



Environmental Issues and Research Skills

Session Outline

- **Session 1** - Presentation – overview of marine pressures using Harbour porpoises *Phocoena phocoena* as a bio-indicator
- **Session 2** – data workshop using raw porpoise data and strandings information

Bycatch

Infanticide

Pollution

**Population
Monitoring**

**Over -
fishing**

**Habitat
Degradation**

Bio-Indicators



Why monitor them?

- Bio indicators
- Marine organisms at every trophic level are increasingly under pressure from anthropogenic activities
- Economic – tourism & conservation drive
- Ethics

STRANGERS TO THESE SHORES



Whales and dolphins recorded in the UK and Ireland since 1950

- Atlantic white-sided dolphin
- Beluga
- Blainville's beaked whale
- Blue whale
- Bottlenose dolphin
- Common dolphin
- Cuvier's beaked whale
- False killer whale
- Fin whale
- Fraser's dolphin
- Gervais' beaked whale
- Harbour porpoise
- Humpback whale
- Killer whale
- Long-finned pilot whale
- Minke whale
- Narwhal
- Northern bottlenose whale
- Northern right whale
- Pygmy sperm whale
- Risso's dolphin
- Sei whale
- Sowerby's beaked whale
- Sperm whale
- Striped dolphin
- True's beaked whale
- White-beaked dolphin

Amanda Truett

The Sea Watch Foundation

(11 Jersey Road, Oxford
OX4 4RT

☎ 01865 717276 website:

www.seawatchfoundation.org.uk

is a marine environmental research charity responsible for monitoring whale and dolphin populations around the UK and the conservation threats they face.

Mark Holmes

Impacts of Climate Change?

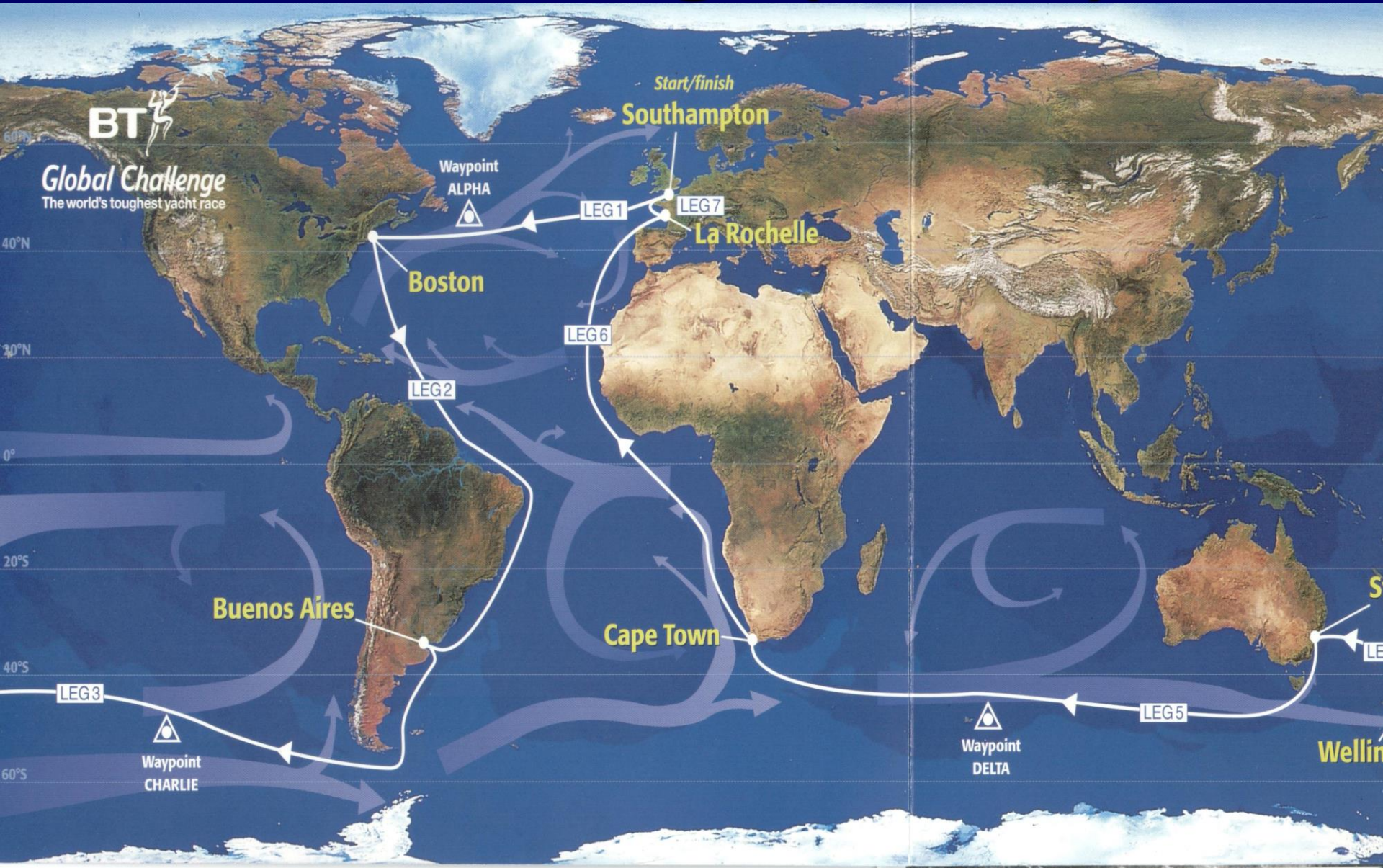
- Seawatch Foundation
- Marine Conservation Society
- WWF

British Steel/BT Global Challenge



- Every 4 years
- Yachts
- 30,000 miles
- East to West
- Data collection
- Is climate change having an effect on distribution?
- El Nino

BT Global Challenge (2000/1)

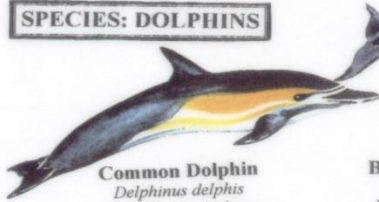


Methodology

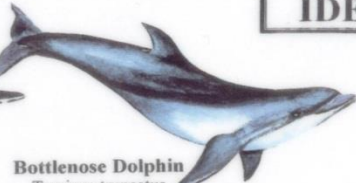
- 51 Indicator Species.
- Detailed File.
- Logs:
 - Cetacean;
 - Seabird;
 - Day.
- Field Key.
- 5 Yachts participated.
- Training given.
- Submission of Logs.
- Queries

Field Key

SPECIES: DOLPHINS



Common Dolphin
Delphinus delphis
N. and S. hemisphere



Bottlenose Dolphin
Tursiops truncatus
N. and S. hemisphere



Atlantic White-Sided Dolphin
Lagenorhynchus acutus
N. hemisphere



Atlantic Spotted Dolphin
Stenella frontalis
N. and S. hemisphere



Striped Dolphin
Stenella coeruleoalba
N. and S. hemisphere



Long-Snouted Spinner Dolphin
Stenella longirostris
N. and S. hemisphere



Short-Snouted Spinner Dolphin
Stenella clymene
N. hemisphere



Pantropical Spotted Dolphin
Stenella attenuata
N. and S. hemisphere



Dusky Dolphin
Lagenorhynchus obscurus
S. hemisphere



Hector's Dolphin
Cephalorhynchus hectori
S. hemisphere



Southern Rightwhale Dolphin
Lissodelphis peronii
S. hemisphere



Risso's Dolphin
Grampus griseus
N. and S. hemisphere



White Beaked Dolphin
Lagenorhynchus albirostris
N. hemisphere



Harbour Porpoise
Phocoena phocoena
N. hemisphere

SPECIES: WHALES



Sperm Whale
Physeter macrocephalus
N. and S. hemisphere



Minke Whale
Balaenoptera acutorostrata
N. and S. hemisphere



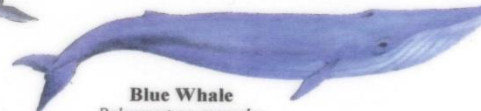
Fin Whale
Balaenoptera physalus
N. and S. hemisphere



Sei Whale
Balaenoptera borealis
N. and S. hemisphere



Killer Whale
Orcinus orca
N. and S. hemisphere



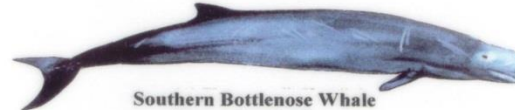
Blue Whale
Balaenoptera musculus
N. and S. hemisphere



Humpback Whale
Megaptera novaeangliae
N. and S. hemisphere



Short-Finned Pilot Whale
Globicephala macrorhynchus
N. and S. hemisphere



Southern Bottlenose Whale
Hyperoodon planifrons
S. hemisphere



Southern Right Whale
Eubalaena australis
S. hemisphere

Species File

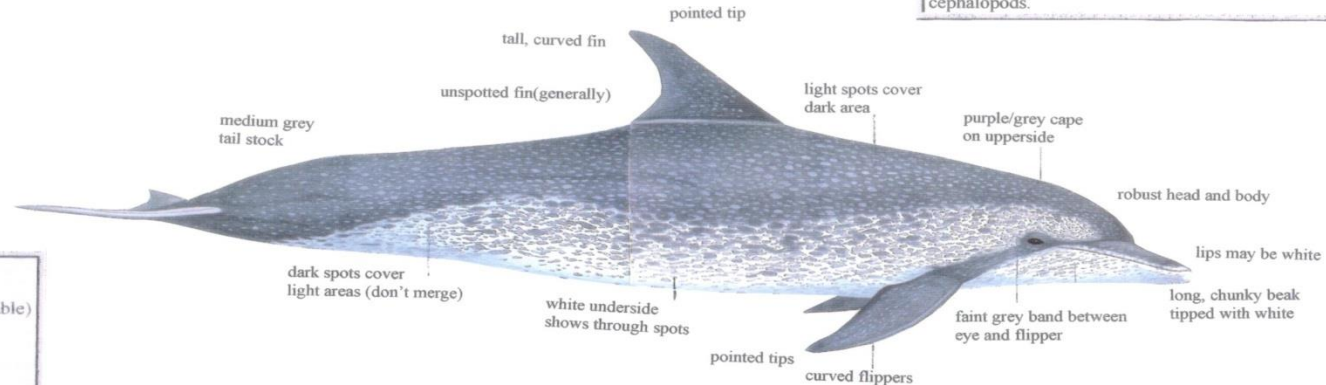
Atlantic Spotted Dolphin

Stenella frontalis

The Atlantic Spotted Dolphin closely resembles the Pantropical Spotted Dolphin, but it differs by being slightly more robust and having a pale streak on each shoulder. They also have distinct spots on the underside which do not merge. In a mixed school, with multi-aged dolphins, the older ones can be distinguished by the extensive spotting. In the Eastern Caribbean, fishermen still hunt these dolphins for food and like many others, they also fall victim to purse-seine nets. Yet locally, their status is common.

Behaviour

These dolphins are very active at the surface. A fast and energetic swimmer, this dolphin frequently breaches. This behaviour is most often exaggerated while feeding. They are avid bow-riders and like to play at every opportunity. Group sizes tend to be between 5 and 15. Temporarily, others may join the school. There appears to be a fairly fluid structure to the schools, with dolphins often joining and splitting up into sub-groups. Yet the bonding seems to be fairly complex and studies have suggested that individual recognition occurs. Diet comprises of small fish and cephalopods.



ID Checklist

- Robust head and body
- Adults heavily spotted (variable)
- Long, white-tipped beak
- 3-toned colour pattern
- Tall, curved fin
- Dark grey/purple cape
- Very active at surface

An adult can reach a length of 2.3m, and can weigh between 100-140kg.

Colour Variations



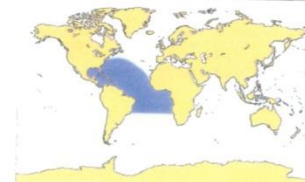
Flukes

- Slight notch in middle.
- Flukes usually unspotted
- Pointed tips



Distribution

As the name suggests, this dolphin is only found in the Atlantic, where it is found mainly in warm waters. Data from the area around South America and West Africa is poorly documented and so the distribution could be more extensive than the map would indicate. There have also been recent sightings around the Azores and so this species could extend further north on the Eastern side as well. As with the Pantropical Spotted Dolphin, there are two groups: one offshore and one coastal. The offshore one is more robust.



Data Collection



DAY LOG: LEG 1 SOUTHAMPTON – BOSTON

(Please record even when you don't see anything)

DATE: TIME:
POSITION: YACHT:
CREW NAME:

WEATHER:

WIND/SEA CONDITIONS:

SEA DEPTH: (m)

SEA TEMPERATURE: °C

AIR TEMPERATURE: °C

OBSERVATIONS:

- Cetaceans: Number Species
- Seabirds: Number Species
- Pollution details:
.....
.....
- Any other activities in vicinity (eg fishing, dredging):
.....

Data Collection

CETACEAN SIGHTINGS: LEG 1 SOUTHAMPTON - BOSTON

DATE: TIME:
POSITION: BOAT'S HEADING:
YACHT: CREW NAME:

(Tick one where appropriate and circle further options if required)

SIZE: ☐ Up to 3m ☐ 3-10m ☐ over 10m

DORSAL FIN PRESENT: ☐ YES ☐ NO IF YES, POSITION OF FIN :

BODY SHAPE: ☐ ROBUST ☐ LONG, STREAMLINED ☐ BLUNT SNOUT

HEAD SHAPE: ☐ ROUNDED ☐ BEAK ☐ POINTED MUZZLE

COLOUR & MARKINGS ON BACK: ☐ GREY ☐ BLUE ☐ BLACK ☐ BROWN ☐ SCARRING

COLOUR & MARKINGS ON FLANKS: ☐ GREY ☐ BLUE ☐ BLACK ☐ STRIPED

.....
Please note any stripes or patches of light or dark; describe general pigmentation

BLOW: ☐ HEARD BUT NOT SEEN ☐ SEEN AND HEARD ☐ NOTHING

.....
Please note any details, i.e shape/angle of blow and height if observed

FLUKES: Is there a distinct notch in middle of flukes ☐ YES ☐ NO

BEHAVIOUR:

☐ SLOW/NORMAL SWIMMING – leisurely surfacing with no splash

☐ FAST SWIMMING – rapid surfacing

☐ DIRECTION OF MOVEMENT (generally) ☐ NORTH ☐ SOUTH ☐ EAST ☐ WEST

☐ FEEDING – changing direction as if in pursuit or prey seen in vicinity

☐ LEAPING/SPLASHING – tail or fin slapping, breaching, spyhopping (circle appropriate ones)

IF BREACHING, HOW MANY TIMES:

☐ BOW-RIDING – riding the bow wave of vessels

☐ RESTING – lying motionless at the surface

☐ TIMID – shy or indifferent to the boat's presence

ESTIMATED NUMBER OF GROUP: ☐ 1-15 ☐ 15-50 ☐ 50+

SEA TEMPERATURE:°C WATER DEPTH:(m)

ICE IN VICINITY: LOCATION: ☐ NOT APPLICABLE

WEATHER CONDITIONS:
Please note wind speed, precipitation, visibility etc

SWELL HEIGHT: ☐ Light (0-1m) ☐ Moderate (1-2m) ☐ Heavy (2+m)

POSSIBLE IDENTIFICATION OF CETACEAN:

SEABIRD SIGHTINGS: LEG 1 SOUTHAMPTON - BOSTON

DATE: TIME:
POSITION: YACHT:
CREW NAME:

(Tick where appropriate)

DESCRIPTION:

SIZE: ☐ Fat ☐ Skinny ☐ Long ☐ Short

SHAPE OF WINGS: ☐ Sharply angled ☐ Long & thin ☐ Straight ☐ Pointed

PREDOMINANT COLOUR: ☐ White ☐ Black ☐ Brown ☐ Blue

HEAD COLOURING: ☐ White ☐ Black ☐ Yellow ☐ Brown

ARE THE WINGS UNIFORMLY COLOURED: ☐ Yes ☐ No
please note any markings or colourings

SHAPE OF THE BEAK: ☐ Short & stocky ☐ Long & slender ☐ Long & robust

SHAPE OF THE TAIL: ☐ Pointed ☐ Wedge-shaped ☐ Rounded ☐ Square ☐ Notched ☐ Forked

COLOUR OF THE TAIL: ☐ Black-tipped ☐ All white ☐ Black outer feathers

FLIGHT: WHAT IS THE FLIGHT PATTERN:

☐ Gliding on stiff, outstretched wings, occasionally flapping

☐ Flapping and gliding, twisting and banking

☐ Circling and zigzagging above the waves

☐ Pattering a few inches from the surface

HABIT: DOES THE BIRD APPEAR:

☐ In large flocks ☐ Individually ☐ In pairs

FEEDING:

☐ Harasses other birds ☐ Follows ships/boats ☐ Dives into water from a great height

☐ Dives from the surface

SEA TEMPERATURE:°C WATER DEPTH:(m)

ICE IN VICINITY: LOCATION: ☐ NOT APPLICABLE

WEATHER CONDITIONS:
Please note wind speed, precipitation, visibility etc

SWELL HEIGHT: ☐ Light (0-1m) ☐ Moderate (1-2m) ☐ Heavy (2+m)

POSSIBLE IDENTIFICATION OF SEABIRD:

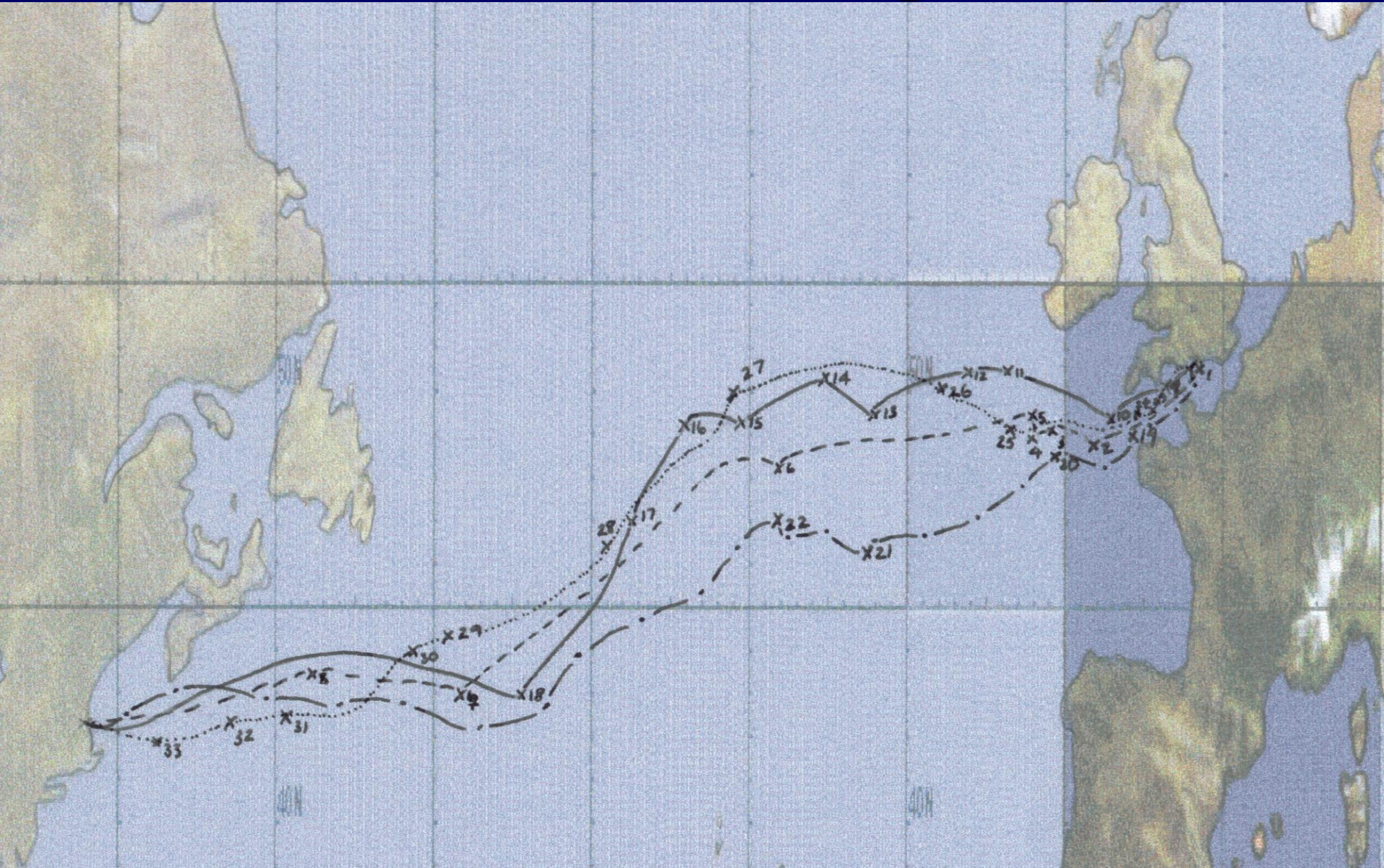
Results of Leg 1

DATE	POSITION	SEA TEMP	DOLPHIN	WHALE	SEABIRD
Yacht TeamSpirIT (TS)					
11.09.00	50 10.80N 03 30.00W	17°C			Northern Gannet (<i>Morus bassanus</i>) (1)
12.09.00	48 51.00N 09 02.00W	17°C	Common Dolphin (<i>Delphinus delphis</i>) (25)		
13.09.00	49 26.00N 10 57.00W	17°C	Common Dolphin (20)		Southern Giant Petrel (<i>Macronectes giganteus</i>) (3)
15.09.00	49 35. 00N 12 07.00W	17°C	White Beaked Dolphin (1) (<i>Lagenorhynchus albirostris</i>) Common Dolphin (25)		Wilson's Storm Petrel (<i>Oceanites oceanicus</i>) (15)
17.09.00	49 10.00N 12 07.00N	18°C		Sperm Whale (<i>Physeter macrocephalus</i>) (1) Pilot Whale (<i>Globicephala macrorhynchus</i>)(15)	Wilson's Storm Petrel (10)
18.09.00	48 19.38N 28 45.97W	18°C	Common Dolphin (20)		
24.09.00	43 20.00N 48 02.00W	11°C	Common Dolphin (50)	Pilot Whale (20)	Wilson's Storm Petrel (50)
26.09.00	43 52.00N 57 06.00W	17°C	Common Dolphin (30)	Unidentified whale	
Yacht Save The Children (STC)					
11.09.00	50 00.01N 4 12.60W	18°C			Northern Gannet (2)
12.09.00	49 54.20N 7 11.01W	16°C	Bottlenose Dolphin (<i>Tursiops truncatus</i>) (15) Harbour Porpoise (<i>Phocoena phocoena</i>) (3)		Northern Gannet (1) Dusky Shearwater (<i>Puffinus obscurus</i>)(50)
14.09.00	50 47.50N 13 53.01W	16°C			Arctic Skua (<i>Stercorarius parasiticus</i>)(1)
15.09.00	50 55.40N 16 00.09N	16°C	Common Dolphin (1)	Sperm Whale (1)	Arctic Skua (1)
16.09.00	49 55.80N 22 22.30W	16°C	White Beaked Dolphin (1)	Sperm Whale (2)	
17.09.00	50 18.90N 25 36.40W	16°C	Common Dolphin (2)		
18.09.00	49 35.67N 30 29.17W	16°C	Common Dolphin (20)		Northern Fulmar (<i>Fulmarus glacialis</i>) (20) Arctic Skua (2)
19.09.00	49 37.20N 34 32.70W	16°C	Common Dolphin (8)		Northern Fulmar (100)
20.09.00	47 09.90N 37 49.40N	16°C	Common Dolphin (1)		
23.09.00	43 20.00N 44 41.00W	14°C	Striped Dolphin (<i>Stenella coeruleoalba</i>) (50)		

Results Leg 1

- Data collated from Day Logs, Cetacean Logs and Seabird Logs.
- Sightings plotted.

Leg 1 – Locations of Sightings



Analysis

- Geographical location
- Many sightings not unusual (e g Harbour Porpoise / Bottlenose Dolphin)
- Atlantic Spotted Dolphin
- Striped Dolphin
- Short Snouted Spinner Dolphin
- Southern Giant Petrel

Results Overview



- Full race results collated
- Compared with British Steel Challenge 1992/3; BT Global Challenge 1996/7.
- Unusual observations in geographical distribution.
- Last Challenge race – 3rd October 2004 – Global Challenge 2004/5
- PhD research – *Phocoena phocoena*

PhD Research



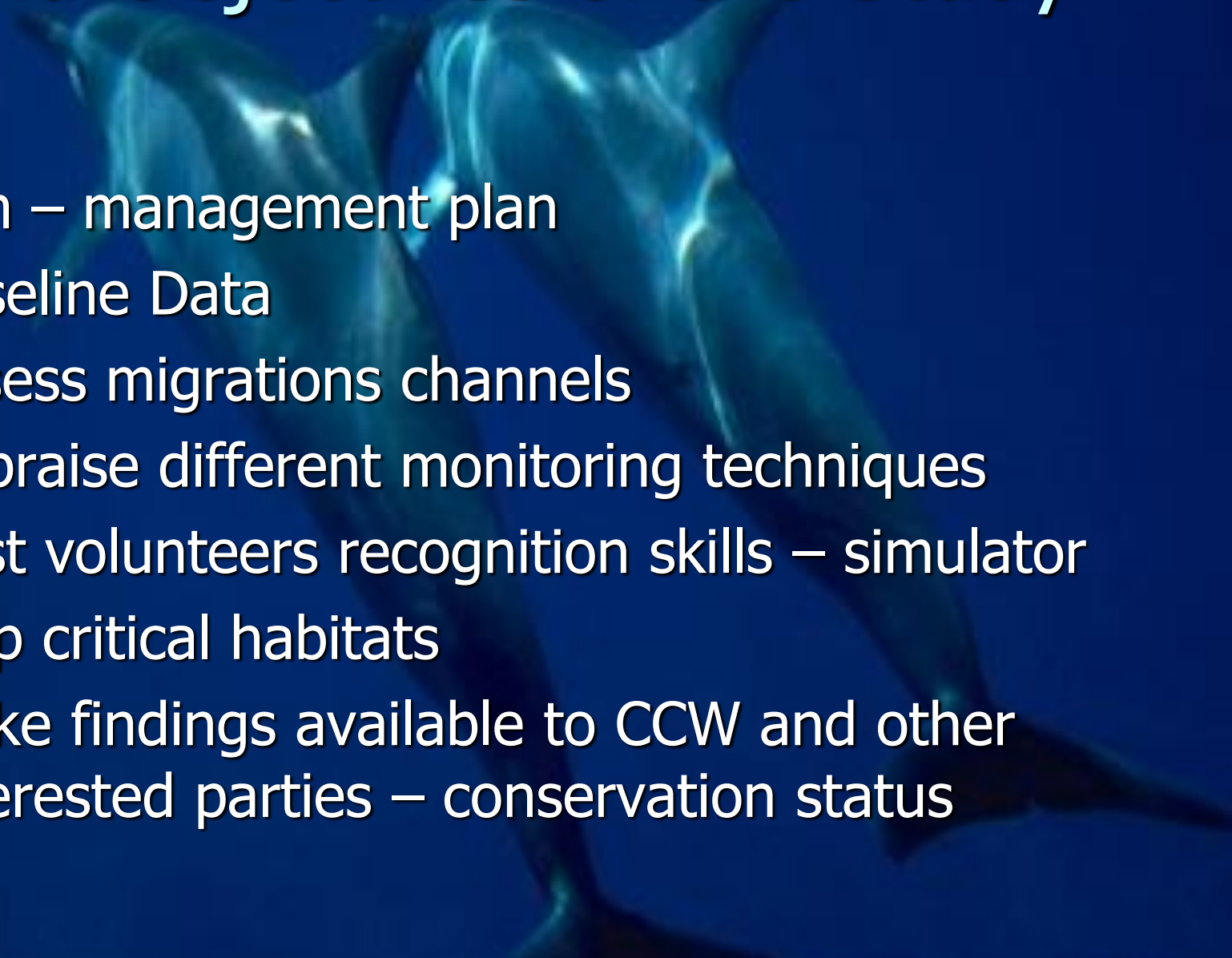
- Focus - Harbour Porpoise
- CCW and Local Authority match funding
- Geographical area Swansea Bay, Gower and Carmarthen Bay
- Land, boat and aerial surveys – baseline data

Harbour porpoise *Phocoena phocoena*



Smallest and most
regularly seen
cetacean in our waters

Aim and Objectives of the Study

A background image showing two dolphins swimming underwater. The dolphins are dark in color, and the water is a deep blue. The dolphins are positioned diagonally across the frame, with one slightly ahead of the other.

- Aim – management plan
- Baseline Data
- Assess migrations channels
- Appraise different monitoring techniques
- Test volunteers recognition skills – simulator
- Map critical habitats
- Make findings available to CCW and other interested parties – conservation status

IDEAL SCENARIO



(Jenkins, 2003)



(Fairbairns, 2004)



(Robinson, 2004)



(Bruinvissen, 2003)

REALITY



(Jenkins, 2003)

Marine Mammal Sightings



3 Porpoises at Oxwich

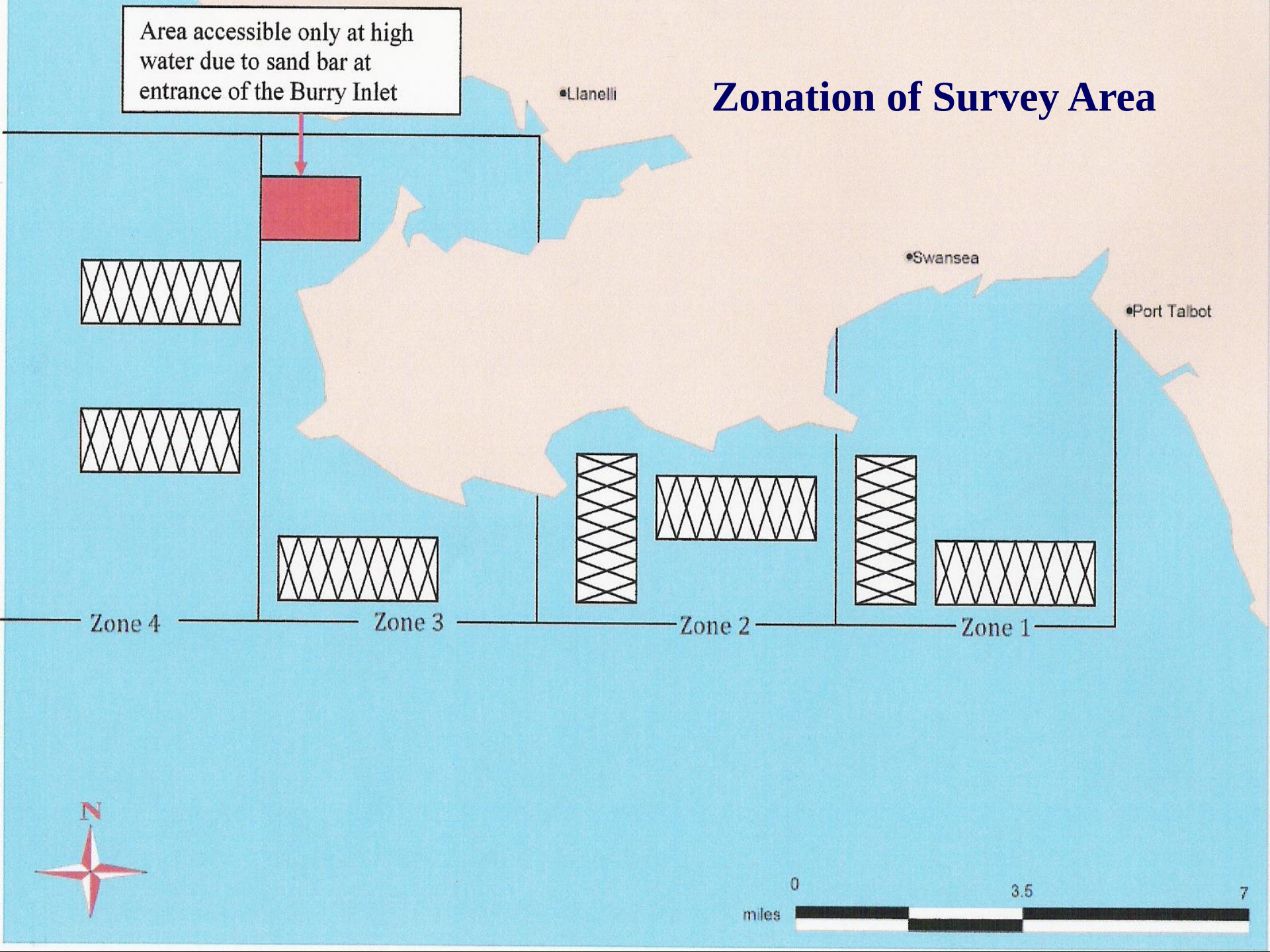


Data Validation

- Recorder variability – ameliorated by training (Baines *et al.*, 1997)
- Training days and pilot study
- Challenge crew training successful
- Ocean Eye – simulator experiment

Area accessible only at high water due to sand bar at entrance of the Burry Inlet

Zonation of Survey Area



Shore-based Surveys

- Constant effort watches
- Locations – Mumbles Head, Port Eynon Point, Oxwich Point and Burry Holms







RIVER TWE BARRAGE

RV NOCTILUCA

Vessel-Based Transects

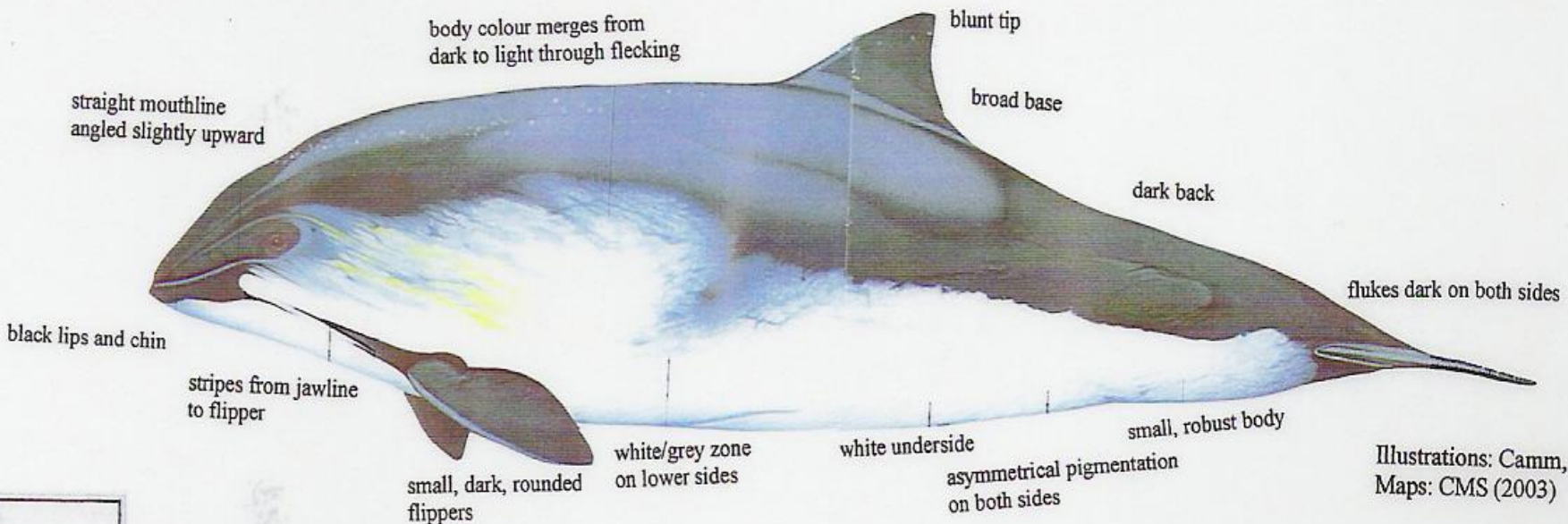


Aerial Surveys



Phocoena phocoena

- 1.5m –2.0m long / 85kg
- Robust
- Countershading



Illustrations: Camm, M. (1995)
Maps: CMS (2003)

'Puffing pig' – *Porcus piscus* - Identification

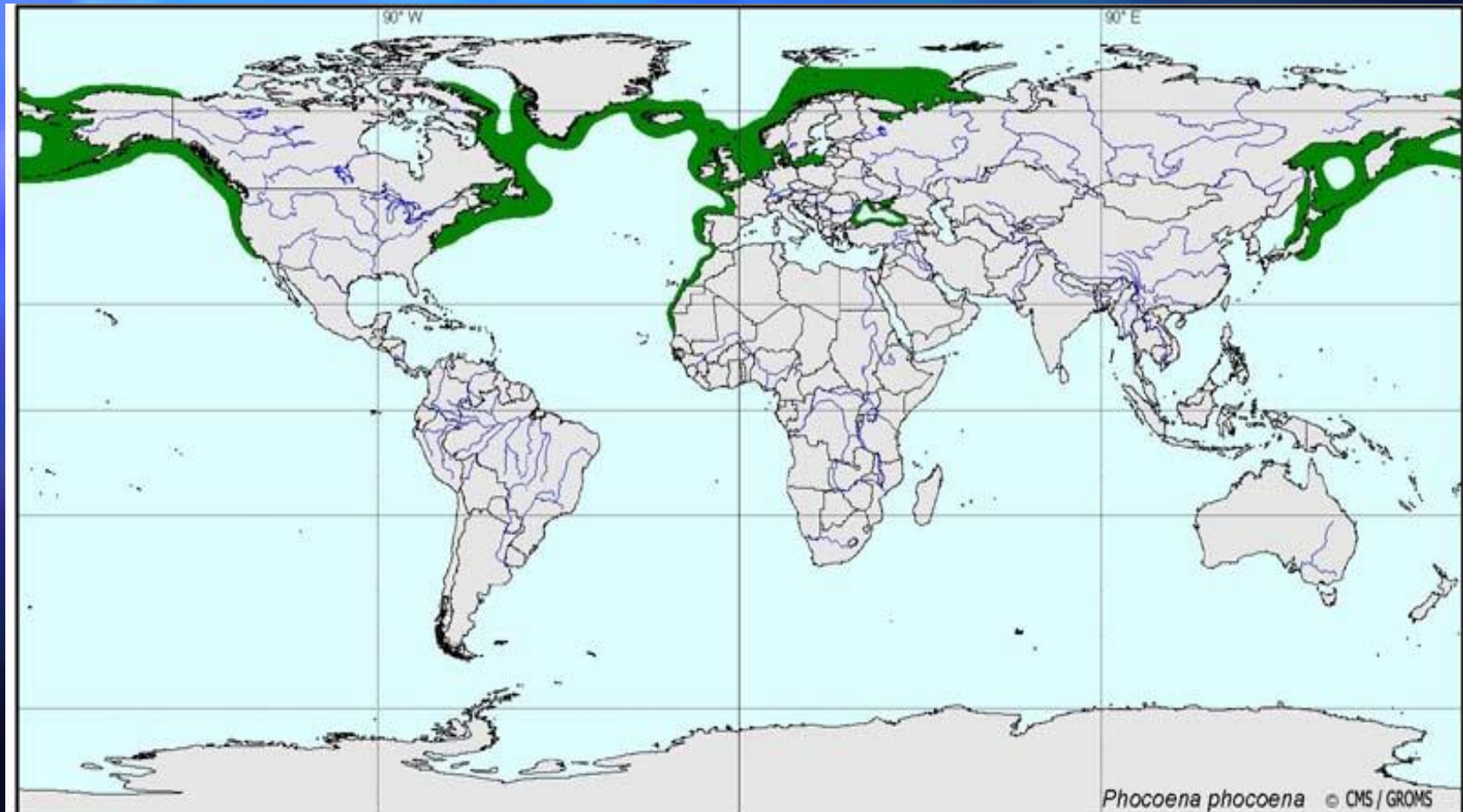
- Puffing at surface
- Slow rolling swim action
- Small triangular dorsal fin
- 15-24 years
- High productivity, low investment strategy
- Young evolution rapid – cold environment

Monitoring

- 90% time below surface
- 76% time actively foraging
- Echolocation
- Need to surface to breathe – methodologies derived

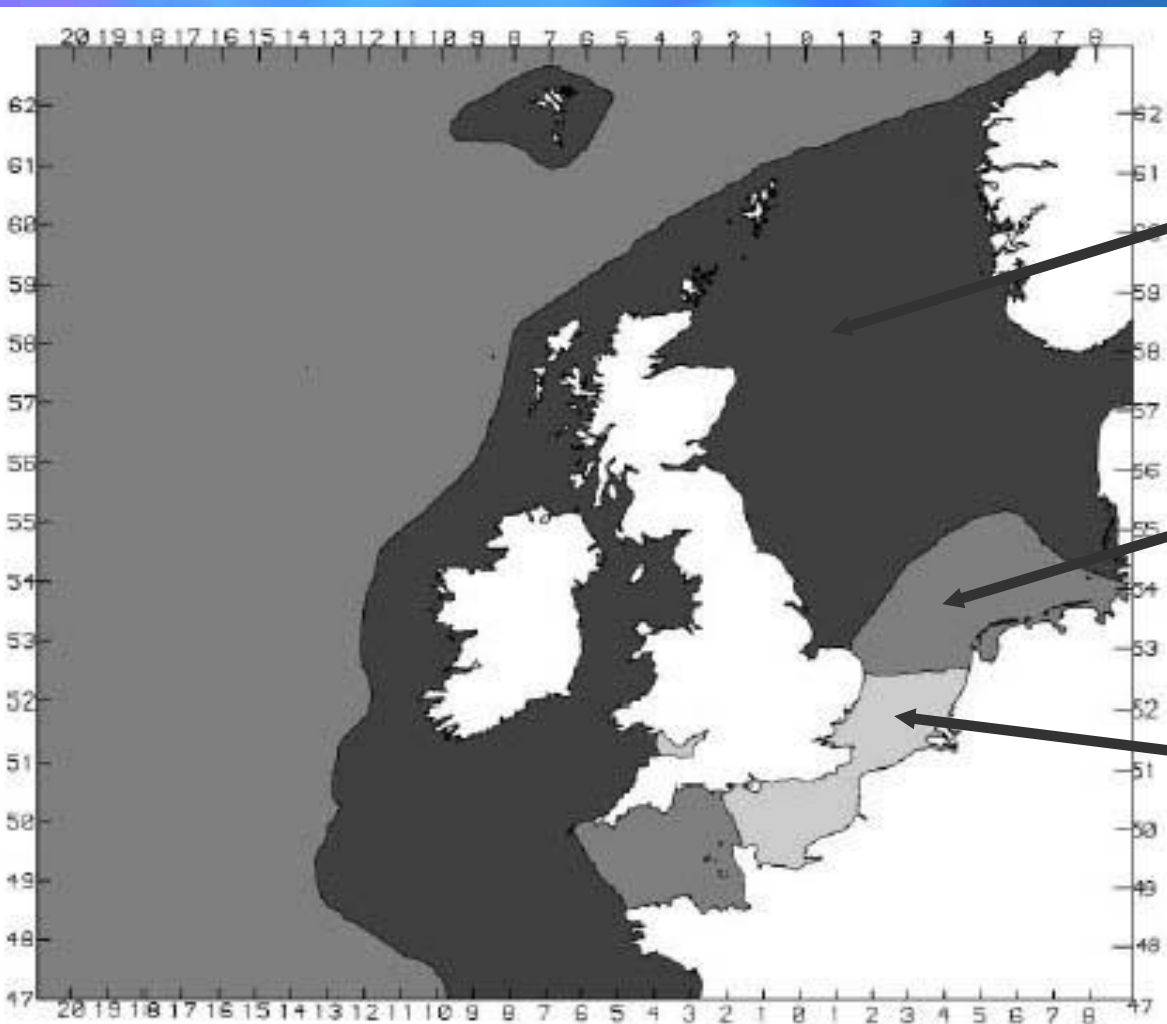


Distribution: Global





Distribution: UK



Key

Regular, common or fairly common

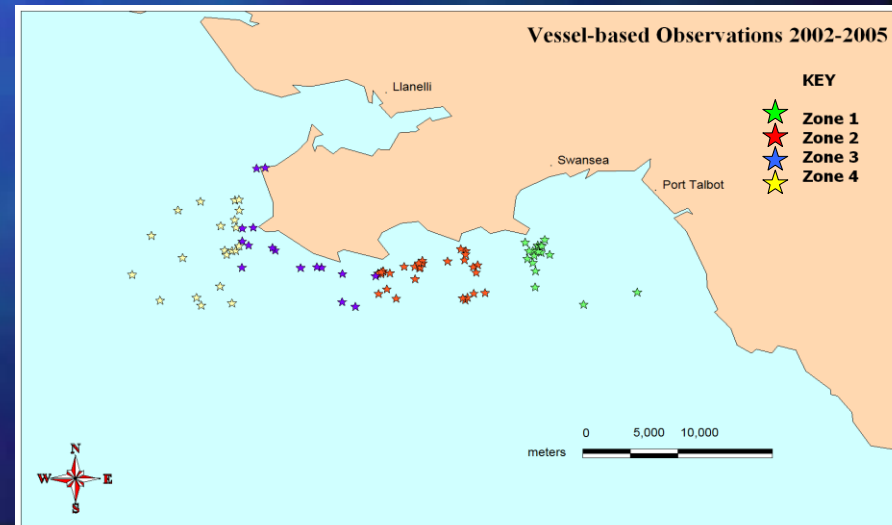
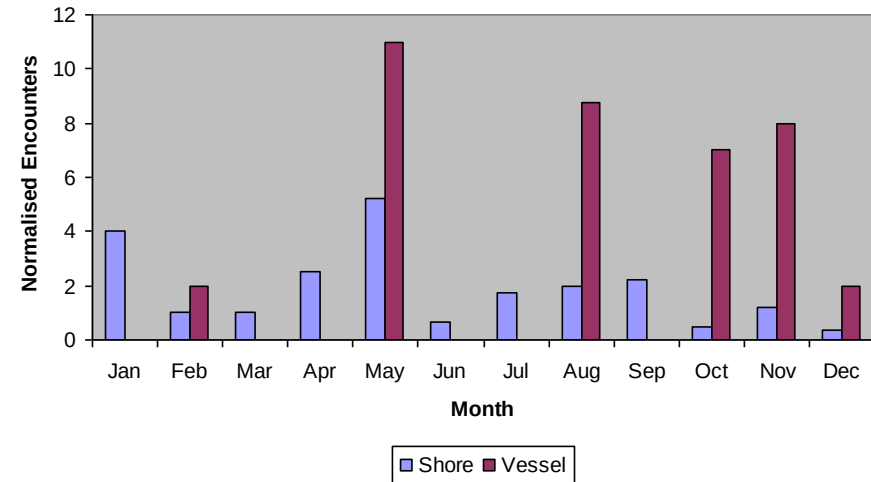
Occasional

Casual or absent

Key Findings

- Resident inshore population
- Stranding evidence
- Watkins and Colley (2004)

Temporal distribution of porpoise encounters (2002-2005)

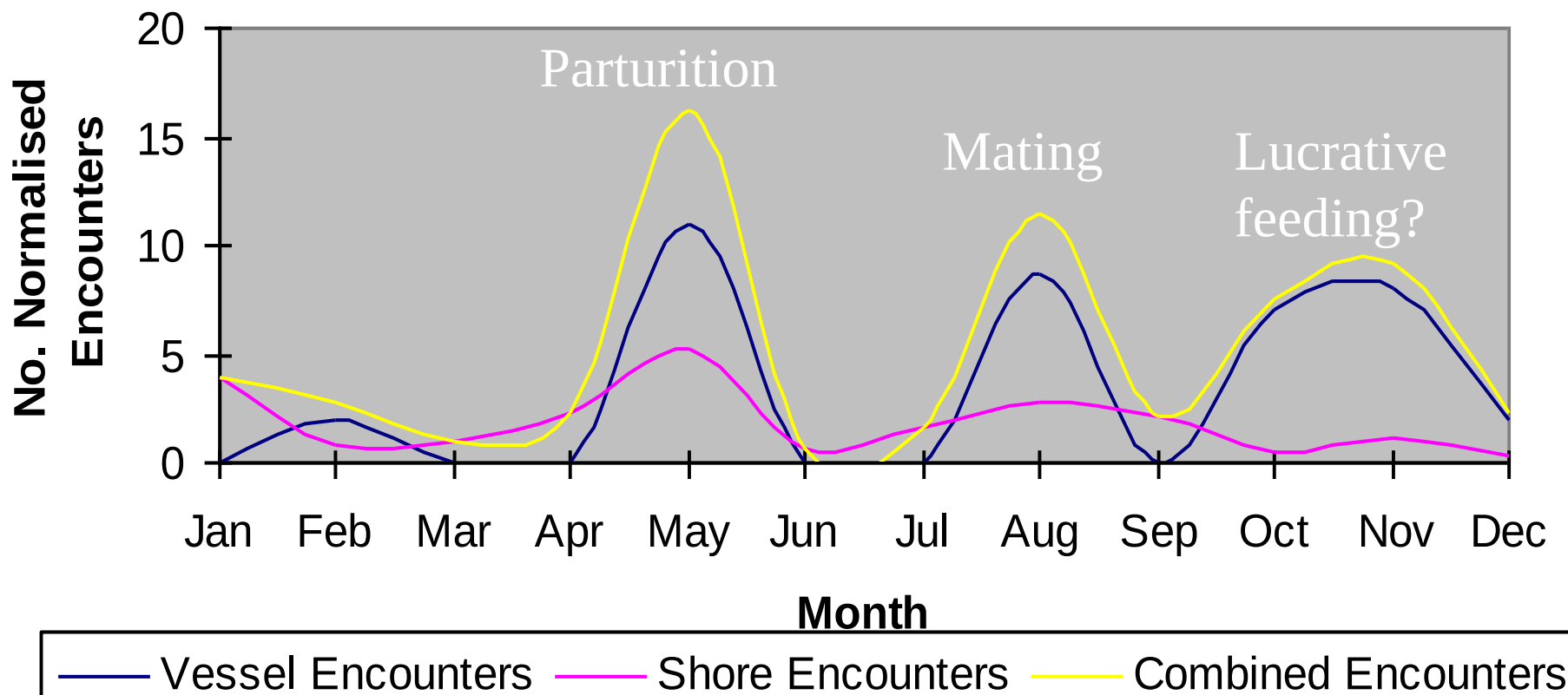


Reproductive Timing

- Parturition – May and August
- Within several weeks of calving, mating takes place again
- Coastal distribution
- Males and immature females migrate

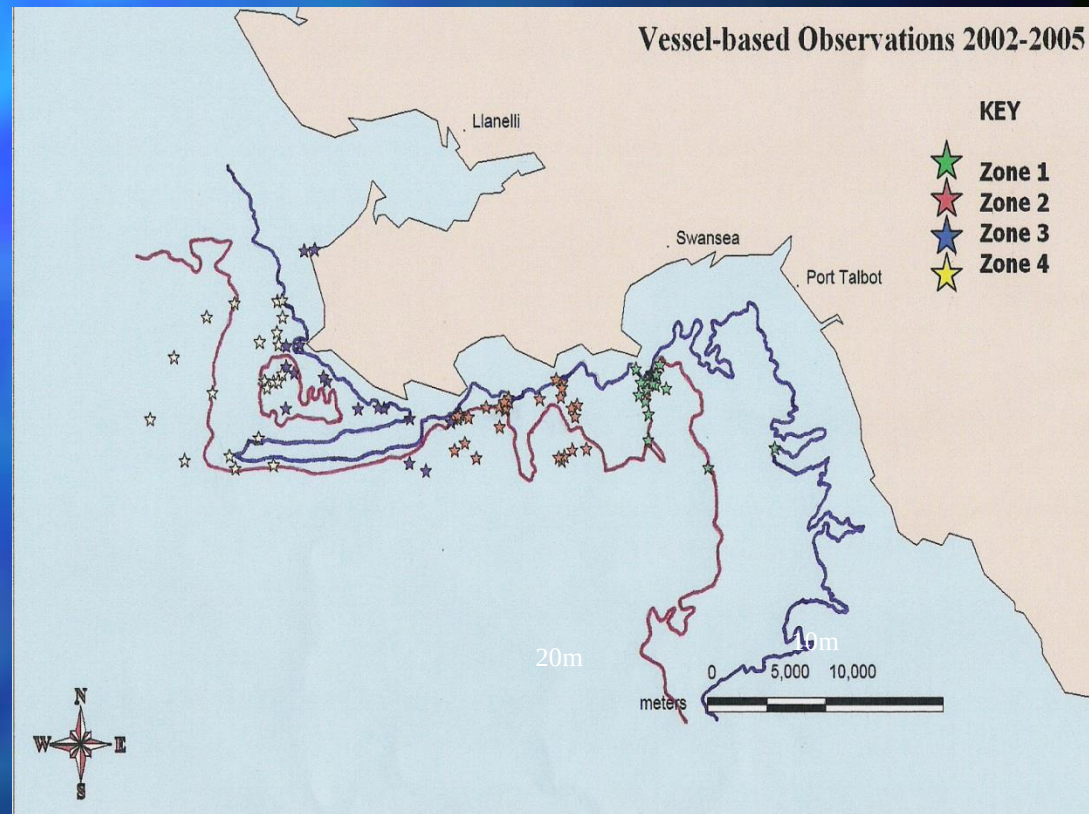
Porpoise Habitat Use

Inshore habitat use of porpoises in this area



Depth Contours and Vessel Observations

- Affinity with 20m contour
- 70% dives <20m (Westgate *et al.*, 1995)
- Camphuysen (2004)



Feeding

- Herring *Clupea harengus* - weirs
- Whiting *Merlangius merlangus*, Sand eels *Ammodytes tobianus* – lipid rich
- Crustaceans
- Geographical variations



Feeding Behaviour

- Best documented from shore
- Milling, rapid porpoising, circling, zig zagging,
- Association with seabirds
- Tidal races, strong currents, bathymetry
- Solitary – no group herding



Behavioural Analysis

- 47 completed ethograms – 39 analyses as >15min duration (Ribeiro et al., 2004)
- **Event:** activity of short duration
- **State:** prolonged activities

- Mumbles – Feeding
- Oxwich – Socialising and Nursery ground
- Limekiln Point – Breeding and Feeding
- Circling increased throughout the year in both Mumbles and Oxwich
- Negative responses to vessels

Stranding analysis

- Limiting weather conditions (Penrose and Pierpoint, 1999, Baumgartner *et al.*, 2006)
- Assess nursery grounds
- Resident population



(Ellis, 2004)

Over-fishing

Bycatch

Infanticide

Pollution

**Population
Monitoring**

**Habitat
Degradation**

Bio-Indicators



The Legacy of Overfishing

- Largest impact on world's oceans
- Unsustainable harvesting
- Immature
- Overcapacity
- One in every 4 fish caught is wasted
- Bycatch!



Atlantic Dawn



**The Atlantic Dawn
catches in one
month what 7,000
artisan fishermen
would catch in a
good year.**



Fishing Industry



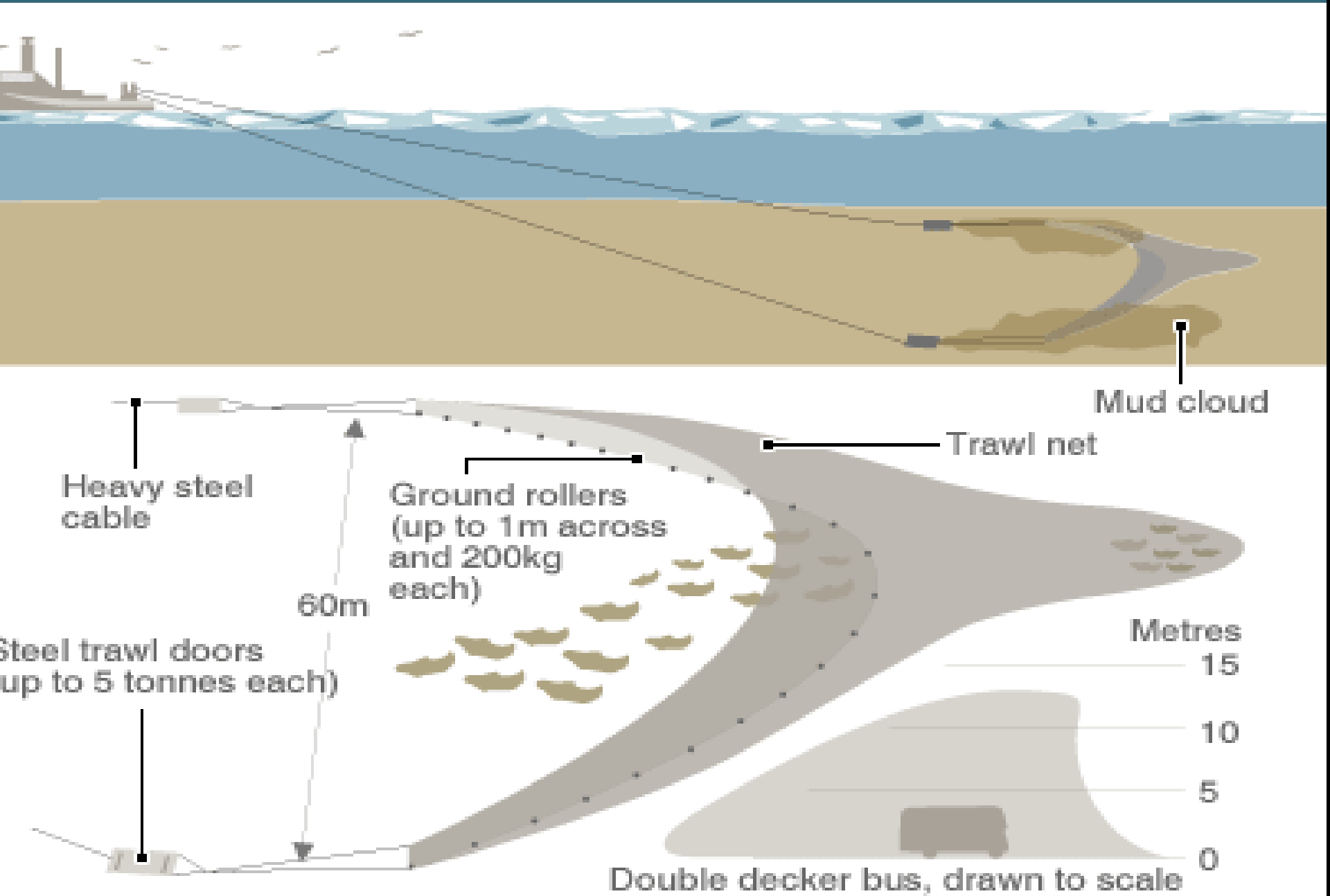
- 1% global economy
- 200 million people
- Increased capacity
- Poor management and regulations
- Lack of baseline on many species
- Ecosystem changes
- Predator switch

Fishing Statistics



- 2/3 over exploitation around UK
- Reduction in size of fish caught
- Demise albatross

HOW BOTTOM TRAWLING WORKS



Bycatch



- 29 million tonnes of fish, seabirds, turtles and marine mammals each year
- For every kg of sole by North Sea trawlers, 14kg other seabed fauna killed (McCarthy, 2015)

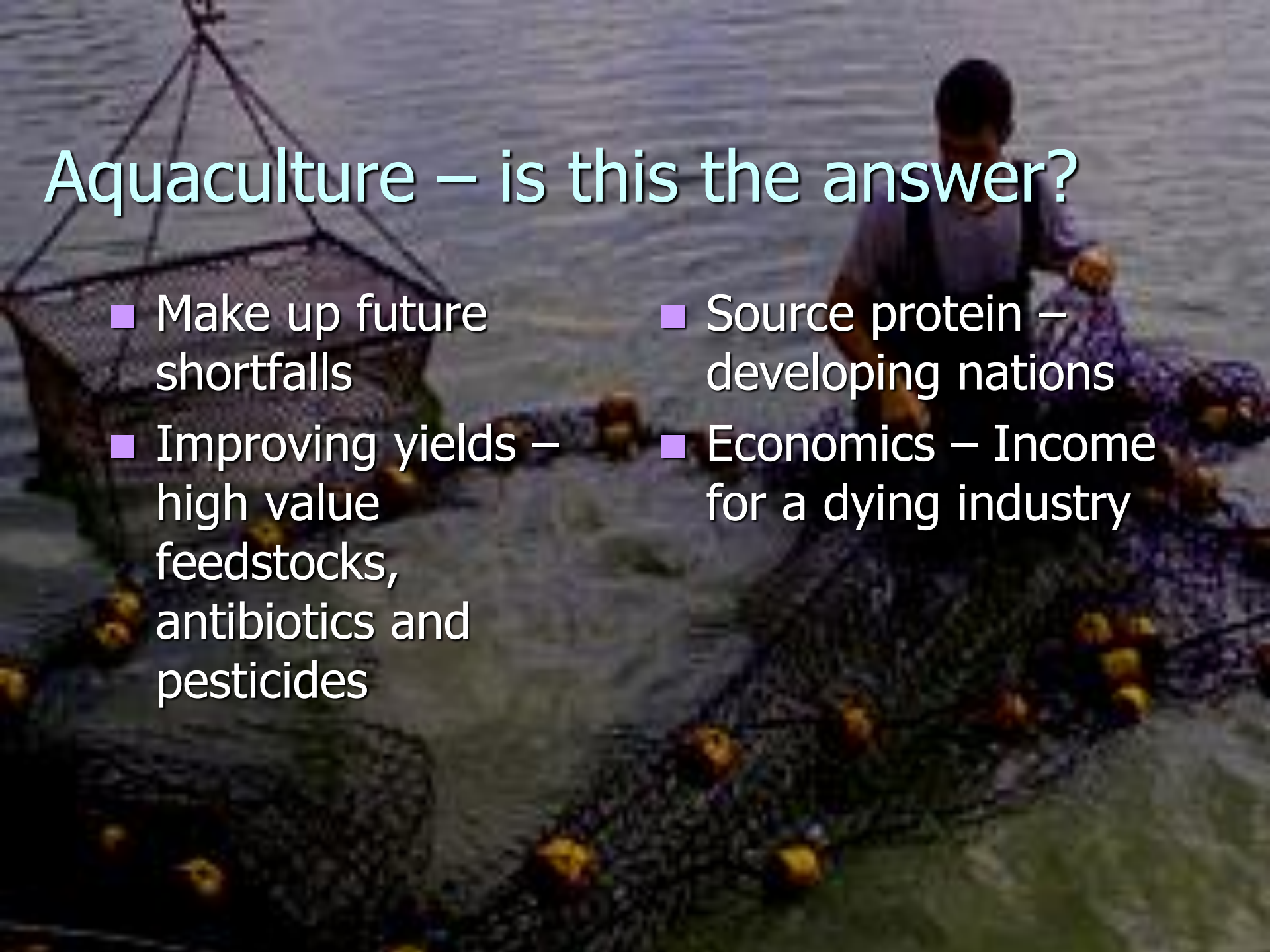
Aquaculture/Mariculture

- Cultivation aquatic species
 - Fin fish
 - Crustaceans
 - Molluscs
- By 2016 - ↑ production of farmed fish by 30 million tonnes (FAO, 2017)



Aquaculture – is this the answer?

- Make up future shortfalls
- Improving yields – high value feedstocks, antibiotics and pesticides
- Source protein – developing nations
- Economics – Income for a dying industry



How does Over-fishing/Mariculture affect *Phocoena phocoena*?

- Bycatch
- Boat collisions
- Habitat Degradation
- Resource depletion



Bycatch



- Between 1990 and 2002, 39 porpoises on Welsh beaches (Thomas, 2003)
- 6.2% of Celtic Sea harbour porpoises are killed each year in fishing nets (ECBC, 2002)
- 1.6% limit set (Defra & IWC, 1995)



Harbour Porpoise – Caswell Bay.
15/12/14

Harbour Porpoise – Sker Point



Bycatch



(Baines, 2003)

Boat Collisions

- A third of whales found dead display signs of a collision (Laist *et al.*, 2001)
- Some non-fatal
- Motorised and non-motorised vessels
- Calves & juveniles especially susceptible
- Feeding, mating, habituation

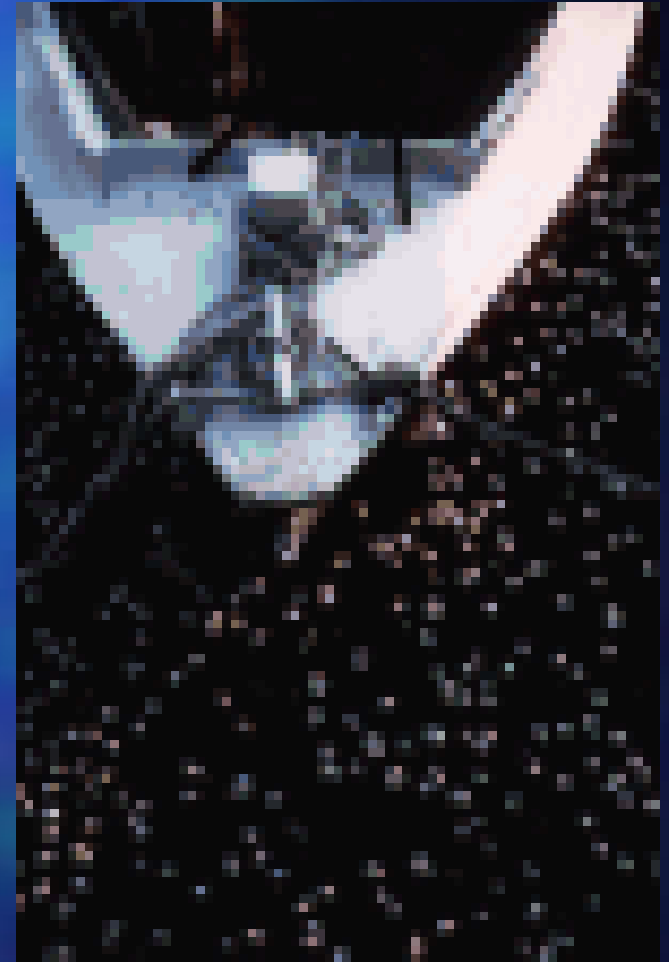




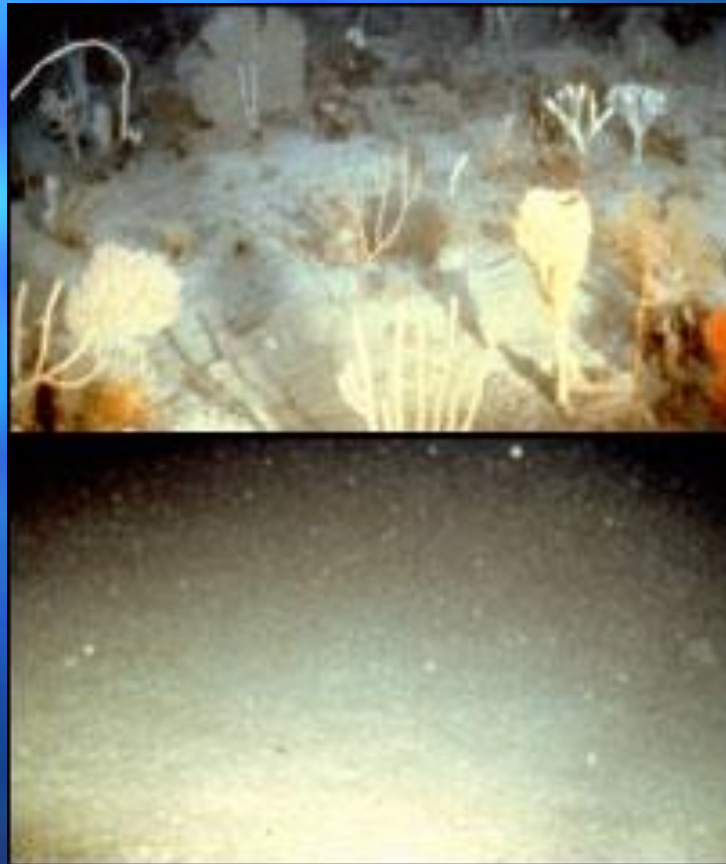
Boat Collisions (Jones, 2006)

Habitat Degradation

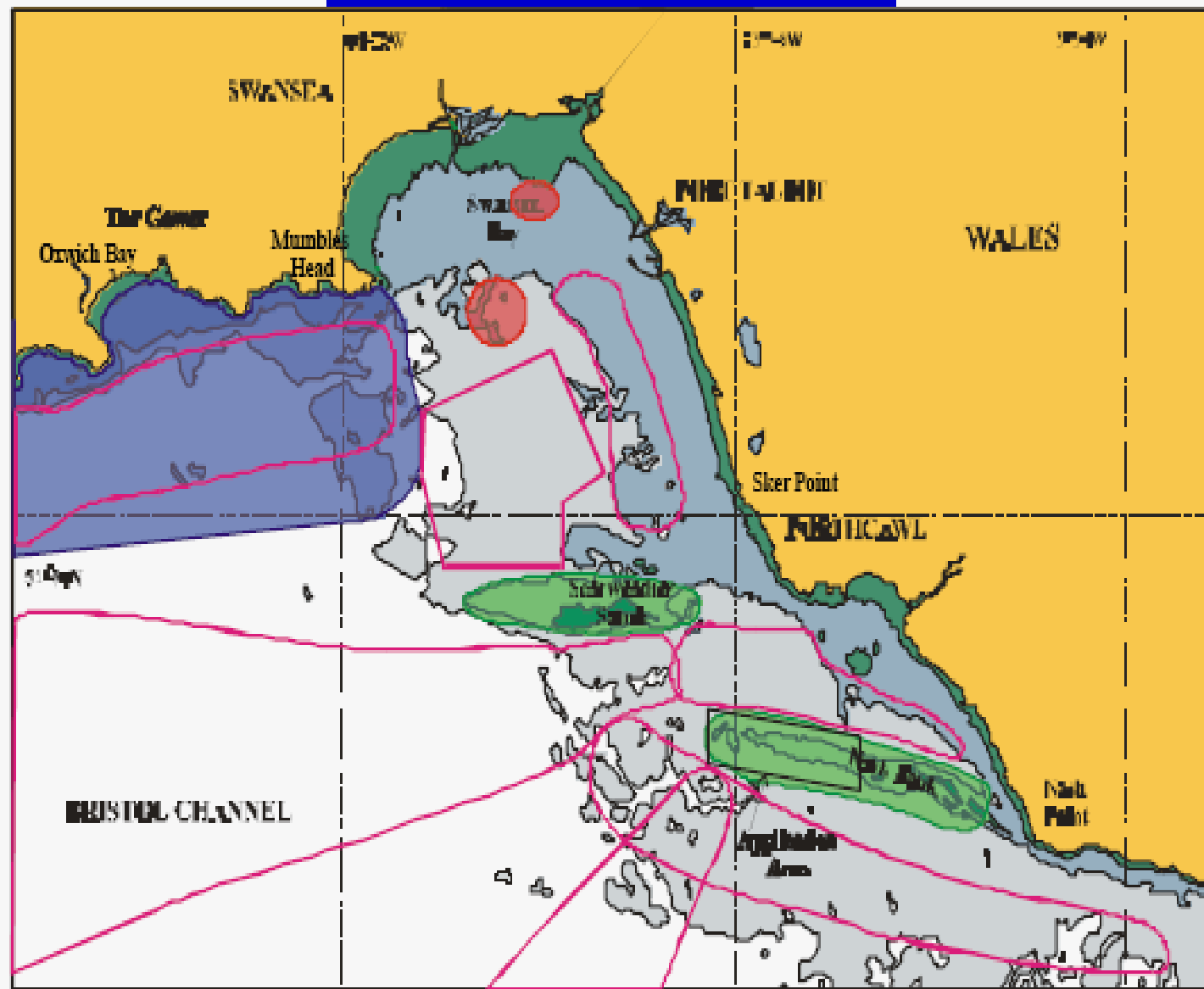
- Eutrophication:
 - 75% global population living in coastal zone in 2015 (UN, 2002)
 - Human pressures
 - Aquaculture
- Oil, sewage, heavy metals
- Pollution: via air, sea and prey



Habitat Degradation: Before and After Trawl



(Hanson, 1999)



KEY

- M.M.W.A.
- CHART DARTMOUTH
- 20m depth
- 20m depth
- 30m depth
- Areas where Drift Nets May be Laid
- Areas where Set Nets May be Laid
- Areas where Both Set and Drift Net May be Laid
- Principal Trawl Tows within Swansea Bay for Both Local and North Devon Vessels (>10metres & <10metres)

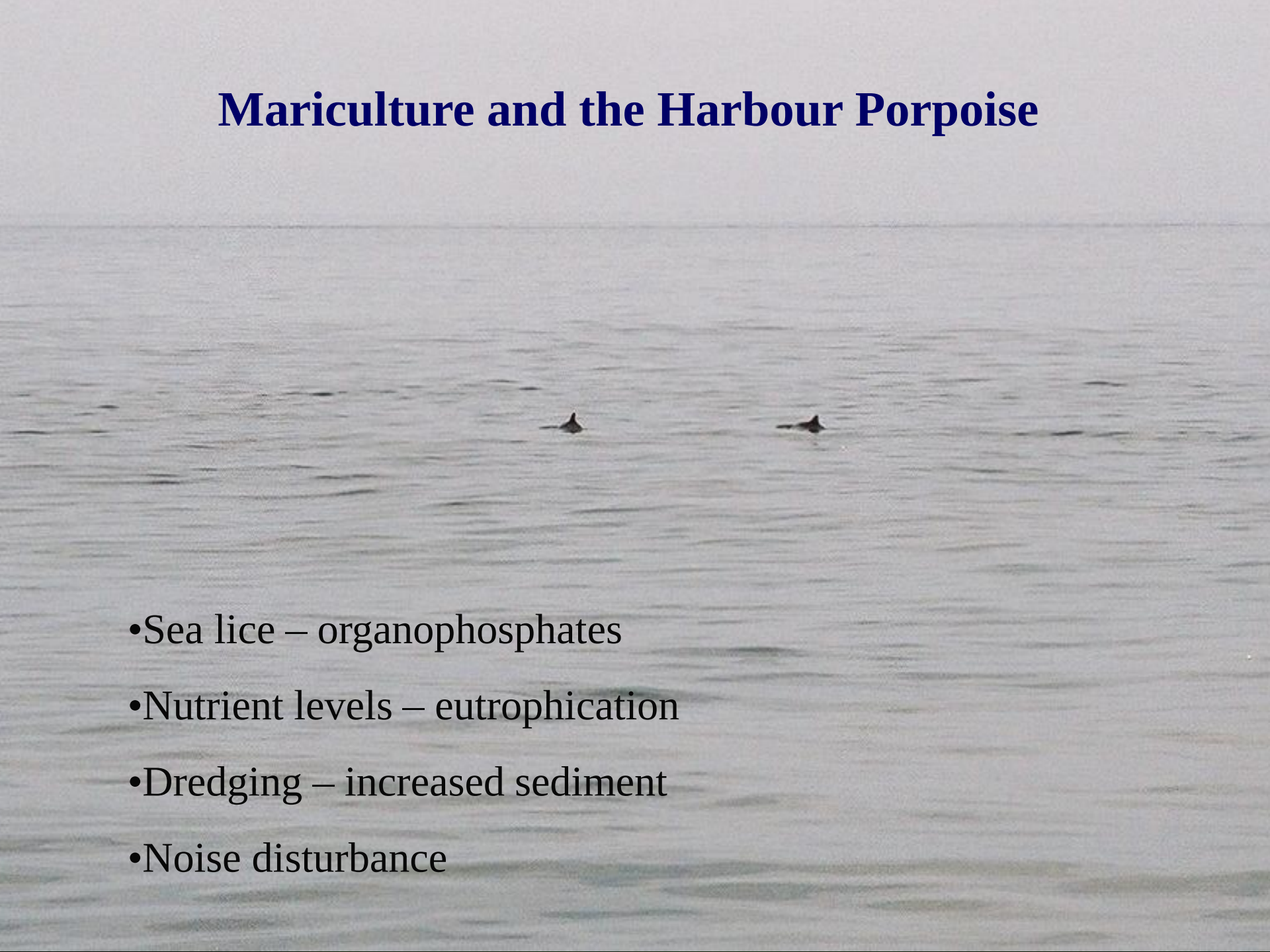
N



0 2 4 6 8 10

Approximate scale in Km

Mariculture and the Harbour Porpoise

- 
- A photograph of two harbour porpoises swimming in a body of water. The porpoises are visible as dark, rounded shapes with small dorsal fins breaking the surface. The water is a light, hazy blue-grey color with gentle ripples. The horizon line is visible in the upper third of the image.
- Sea lice – organophosphates
 - Nutrient levels – eutrophication
 - Dredging – increased sediment
 - Noise disturbance

Climate Change - Emaciated Sea Mammals



Climate change, habitat degradation and overfishing are all contributing to the demise of natural resources → starvation

- Climate change – higher temperatures → stressed populations
- Important fishery - sandeels
- Evidence HPs affected – switching prey



New Pressure: Infanticide

- Predatory attacks from other dolphins
- Common in mammals
- Reproductive mechanism
- Competition for food or target practice?



Harbour Porpoise Workshop

- For the next two hours you will use the information provided to identify Harbour Porpoise *Phocoena phocoena* occurrence in the Swansea Bay and Gower areas. You will be able to use the data provided to ascertain temporal and spatial variation and determine what they use the coastal area for. Finally you will also be able to comment upon threats facing this species, based upon stranding data.