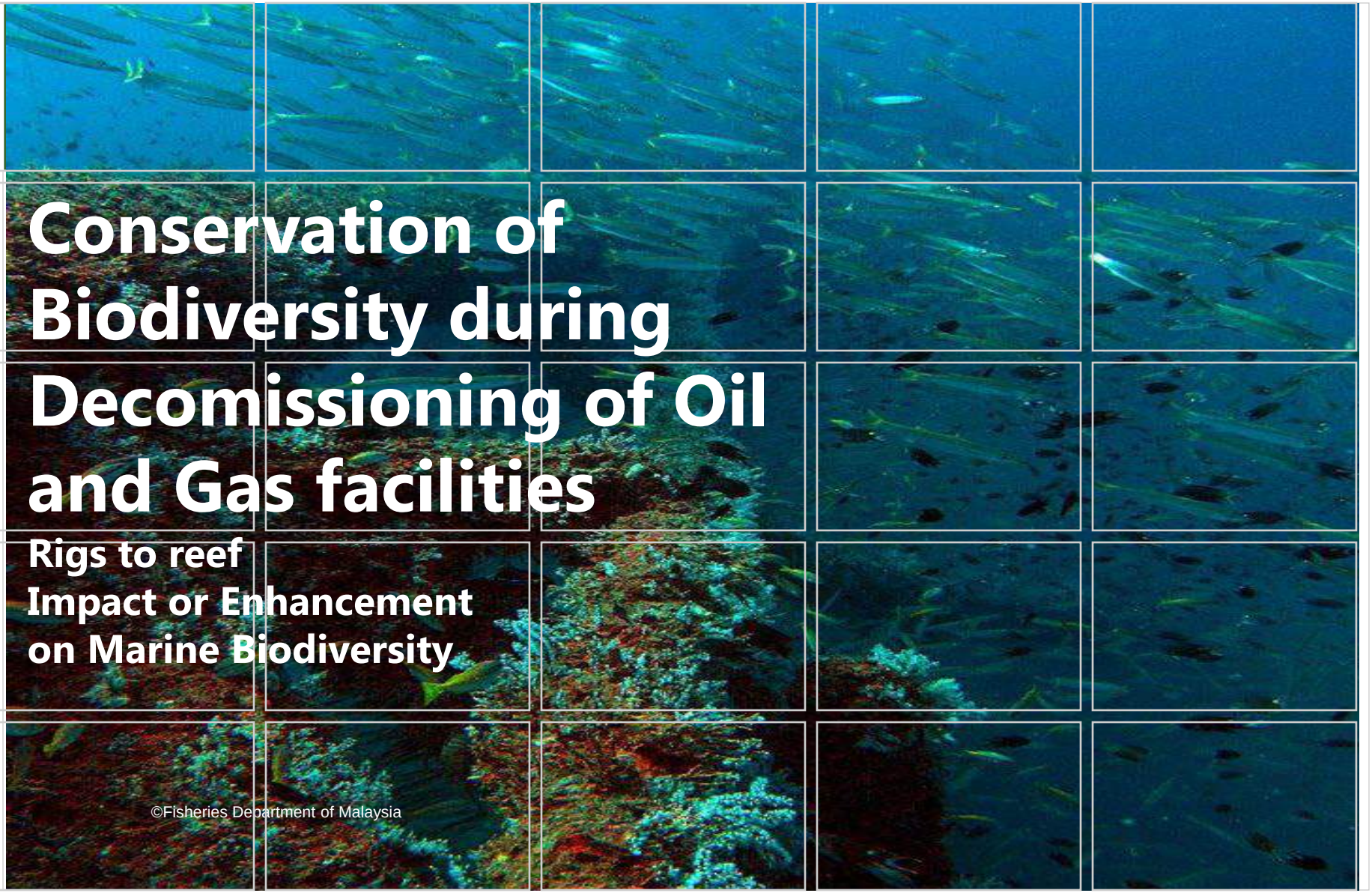
Conservation of Biodiversity during Decomissioning of Oil and Gas facilities

Rigs to reef
Impact or Enhancement on Marine Biodiversity



Delivering sustainable solutions in a more competitive world

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Presentation's objectives

- **Enhance knowledge about Decommissioning/Asset retirement**

  - **Background**
  - **Situation in South East Asia**

- **Rigs to reef Impact and/or Enhancement of Marine Biodiversity**

  - **Rigs to reefs Objective**
  - **Rigs to reefs Evaluation**

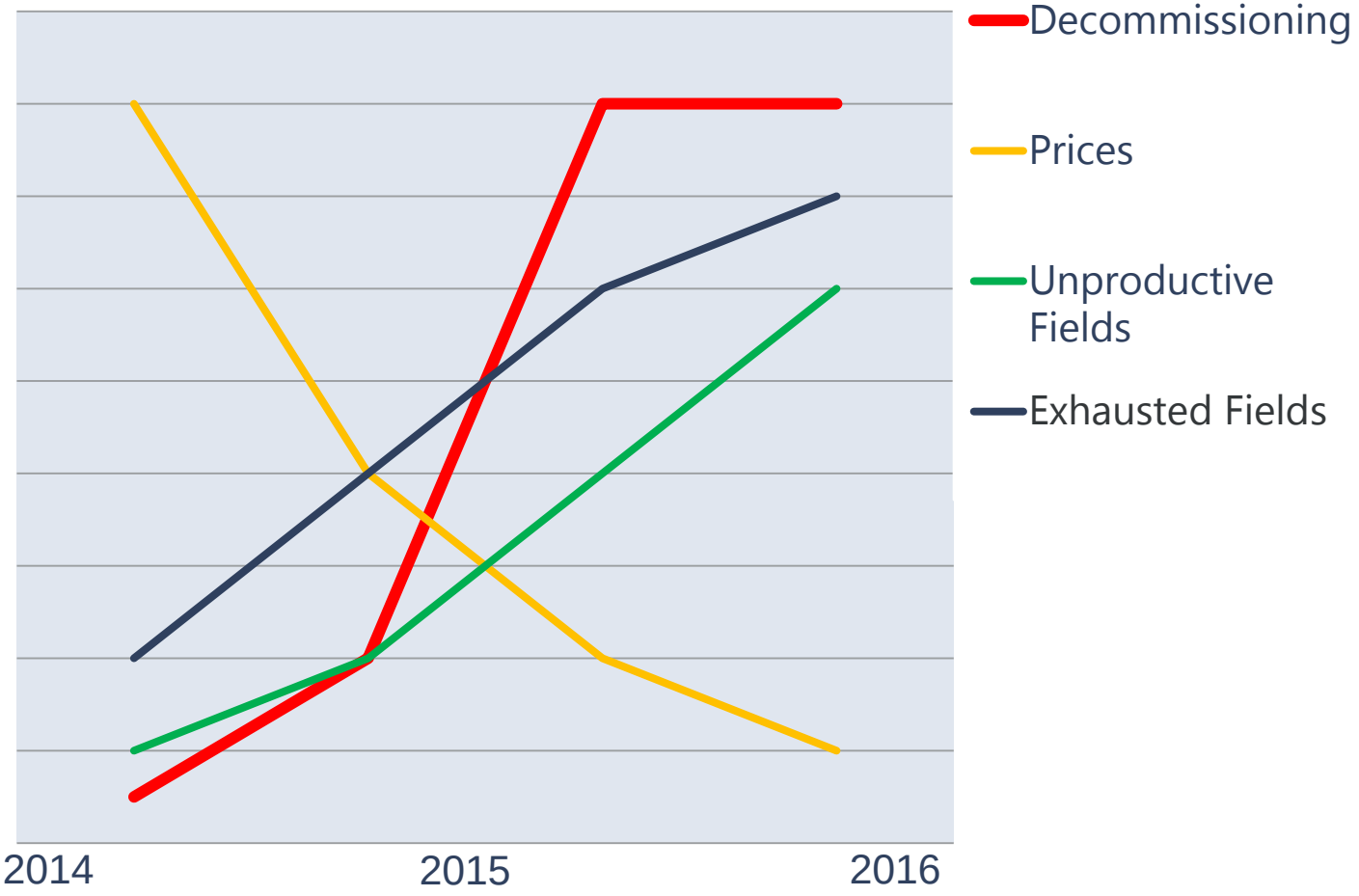
- **Case Studies**

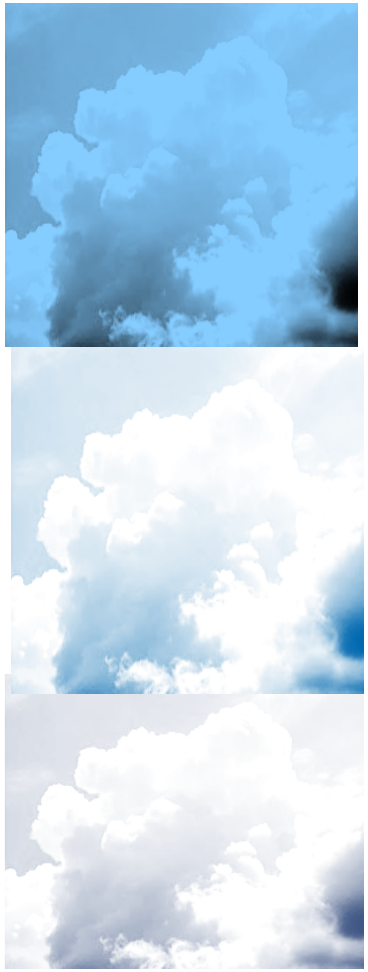
- **Conclusion**

Decommissioning/Asset retirement

- Decommissioning is a process implemented when an oil or gas facility approaches the end of its useful life or the field is exhausted.
- The structures are cleaned and secured.
- Decommissioning projects are **LARGE, COSTLY** and raises many **COMPLEX** issues
- The Oil and Gas sector is one of the **world's most contaminating industries** (mercury, cadmium, chromium, asbestos, arsenic, lead TENORM etc.)
- The Oil and Gas sector is among the **world's least regulated** industries

Decommissioning/Asset retirement





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Oil and Gas Facilities Description

- Oil platforms, Oil rigs
- Jackets
- Pipelines
- Topsides
- Associated structures

Background to today's regulatory framework

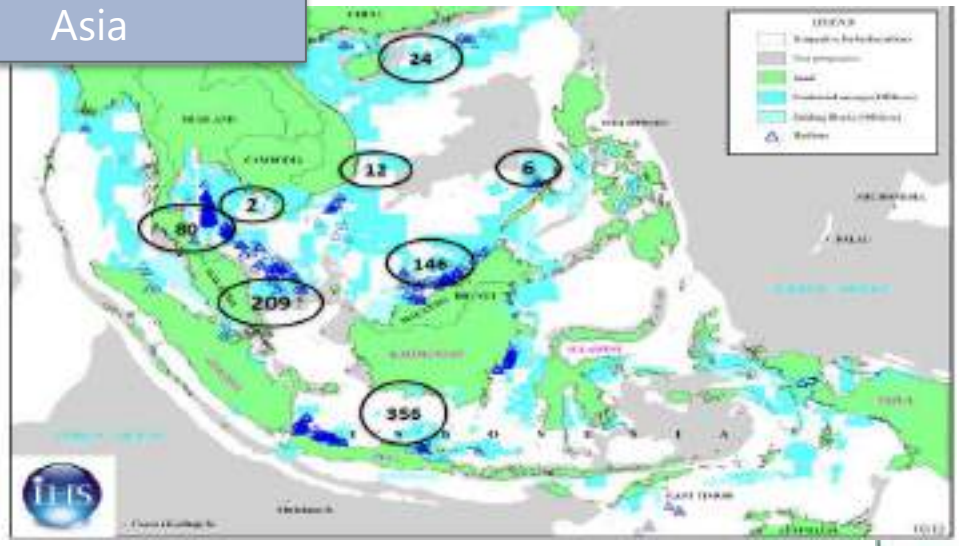
- The offshore oil and gas industry has been operating worldwide for many years, concerns regarding the environment were highlighted already in the **1950s;**
- **Different areas have a different approach** to understand and manage the environmental impacts of these operations;
- **Catastrophic events have shaped legislation** and enhanced public awareness, knowledge, experience, and time have all contributed to knowing what we know now;
- Hazardous waste transport triggered the **Basel Convention** to control transboundary movements of hazardous waste and their disposal;
- Brent Spar decommissioning project triggered OSPAR Decision, on the **Disposal of Disused offshore Installations in the North Sea- "the entire platform must be treated as waste"**

Decommissioning Hot Spots and Issues

South East Asia hosts many aging offshore facilities and present a combination of issues:

- Shortage of decommissioning yards;
- Shortage of waste recycling facilities;
- Lack of technical expertise;
- Lack of policy framework or applicable guidelines;
- Lack of financial support;
- Sensible marine receptors already under threat of Climate Change;
- A total of 833 platforms

Offshore Facilities Mayor **> 20 years** Offshore South East Asia



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Decommissioning Issues

South East Asia hosts:

- 75% of world's coral spp.
- 40% of world's reef fish spp.
- 6/7 of world's marine turtle spp.
- 51 of world's 70 mangrove spp.
- 23 of world's seagrass spp.
- A third of world's coral reef, mangroves and seagrass beds
- Marine Biodiversity Global Hotspot
- Many Endemic species to this region

Highest Marine Biodiversity in the world in the Coral Reef Triangle

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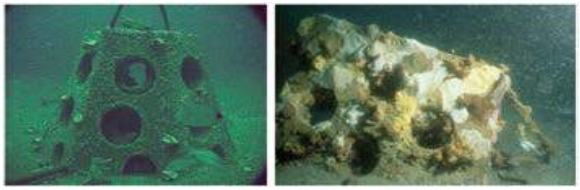
Artificial Reef Background

A succint definition of an artifical reef can be found in Seaman and Jensen, 2000:

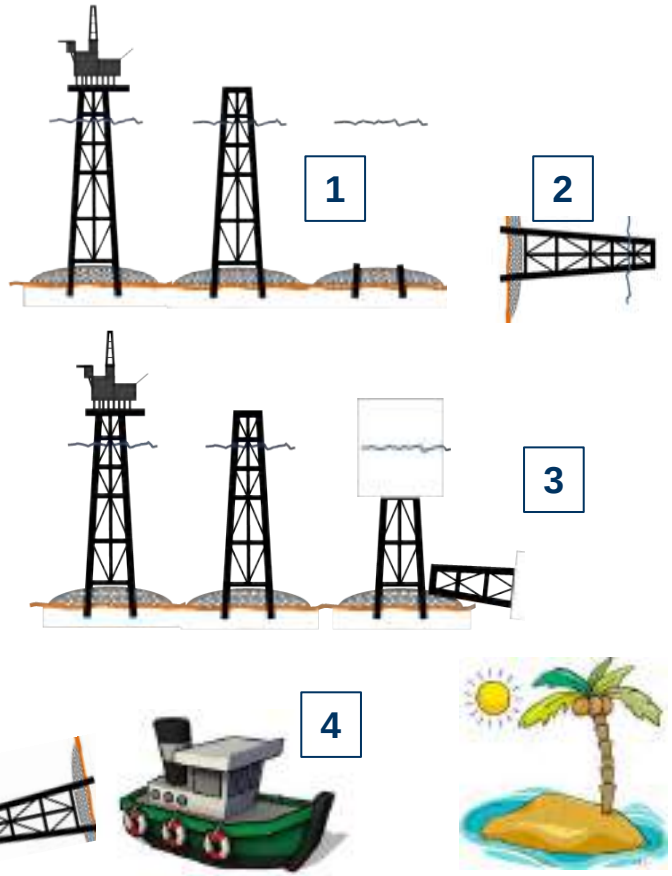
" An artificial reef may be described as one or more objects of natural or human origin deployed purposefully on the seafloor to influence physical, biological or socioeconomic processes related to living marine organisms"

Materials of opportunity

Designed Material



Oil and Gas artificial reef/rigs to reef



Rigs to reef Considerations

Physical

- **Site selection of the AR**

oEcological Criteria (e.g. proximity to NR)
oHydrological criteria (e.g. wave height, depth)
oWater Quality (e.g. turbidity)
oGeographic criteria (e.g. run off from rivers)
oGeology (e.g. substrate)

- **Asset integrity**

oCondition of structure
oRisks from corroding structure
oSize of structure
oPhysical habitat damage
oRelease of contaminants

Socio-Economics

- **Fishing**
  - Recreational/Commercial
- **General Importance**
  - Cultural, Historical or Archaeological
- **Liability**
- **Reputational risk**
- **Stakeholders' engagement**
- **Monitoring**
- **Policy framework & legislation**

Rigs to Reef Considerations

Biological

How do you **Evaluate** Biological **Benefits and/or Risk**

Enhancement/benefits

- **Ecological Metrics/ Enhanced biological productivity**
  - oDensity
  - oDiversity
  - oAbundance and/or growth rates

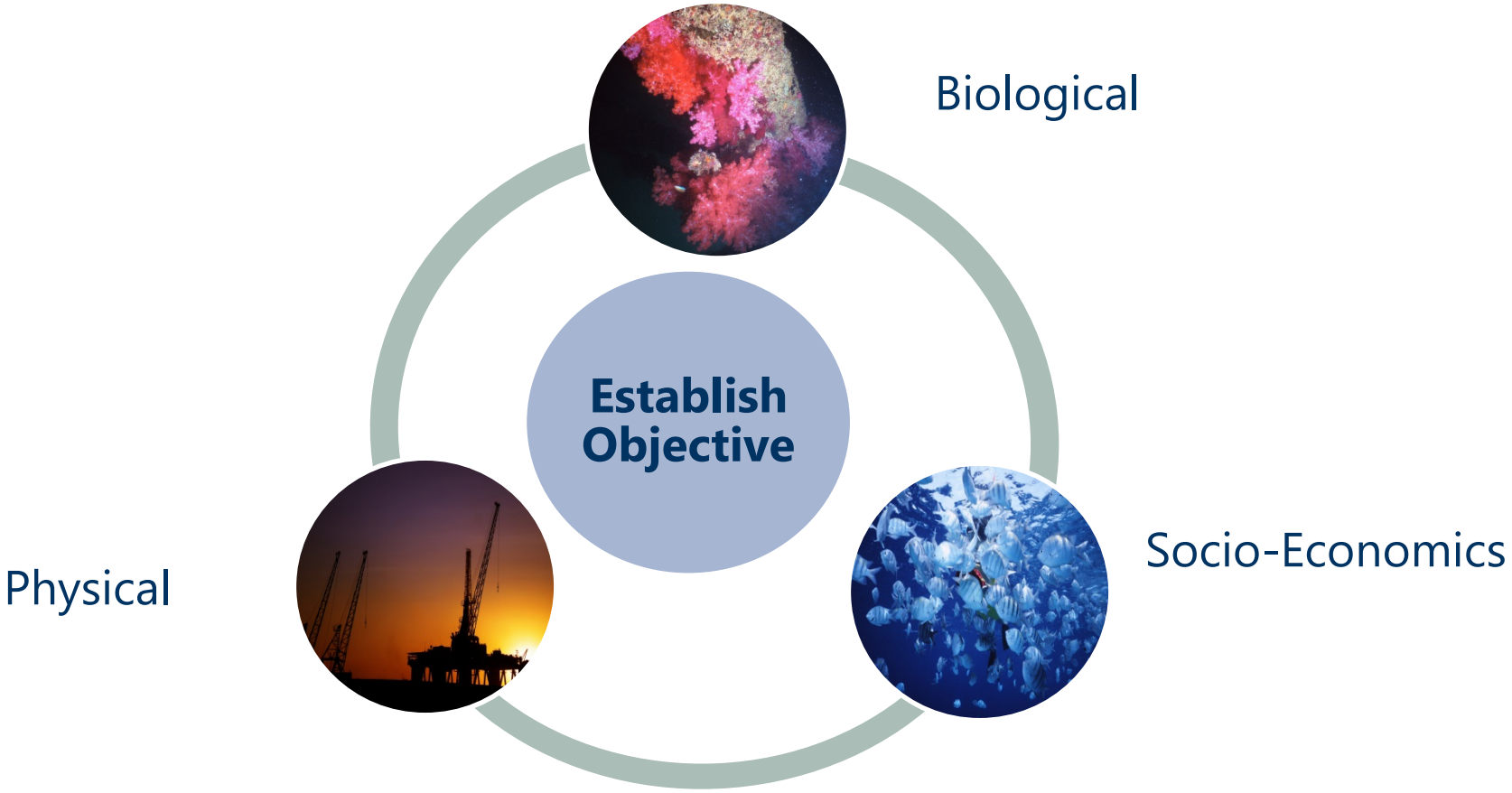
  More food, increased survival
  More shelter, decreased predation
  More recruitment, intercepting larvae, nursery for juveniles
- **Improved population connectivity**
  - oIntercepting larvae otherwise lost
  - oNew habitat
- **Prevent trawling**

Impacts/risks

- **Physical habitat damage**
- **Change of marine food webs**
- **Overfishing (FAD)**
- **Spread of invasive**
- **Release of contaminants over time**

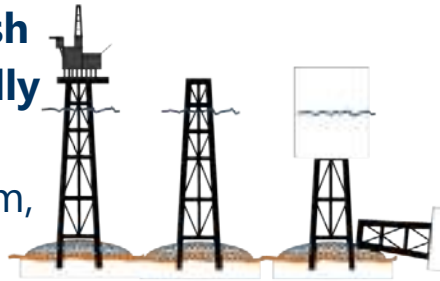
Rigs to reef Objective

- **Creation of New Habitat**
- **Restoration of Damaged habitat**
- **Protection of Valuable habitat**



Creation of New Habitat

Fish Communities



- **To study the effect reefing a platform plays on the surrounding fish communities these communities associated with a toppled, partially removed, and standing platform was observed;**
- **Fish density and fish size** are greater near the surface than the bottom, and it was determined that fish communities are most likely found **shallower than 30 m** to the surface;
- Fish communities were determined not follow a predictable pattern and are likely **site-specific**.

Benthic Communities

- **A Study was carried out in order to compare the success rate of biofouling communities inhabiting the structures of decommissioned assets;**
- Structures were compared in relation to their distance from shore.;
- This study states that **reefing in shallower water does not increase benthic assemblage success rate but rather vertical zonation did;**
- Other studies highlight the fact that rigs placed as reef may provide unoccupied habitat and **facilitate invasive species** settlement, many invasive species are associated to rigs close to major shipping lanes.

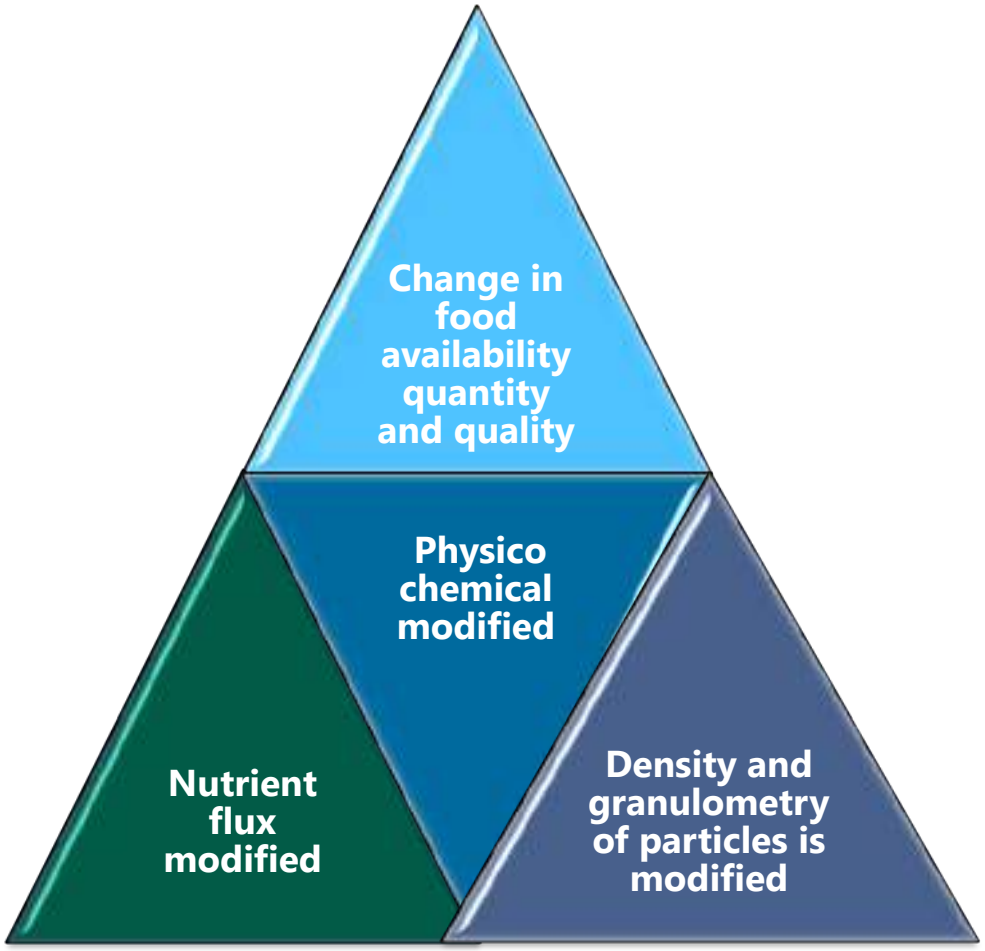
Creation of New Habitat

Seabed Communities

- The effect of artificial reef on sediment **physicochemical characteristics**, **benthic communities** and **trophodynamics** are **poorly studied**.
- **Is a rig placed on a sandy plain increasing biodiversity?** It facilitates the replacement of the biodiversity associated with a sandy substrate with that of a rocky reef, and if placed in an area which is important for sandy-bottom species, may actually have a negative impact according to many studies.
- Many colonised epifauna on the artificial reef are filter feeders that remove suspended matter from the water column and produce faecal pellets, that settle on seabed, and bio filtration occurs.
- **Artificial reefs have been called "biofiltration units**"

Creation of New Habitat

Food Web



Restoration of Damaged Habitat

- **Rigs to reef programme have the opportunity to place rigs in locations that may maximize ecological benefits**. Knowledge of larval dispersal trajectories may allow the strategic placement of rigs to increase recruitment success and retain larvae that otherwise would be "lost" to inhospitable substrates;

- **Rigs to reef may provide an alternative** in areas where coral bleaching or other impacts have heavily impacted and reduced habitat for fish, sea turtles etc.

- **Enhanced fishery productivity**, is it realistic to place an artificial reef in a ecosystem that is severely overfished and expect that the site will be colonized by economically valuable species?

o In **South East Florida** despite construction of artificial reef habitats that would be ideal for economically important species, in many cases the most abundant fish species are represented by grunts (*Haemulidae).*

o In **South East Asia** on the rigs to reef many fusiliers (*Caseonidae*) and red tooth triggerfish (*Balistidae*) are common and none represent valuable economic species.

Protection of Valuable Habitat

- Rigs themselves have been described as "**de facto marine protected areas**" because they offer large internal spaces and act as shelter to fish and other marine organism;
- Rigs are many times deployed with the argument to be **used as barrier** to protect natural habitat from over fishing eg reduce the impact **from trawling**(however there are little/no research on the efficiency of this);
- Many foreign/local vessels are often found trawling illegally in gazetted protected areas;
- It is clear that the placement itself of an artificial reef is **not enough** to provide protection of the natural habitat areas without regular surveillance and monitoring.

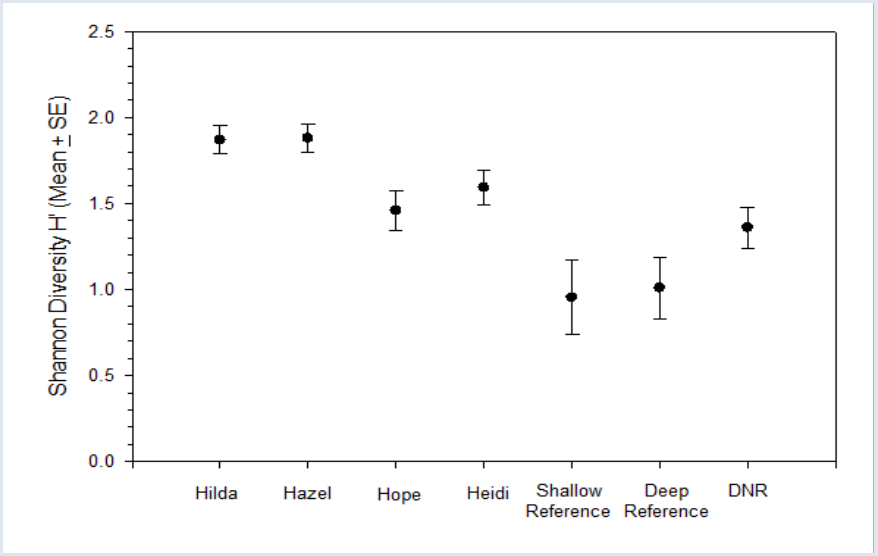
Case Study- Temperate Environment

- Generally located between 20 and 40 degrees latitude (North and South)
- Temperature regimes between 0 – 37 C
- High Wave Energy
- High Primary Productivity
- Soft and Hard Bottom Habitats

Fish Trap Survey (Diversity)

- Two Year Study that collected organisms at Four shell "rigs to reef" sites
- Ecological comparisons between artificial locations and reference site (shallow, deep and natural reef site) offshore California.

Species Diversity (H')



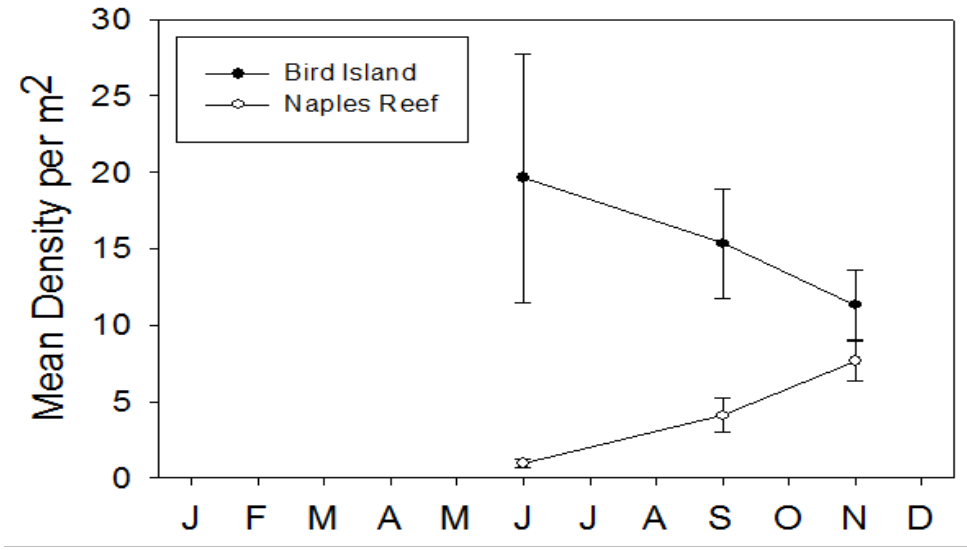
Case Study- Temperate Environment

- 1930's Era – Oil production pier in Santa Barbara, California.
- Removed in 2005 to near shore environment
- Utilized concrete columns as the basis of an artificial reef

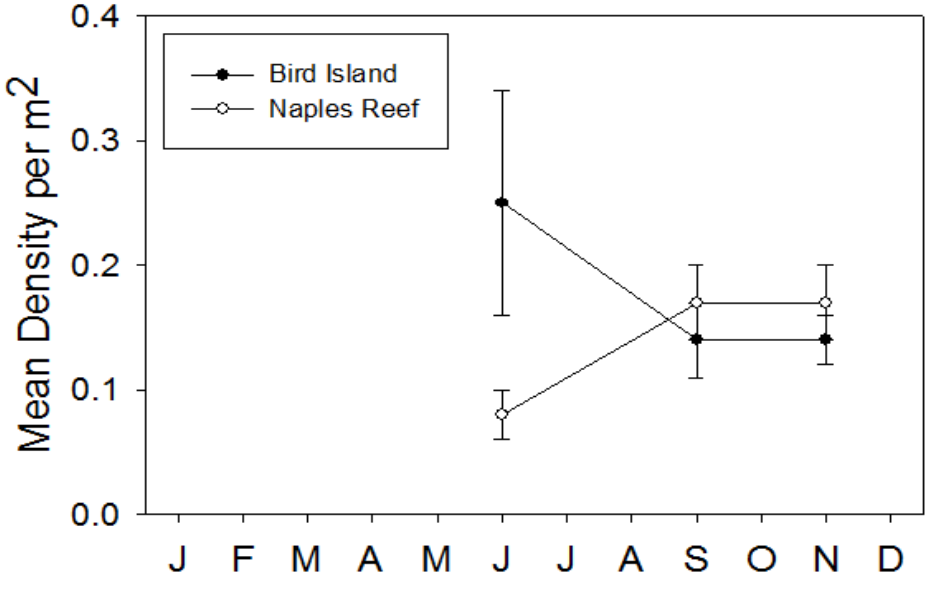
Ecological Study (Density)

- Comparison to nearby natural reef estimation of fish, invertebrate and algal resources
- Measure how long will it take to be productive

Density of Giant Kelp



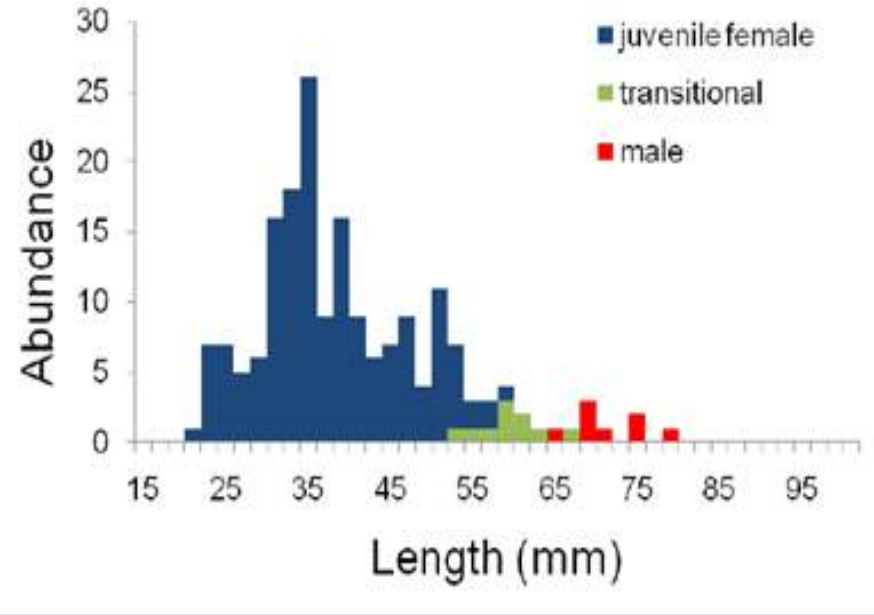
Density of Fish Resources

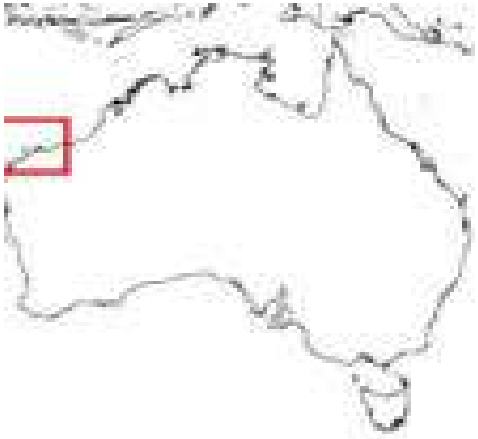


Case Study - Temperate/Tropical

Ecological Study (Fish Communities Structure Analysis)

- Do they provide sufficient resources to sustain populations? Or just FAD?
- Do they provide recruitment and nursery function?



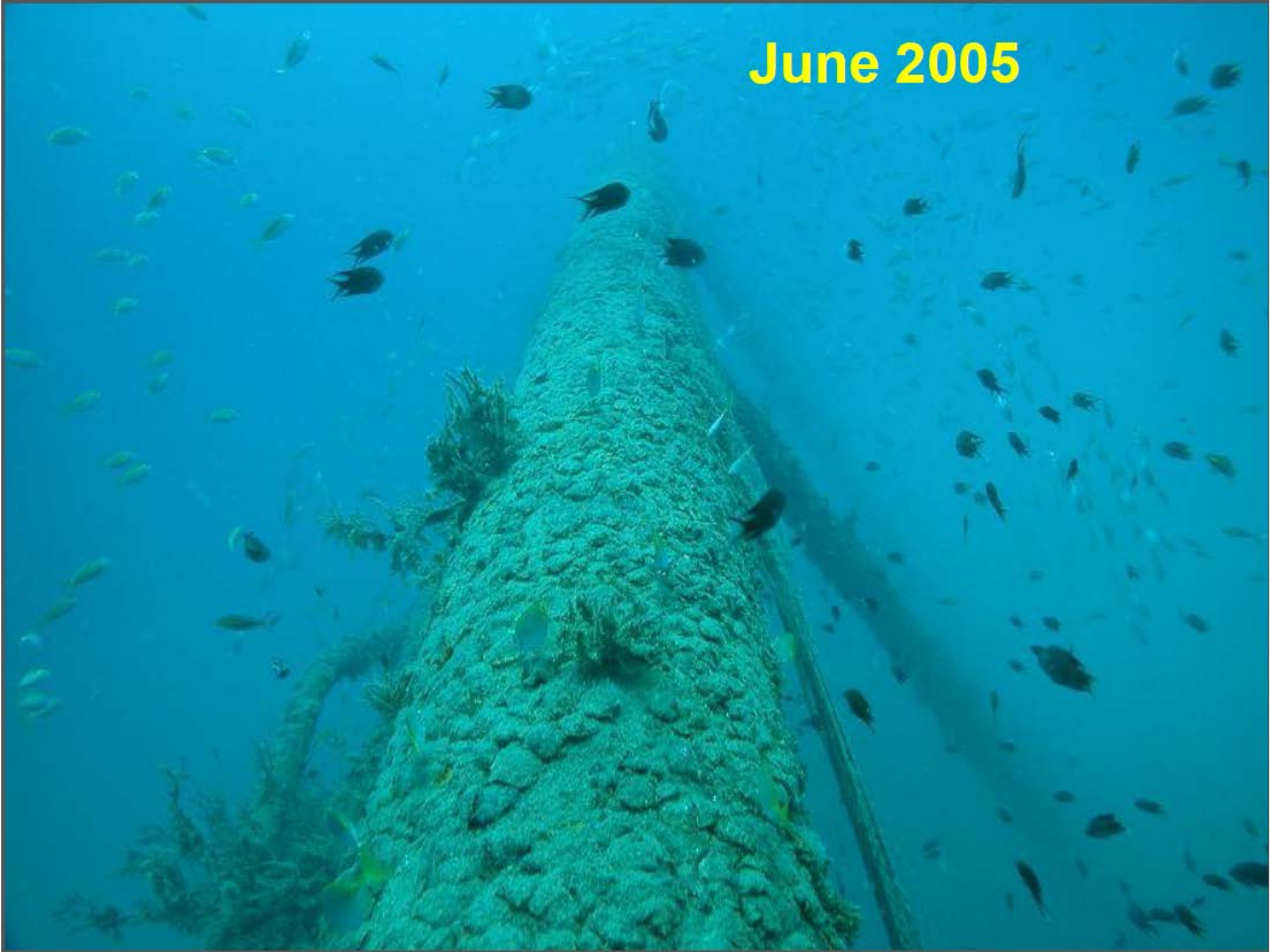


- Fully sustained populations up to 5 years
- Confirmation that artificial reef may wholly sustain fish populations
- Artificial reef may serve as **recruitment** and **nursery** stations

Case Study- Tropical Environment

Baram 8/the only Artificial Reef up to date in Malaysia

*The following photographs are courtesy of Daud Awang from the Fisheries Research Institute Sarawak Branch Malaysia paper "*OIL RIG AS ARTIFICIAL REEF: EXAMPLE OF BARAM 8 " at the RIGS-TO-REEFS: PROSPECTS FOR LARGE ARTIFICAL REEFS IN TROPICAL SOUTHEAST ASIA WORKSHOP (12-13 November 2013, Singapore)


June 2005


September 2012


September 2012

Case Study- Tropical Environment

Expected Outcome of Baram 8	Current status of Baram 8
• **Predicted to have a positive impact** on the diversity of epifaunal communities	• **No** published **data** to support this • Photographs show very **slow colonisation** of important benthic assemblages but further research is needed to confirm this
• Artificial reef replacement would lead to **greater fish diversity and abundance**	• There are pelagic fish species present • Artificial reef **may** act as shelter and/or feeding station
• Potential for provision of new fisheries resource at artificial reef site	• Photographs show snagged **fishing nets**
• Placement of the structure on the seabed will constitute a new potential hazard/ obstruction	• Photographs show snagged **fishing nets**

Conclusion

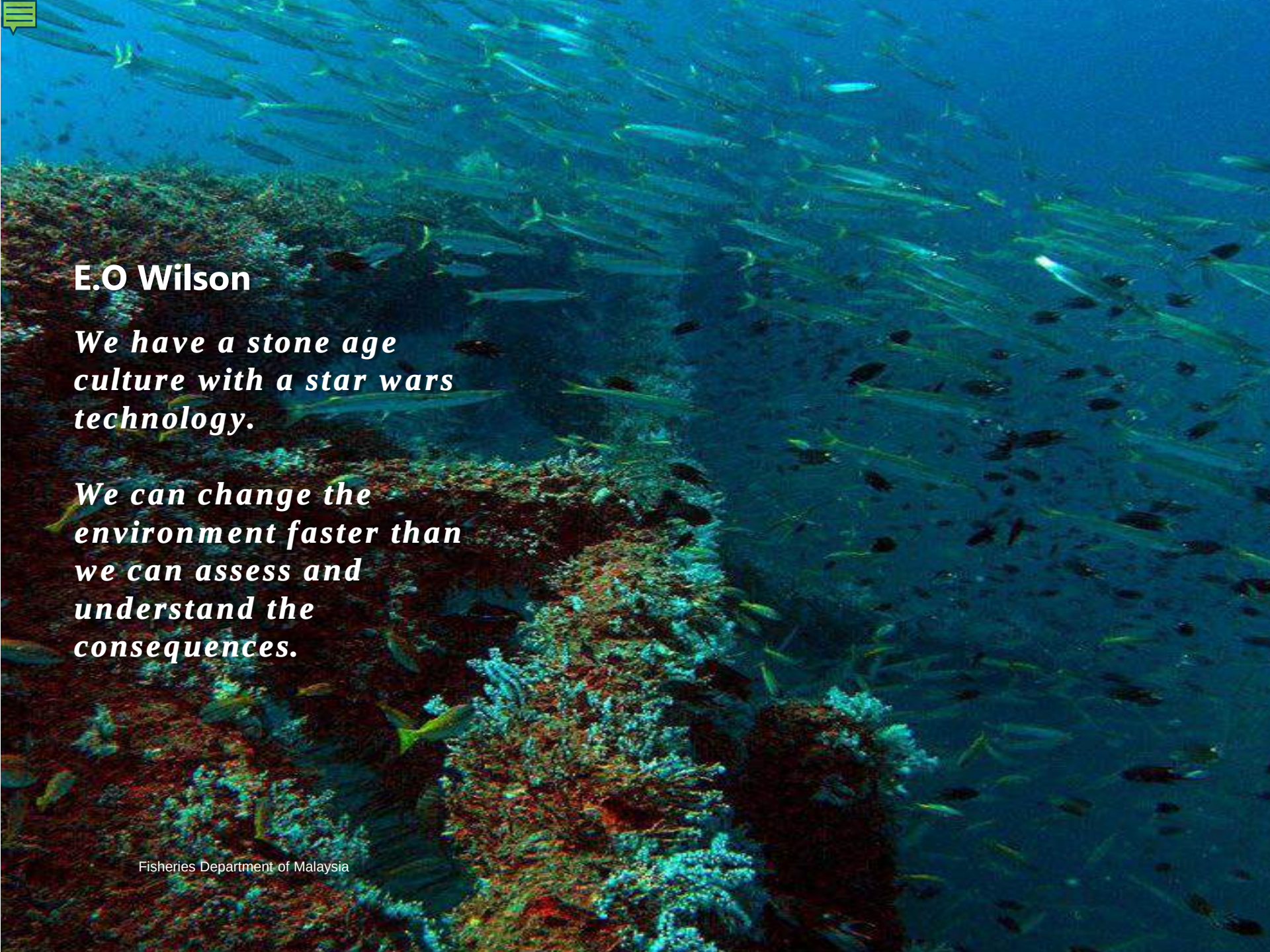
- **Creation of artificial reefs/ reefing induce changes in:**
  Water quality/ Water circulation/Wave action/ Sedimentation rate/ Seabed ecology/Seabed chemistry, that indirectly affects marine environment and biodiversity **in a way not yet properly estimated/assessed;**

- Difference in width of continental shelf, temperature, fish communities and seabed structure will all play a role in the function and establishment of the artificial reef, hence research outcome are likely to be **site specific;**

- Artificial reef deployment should only be viable after a process assessing the different factors and criteria have been undertaken, and where trade off priorities consider environmental risks and **biodiversity conservation;**

- The **objective** of the artificial reef needs to be clearly defined and ecological targets set for monitoring;

- In the absence of supporting guidelines and with many uncertainties that require answers larger scale reefing as of today in South East Asia is not environmentally responsible.



E.O Wilson

We have a stone age culture with a star wars technology.

We can change the environment faster than we can assess and understand the consequences.

Fisheries Department of Malaysia

Questions

Close

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