Fisheries Resource Education Programme: Introduction to Sustainable Fishing training workshop

SCIENCE 1: Setting the scene

6th March 2018

Dartington Hall Conference Centre, Devon

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Centre for Environment
Fisheries & Aquaculture
Science

Cefas

- *My personal journey*
- Lowestoft Laboratory
  - Edward S. Russell, Director (1921 – 1945)
- Ecological approach
- Competition for marine space
- Process overview
  - from science to management

Outline of presentation

baltic sea RAC

DATA-DEFICIENT FISHERIES IN EU WATERS

STUDY

Dr Carl O'Brien, Chief Fisheries Science Advisor to DEFRA and 2015 joint Buckland Professor (left), with NFFO Chief Executive Barrie Deas, in one of the working groups that followed the presentations.

brief communications

Fisheries

Climate variability and North Sea cod

The stock of North Sea cod is under pressure because of overfishing, and we show here that it is also threatened by a decline in the production of young cod that has paralleled warming of the North Sea over the past ten years. The combination of a diminished stock and the possible persistence of adverse warm conditions is endangering the long-term sustainability of cod in the North Sea. To decrease the risk of collapse, fishing pressure must be reduced.

Over the past four decades, cod in the North Sea has been a valuable fishery, yielding an average of 200,000 tonnes per year. Nowadays, the catch is mainly constituted of fish that are younger than three years old, most of which are immature. This resource is currently managed by imposing landing quotas based on annual stock assessment: the latest advice from the International Council for the Exploration of the Sea (ICES) is to reduce catches by 40–60%.

For North Sea cod, apart from fish spawned in 1996 (termed the 1996 year-class), the annual number of one-year-old cod in the population (known as the recruitment) has been at or below the long-term average for over a decade[1]. The recruitment of cod spawned in 1997 was the lowest for 30 years. Taking account of the stock from being able to produce recruitments as high as those that occurred during the 1960s and 1970s, even if the spawning-stock biomass were to rebuild to the abundant levels of that period.

Since 1988, mean sea temperatures during the first half of the year in the North Sea recruitment. The 1996 year-class was the strongest for over a decade but, at the present high exploitation rate of young cod, few individuals have survived to reach sexual maturity.

The combination of this exploitation with the recent changes in North Sea temperature, a low spawning-stock biomass and a stock dominated by young immature individuals, means that fishery managers must take precautionary measures[2]. In order to give the mature stock a chance to rebuild, fishing mortality rates need to be reduced to at least the precautionary levels advised by ICES[1].

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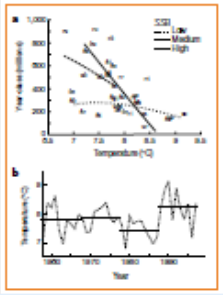

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My personal journey

Cefas

- Origins:
  - Research station established in 1902 to study the North Sea plaice fishery
  - Support the UK's contribution to the newly created International Council for the Exploration of the Sea (ICES)
  - Established seagoing surveys, with a focus on offshore fisheries

- Ministry of Fisheries
  - Edward S. Russell appointed Director (1921 – 1945)

- Directorate of Fisheries Research (*dfr*)
  - Broadened to include inshore and freshwater species

- Recent past:
  - *dfr* renamed Cefas in 1997 - Executive Agency of the Ministry of Agriculture, Fisheries and Food (MAFF), now the Department of Environment, Food and Rural Affairs (Defra)

By 1921 the station had become a laboratory with experimental facilities. Biological studies expanded in the 1920s and 1930s and many aspects of fisheries theory were developed. This was a period of major discovery in all aspects of marine biology from physics to plankton to fish.

Russell and the 1920s

- *Lumby*: developed fisheries hydrography both in Lowestoft and in ICES
- *Hardy*: famous for Continuous Plankton Recorder, worked at Lowestoft and participated in discussions of plankton research at ICES
- *Russell*: mathematically formulate factors that affected fish abundance

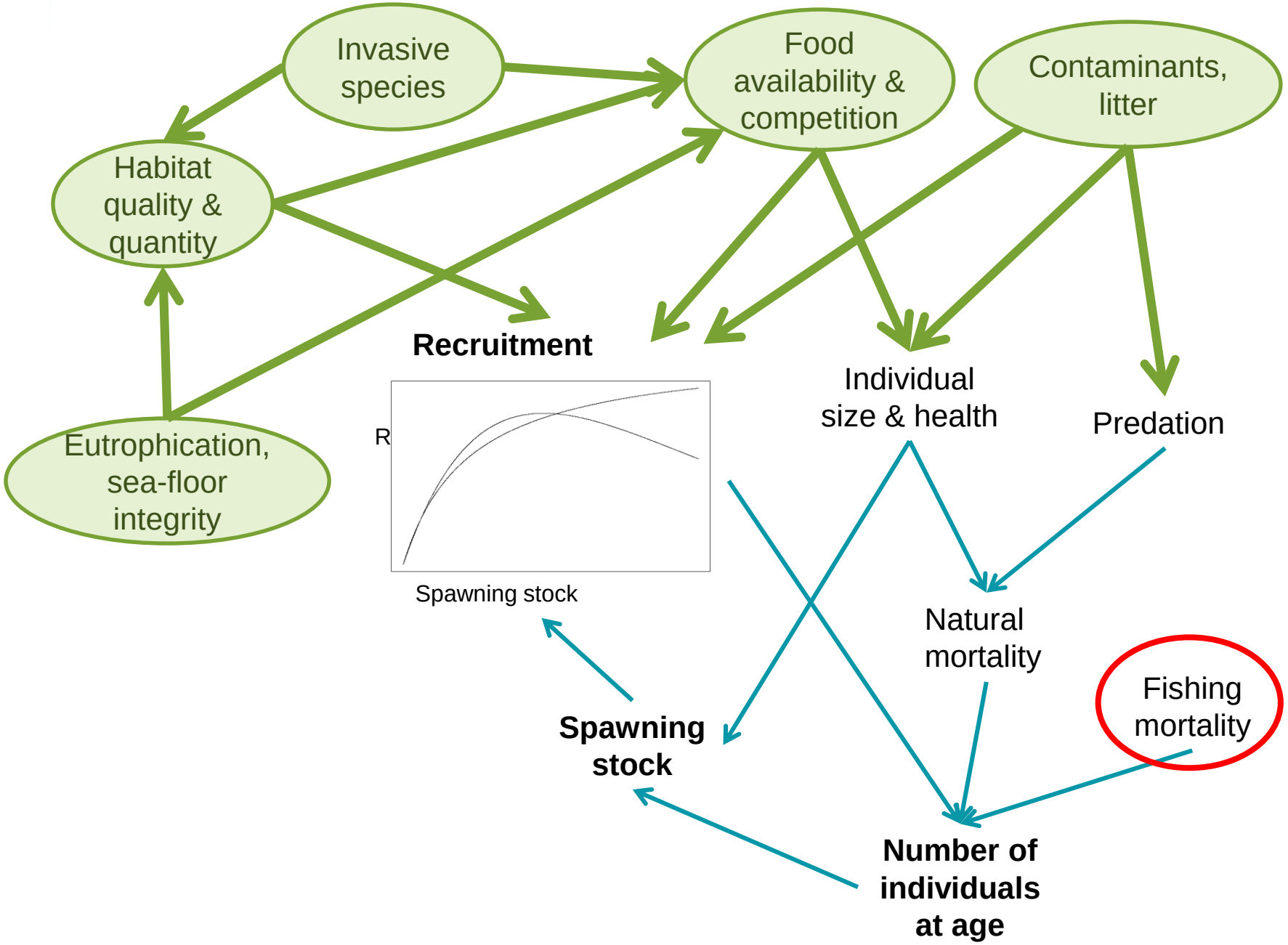
At sea in the 1920s

- Russell's work explained the observations of declining catches and offered tools for remedying the problem of overfishing.

- A simple relationship to compare the weight of the stock of fish at the end of the year to the amount that had been available at the beginning.

- Ecological approach involving the study of fish in relation to all factors that affect their abundance:

    - Growth rate
    - Food supply
    - Reproduction
    - Effects of fishing
    - … etcetera …


Invasive species
Food availability & competition
Contaminants, litter
Habitat quality & quantity
Recruitment
R
Spawning stock
Individual size & health
Predation
Eutrophication, sea-floor integrity
Natural mortality
Fishing mortality
Spawning stock
Number of individuals at age

In the 1940s-50s, Beverton and Holt (*below*) developed groundbreaking theories of fishing and fish population dynamics that cemented Lowestoft's international reputation for leading fisheries science.

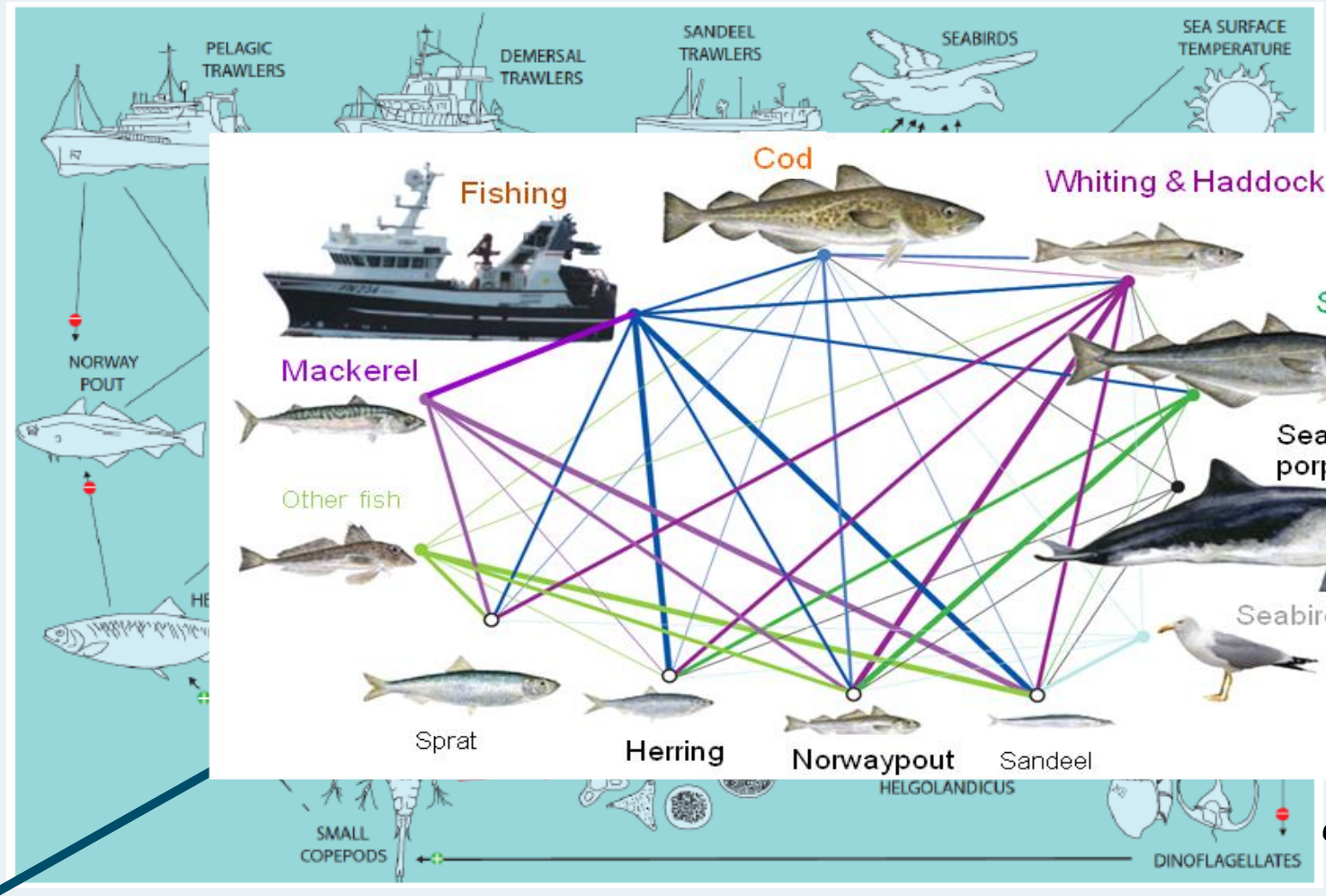
Surplus production theory

Spawner-recruit theory

Yield-per-recruit theory

Russell predicted:

"It seems likely, therefore, that all fisheries research will become more fundamental in nature and aimed at understanding the great natural fluctuations in the fish populations and the causes of the habits of the fish themselves."



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Today

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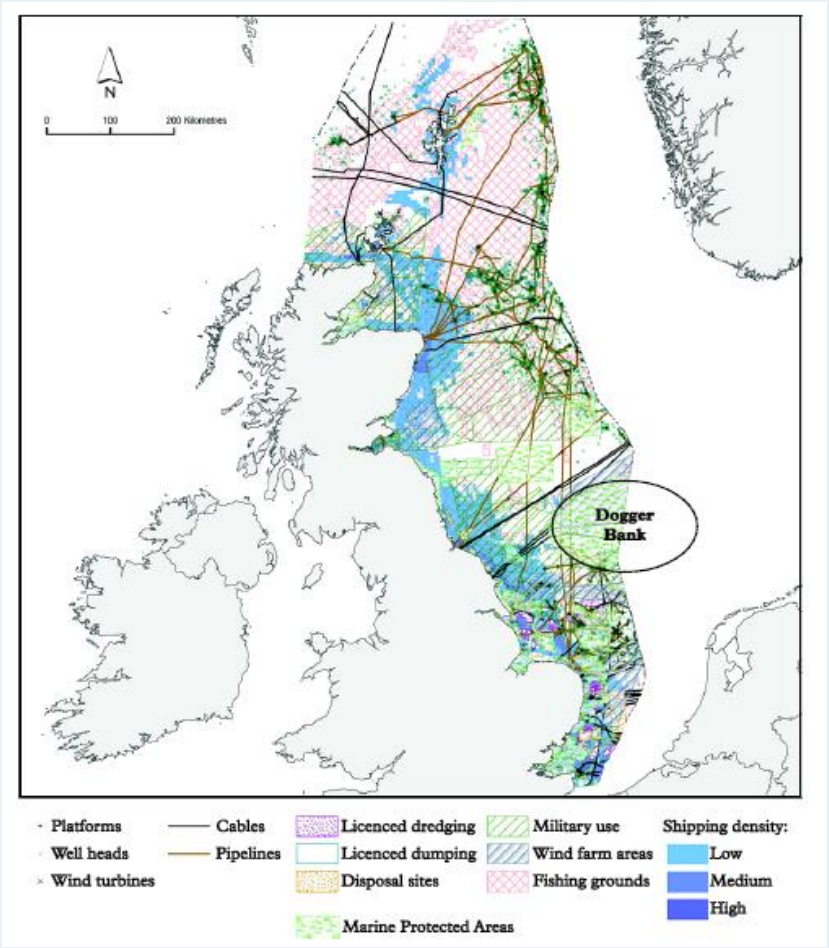

HOUSE OF LORDS

European Union Committee

10th Report of Session 2014–15

The North Sea under pressure: is regional marine co-operation the answer?

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Challenge - Competition for marine space

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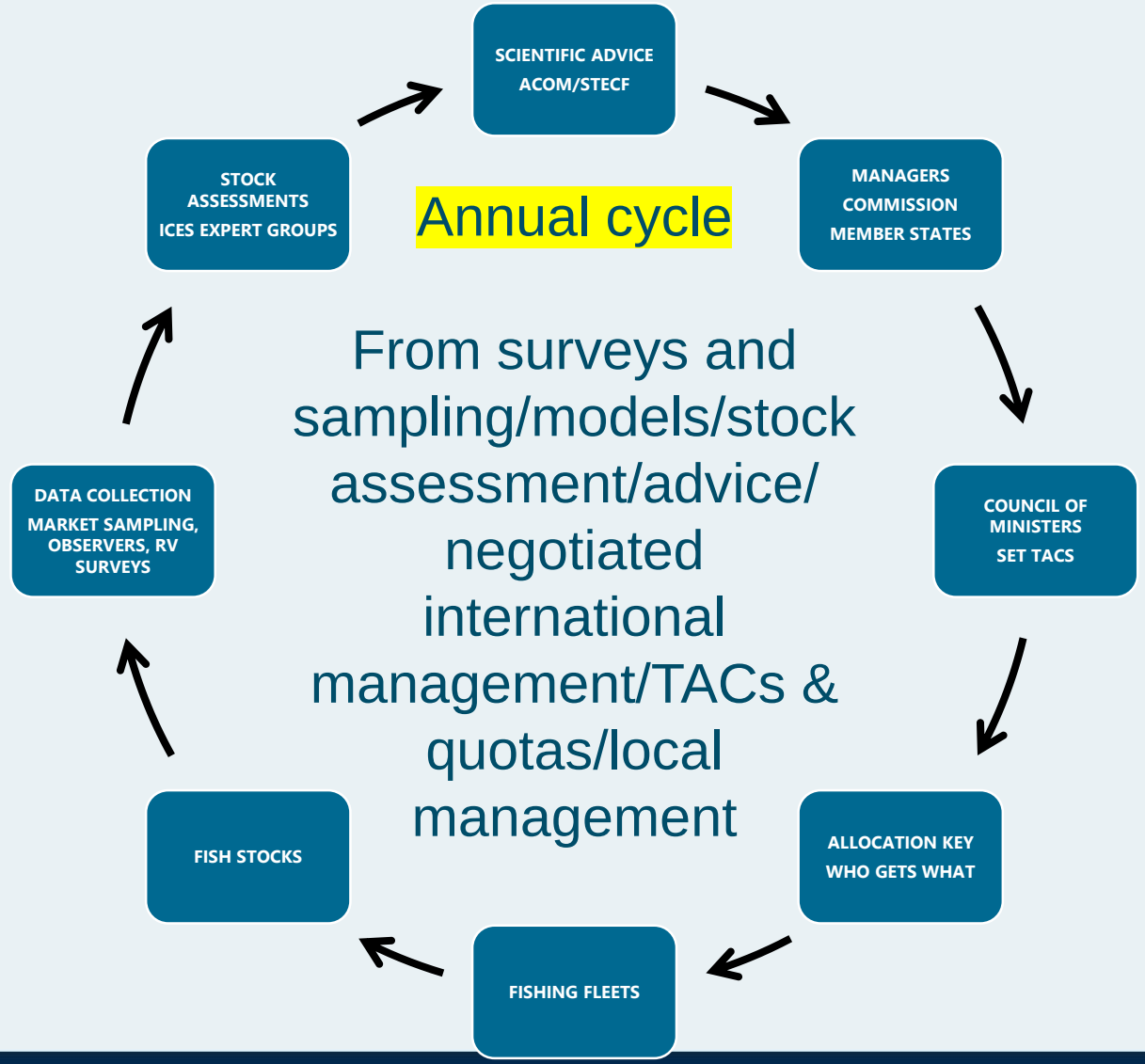

Start here: then move clockwise

Process overview: from science to management

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