

Marine and Coastal Pollution



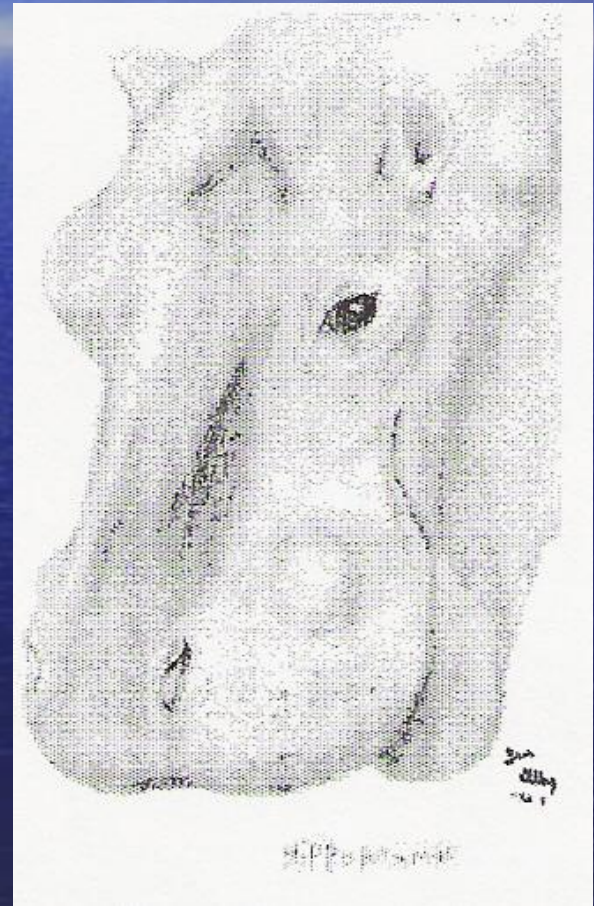
Oceans

- Commonly used as a dumping ground
- Out of sight out of mind
- Diffuse toxins
- Bio-accumulation
- Serious threat to biodiversity



Generalised threats

- **H** – Habitat loss
- **I** – Introduced Species
- **P** – Population
- **P** – Pollution
- **O** – Over-consumption



Pollution

- Limited capacity to assimilate waste
- Chemical and toxic
- Nutrient
- Noise
- Litter
- Thermal

Types of pollution

- **Non-native & invasive species**
- **Oil**



Environmental Impact of Tourism

- Multifaceted relationship
- Based on man's desire to get out and see and experience nature
- Exceeding carrying capacity leads to :
 - Depletion natural resources
 - Pollution
 - Physical impacts
 - Loss of biological diversity
- Careless mismanagement leads to irreversible consequences



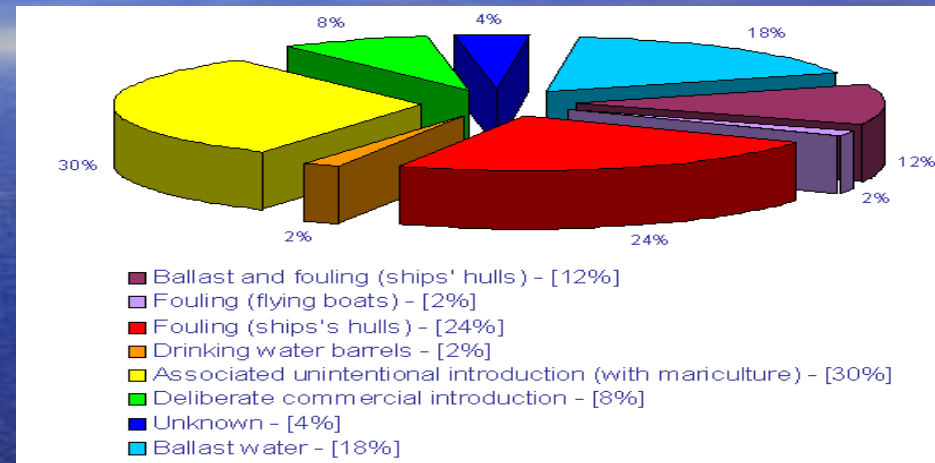
What are non-natives?

- Established outside native territory
- *Caulerpa taxifolia*
- Threat second only to habitat loss
- Significant change in community composition
- 138 marine alien species in UK

(Marlin, 2009; The Blue Green, 2010; Oakley, 2012 pers comms)

Introduced Species

- Aliens: Seeds, animals, insects etc
- Increased travel and export business
- Out compete native species - Lead to fundamental changes



- Vectors: natural or man –made
 - Deliberate or accidental release
 - Hull attachment
 - Bilge / engine water



Marine menace

- 7,000 species carried in ballast water every day
- Comb Jellyfish *Mnemiopsis leidyi* – Black Sea
- Freshwater zebra mussel *Dreissena polymorpha* (US) – \$750 million – 1 billion 1989-2000



Red Sea Jellyfish *Rhopilema nomadica*



Invasive Impacts

- **Loss of native biodiversity**
- **Changes to ecosystem function**
- **Changes in nutrient cycles**
- **Reduced water quality**
- **Reduced recreation**
- **Interference with fisheries**
- **Fouling of pipes/buoys**
- **Economic cost of clean-up**



- *"Shipping moves 80% of the world's commodities and transfers approximately 3-5 billion tonnes of ballast water internationally each year" (Globallast, 2002: 2)*



Marine Alien's 2 Project : "Most wanted"



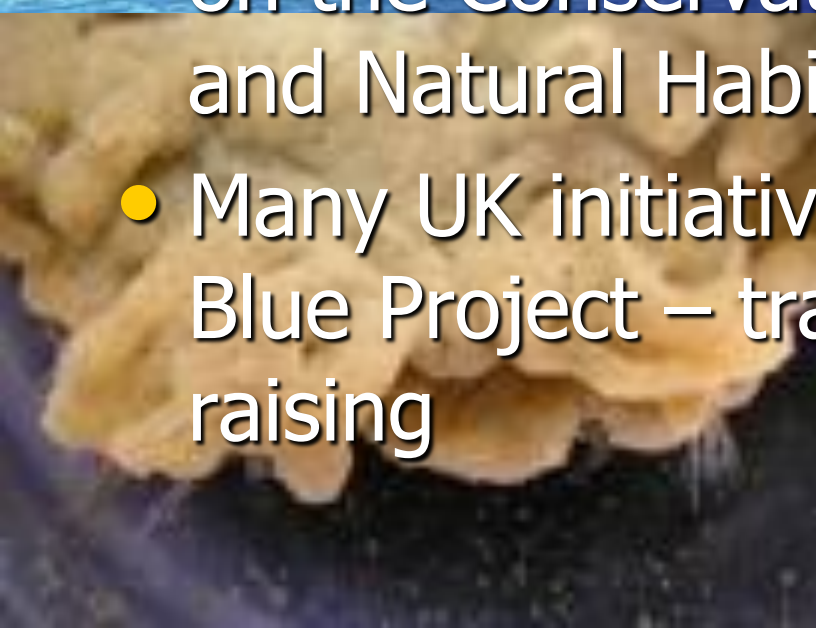
SPECIES	COUNTRY OF ORIGIN	IMPACTS	MANAGEMENT
Slipper Limpet <i>Crepidula formicata</i>	America	Competes with other filter feeders for food & space. A pest in commercial oyster beds	Dipping infested oysters in saturated solutions of brine for a short period
Wireweed <i>Sargassum muticum</i>	Pacific – associated with unintentional introductions with commercial oysters from Japan & Canada	Out-competes native species due to rapid growth. Interferes with navigation – fouls propellers. Can foul oyster beds & fishing nets	No effective method for its permanent removal. Cutting is the preferred method. Chemicals and trawling have been tried but were unsuccessful

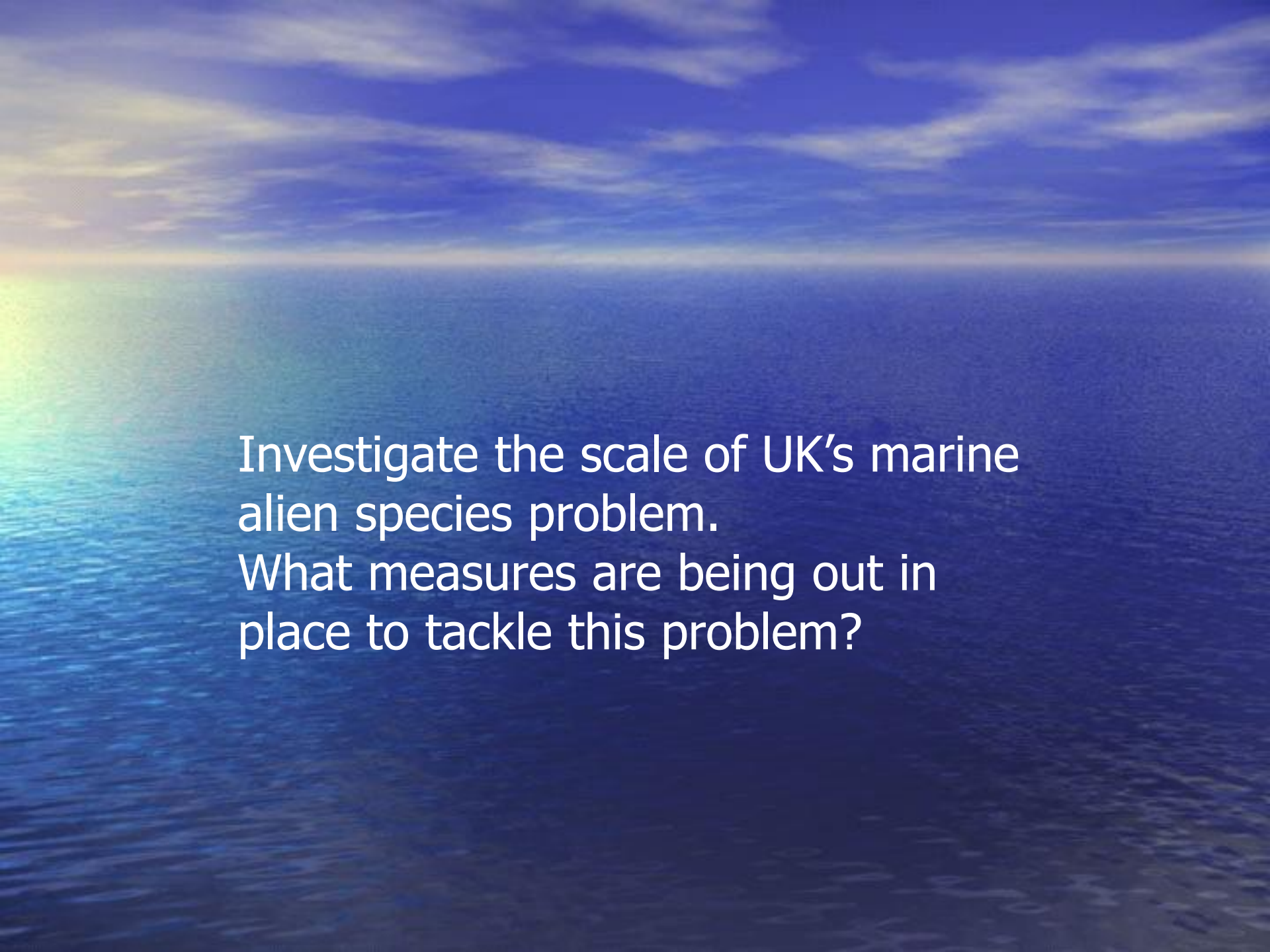
Means of Prevention

- Control import/export species – mariculture
- Sterilise ship's ballast water
- Change ship's ballast water by controlled and appropriate means
- Dispose of aquarium species appropriately
- Clean hull regularly (for those left in water)
- Clean all equipment when hauling out trailer, boat etc and remove visible plants, mud etc – dispose of appropriately

Control measures

- Invasive Species Specialist Group – part of the World Conservation Union (IUCN)
- Council of Europe under the Convention on the Conservation of European Wildlife and Natural Habitats
- Many UK initiatives underway – The Green Blue Project – training and awareness raising



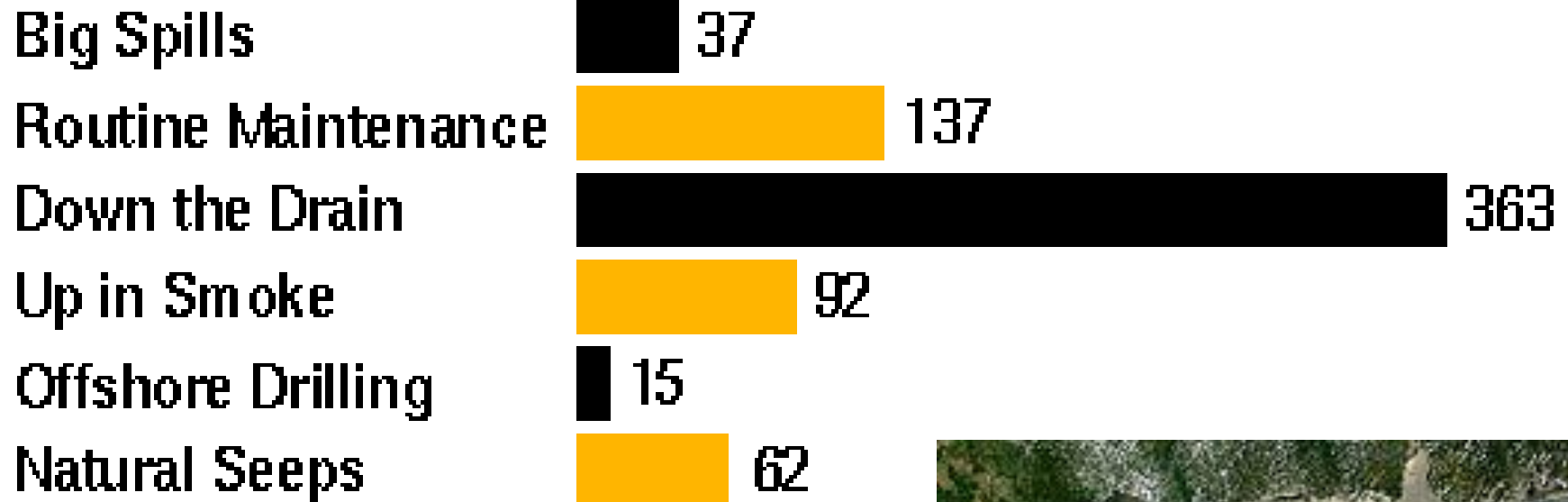


Investigate the scale of UK's marine
alien species problem.
What measures are being put in
place to tackle this problem?

Oil Pollution: Sea Empress



Oil Pollution



(Million gallons per year worldwide
EPA, 2002)



Oil Pollution

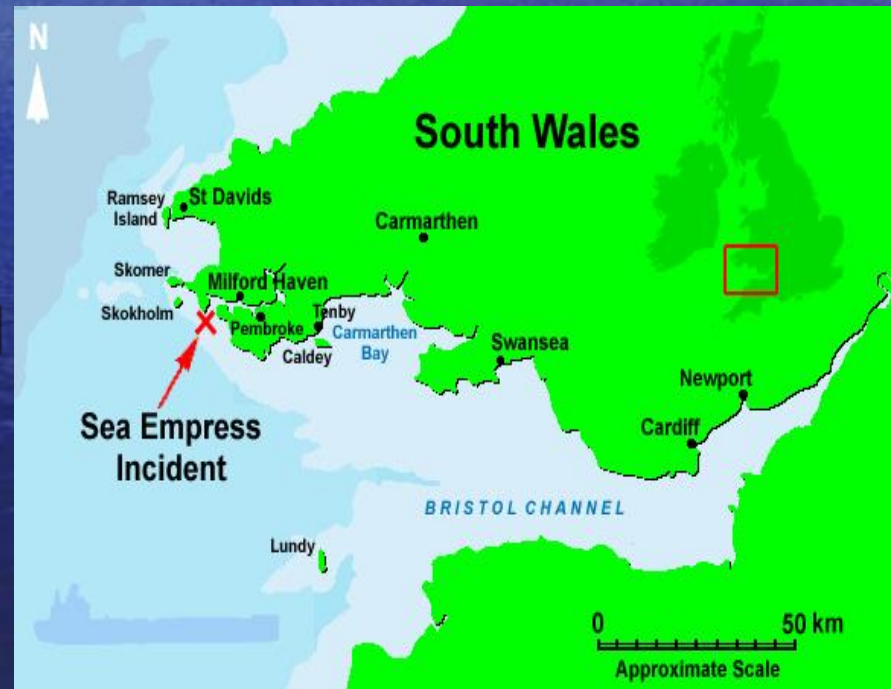
- ❖ Effects of spill:
 - ❖ Currents and wind
 - ❖ Amount spilled
 - ❖ Chemical properties of oil
 - ❖ Salinity
 - ❖ Water temperature
 - ❖ Type and slope of shoreline

- ❖ Ships routinely discharge 50 million tonnes of oil at sea each year (Lee 2002)

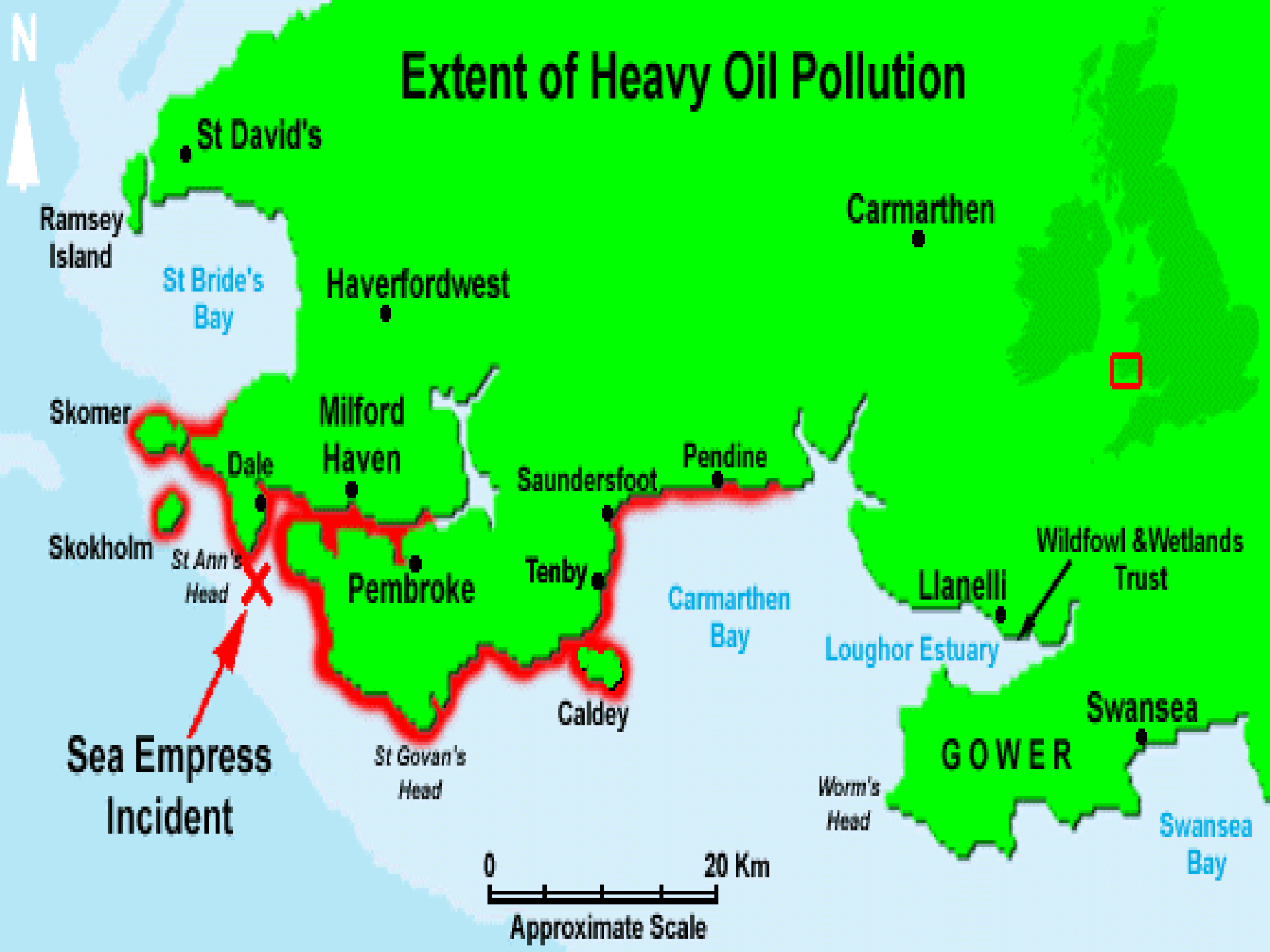


Sea Empress

- 72,000 tonnes crude oil
- Wave exposed shores cleansed quickly
- Shingle, sands and mud persisted
- Autumn storms buried oil
- Shore seaweeds and invertebrates killed in large numbers
- Shellfish and bird life affected
- Seals largely unaffected



Extent of Heavy Oil Pollution





- **Pilot error & miscalculation tidal stream**
- **Sea Empress – 7 day period leaking oil**
- **72,000 tonnes light crude oil**
- **250 tonnes heavy fuel oil (power ship's engine)
plus a further 230 tonnes once towed to jetty**



- 50 vessels
- 19 aircraft
- 25 organisations
- 25 staff on vessel; 950 on shoreline



40% evaporated

50% dispersed in water column

1-2% collected from recovery vessels

8% came ashore

200km coastline affected

(SEEEEC, 1999)

- Absorbent scrubbing
- High pressure hosing



Clean-up

- Aircraft – spray chemical dispersants
- Booms – protect ecologically sensitive areas
- Hand scrapers
- Mechanical diggers & bowzers
- Inaccessible shores – natural cleansing
- Total cost of cleanup - £23m





•Factors that reduced impact:

- Time of year**
- Wind direction**
- Type of oil spilled**
- Success of chemical dispersants**

CASUALTIES



- **7,000 oiled birds washed ashore**
- **60% survived cleaning – variable success rate post release**
- **90% of birds were common scoter, guillemot or razorbill**
- **Diver species but few gulls**
- **3,500 common scoter – 10,000 fewer in 1997**

- Feather damage
- Breakdown of insulation – hypothermia
- Skin irritations
- Ingestion



Without use of dispersants, bird mortalities would have been higher



- **90% mortality in West Angle Bay**
- **Topshells and periwinkles**
- **Overgrowth of algae**
- **Reduction of barnacle larvae**
- **Polychaete worms**





Cushion Star *Asterina phylactica*

West Angle Bay, Pembrokeshire

Mammals appeared not to be affected

Short-term – eye or respiratory tract irritation

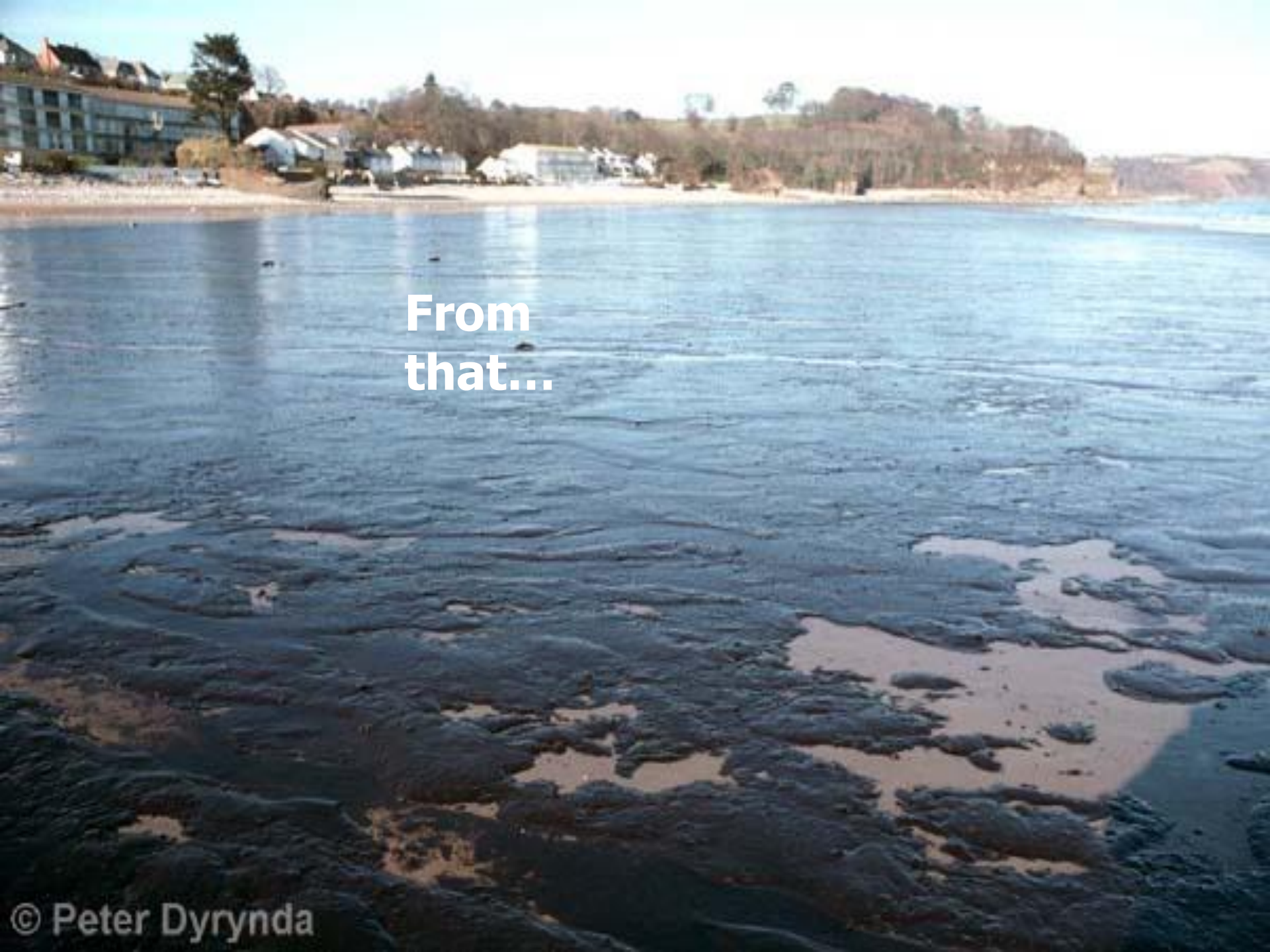
Long-term?



- **Ban on collection edible plants & shellfish – St David's Head – Port Eynon**
- **Fishing for salmon & trout in rivers**
- **Samples analysed**



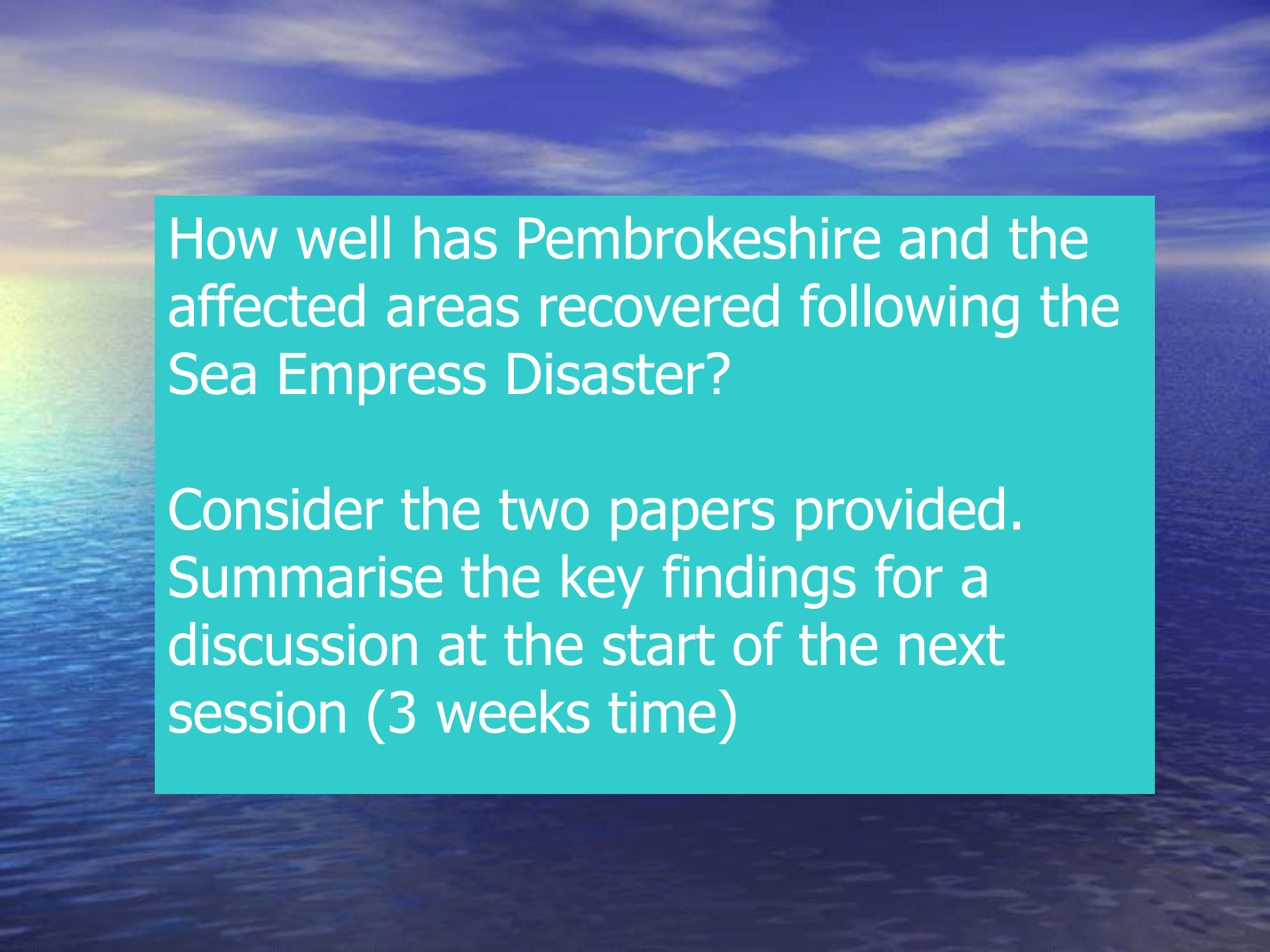
- **Catch rate in Tywi of sea trout ↓ 1996**
- **Bivalve molluscs**
- **Absence of amphipods**



From
that...

A wide-angle photograph of a coastal scene. In the foreground, a grassy cliff edge with tall, dry grasses is visible on the right. Below it, a vast, flat, light-colored sandy beach stretches across the middle ground. The ocean is on the left, with several lines of white-capped waves breaking onto the shore. In the background, a rugged coastline with dark, rocky cliffs and some green vegetation is visible under a grey, overcast sky. A single dark rock sits on the sand near the water's edge.

**To this in just 6
months.....**



How well has Pembrokeshire and the affected areas recovered following the Sea Empress Disaster?

Consider the two papers provided. Summarise the key findings for a discussion at the start of the next session (3 weeks time)