

# The Clyde Marine Ecosystem

The Status of White Fish in the Clyde



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**marinescotland**  
**science**

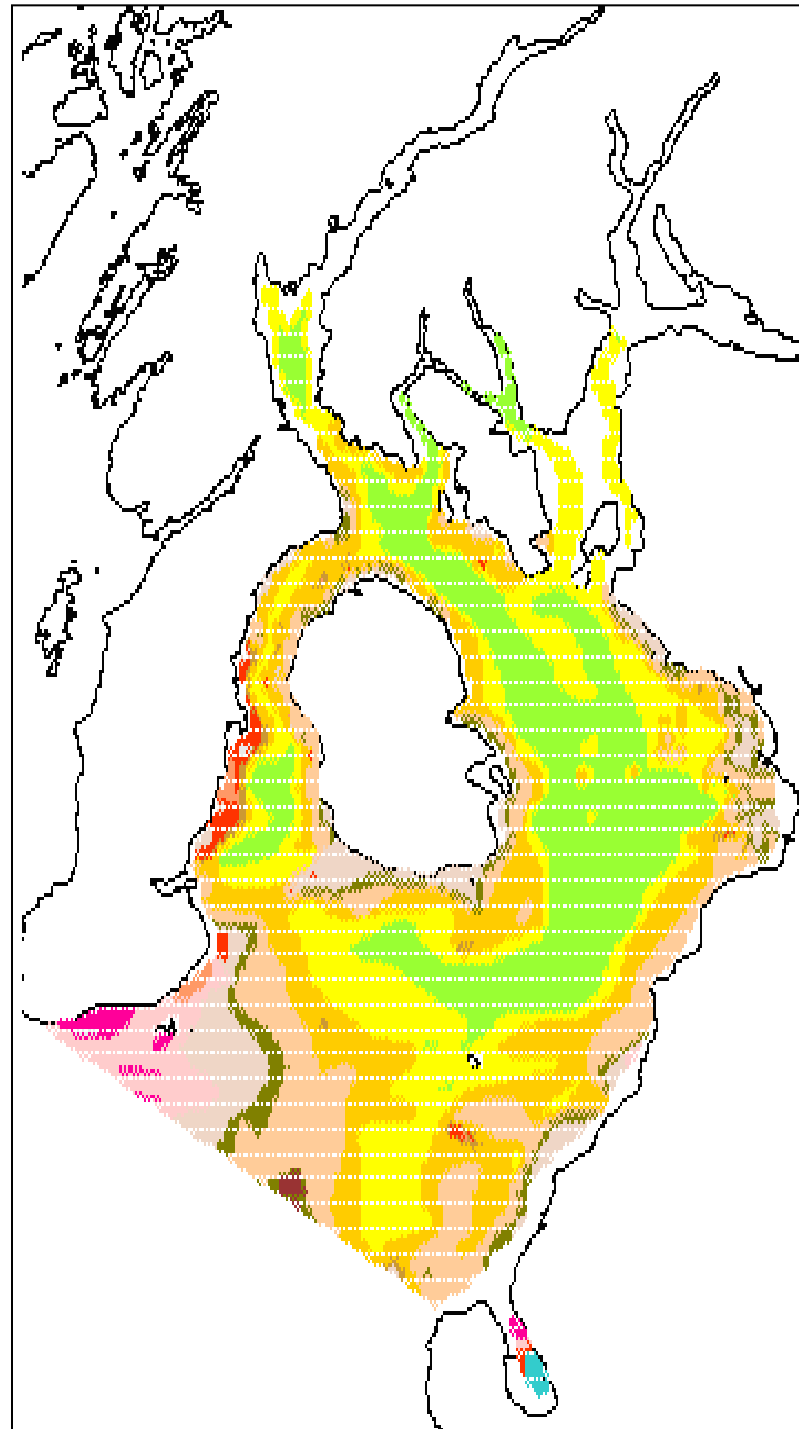


Surface Area	3,671 km <sup>2</sup>
Volume	179 km <sup>3</sup>
Average Depth	49 m
Maximum Depth	170m

0.8% Scottish waters

Data from BGS and SeaZone

# Habitats



Gravels



9%

Sands



66%

Muds



25%

Data from BGS and SeaZone

# Clyde White Fish - Two Data Sources



## Landings

## Surveys

### Strengths

Coherent data set from 1950s and before  
Easy to work with

Data independent of fishery  
All species and sizes

### Weaknesses

Dependent on fishery (fishing effort, market forces, quota, legislation, weather, fuel price, fishing method, etc.)  
Commercial species and sizes only

Requires specialist analysis  
Some change of methods over years  
Not trusted by fishing industry

Thurston and Roberts (2010)

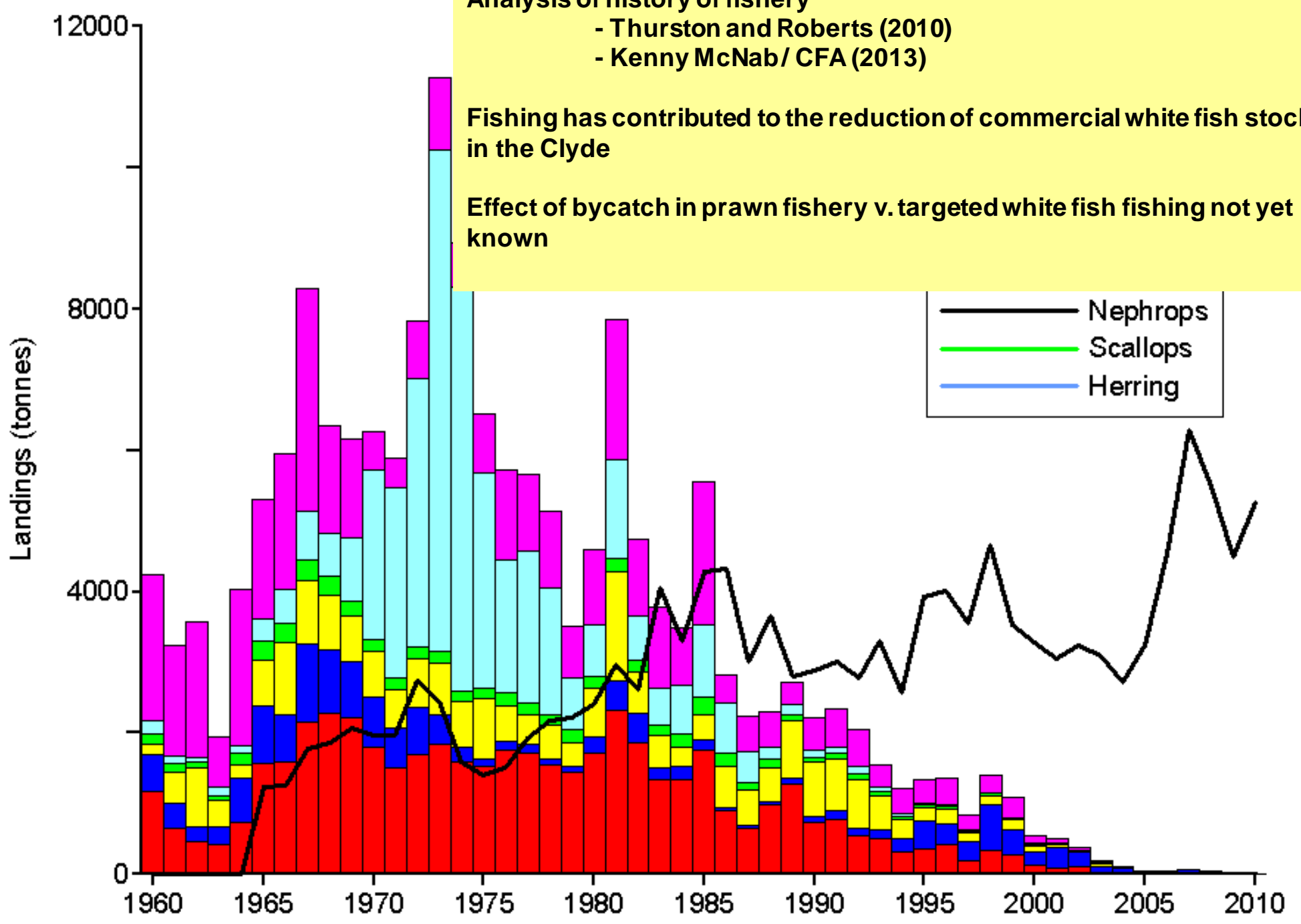
Heath and Speirs (2011)

# Landings Data

**Analysis of history of fishery**  
- Thurston and Roberts (2010)  
- Kenny McNab/ CFA (2013)

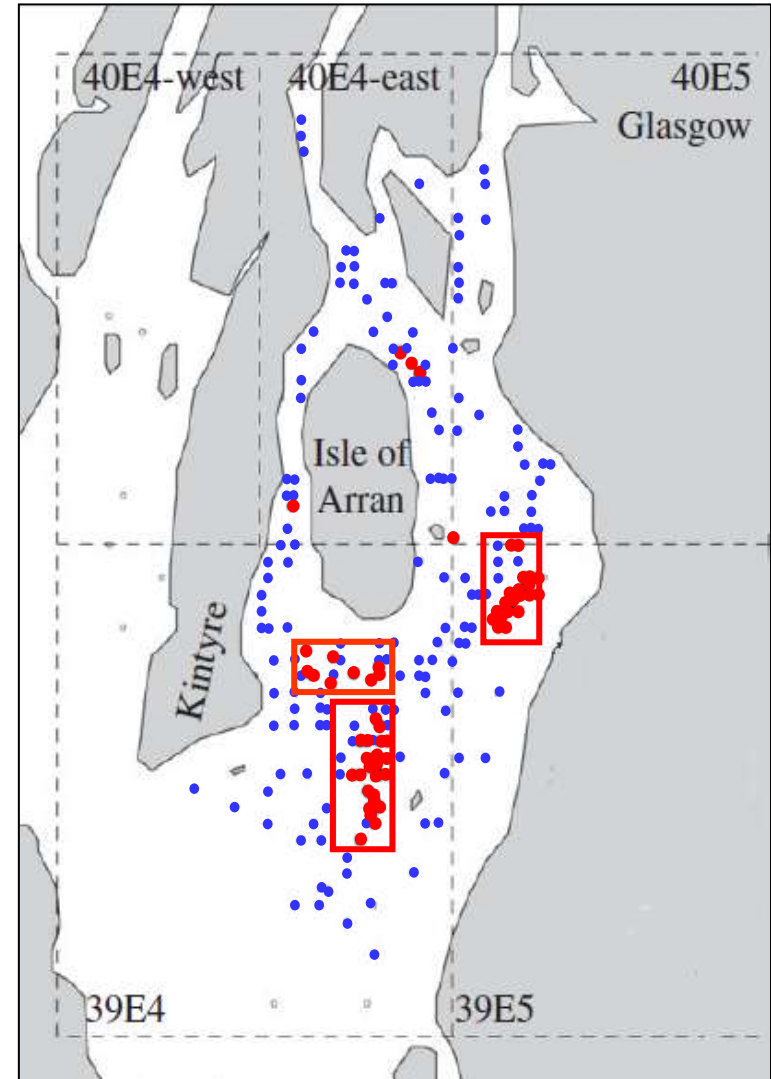
**Fishing has contributed to the reduction of commercial white fish stocks in the Clyde**

**Effect of bycatch in prawn fishery v. targeted white fish fishing not yet known**

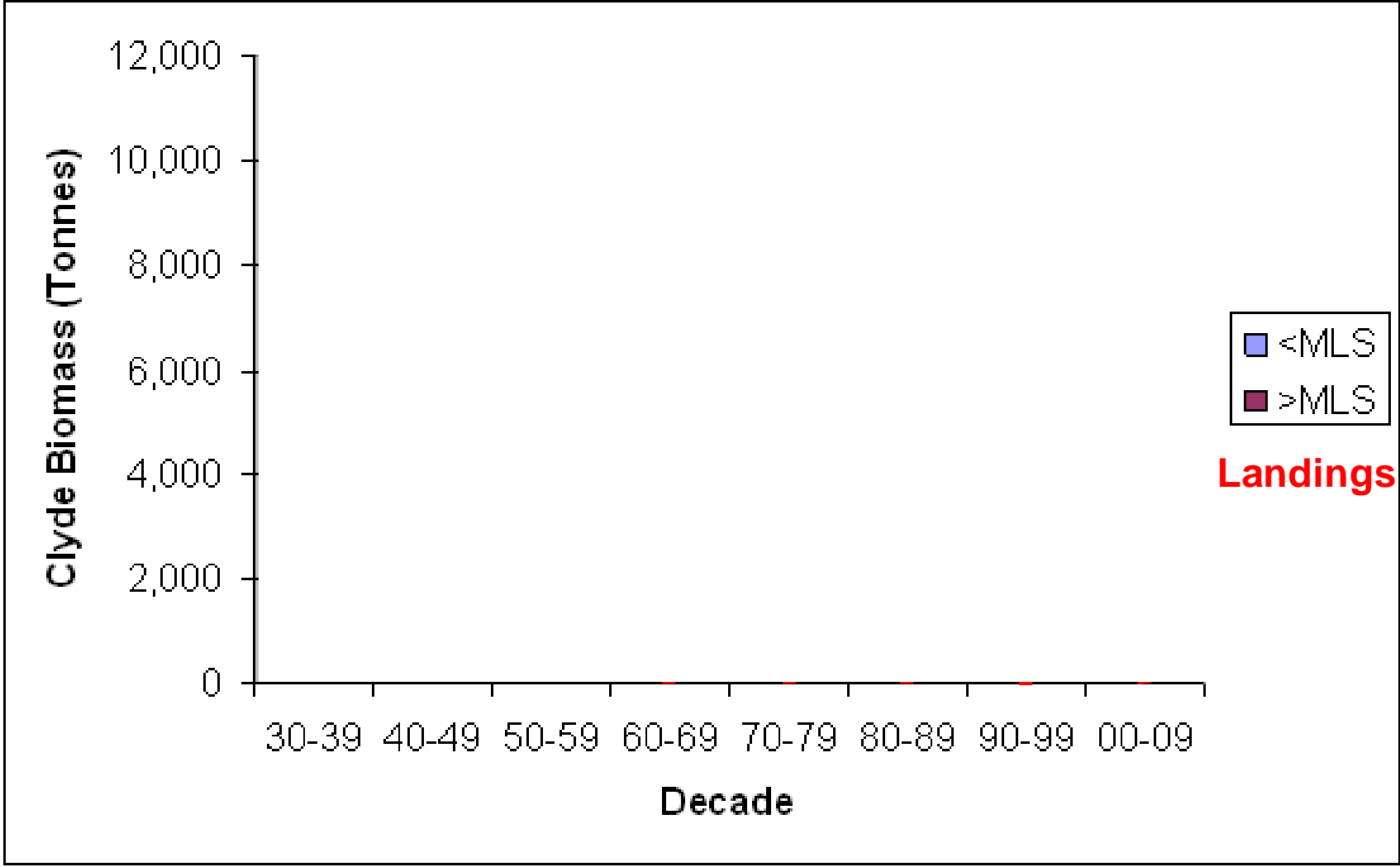


# Research Vessel Survey Data

- **Heath and Speirs (2011)**
- **1985 onwards** ●
  - Standard survey gear (GOV)
  - Part of west coast IBTS
- **Prior to 1985** ●
  - Used hauls with similar gear
  - Averaged over boxes
- **Also took results from**
  - Hebrides
  - Irish Sea



# Survey Data – White Fish Biomass



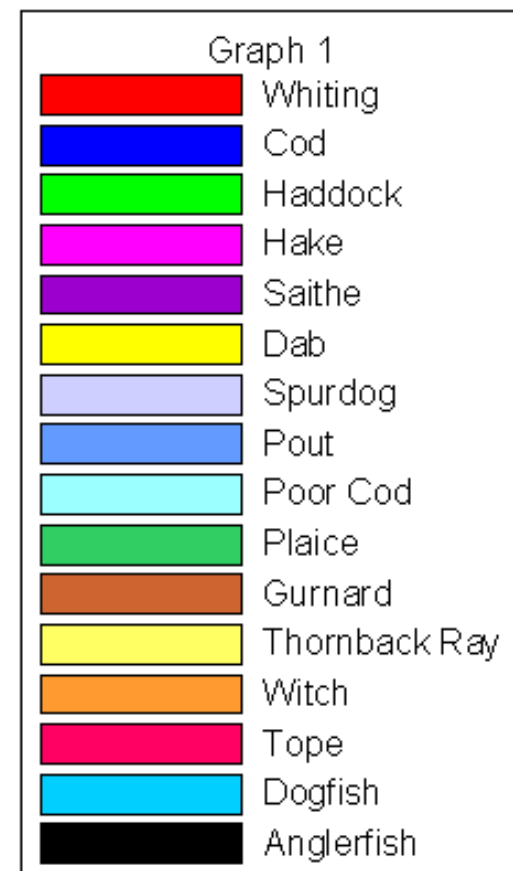
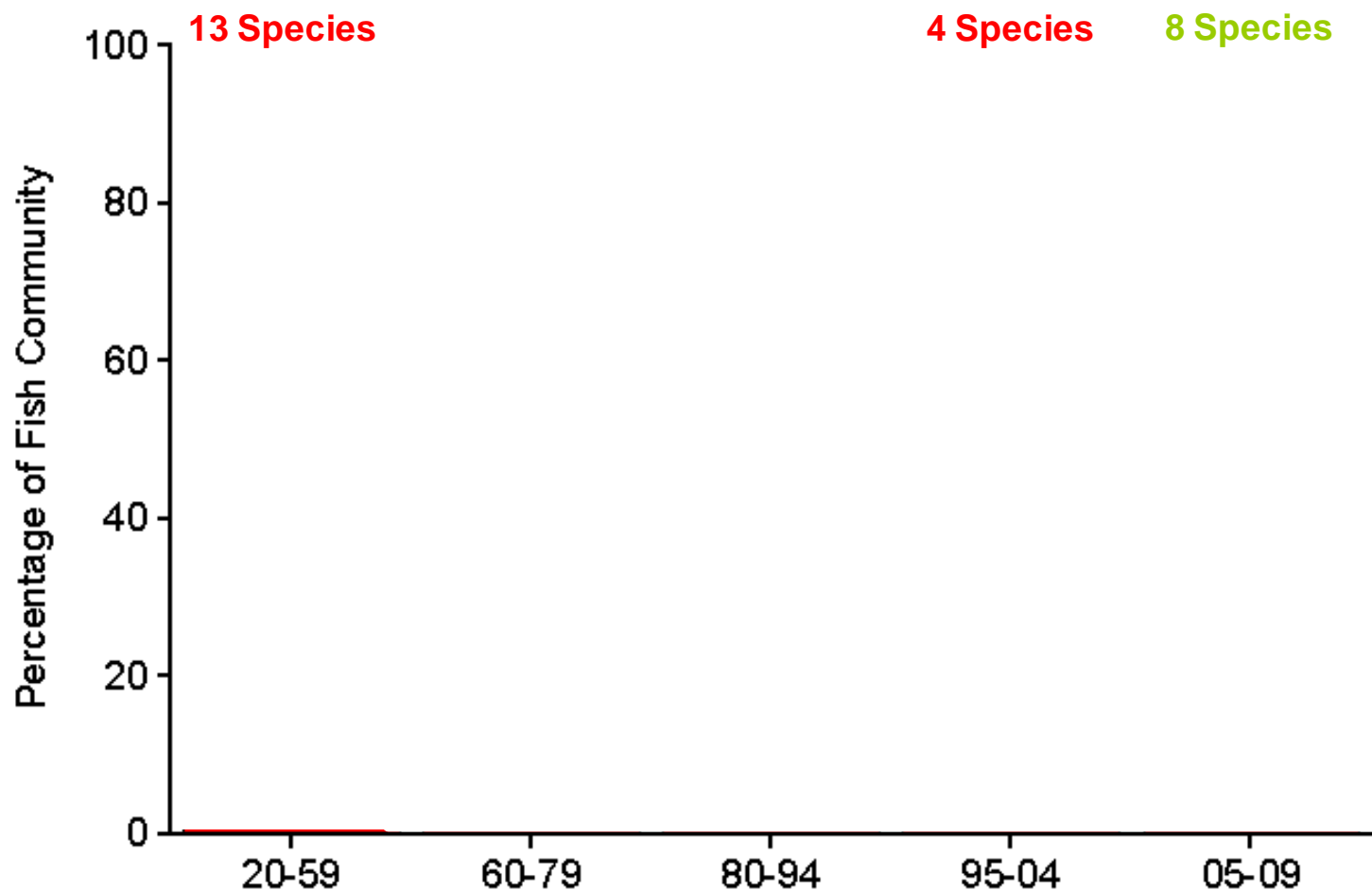
cod haddock whiting hake saithe plaice

# Survey Data – White Fish Biomass

- **Biomass now greater than it was in the 1930's and 1940's**
- **In fact more than twice**
- **But 90% of it is <MLS and 72% of it is whiting**
- **Biomass has recovered from very high exploitation rates in 1970's 1980's**
- **Clyde is still productive**
- **But it is in a new regime of small fish**



# Survey Data - Mix of Fish Species in the Clyde



Whiting  
87%

Whiting  
72%

1920 - 1959



Spurdog 23%



Hake 14%



Cod 13%



Grey Gurnard 8%



Whiting 7%



Saithe 6%



Thornback Ray 6%



Haddock 5%



Long Rough Dab 4%



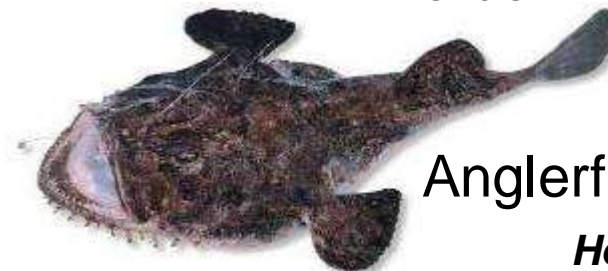
Witch 3%



Tope 3%



Plaice 3%



Anglerfish 2%

Heath and Speirs (2011)

2005 - 2009



Hake

2%



Cod

2%



Haddock

12%



Long Rough Dab

1%



Whiting

72%



Plaice

2%



Norway Pout

4%



Poor Cod

2%

*Heath and Speirs (2011)*

# Survey Data - Mix of Fish Species in the Clyde

- **Results suggest fishing has significantly altered the mix of species in the Clyde**
- **Changed**
  - FROM - An even mix, with many large predator species
  - TO - One dominated by whiting and other small fish
- **Species evenness changes in the Clyde very differently than observed in nearby waters**
  - i.e. Sea of the Hebrides and the Irish Sea
  - Suggests Clyde fish populations respond locally to fishing pressure
  - But also Clyde can be managed separately from the Scottish west coast
  - Good chance of local measures working
  - General west coast measures may not be effective in Clyde, as Clyde responds differently

- **Research vessels**
  - Use wrong type of net
  - Fish at wrong time of year
  - Tow for too short a time (30 mins)
  - Fish in the wrong way (i.e. not semi-pelagic)
  
- **MSS Industry Surveys**
  - Shangri La – December 2013
  - Shangri La – March 2014
  - Frigate Bird – March 2014
  
  - RV Survey – Quarter 1 2012
  - RV Survey – Quarter 4 2012
  - RV Survey – Quarter 1 2013

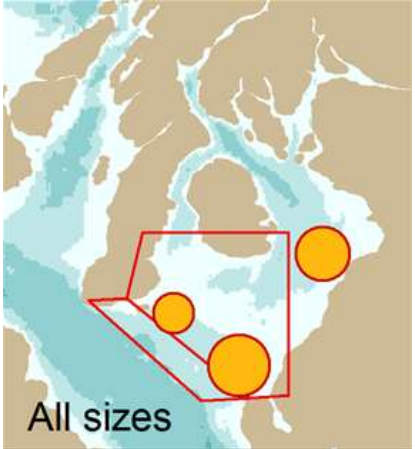
# MSS Industry Surveys



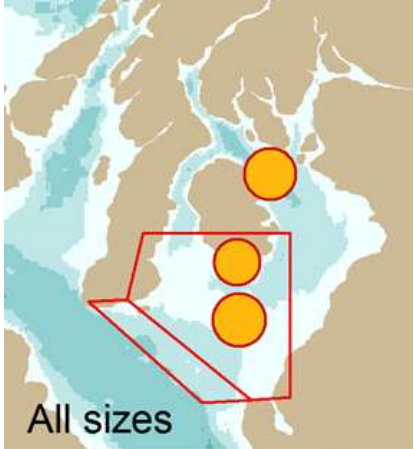
	Type of Fishing	Type of Net	Tow Duration	Cod End	Where
Research Vessel	Bottom	Survey Gear	30 mins	Small mesh	Survey Locations
Shangri La	Bottom	Commercial Gear	30 – 60 mins	Small mesh	All Clyde
Frigate Bird	Semi-Pelagic	Commercial Gear	4-12 Hours	Large mesh (except 2 tows)	Deep Inner Basins

# Whiting

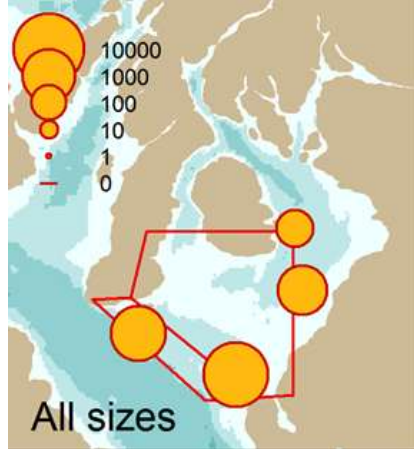
RV Q1 2012



RV Q4 2012



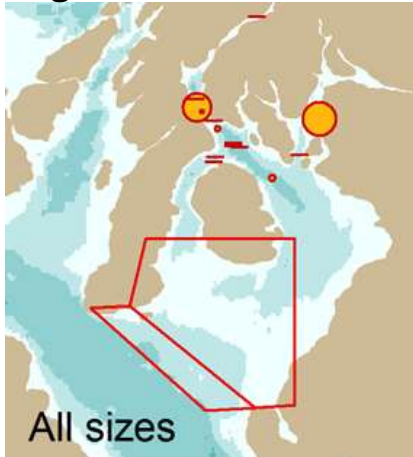
RV Q1 2013



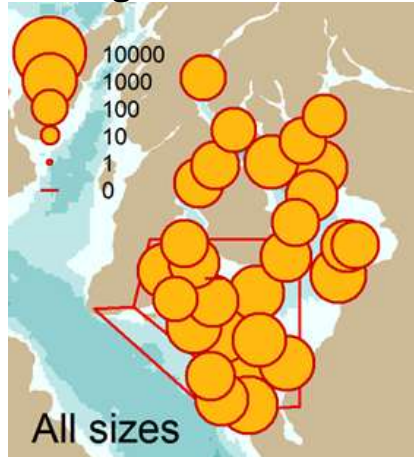
ShangriLa Dec 2013



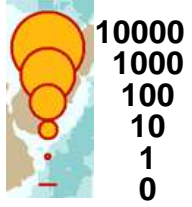
Frigate Bird Mar 2014



ShangriLa Mar 2014



Catch Rate  
(Fish / Hour)

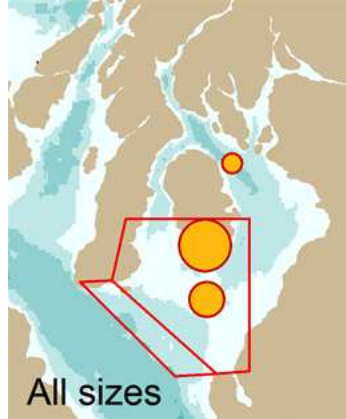


# Haddock

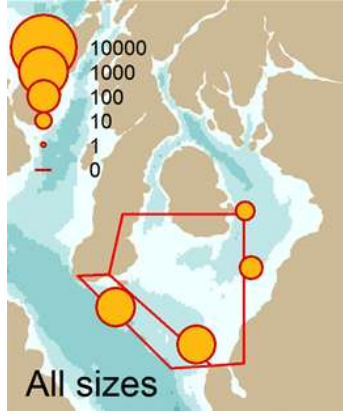
RV Q1 2012



RV Q4 2012



RV Q1 2013



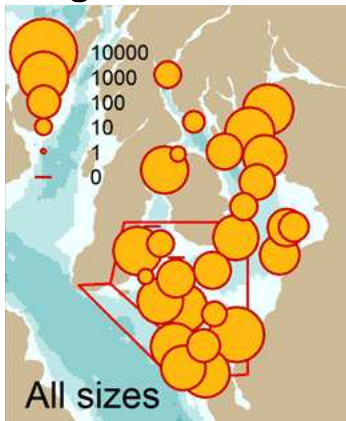
Shangri La Dec 2013



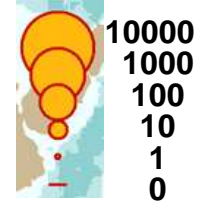
Frigate Bird Mar 2014



Shangri La Mar 2014



Catch Rate  
(Fish / Hour)



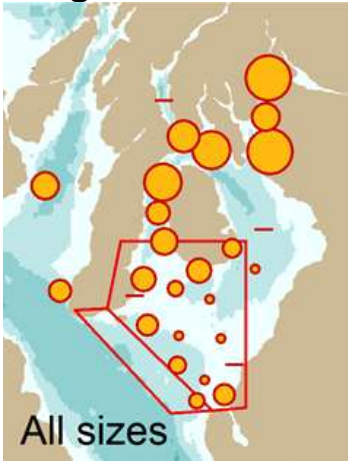


# Cod

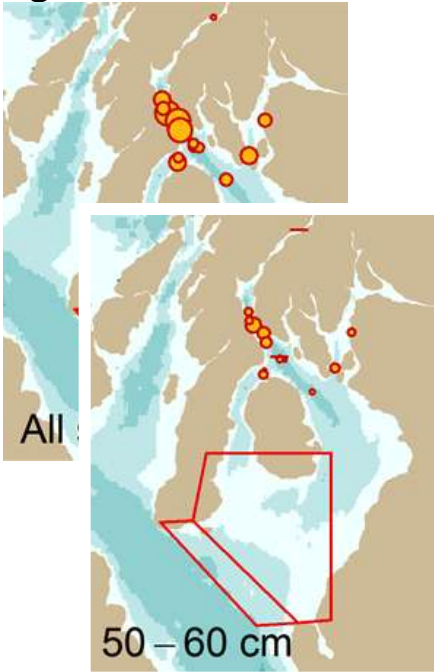
## Early Conclusions

- RV, demersal commercial fishing and semi-pelagic commercial fishing all returned similar catch rates in all species
- Catch rates in 100-1000 fish / hour range
- Most fish were small (<20cm)
- Confirms Heath and Speirs picture of abundant small fish, whiting most abundant
- Frigate Bird (semi-pelagic, commercial) did catch large cod – relict population in deep basins ?

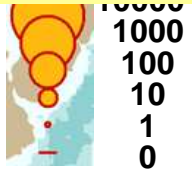
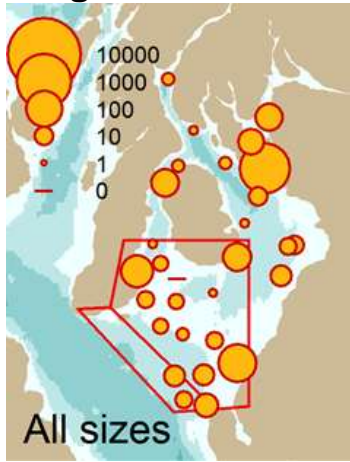
Shangri La Dec 2013



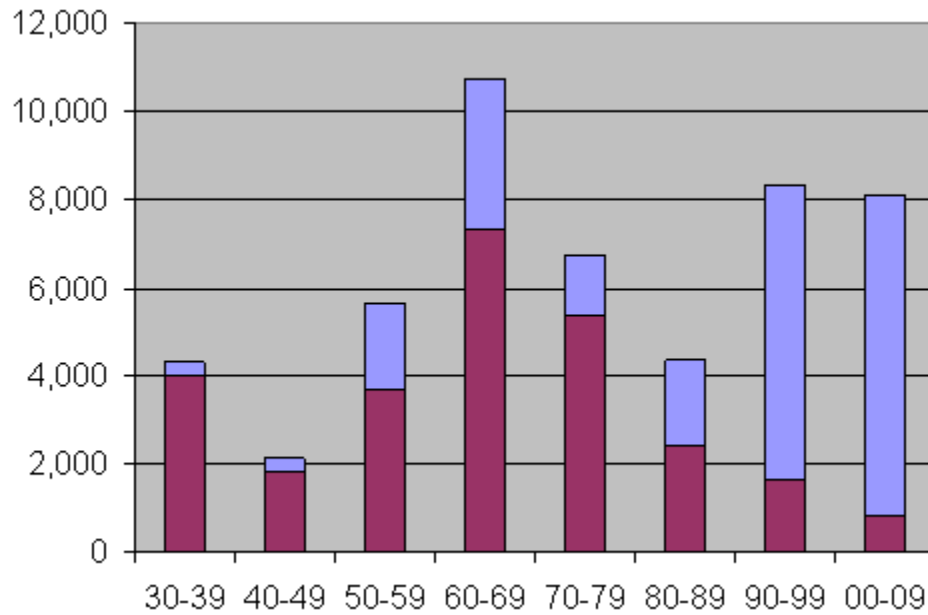
Frigate Bird Mar 2014



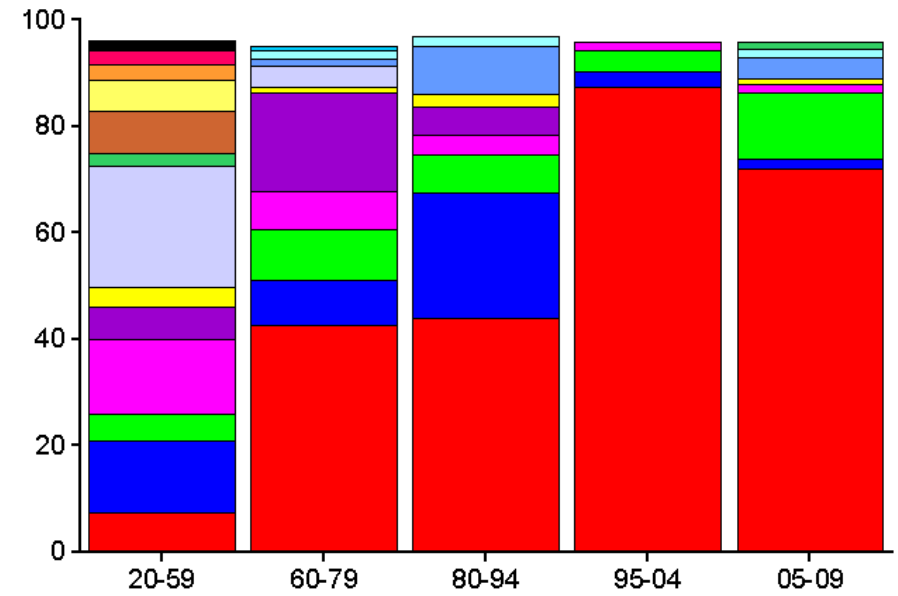
Shangri La Mar 2014



## CLYDE IS NOT DEAD.....



## ..... BUT CHANGED



# Hypotheses To Test

- **Fishing**

- There was only a minor influence from the TR2 fishery on the decline of white fish in the Clyde
- The bycatch in the TR2 fishery is stopping the return of large fish
- Static gear fishing also results in a white fish bycatch
- Different sub-populations of Clyde gadoid fish were removed by the successive application of seine netting, pair trawling, semi-pelagic trawling

- **Ecosystem**

- There has been a substantial alteration at the base of the food chain (zooplankton)
- There has been a substantial alteration to benthic habitats
- A change at the base of the food chain has driven the switch from large fish to small fish
- Climate change, not fishing, has driven a change at the base of the food chain
- Climate change will stop the recovery of an ecosystem with large fish
- Overfishing has caused a change in the genetic composition of the Clyde fish populations
- Top-predators are eating fish before they can grow

- **Gadoid Fish**

- Clyde white fish populations are sustained by spawning adult populations which migrate into and out from the Clyde
- If cod recover there will be an adverse effect on *Nephrops* abundance

- **Pelagic Fish**

- The remaining Clyde herring is an inshore sub-population, as the offshore populations have been removed by fishing

- **Measures**

- A recovering cod population will result in substantial restrictions on the *Nephropstrawl* fishery
- Static gear as well as mobile gear lead to fish mortality, and hence must be managed