Understanding the spawning dynamics of orange roughy *Hoplostethus atlanticus* in south-eastern Australia

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Image courtesy of Alexei Orlov
www.fishbase.org

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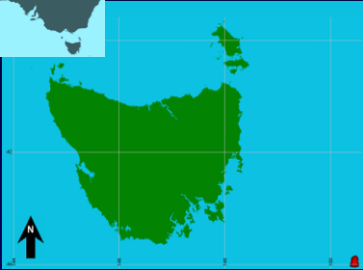[3]Diversity Australia, Perth, WA

Roughy fishing in Australia

➢ **Australian orange roughy fishing began in the early 1980s**

➢ **In the late 1980s large aggregations were discovered off Eastern Tasmania**

➢ **Uncontrolled expansion of fishery, and subsequent serial depletion**
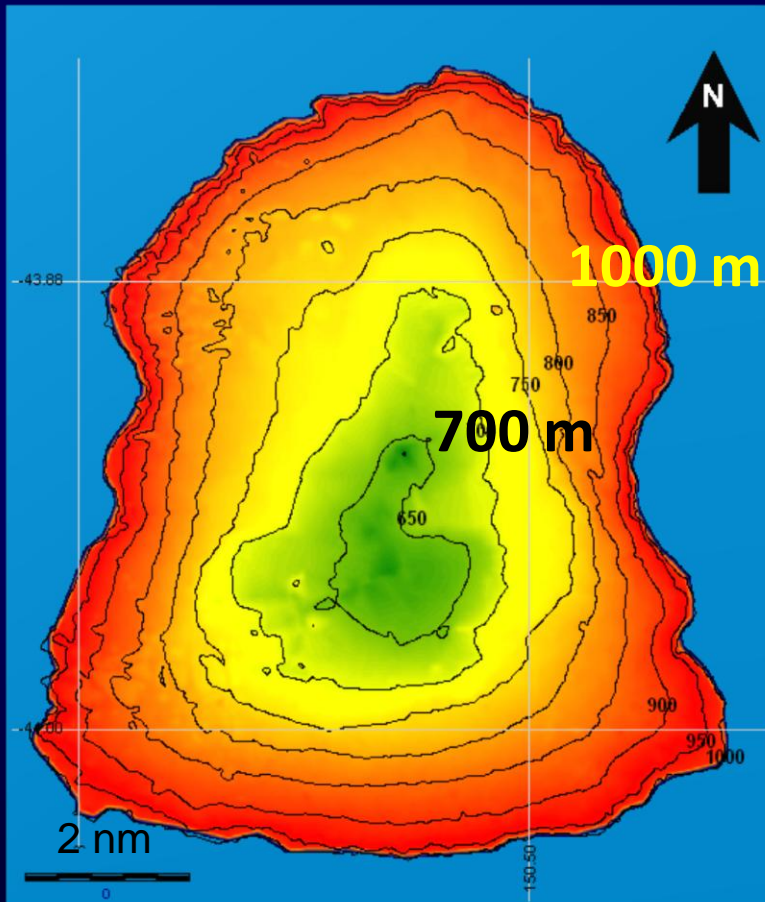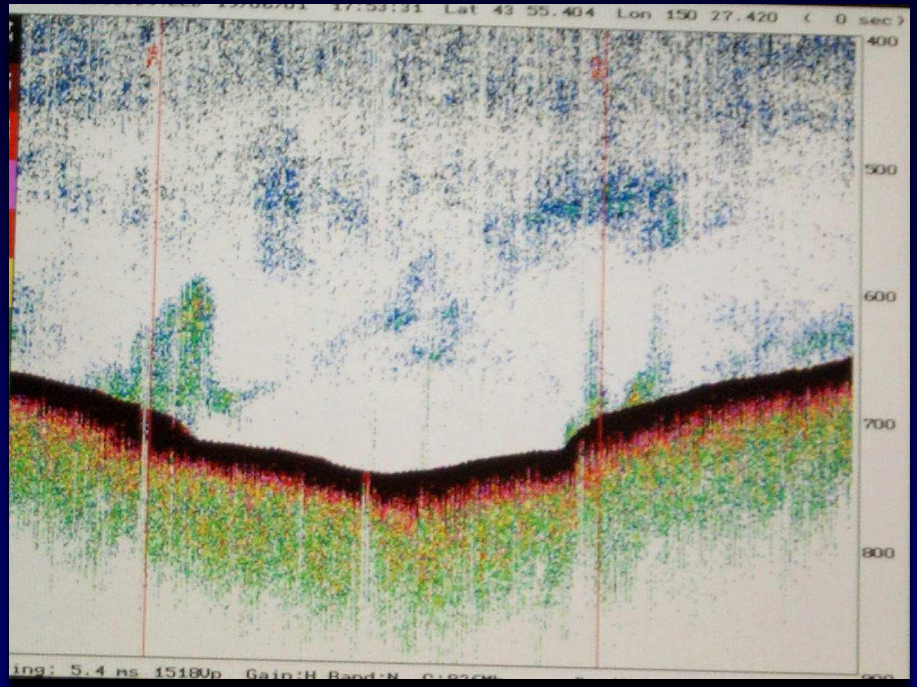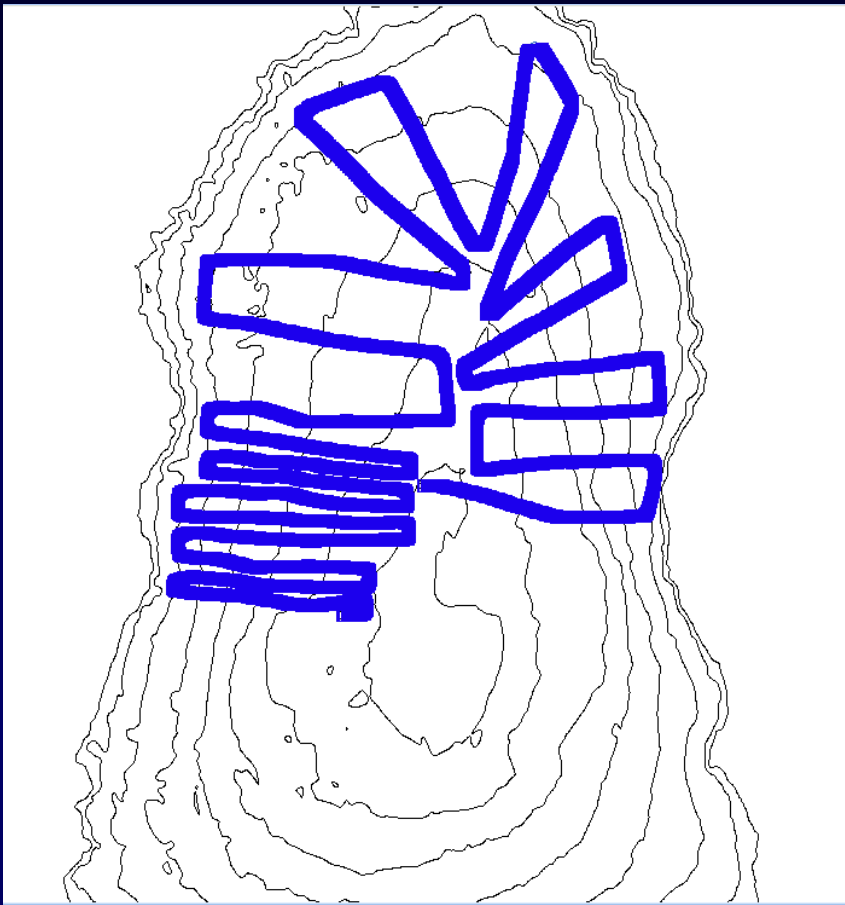
The Cascade Plateau fishery

> **Cascade Plateau is situated 260 km south-east of Tasmania**

> **Cascade Plateau fishery began 1996**

> **Characterised by precautionary management - precautionary quotas**

> **Scientific surveys each year since 1998, when a winter spawning aggregation was discovered**
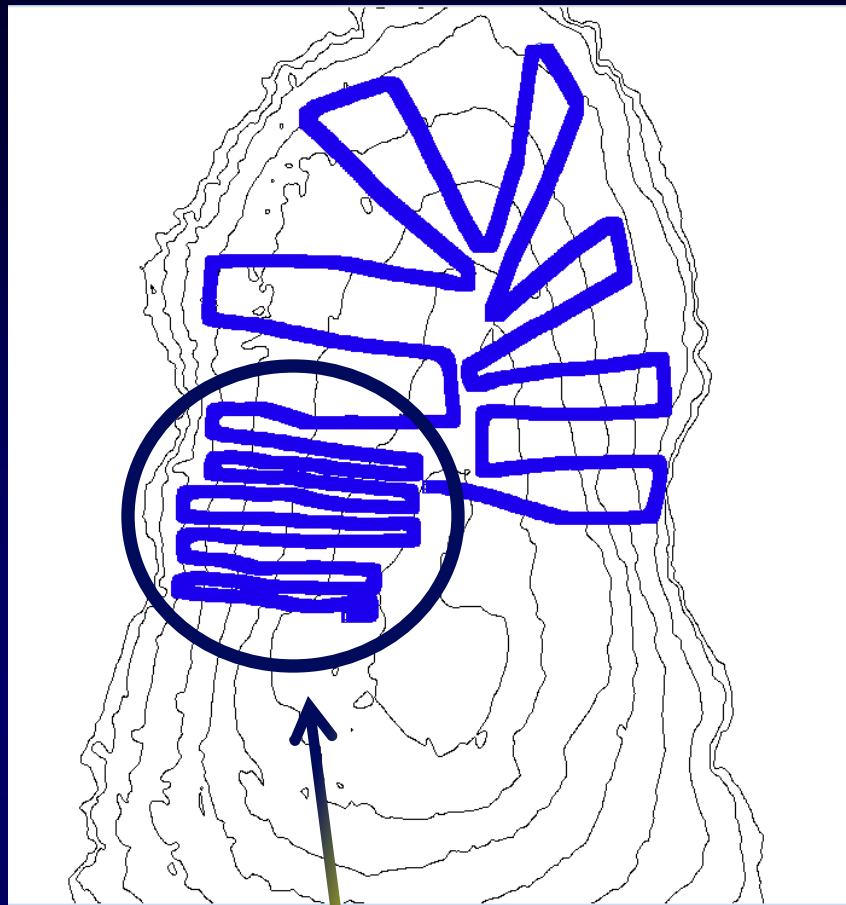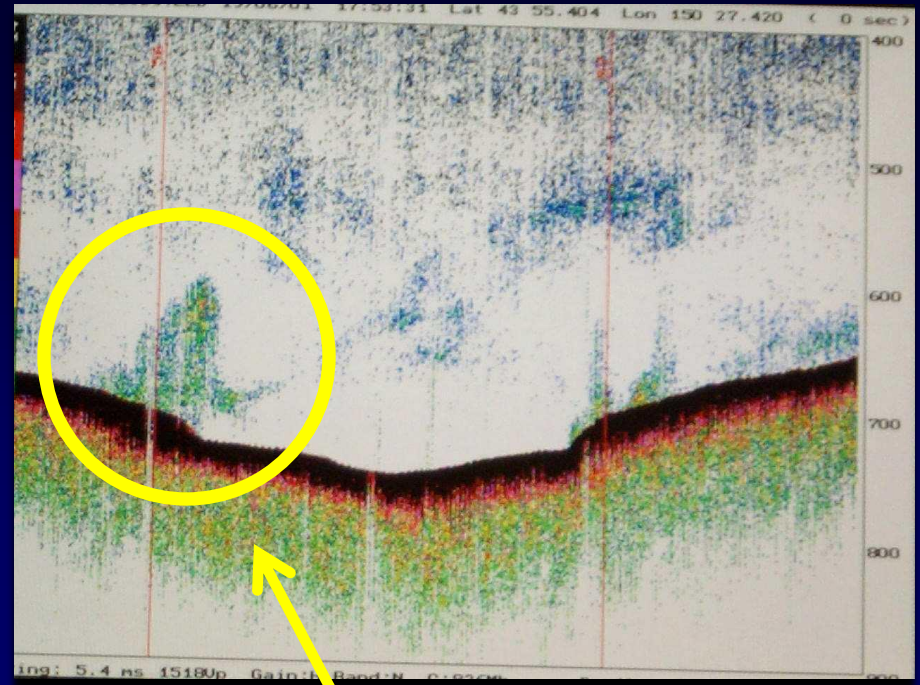
Typical scientific searching pattern

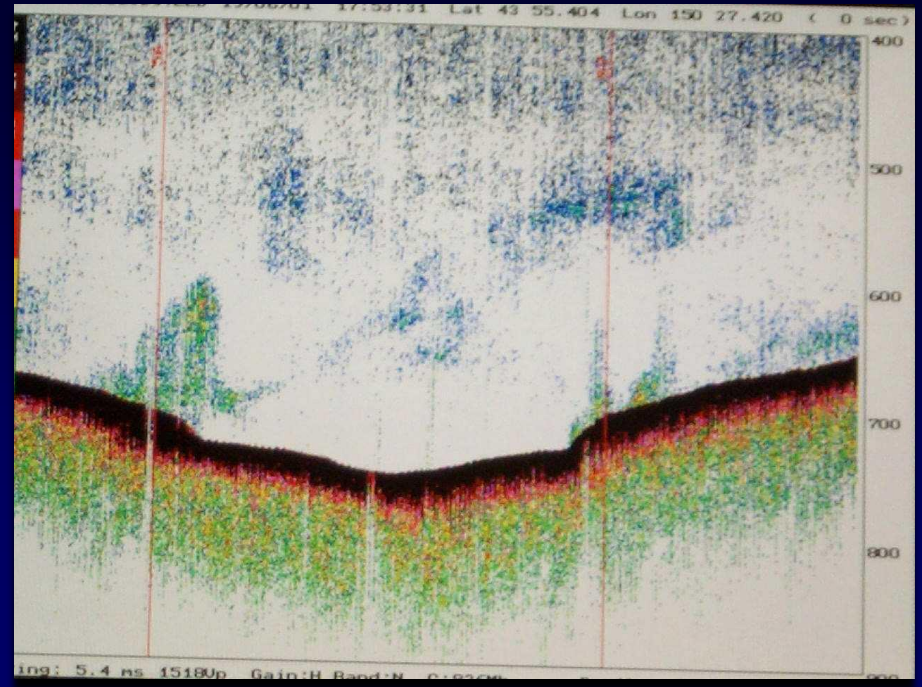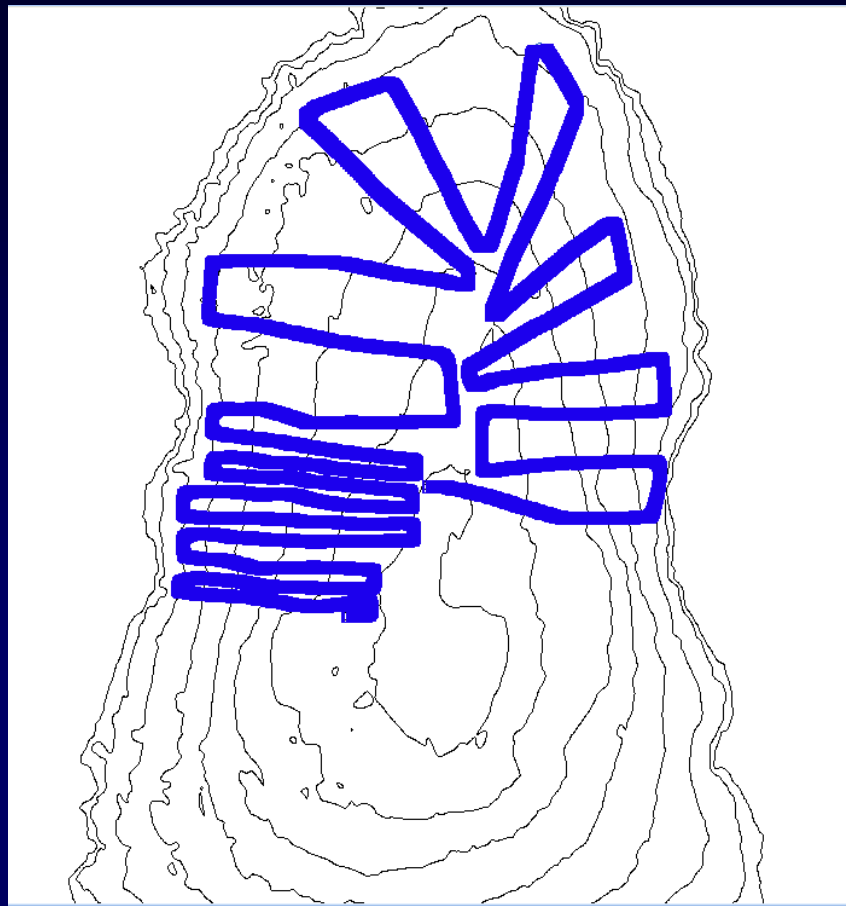Scientific surveys carried out on industry vessels

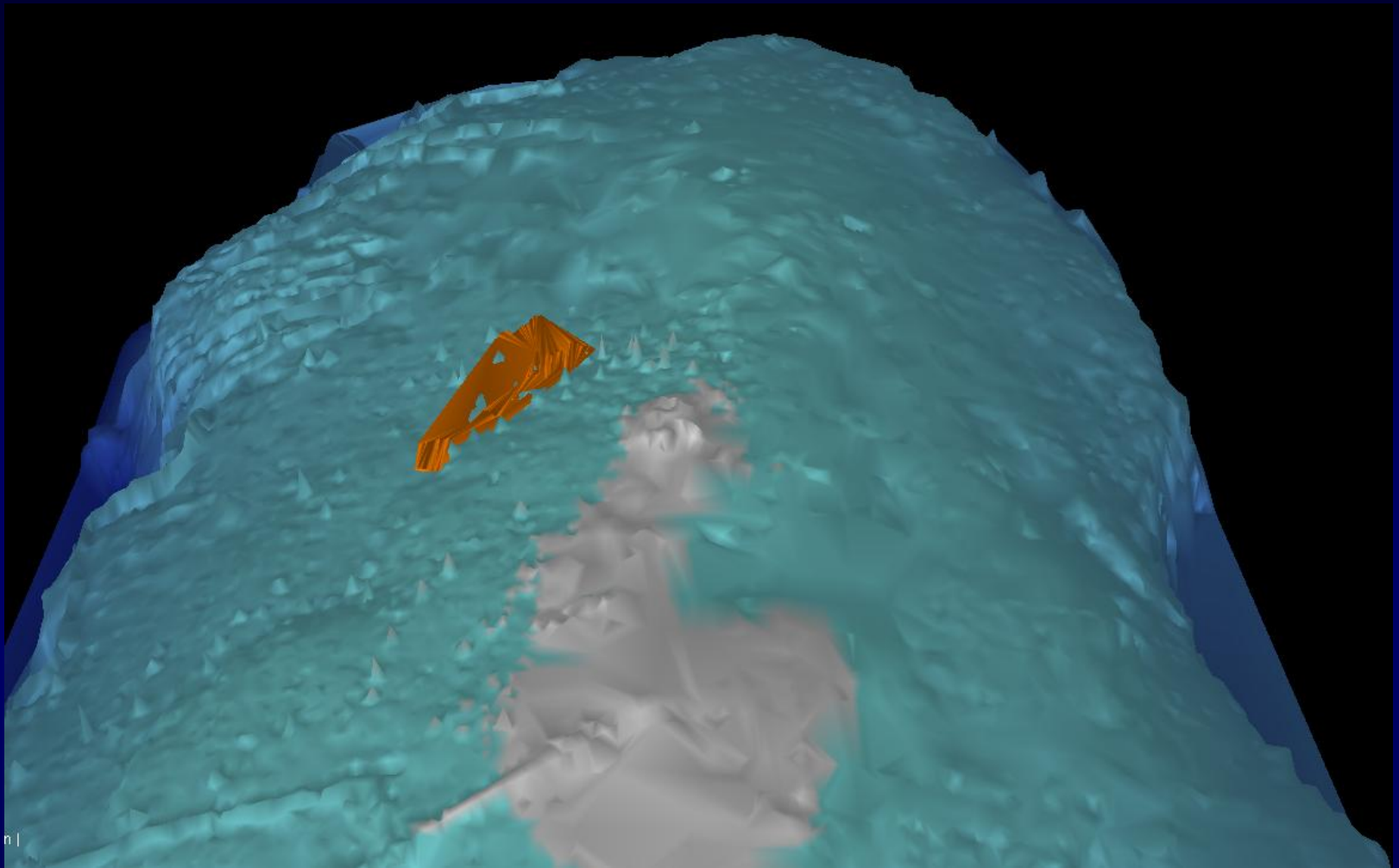**Aggregation found – tight transects**

Orange roughy mark

➢ **Targeted trawl shots at marks**

➢ **Biological data collected (length, sex, spawning stage)**

➢ **Confirmed species composition**

Spawning aggregation was found to be highly dynamic, with large variations in volume throughout the season
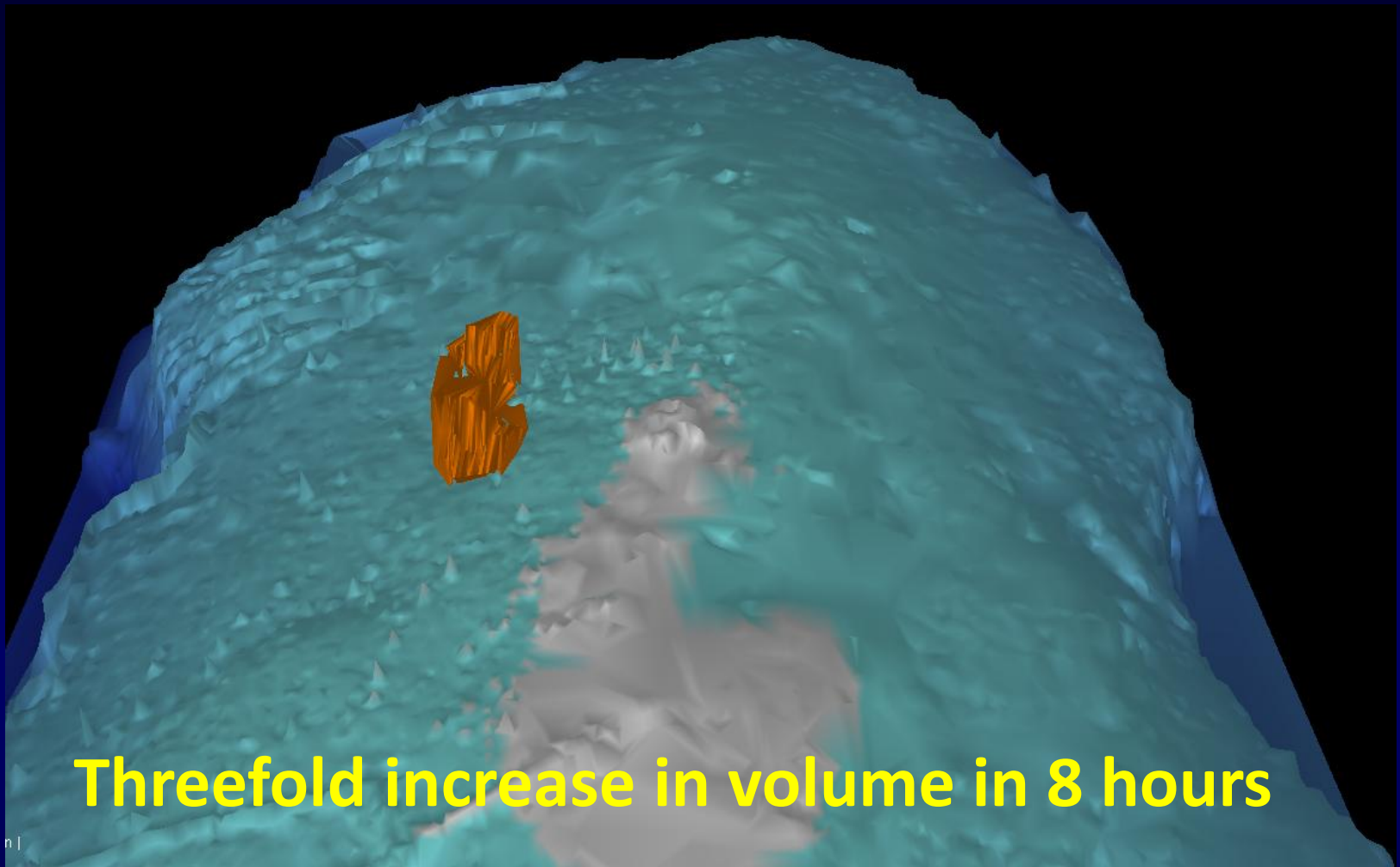
19/06/2001 9:00

Estimated volume: **10 million cubic metres**

Threefold increase in volume in 8 hours

19/06/2001   17:00

**Estimated volume:**   **34 million cubic metres**

Acoustic surveys of orange roughy

➢ **Acoustic data collected using commercial fishing sounders**
  - **1999 to 2002   -   28kHz**
  - **2003 to 2008 –** change in scientific staff and approach   **38kHz**

➢ **Two different methods to estimate aggregation size**

  - **1999 to 2002   - Relative Indices: Volume time series over whole season**

  - **2003 to 2008   - Absolute Indices: Echo-integration of single aggregation in season - 'snapshot survey'**

Acoustic surveys of orange roughy

Two years of very large school size 2001 and 2005
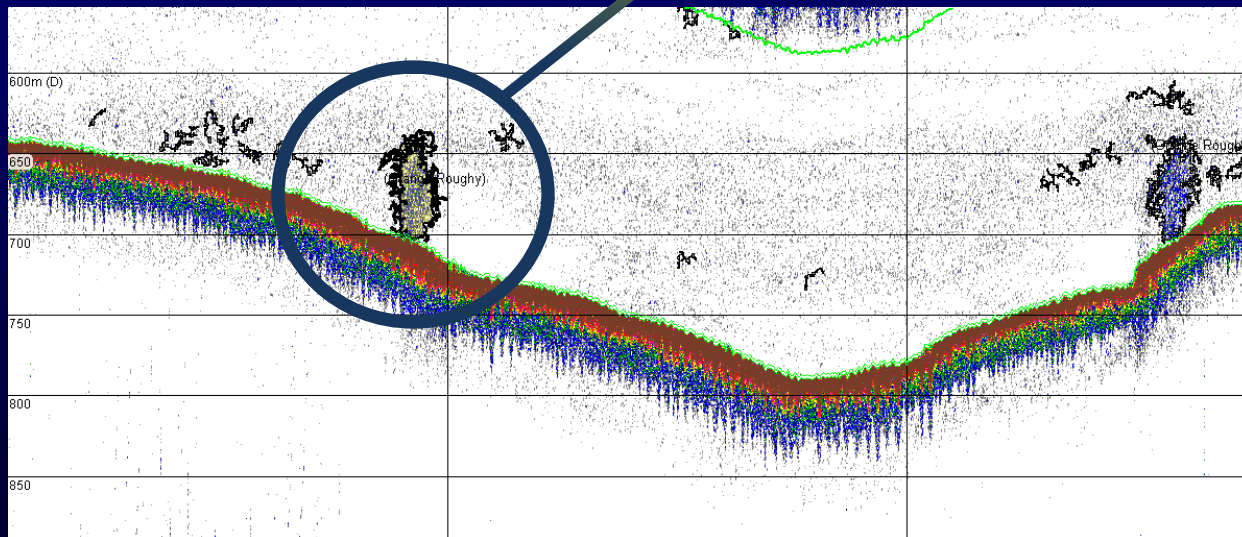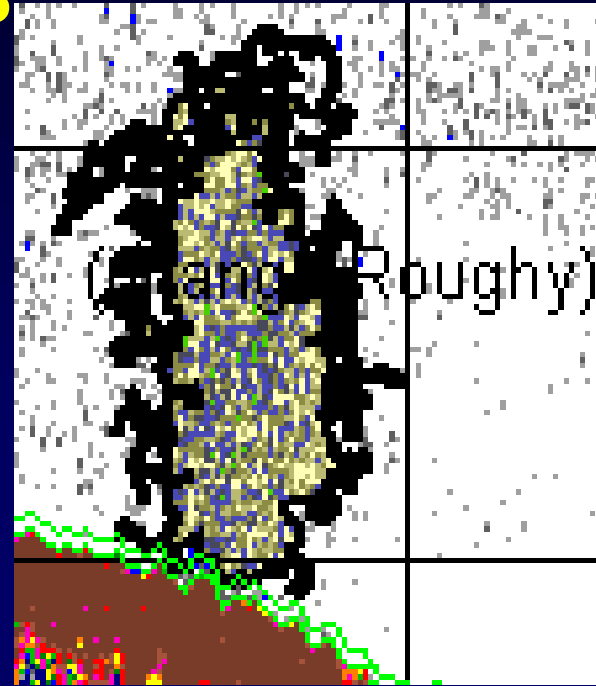

Estimated volume
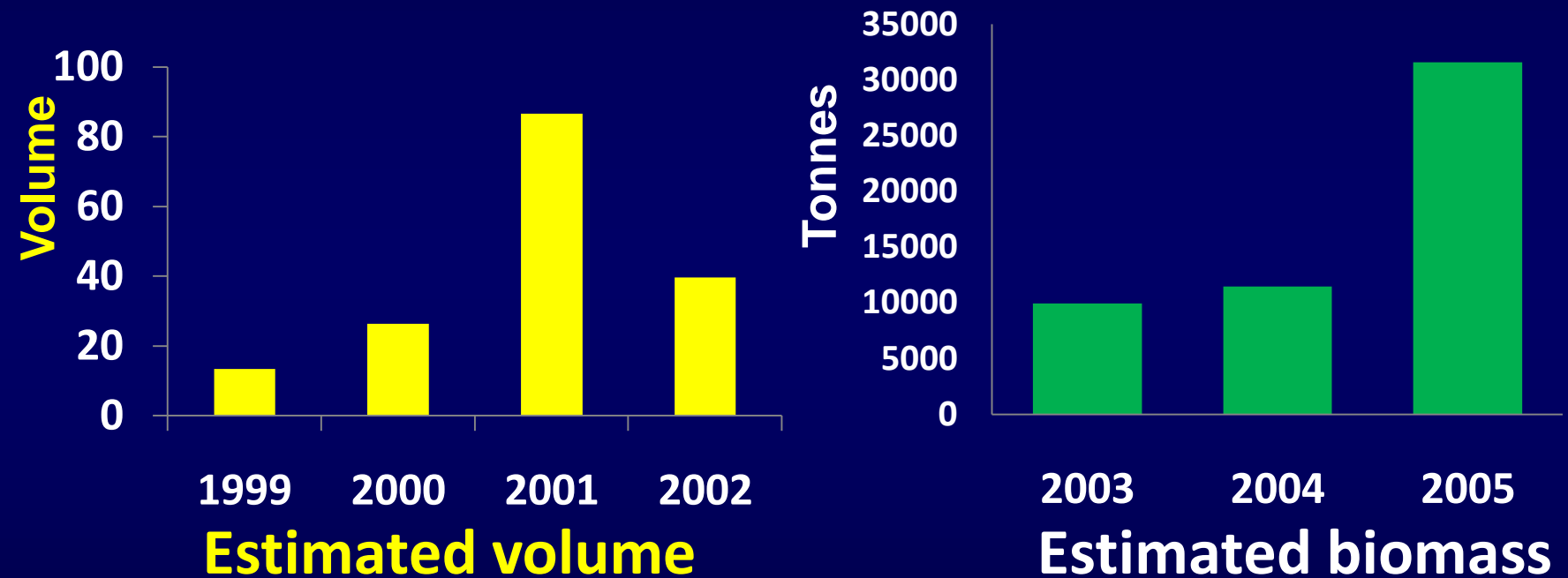
Estimated biomass

As the largest estimated biomass, the **2005** estimate has been used to determine stock assessment
Aim of this study: Are the two peak years similar or different?

Methods

➤ **Acoustic data was processed and analysed using Echoview**

➤ **Schools detection algorithm identifies the fish marks**

Methods

➢ **Criteria – for school identification verified by targeted fishing of schools (1999-2003):**

- **Within typical depth range - 700 – 750 m either on or connected to ocean floor**

- **Generally not shallower than 680 m**

- **Unless clearly connected to high confidence marks in expected depth band**

- **'Typical school shape' – expert judgement (commercial fisher & researcher)**
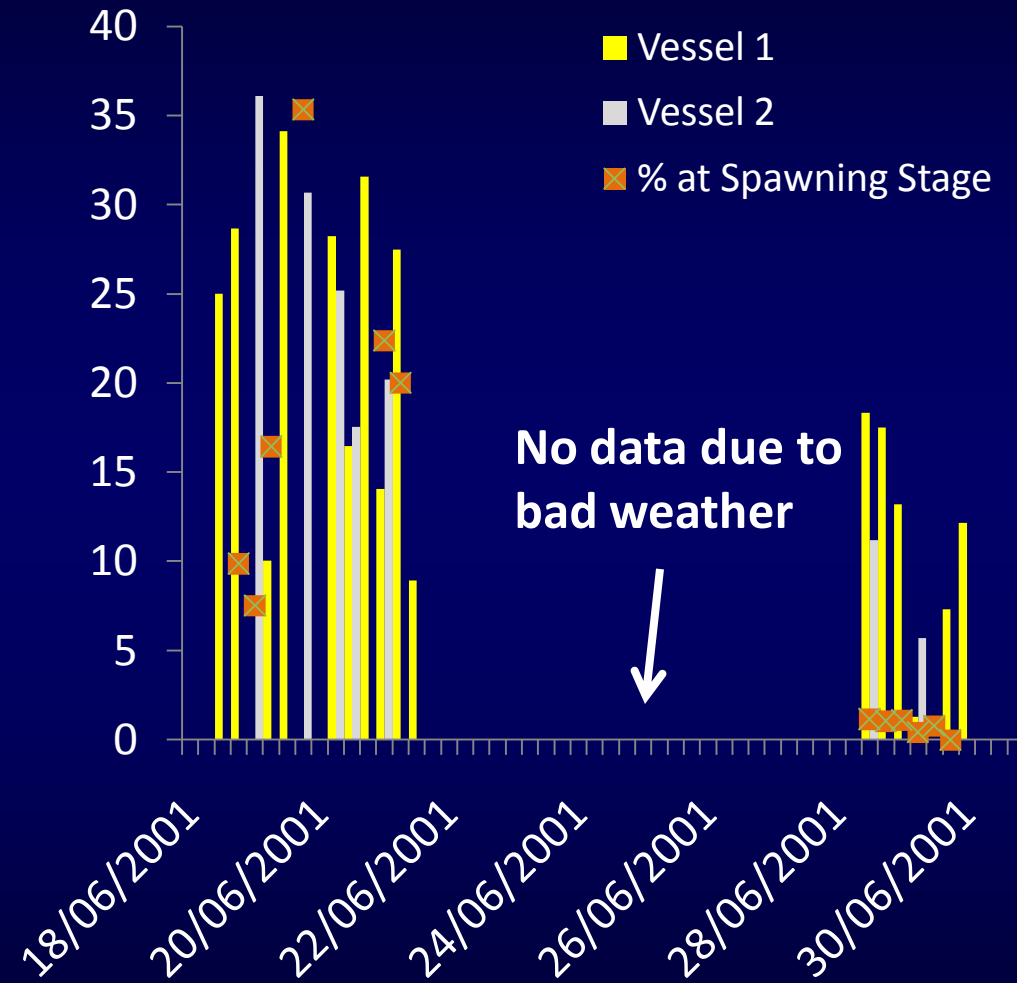
Methods

➢ **Cross-sectional area (CS Area) calculated for each mark on each transect across aggregation**

➢ **Volume of mark estimated at:**

Volume = Mean CS Area x mark length

Transects across aggregation
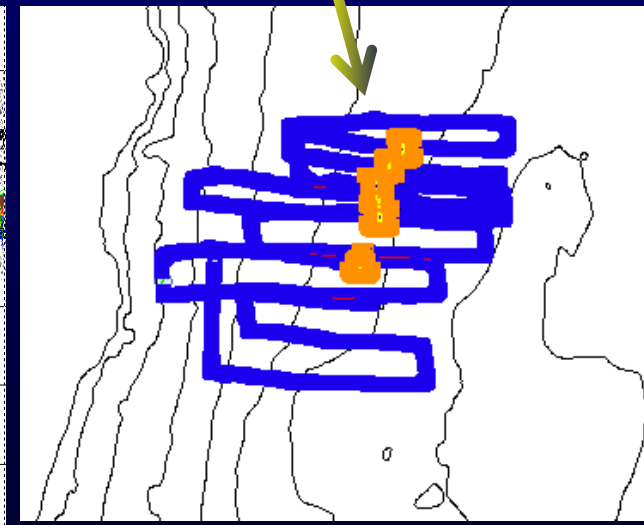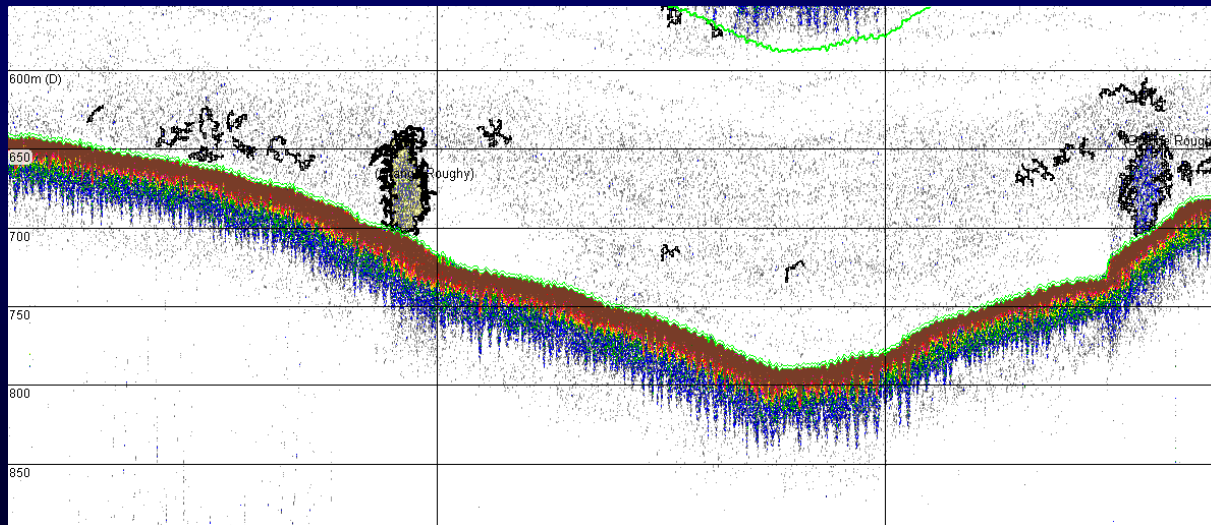
Volume estimation (million cubic metres)

- Estimated volume relatively consistent between two vessels
- Peak = **36 million** cubic metres
- Peak spawning observed early in season
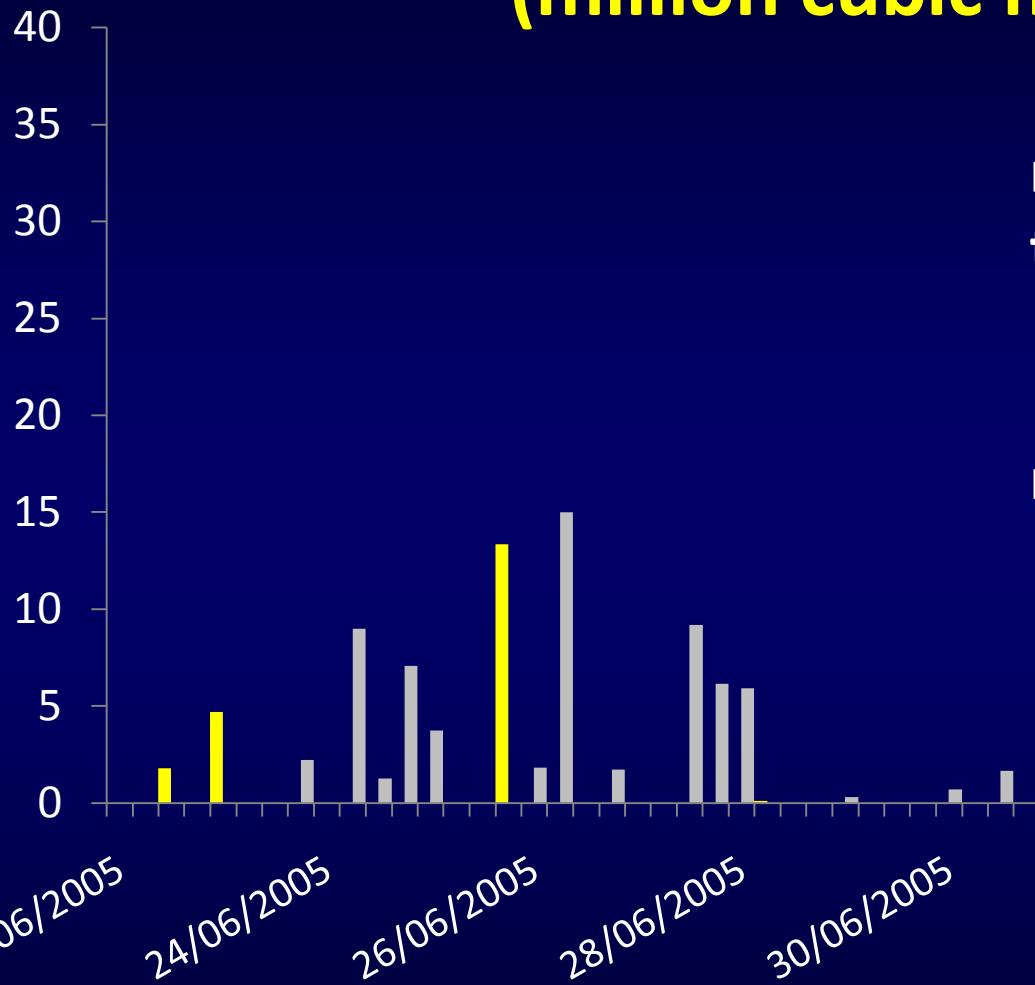- Peak volume occurred around time as peak spawning

2001 Estimated volume

Volume estimation (million cubic metres)

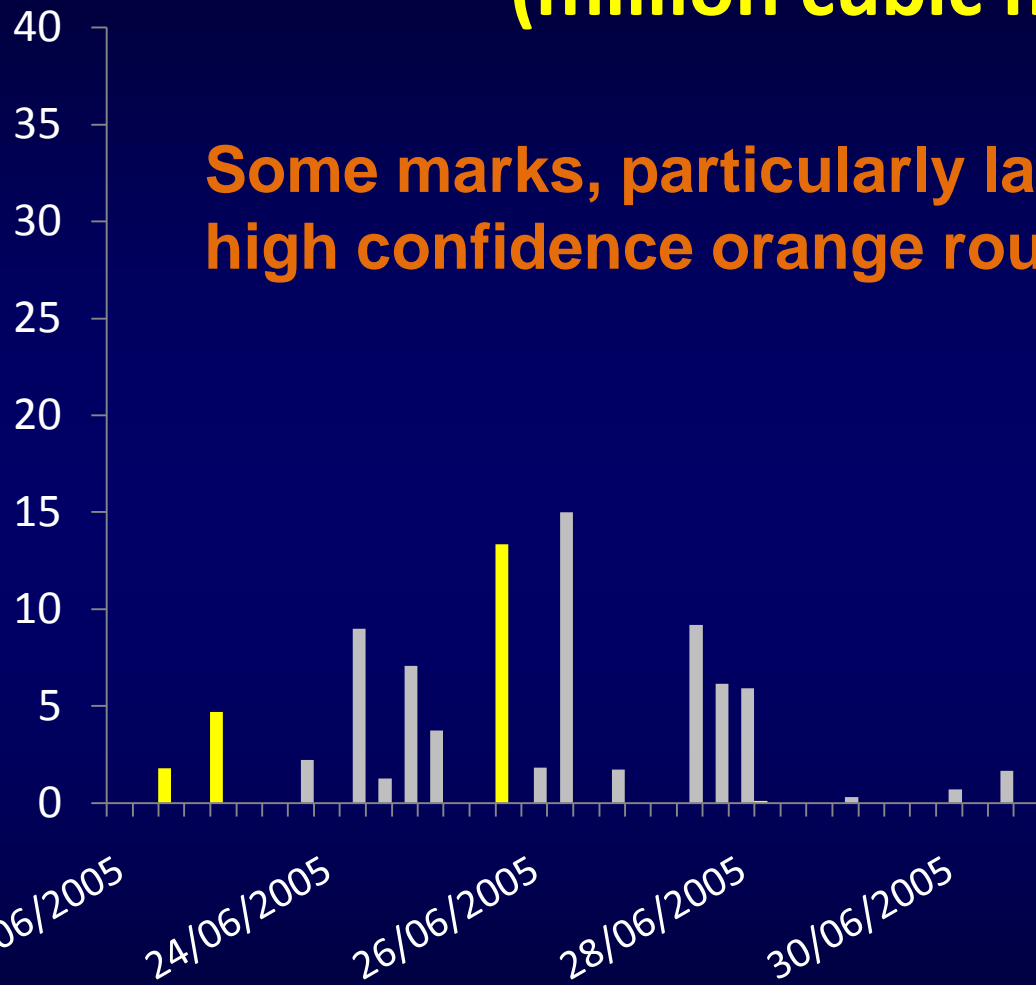- Estimated volume relatively consistent between two vessels

- Peak = **15 million** cubic metres
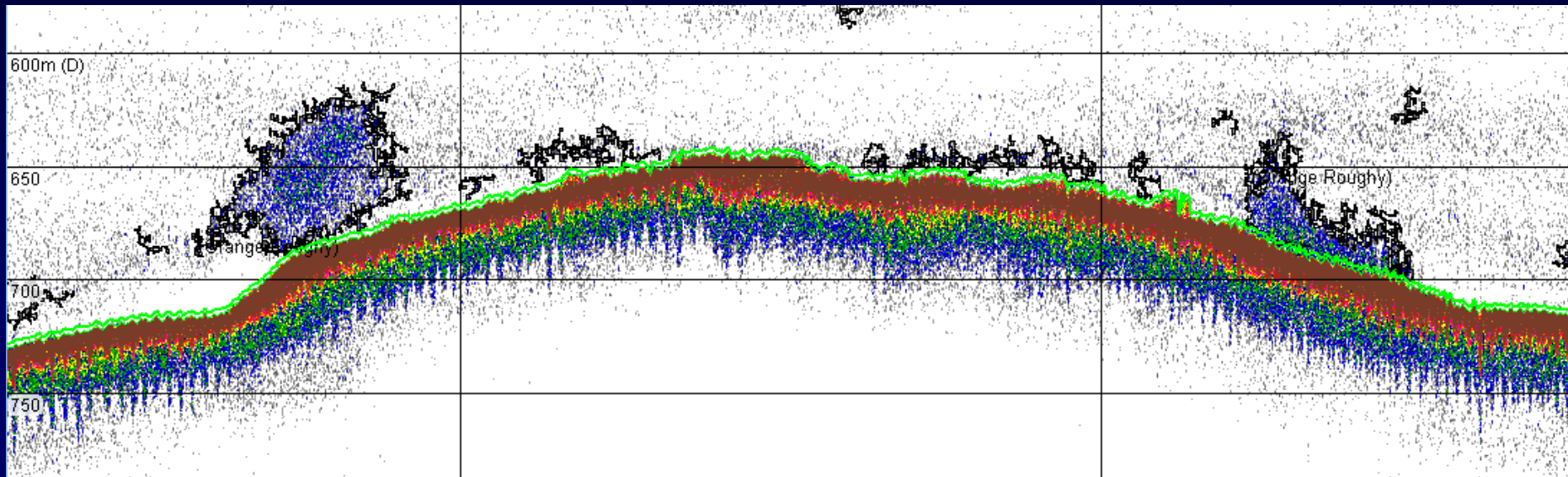
- Peak volume observed mid - survey

2005 Estimated volume

Volume estimation (million cubic metres)

Some marks, particularly large volumes, not high confidence orange roughy marks

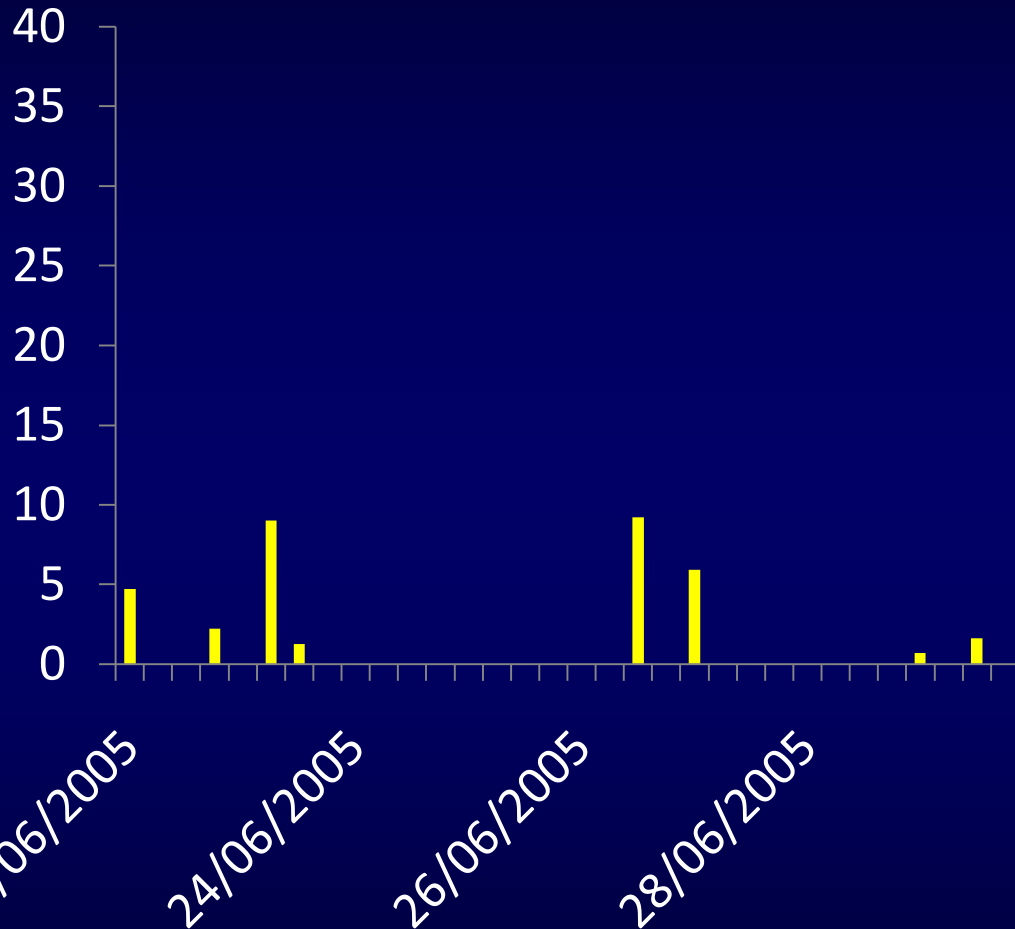**2005 Estimated volume**

Uncertain marks

For example, large marks shallower than **680** m

Historically roughy rarely caught above this depth at Cascade

Appear to be fast moving schools – very difficult to get a meaningful survey of these marks

Volume estimation (million cubic metres)
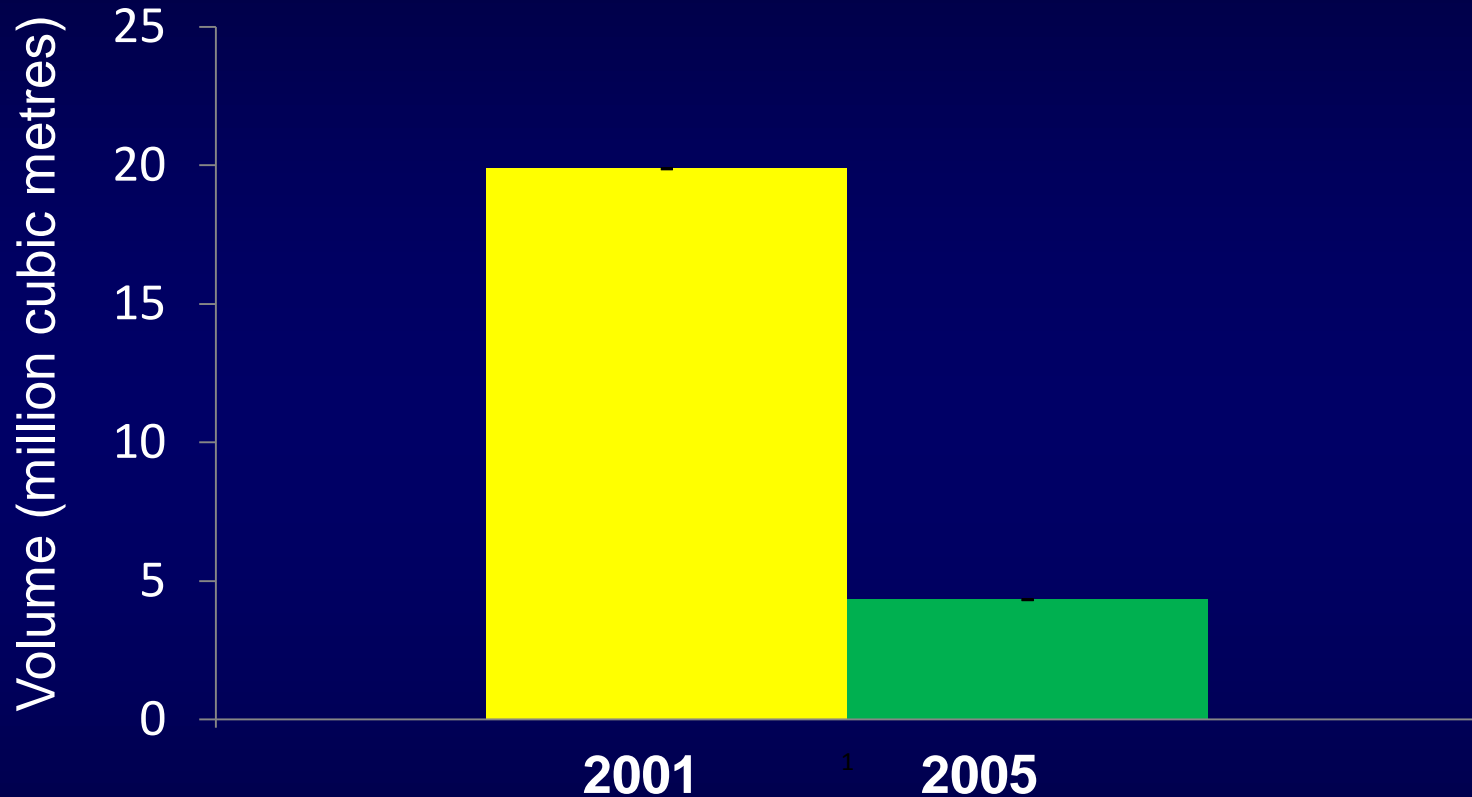
> **Only using high confidence marks**

> **Volume peaks at 9 million cubic metres twice in survey**

2005 Estimated volume

Are the two peak years similar or different?

Mean 2005 volume is significantly less than 2001 volume

Conclusions

➢ **Peak volume in 2005 may be invalid due to inclusion of suspect marks**

➢ **Implications for biomass estimate based on snap-shot survey of peak volume**

➢ **Overlaying biological data (time at which spawning is initiated) may confirm this preliminary finding**

➢**Further work is needed to evaluate the effectiveness of the snap-shot approach to estimating roughy biomass at the Cascade Plateau**

Acknowledgments

Co-authors: Jeremy Prince, Halina Kobryn, Geoff Diver, Neil Loneragan

Industry vessels – Owners, skippers & crew:

FV Saxon Progress, FV Megisti Star,

FV Peterson & FV Riba1

CSIRO: Tim Ryan

Rudy Kloser

Thank You