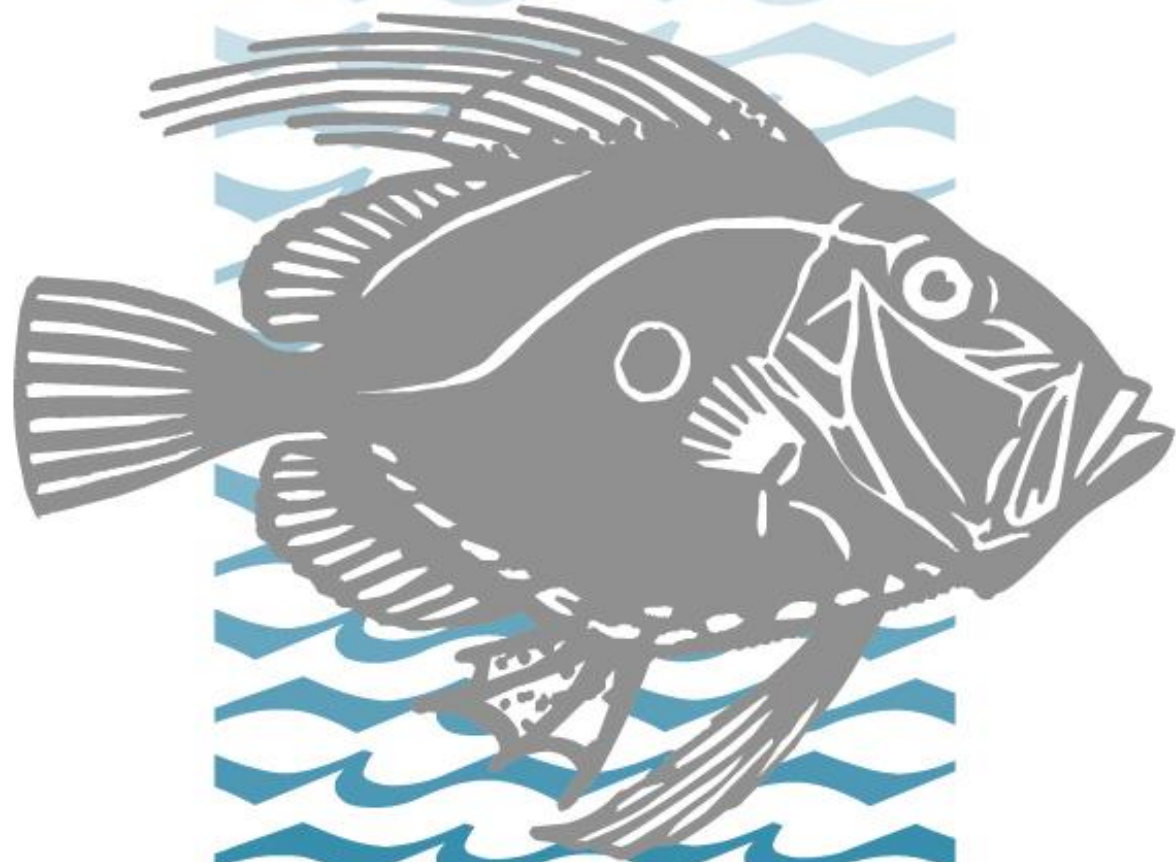


It's a Drag -

Balancing gear functionality with hydrodynamic theory

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CLEMENT



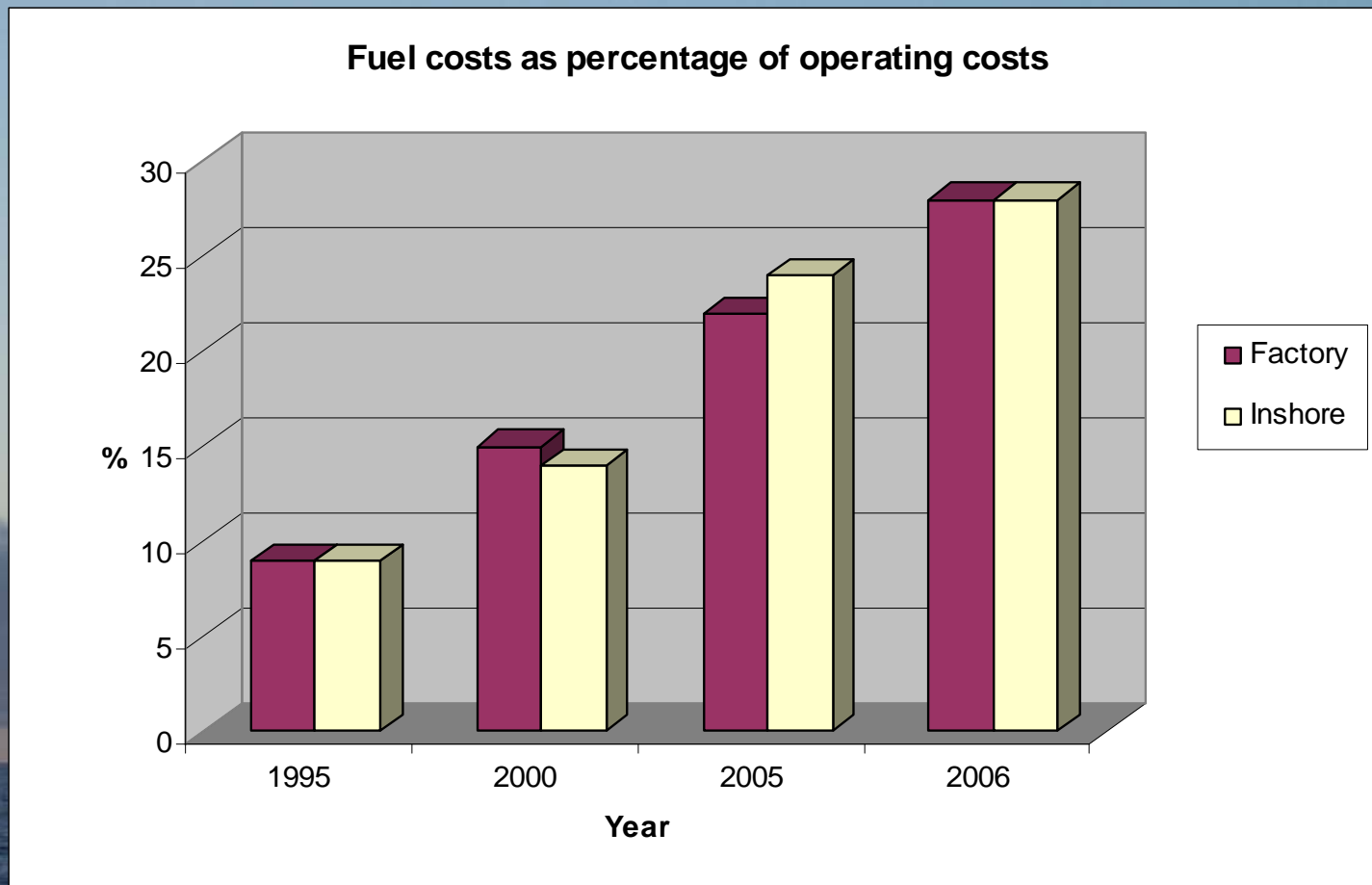
• This slide is here because I love this boat!

Introduction

- **We are here because of high fuel prices**
- **Trawling is a high fuel use business**

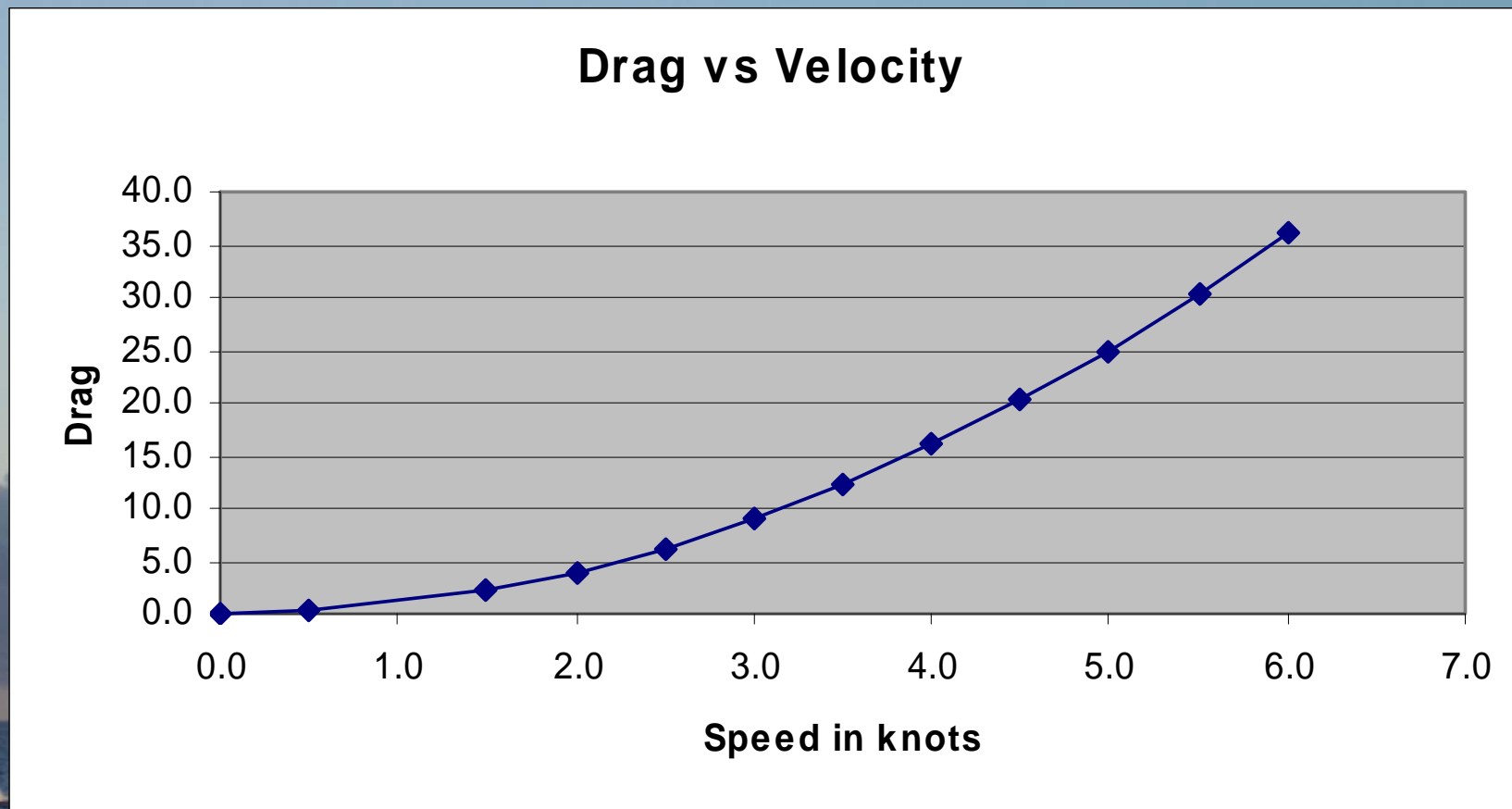


Dangerous Curves



- Trawler fuel as a % of operating costs

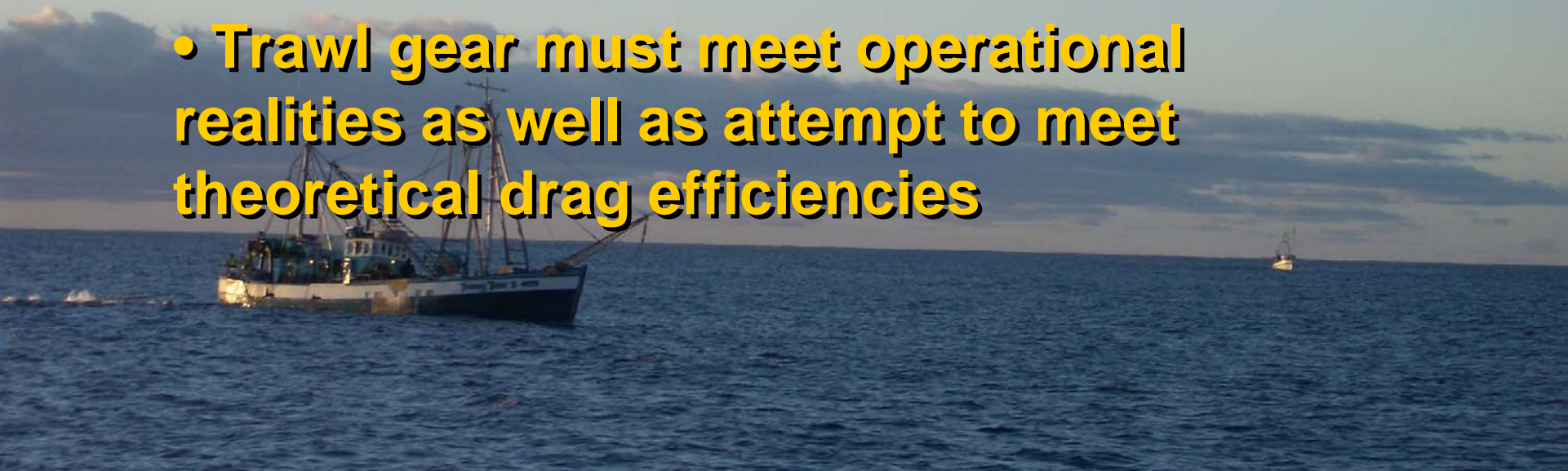
Dangerous Curves



- Drag increases greatly with tow speed

Two reasons why trawlers are gas guzzlers :

- **Trawlers are a design compromise because of the need to travel places, pull things and carry stuff**
- **Trawl gear must meet operational realities as well as attempt to meet theoretical drag efficiencies**



Often a conservative approach is taken to trawl gear development because:

- **Cost of new gear**
- **Risk of the catch reducing**
- **Hard to measure improvements**
- **Lack of understanding as to potential benefits**

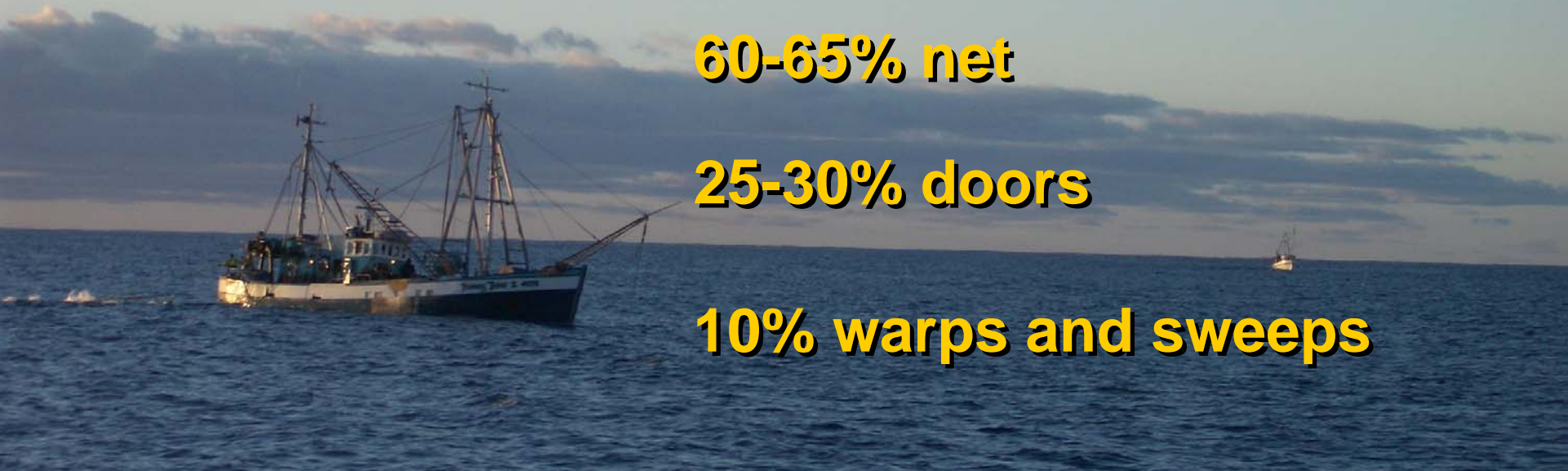
However when improvements are made the spread of that technology can be rapid

- **A trawl in operation is a set of components that add up to a stable system**
- **Symmetry of the parts is critical to its operation**
- **Drag in the system is approximately:**

60-65% net

25-30% doors

10% warps and sweeps



• The design and construction of these trawl components is compromised away from theoretical maximum drag efficiencies by constraints such as:

- Fish behavior
- Cost
- Wear
- Stability
- Reliability
- Simplicity to repair
- Ease of use
- Consistency
- Low maintenance
- Proven efficacy
- Tradition
- Inertia
- Risk

Trawl doors

- **These act like kites and depend on flow (tow speed) to operate**
- **Doors also gain spread from the seabed (ground shear) which creates a sandcloud that can help herd fish**

Trawl doors (cont)

- **Generally doors sacrifice hydrodynamic efficiency to ensure stability, especially when shooting, turning, in cross tides and when encountering obstacles**

- **Most doors are operating at high (30° +) angles of attack to make them stable and hence reliable**

Trawl doors (cont)

- Doors with “optional extras” such as:
 - Curves
 - Slots
 - Foils
 - Lots of tow points
 - More height than length
 - Vees & etc
- Are all attempting to increase spread efficiency without losing stability & reliability

Nets

- **Trawls catch fish by stealth.....**
- **The bigger the holes (mesh size) and smaller the twine diameter for a given trawl size, the less drag**
- **Materials used in trawls are a compromise (again!) mainly due to:**
 - **Cost**
 - **Abrasion resistance**
 - **Tensile strength**
 - **Memory**
 - **Elasticity**
 - **Knot integrity**

Nets (size isn't everything)

- **More modern materials offer opportunities to build “smarter” trawls that sacrifice little in strength or longevity**
- **For many species smaller trawls can catch equivalent or more profitable volumes of fish**

Change Management

- It is critical to consider a trawl system as a whole; significant change to single major component will create a lack of equilibrium:

e.g. If a lighter net is used, door performance will alter as the in-pull on the doors reduces

- If the alteration is great enough, simply changing the tow points on the door will not be enough – you will need smaller doors

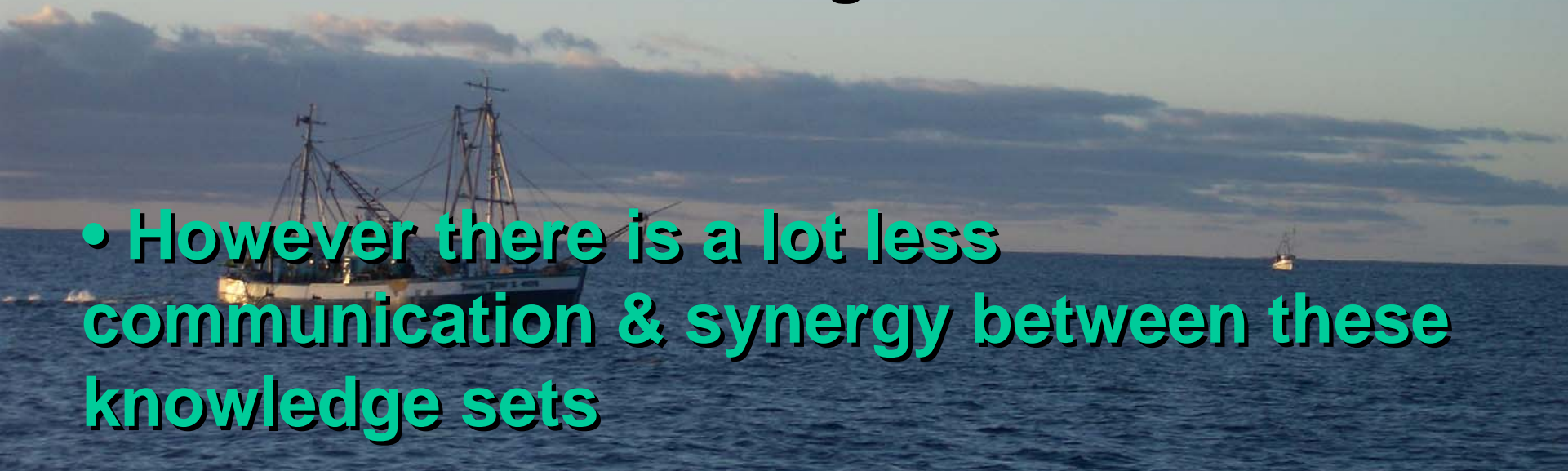
Change Management (cont)

- This is why fishing gear development can be a slow process – it is often done by tweaking

- Large jumps in technology require system changes, these can be financially challenging and risky

So ...

- **The physics of fishing gear is pretty well understood (by some!)**
- **The realities of fishing are some others!**
- **However there is a lot less communication & synergy between these knowledge sets**



So ...

- In my view there are significant gains to be made in the New Zealand inshore trawl fishery with regards to fuel savings

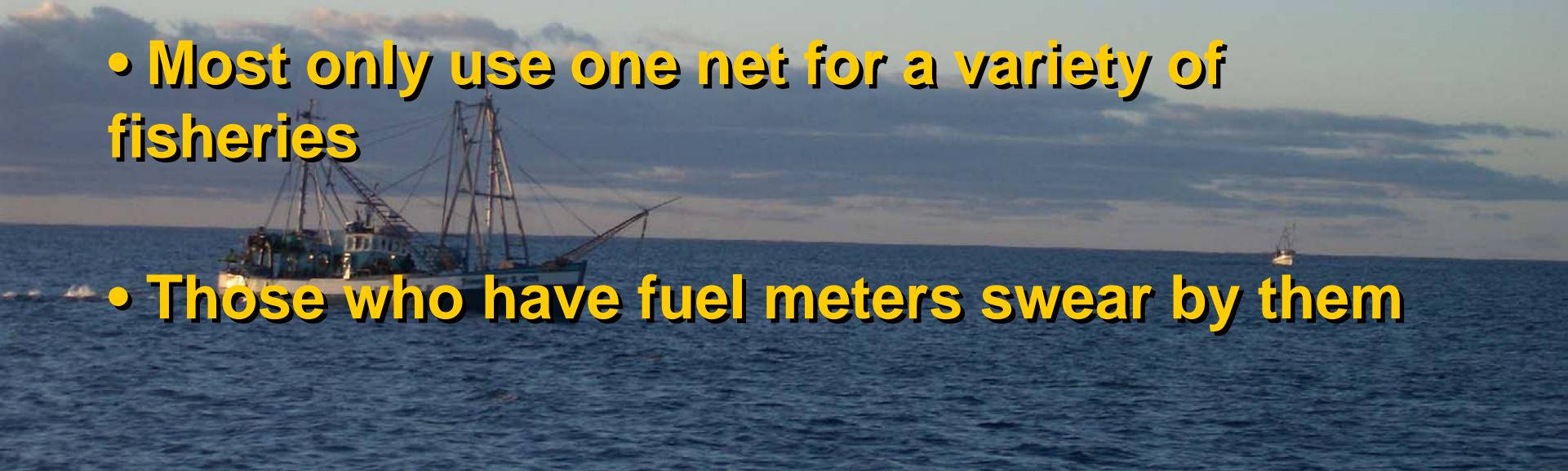
- There may well be spin offs in improved catch rates and selectivity of catch

SIL Inshore Trawl Gear Survey

- **Currently we are undertaking a baseline survey of what vessel, gear and operating methods are being used in the New Zealand inshore trawler fleet**
- **This will allow identification of opportunities to reduce fuel use**
- **It will also mean we can compare our operations with overseas fleets and research & development**

- **Using a survey form designed by fishermen for fishermen, we have started collecting information**
- **After interviewing only 20 vessel operators so far the following themes are emerging:**
 - **Experienced fishermen know more than inexperienced ones!**
 - **Few know the rpm or speed setting where their engine is most efficient**

- **Most can identify options to reduce fuel use but have not managed to implement them**
- **Few know the twine area of their net**
- **Most only use one net for a variety of fisheries**
- **Those who have fuel meters swear by them**



- **Knowledge of door performance is less than desirable**

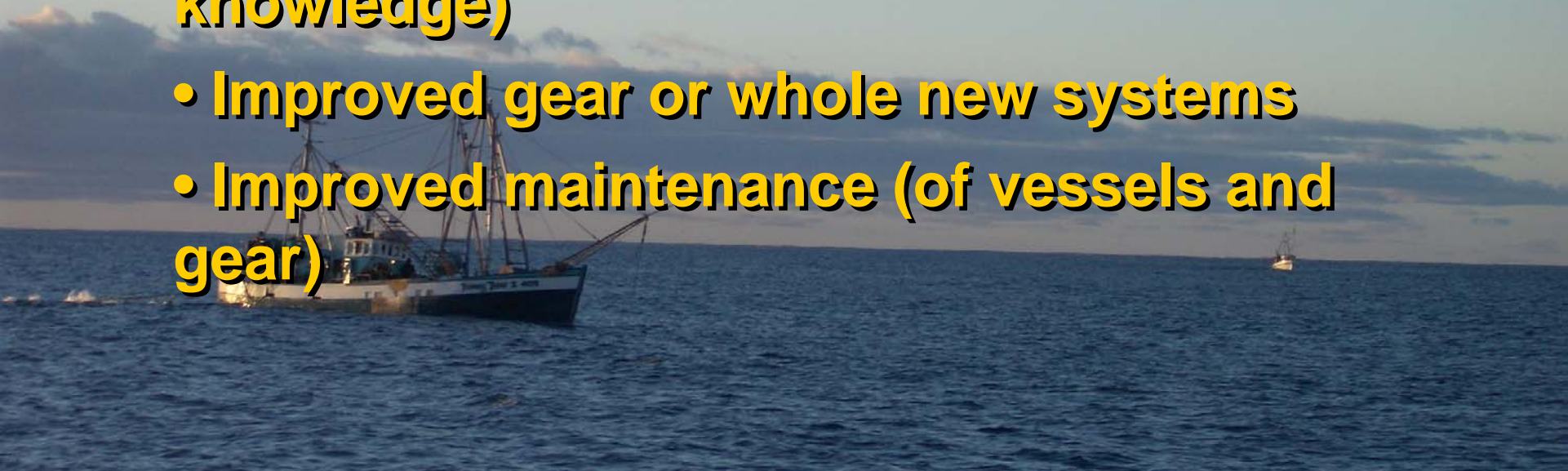
- **BUT MOST IMPORTANTLY:**

- **Trawlermen contacted are happy to be part of this survey**



- **Any future fuel use reductions are likely to stem from:**

- **Change in operations (e.g. tow speeds)**
- **Training (e.g. engine performance & gear knowledge)**
- **Improved gear or whole new systems**
- **Improved maintenance (of vessels and gear)**



- Then we can steam to profitable trawling

