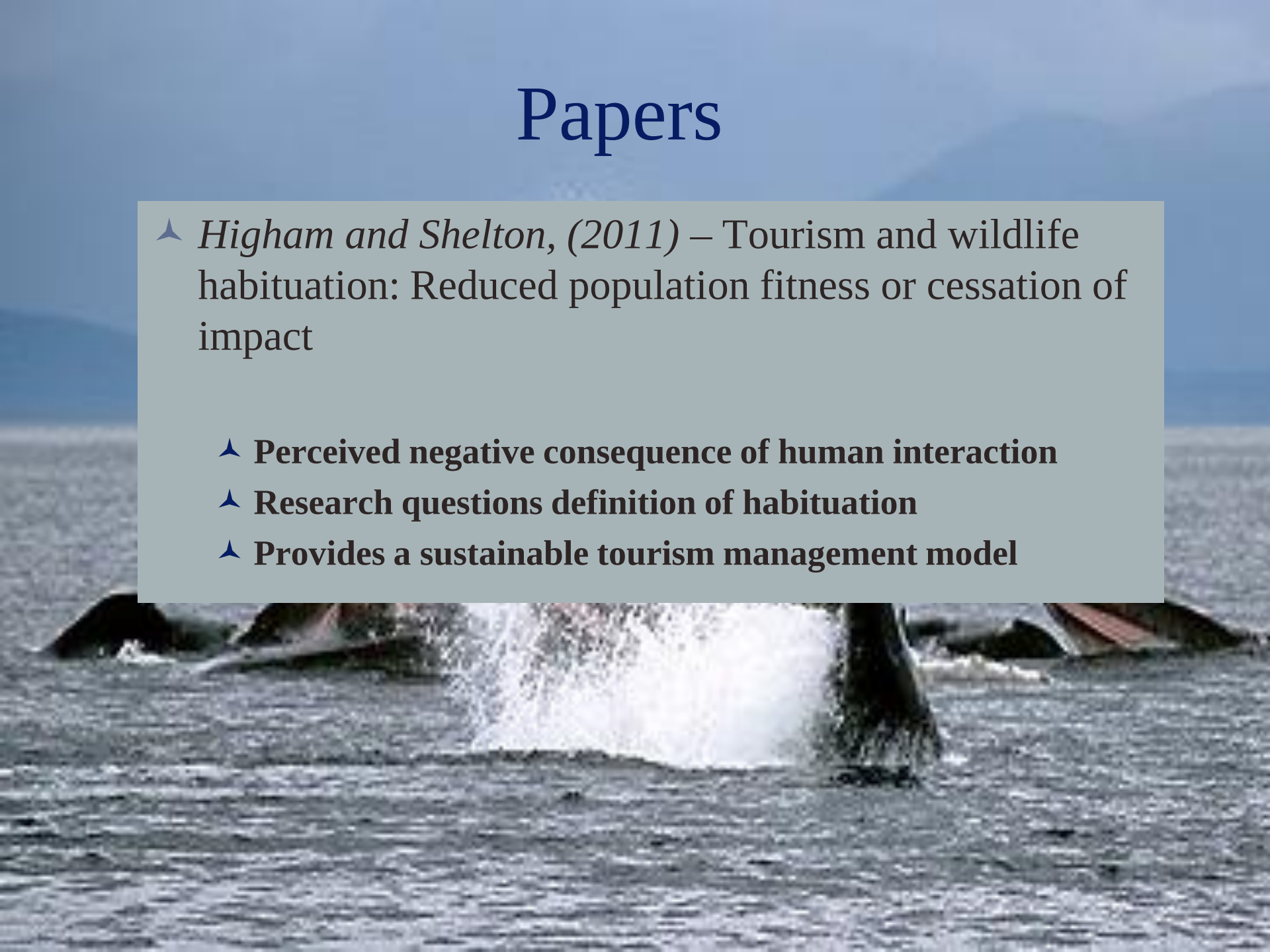
- ▲ *Planktonic communities – abundance and distribution poorly known*
- ▲ *Patterns for five species identified – Irish & Celtic Seas*
- ▲ *Use of ships of opportunity and shoreline strandings*
- ▲ *Distinct patterns (north & south split) reflecting hydrographic regimes.*

Papers

- ▲ Duprey *et al.*, (2008) – Effectiveness of a voluntary code of conduct in reducing vessel traffic around dolphins
 - ▲ *Disturbance of dolphins in Kaikoura, NZ*
 - ▲ *Voluntary ‘rest periods’ instigated*
 - ▲ *Education needed – participation rates increase*

Papers

- ▶ *Higham and Shelton, (2011)* – Tourism and wildlife habituation: Reduced population fitness or cessation of impact
 - ▶ **Perceived negative consequence of human interaction**
 - ▶ **Research questions definition of habituation**
 - ▶ **Provides a sustainable tourism management model**



Papers

- ▲ *Jenkins et al., (2009)* – Harbour porpoise conservation management: A dimensional approach
 - ▲ Priority species CCS - BAP
 - ▲ Coastal pressures and conflict – critical habitat identified
 - ▲ Development of a coastal zone use model
 - ▲ SWOT analysis/ERA – mitigation education

Papers

Reopanichkul, et al., (2009). Sewage impacts coral reefs at multiple levels of ecological organisation

- *Back drop of sea temperature rise & acidification – turbidity threatens coral*
- *Ecological responses to sewage discharges measured – micro algae, fish and hard coral*
- *Mitigation and management options considered*

Papers

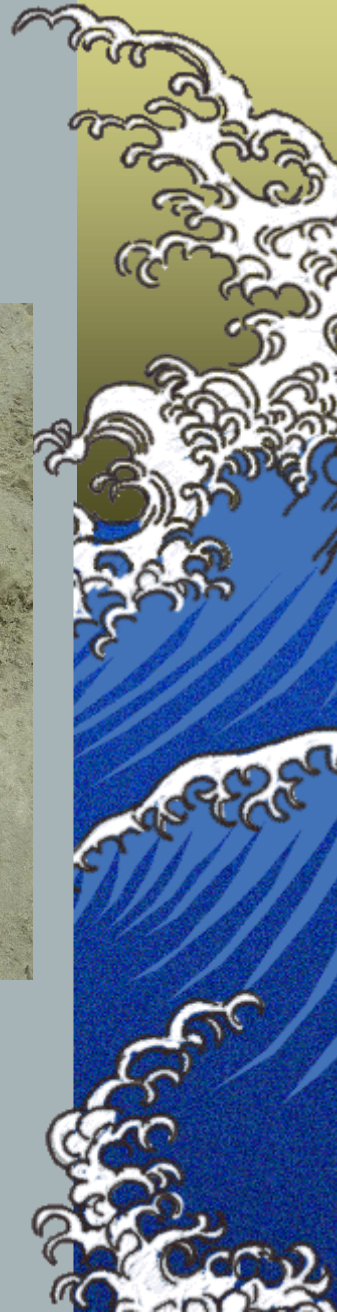
- ✦ *Ziegler et al., (2011). But are tourists satisfied? Importance-performance analysis of the whale shark industry.*
- ✦ *Comprehend motivations behind whale shark tourists*
- ✦ *Satisfaction rates considered – environmental and setting features*
- ✦ *Areas of management concern flagged up – false advertising, overcrowding, cost etc.*
- ✦ *Potential to limit growth of the industry*

Aspects of Harbour Porpoise Population Dynamics in the Bristol Channel and Strategies for Conservation Management



Rationale

- ▶ IWC (1991) – concern for declining populations of harbour porpoises *Phocoena phocoena*
- ▶ Declining numbers across its range (Culik, 2003; Reid *et al.*, 2003)
- ▶ Baseline data



Project Aim and Objectives

▲ **Aim:**

- ▲ Management Framework for the Harbour Porpoise

▲ **Objectives:**

- ▲ Data validation
- ▲ Collect habitat dynamics data
- ▲ Migration
- ▲ Assess legislative effectiveness
- ▲ Assess response to vessels



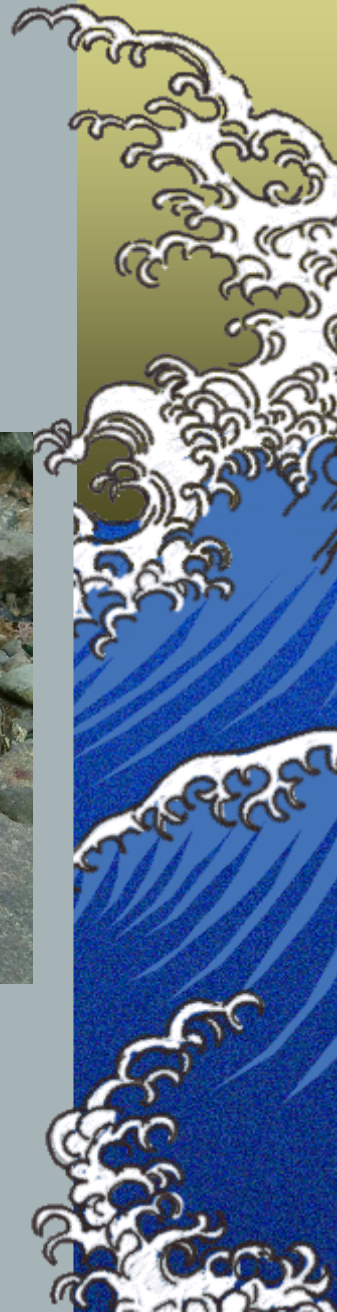
Harbour Porpoise *Phocoena phocoena*

- ▲ Apex predators
- ▲ Genetically distinct groups
- ▲ 1.5-2.0 m
- ▲ 76-89% subsurface (Reed *et al.*, 2000)
- ▲ 70% dives <20m
- ▲ Air breathers
- ▲ Echolocation



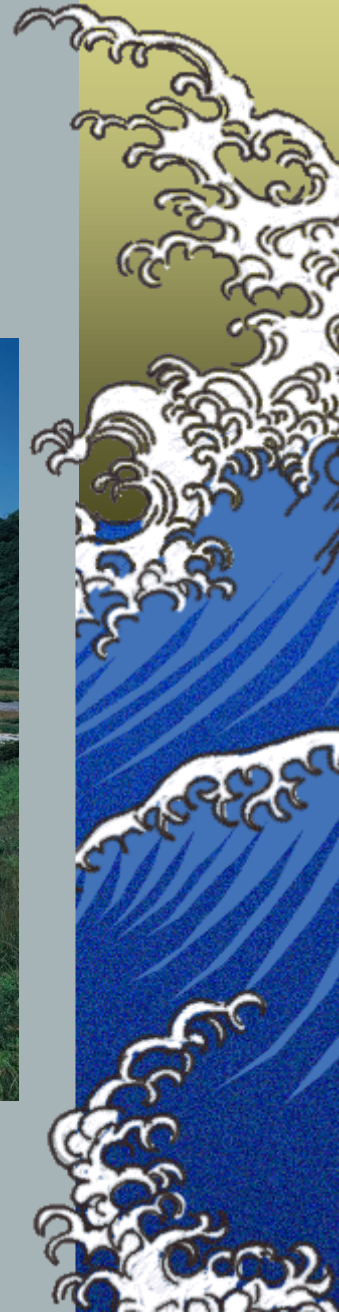
Threats

- ▶ *Bycatch*
- ▶ *Aggregate Dredging*
- ▶ *Noise*
- ▶ *Pollution*
- ▶ *Climate Change*
- ▶ *Predation*



Swansea and Gower

- ▲ High energy environment
- ▲ Large tidal range (16.4m)
- ▲ Tourism – 3 million pa
- ▲ Construction & industry
- ▲ Fishing – 90% <10m
- ▲ Aggregate Dredging –
150,000 tonnes next 7 yrs
- ▲ Carmarthen Bay and Estuaries
European Marine Site



Methodology

- ▲ Vessel transects
- ▲ Shore:
 - ▲ Pilot study
 - ▲ Behavioural surveys
 - ▲ Boat response surveys
- ▲ 25:75
- ▲ Stranding analysis
- ▲ Environmental Risk Assessment



Physical Data Collection

▲ *SHORE:*

- ▲ *260.5 hours*
- ▲ *73 watches*
- ▲ *118 discrete encounters*

▲ *VESSEL:*

- ▲ *85.75 hours*
- ▲ *12 boat trips*
- ▲ *78 discrete encounters*



Key Findings

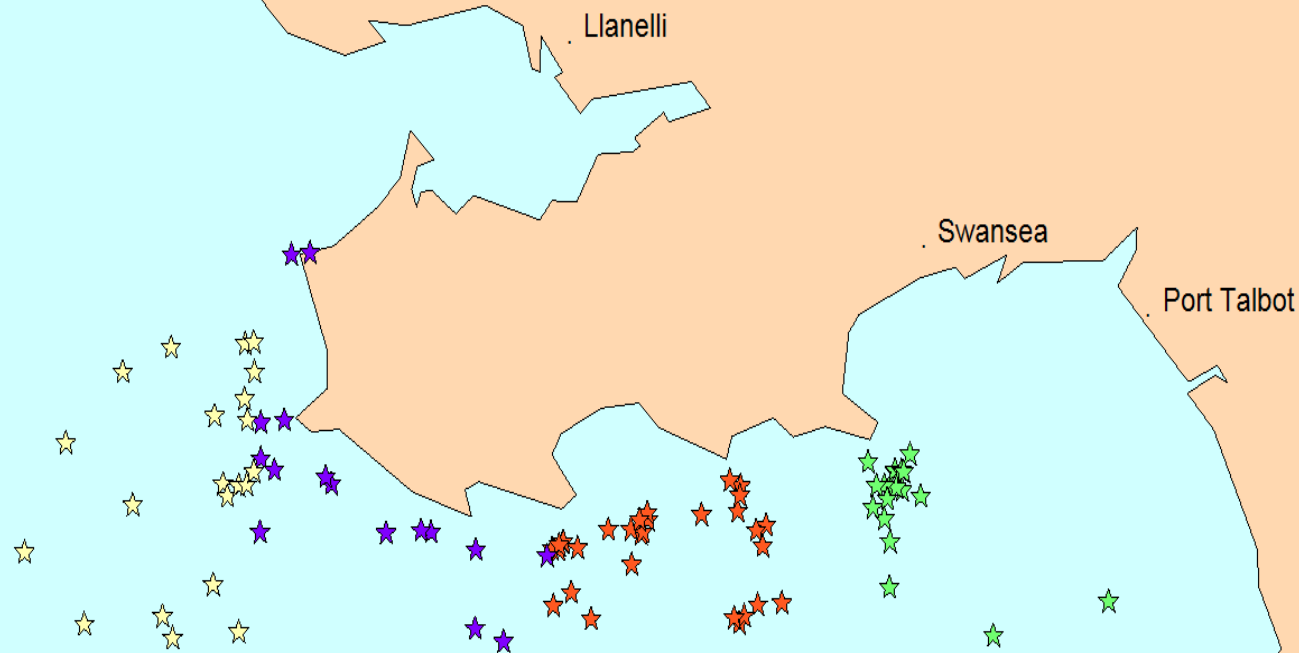
- ▶ Resident inshore population
- ▶ Affinity with 20m depth
- ▶ Site variation in usage
- ▶ Negative response to boats



Vessel-based Observations 2002-2005

KEY

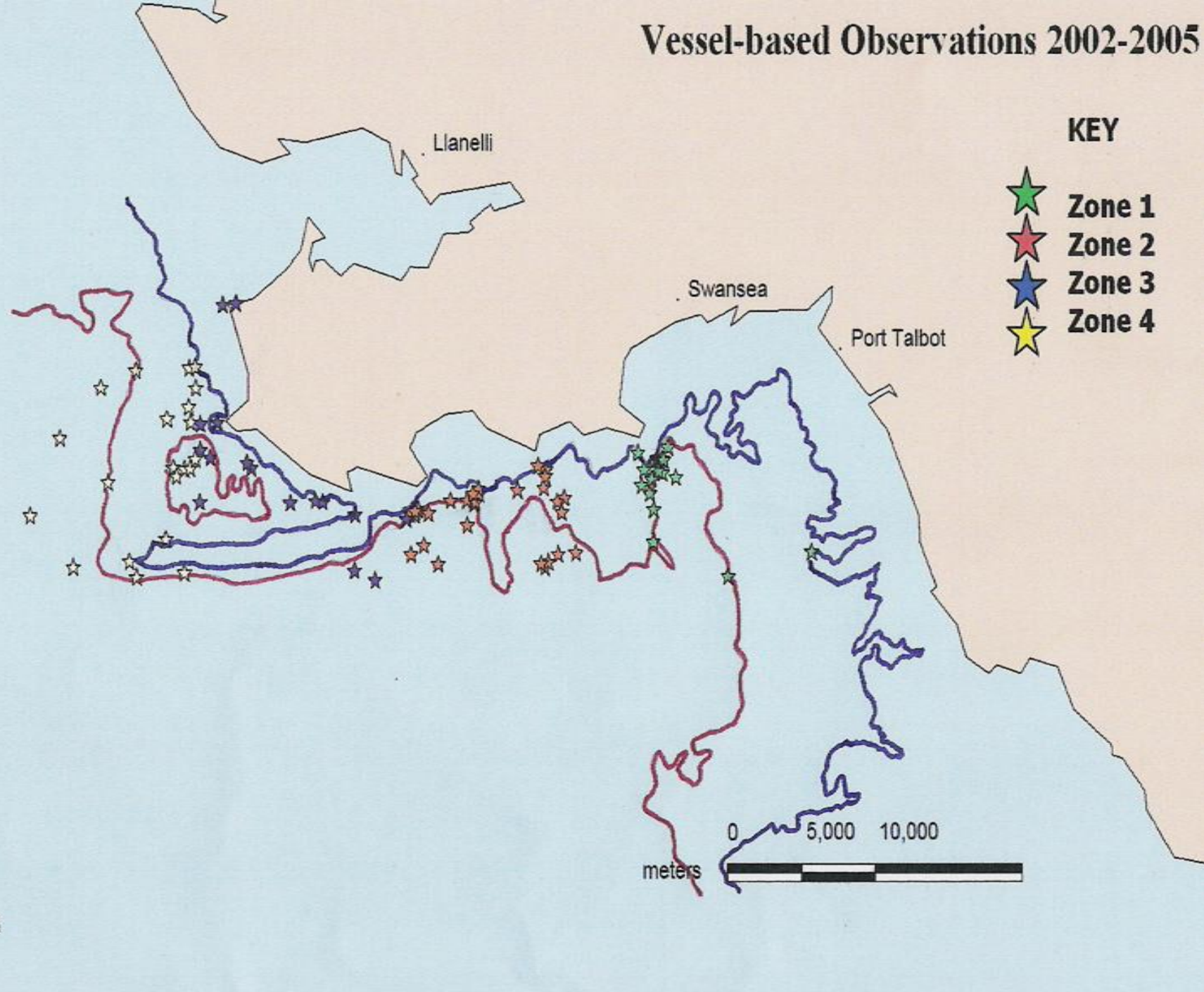
-  **Zone 1**
-  **Zone 2**
-  **Zone 3**
-  **Zone 4**



0 5,000 10,000
meters

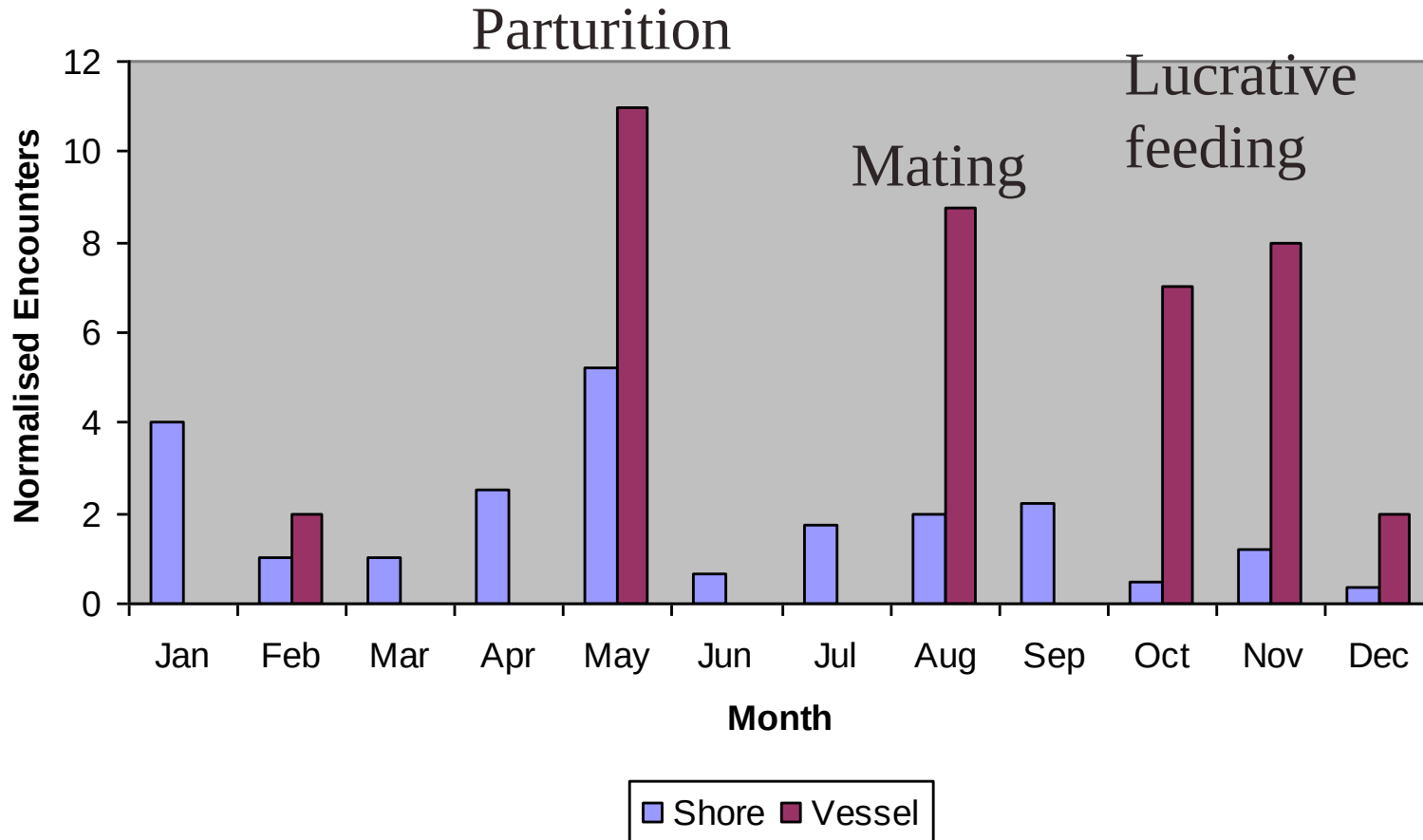


Vessel-based Observations 2002-2005



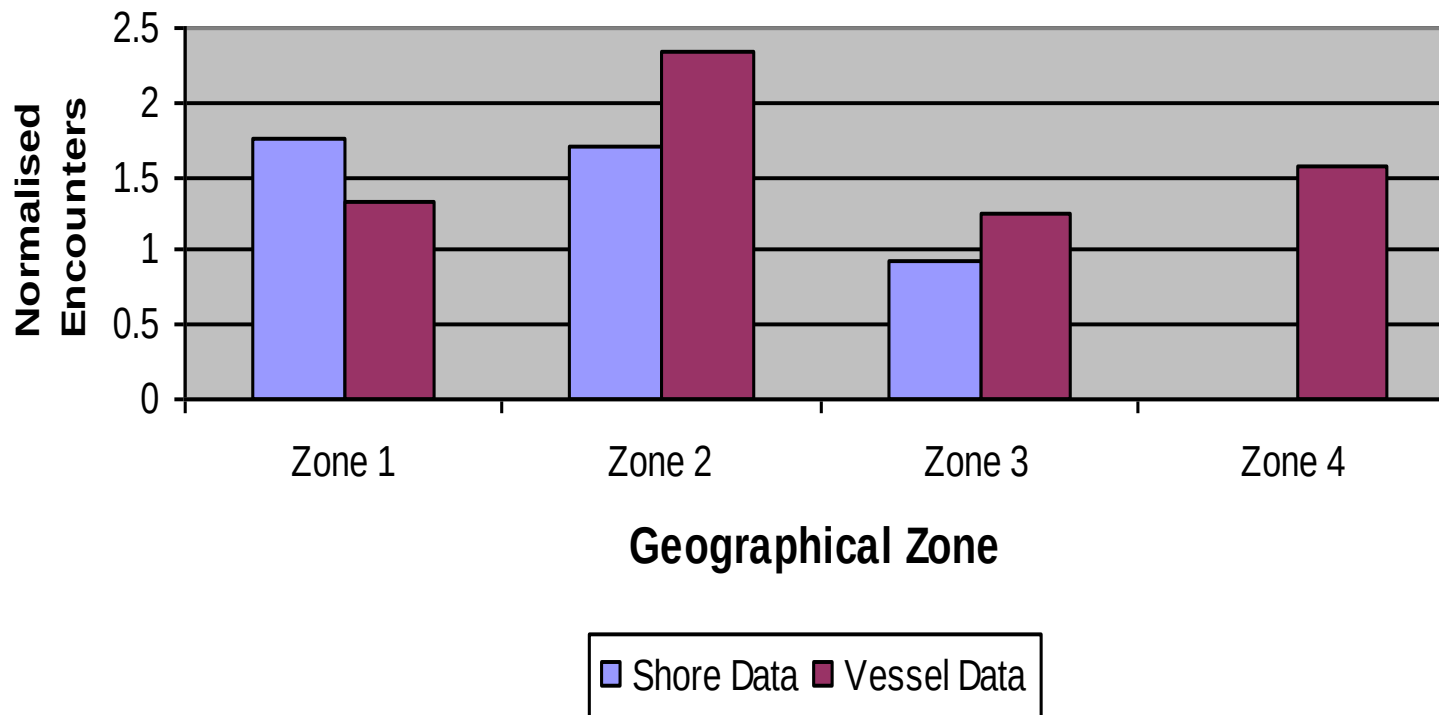
Temporal: Geographical Distribution

Temporal distribution of porpoise encounters (2002-2005)



Spatial Distribution

Shore and Vessel Encounters (2002-2005)



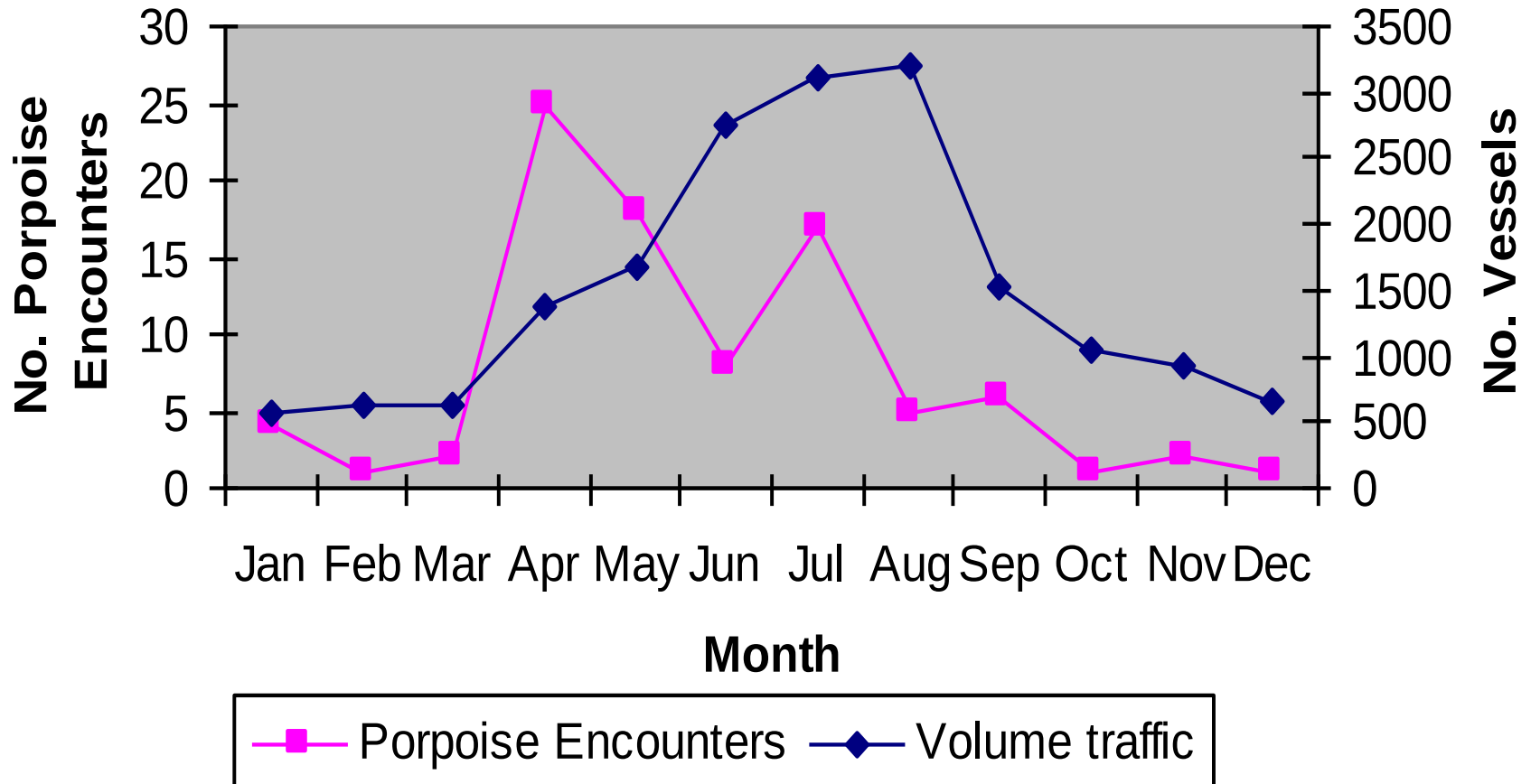
Behavioural Analysis

- ▶ 47 completed ethograms – 39 analyses as >15min duration
- ▶ **Event:** activity of short duration
- ▶ **State:** prolonged activities
- ▶ Mumbles – events indicative of foraging and feeding
- ▶ Oxwich – events indicative of resting
- ▶ Limekiln Point – events indicative of socialising and feeding
- ▶ Circling increased throughout the year in both Mumbles and Oxwich



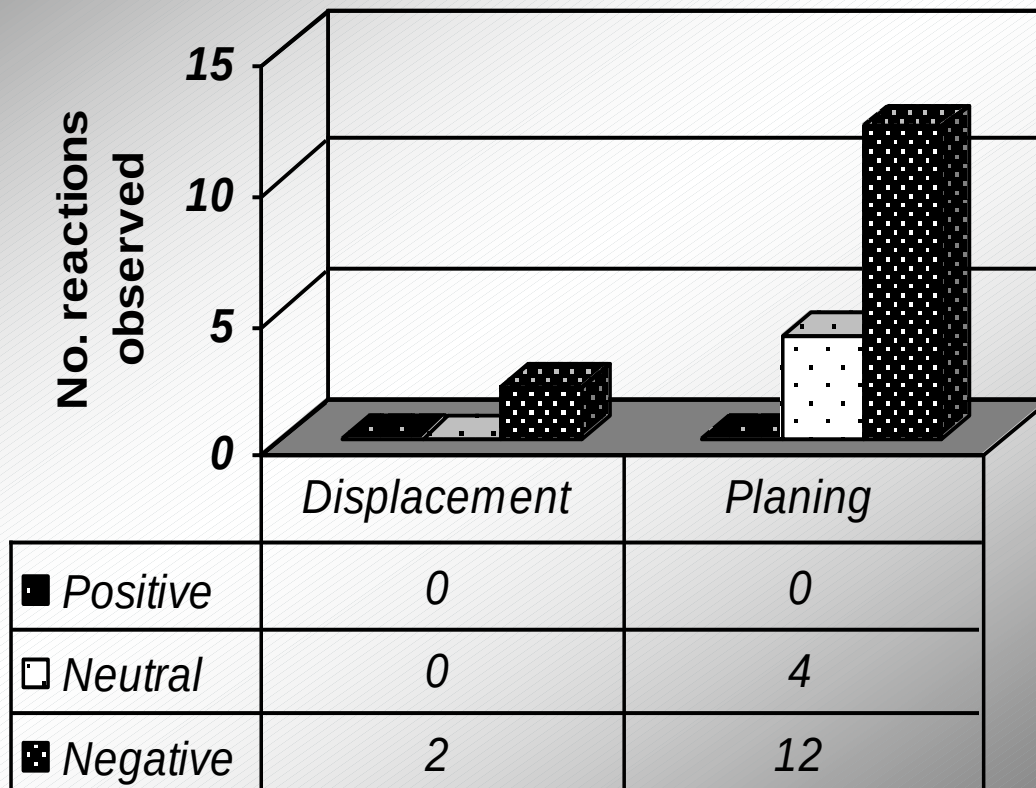
Effect of Boat Traffic on Encounters

Variation in Porpoise Encounters (Shore and Vessel) with Boat traffic: 2005



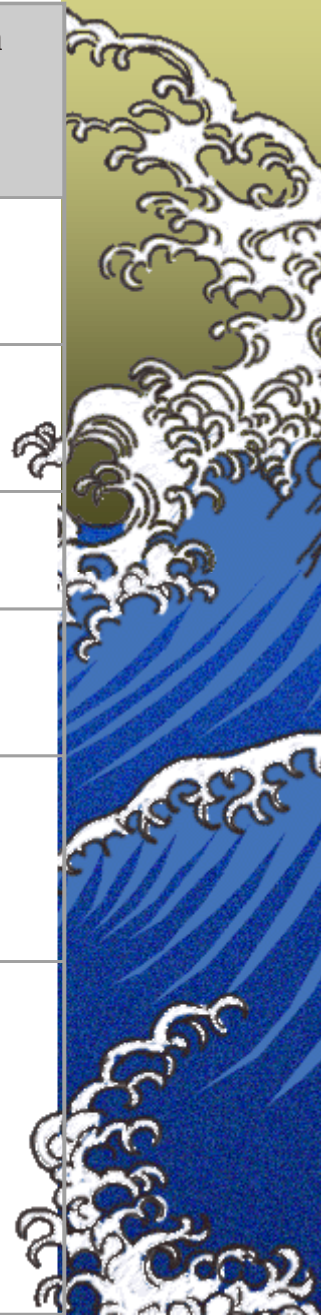
Reaction to Moving Vessels

Reaction of porpoises to moving vessels of various categories



Site Comparisons

Zone 1: Mumbles	Zone 2: Oxwich	Zone 3: Port Eynon & Limekiln Point	Zone 4: Carmarthen Bay
Sediment: muddy sand	Sediment: sand → gravel offshore	Sediment: sand → gravel offshore	Sediment: sandy
Mean Depth at peak encounters: 22.65m	Mean Depth at peak encounters: 28.45m	Mean Depth at peak encounters: 19.97m	Mean Depth at peak encounters: 25.70m
Boat activity: High	Boat activity: High	Boat activity: High	Boat activity: Low
Peak activity: Jan, May, Aug	Peak activity: Aug, Nov	Peak activity: May, Aug, Nov	Peak activity: May, Aug, Oct
Predominant Behaviour: Foraging	Predominant Behaviour: Socialising, resting and rearing	Predominant Behaviour: Transient & opportunistic feeding	Predominant Behaviour: Breeding & nursery area
Notes: Increase in circling behaviour as year progresses. Summer encounters negatively correlated with survey effort. Importance of 20m contour	Notes: Increase in circling as year progresses. Sibling agonistic behaviour seen as well as parental teaching.	Notes: Dominant flood tide to north of Helwick, ebb tide dominant to south – porpoise encounters positively correlated with dominant tidal direction. Importance of 20m contour	Notes: Incidents of stranded individuals more prominent than other zones.



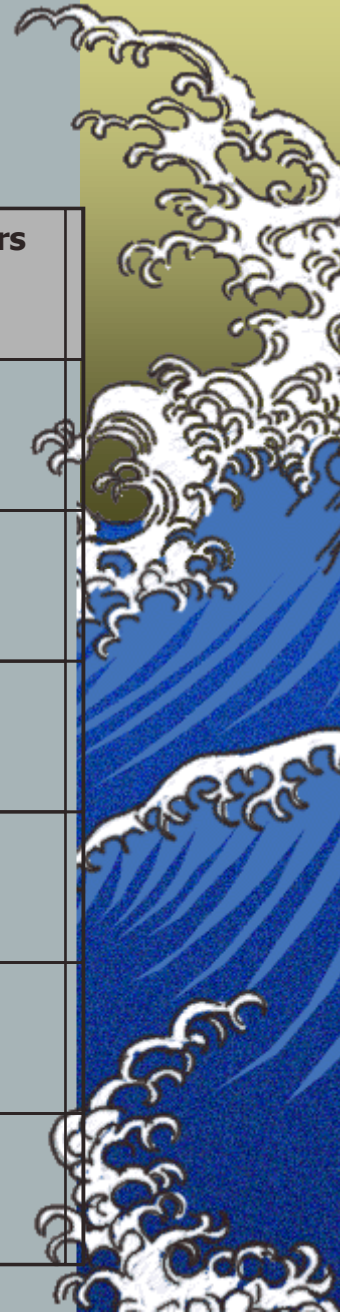
Management Plan

- ▲ Johnson and Scholes (1988) – strategic management:
 - ▲ Problem recognition – coastal user identification
 - ▲ Ketchum (1972):
 - ▲ Commercial and Industrial
 - ▲ Residency and Recreation
 - ▲ Agriculture, Aquaculture and Fishing
 - ▲ Military and Strategic
 - ▲ Conservation
 - ▲ Waste Disposal
- ▲ Harbour porpoise habitat usage:
 - ▲ Feeding
 - ▲ Breeding
 - ▲ Resting
 - ▲ Socialising
 - ▲ Migrating corridors between critical habitats



Coastal User Conflict

HP Uses ► Coastal uses ▼	Feeding	Breeding/Rearing	Resting	Socialising	Corridors
Commercial and Industrial	■	■	■	■	■
Residency and Recreation	■	■	■	■	■
Agriculture, Aquaculture and Fishing	■	■	■	■	■
Military and Strategic		■	■	■	
Conservation	■	■	■	■	■
Waste Disposal	■	■			



Mitigation

▲ Industry:

- ▲ Avoid piling during calving season
- ▲ Soft starts
- ▲ Air bubble curtains

▲ Fisheries:

- ▲ Good working relations
- ▲ Transparency → Bycatch → alerting devices

▲ Tourism:

- ▲ Voluntary Codes of Conduct
- ▲ Speed restrictions → 20m contour
- ▲ Restricted access

▲ Marine Spatial Planning

