New perspectives on fisheries

Combining the distribution of inshore and offshore commercial fisheries in Scotland

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The Scottish Government

EIMR
The Environmental Interactions Of Marine Renewable Energy Technologies

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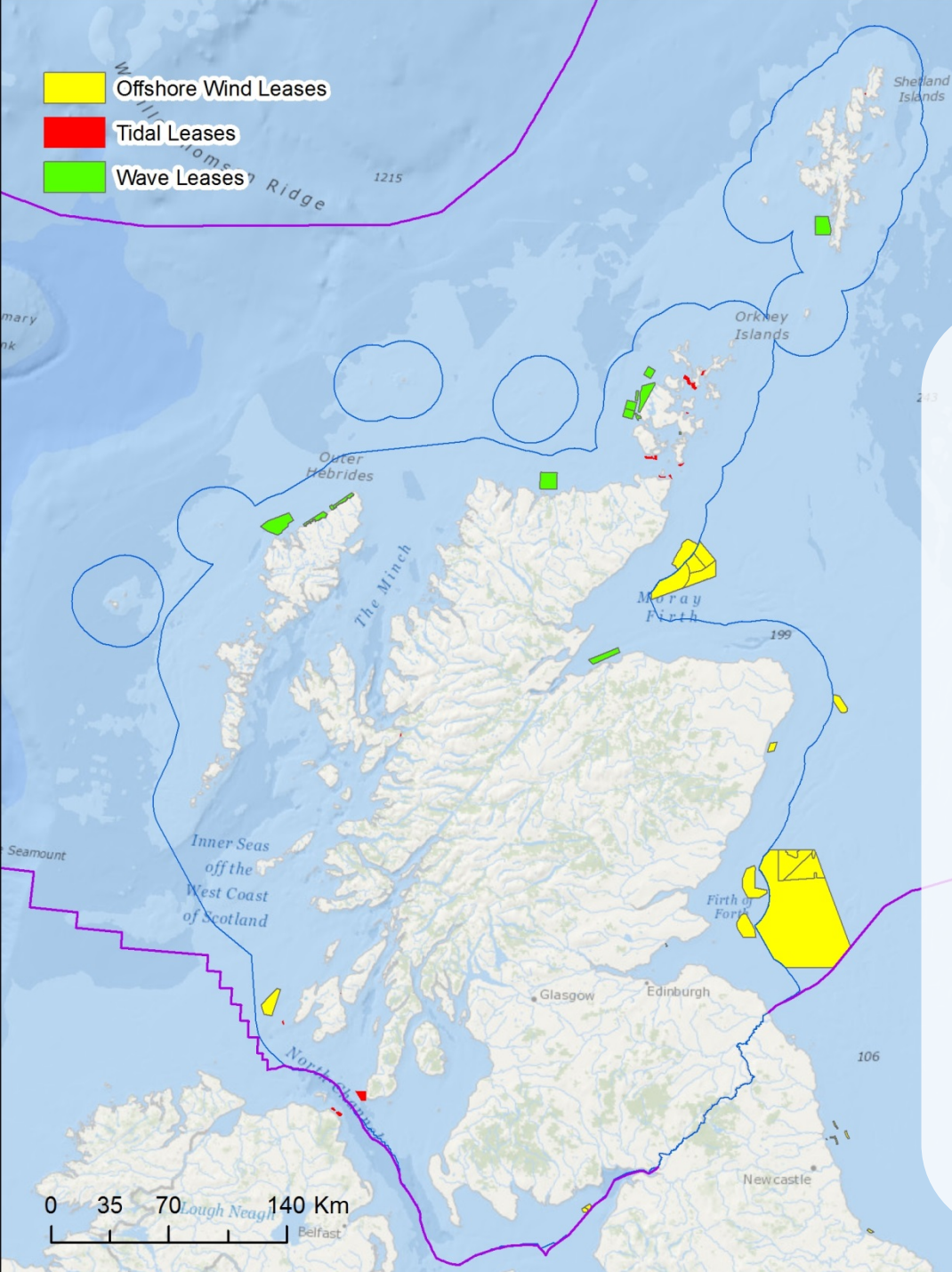
Outline

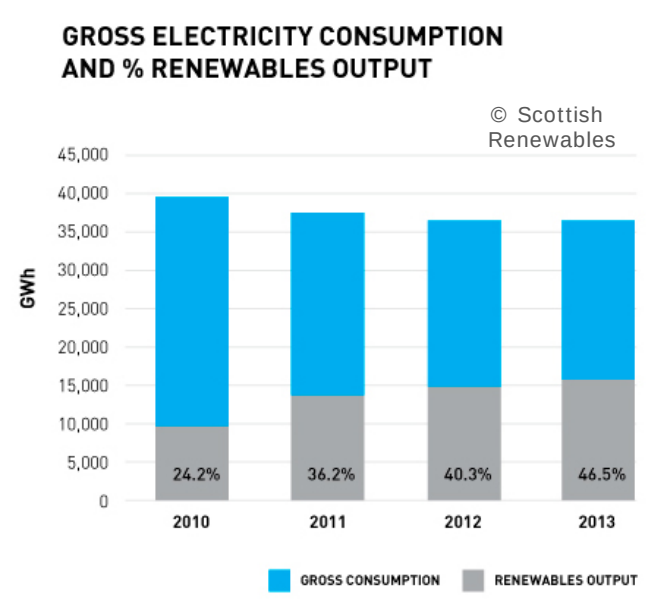
- Introduction
  - Marine Renewable Energy in Scotland
  - Commercial fisheries in Scotland
- Commercial fisheries in Marine Spatial Planning
  - Offshore commercial fisheries (≥ 15 m; VMS)
  - Inshore commercial fisheries (< 15 m; ScotMap)
  - Combining the two distributions
- Conclusions & Future steps

Marine Renewable Energy in Scotland



Policy Targets

- ✓ Harvest Scotland's huge marine resource potential
- ✓ Meet 100% electricity demand by 2020



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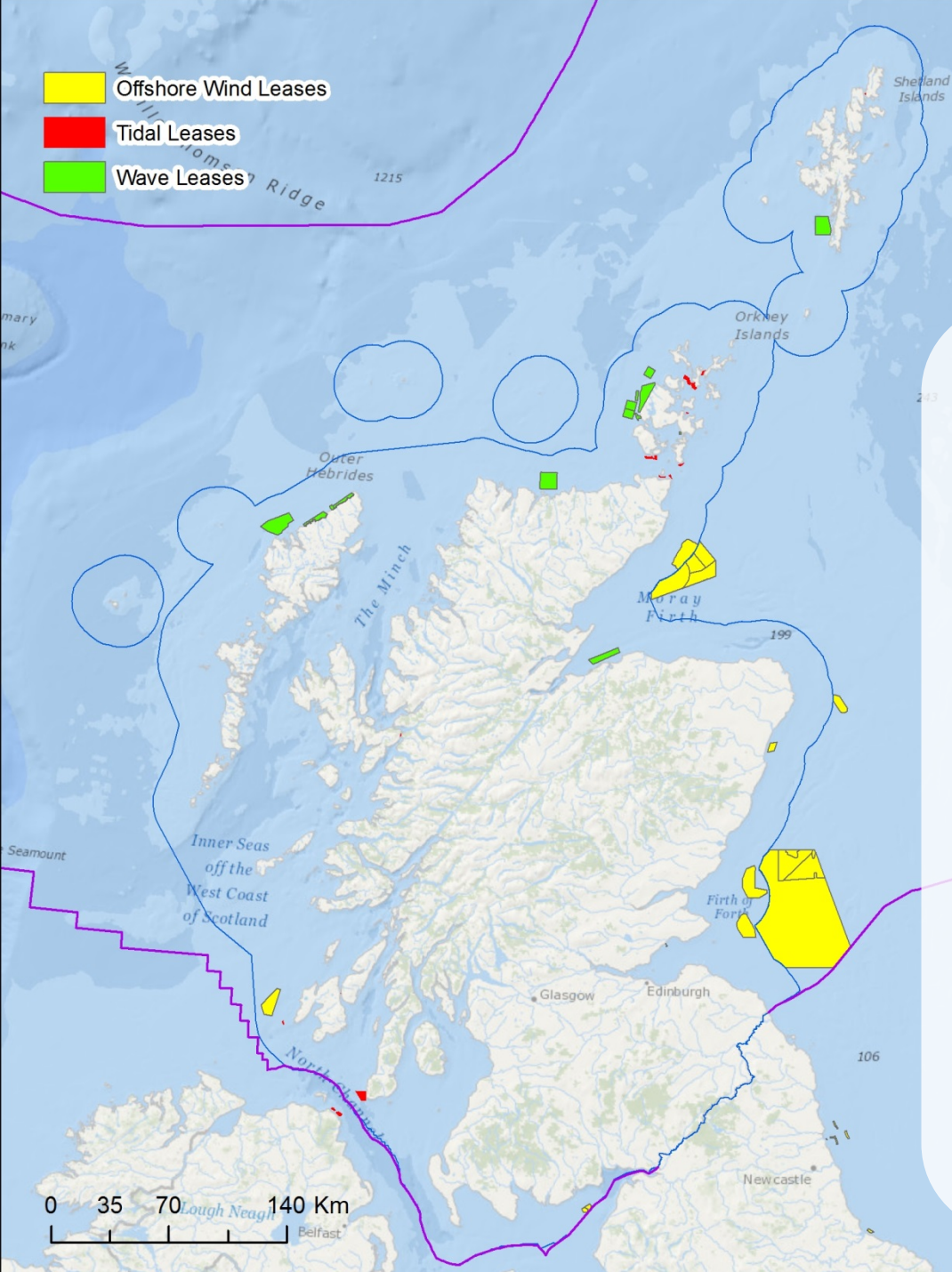
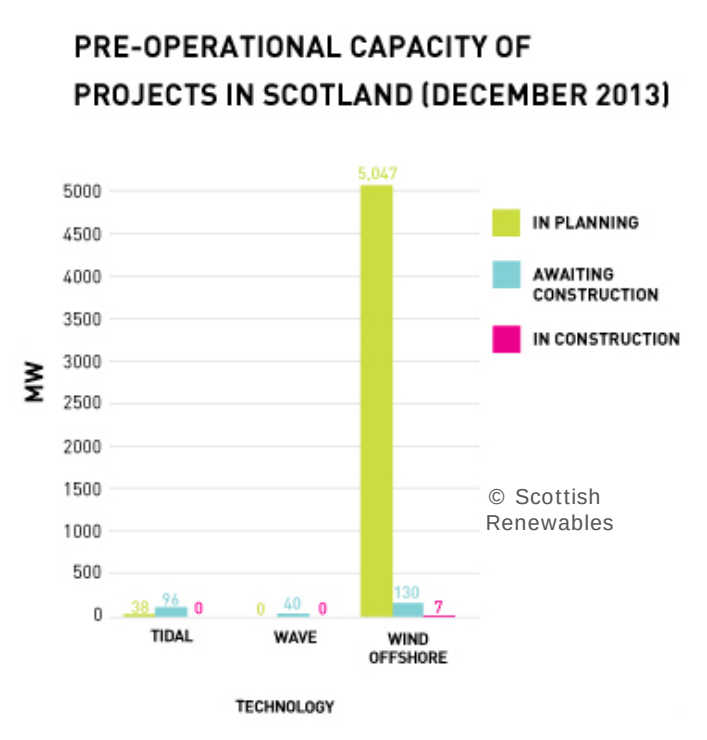
Marine Renewable Energy in Scotland



Facts

✓ ~12,000 jobs in the renewable energy sector in Scotland



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Commercial fisheries in Scotland

Policy Targets

- ✓ Ensure fish stocks are harvested sustainably
- ✓ Sustain vibrant coastal communities

Scottish fishing vessels

2,046
660 >10m

Annual Landings

358,000 t
£ 466 M

Scottish fishermen

4,747

© Scottish Sea Fisheries Statistics 2012

Fishing information in EU

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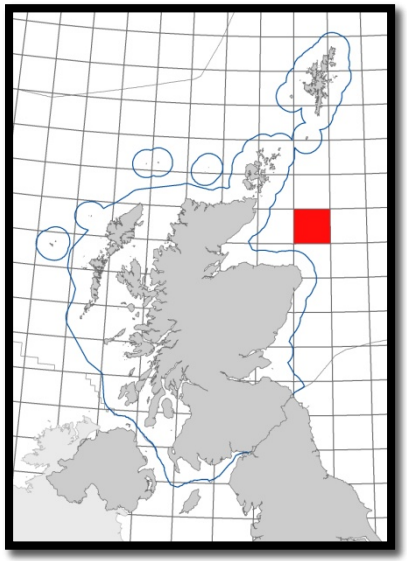

- Logbooks (FIN)
  - Mandatory for Vessels >10m
  - Declare all landing in excess of 50kg
  - Low spatial resolution

- Vessel Monitoring System
  - All vessels ≥15m overall length
  - Exact location and ID of all vessels
  - Submitted to a centralized database

Offshore commercial fishing fleet (≥ 15 m)

Pelagic trawler at sea

Marine Scotland Image Bank © Crown copyright

Offshore commercial fishing fleet (≥ 15 m)

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1. RAW VMS DATA DESCRIPTION

VMS data for all UK registered commercial fishing vessels with an overall length of ≥15m in years 2007-2011 landing into UK ports.

2. DISTINGUISH FISHING OVER STEAMING

Speed threshold (0 < speed < 5 knots); Pings within a 2.5 km^2 radius from ports have been removed.

3. LINK WITH LANDINGS INFORMATION

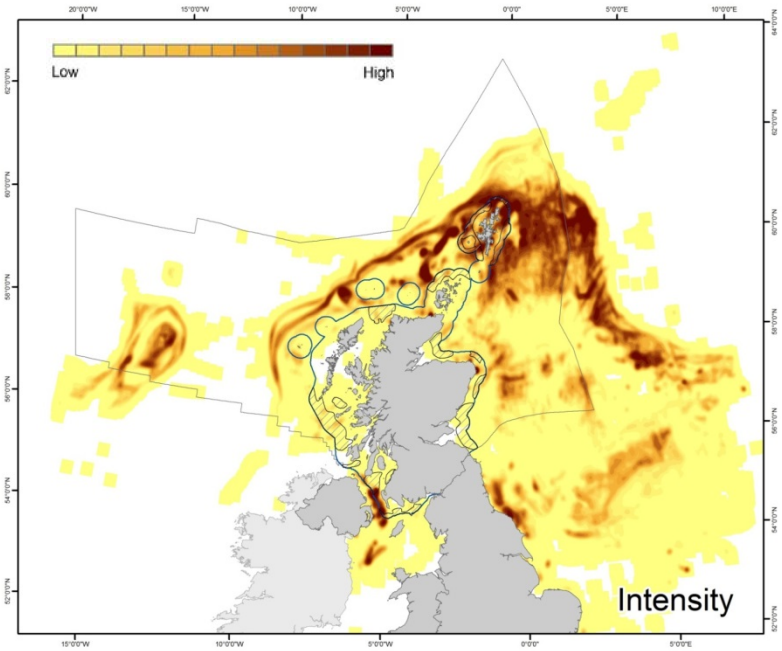
Merged with logbook data

4. GROUP IN TARGETED FISHERIES

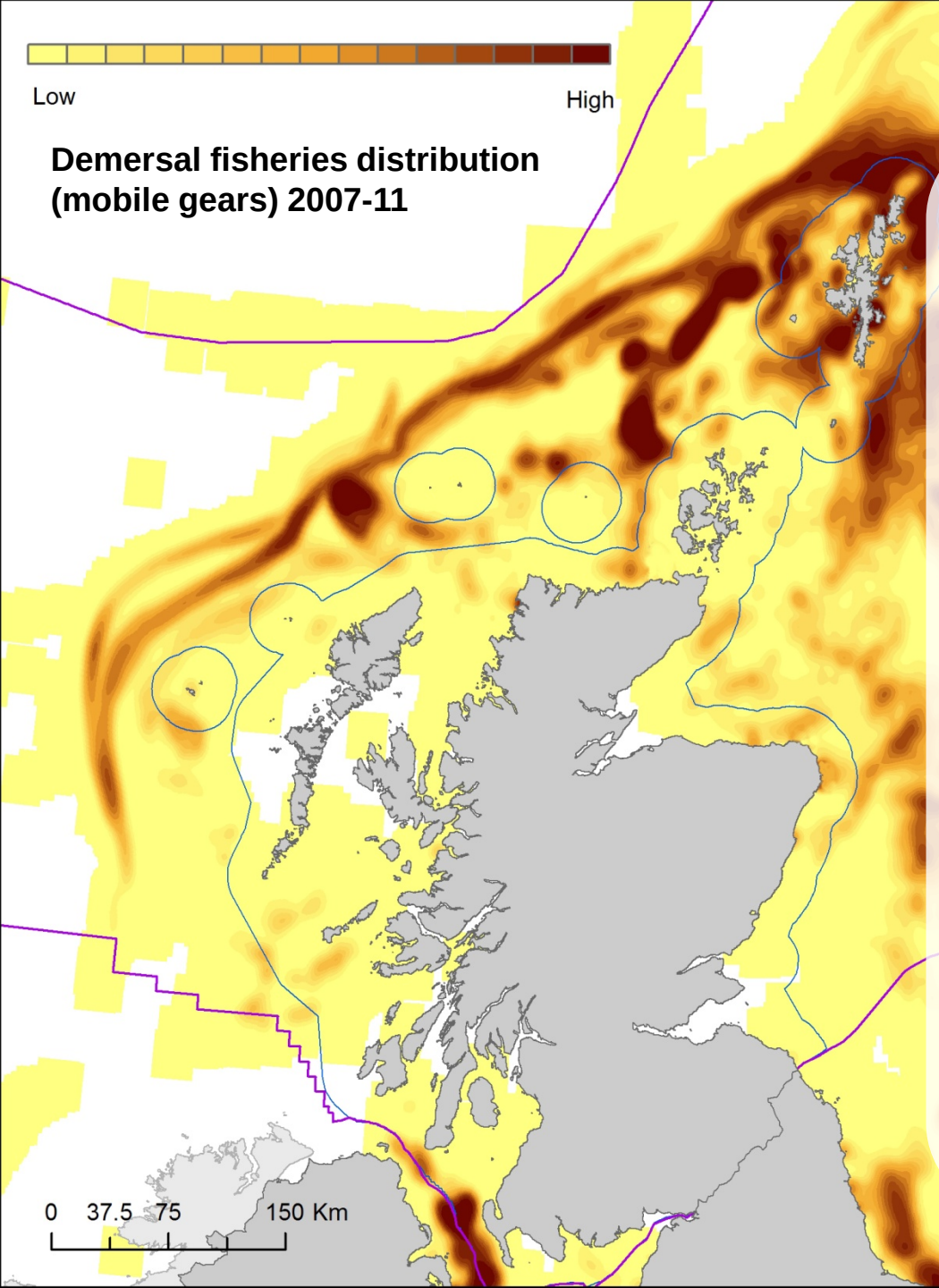
Pelagic (Mackerel, Herring, Other)
Demersal (mobile and static gears)
Shellfish (Crab, Lobster, Nephrop, Scallop)

5. INTENSITY ANALYSIS

Kernel density estimation with a data-driven bandwidth



Kafas, A., Jones, G., Watret, R., Davies, I., Scott, B., 2012. *Representation of the use of marine space by commercial fisheries in marine spatial planning.* ICES CM I:23.



Pros:

- ✓ Advanced density analysis which significantly increases spatial representation
- ✓ Several year's activity can be amalgamated
- ✓ Activity can be weighted against landings volume and value
- ✓ Available for national and regional scales

Cons

- X Units do not represent landing value
- X Challenging to explain to non-technical audience
- X Method highly depended on bandwidth selection process
- X Scale dependent

Inshore commercial fishing fleet (< 15 m)

Prawn vessel tied up at Lochinver
© Robert Watret

Inshore commercial fishing fleet (< 15 m) - ScotMap

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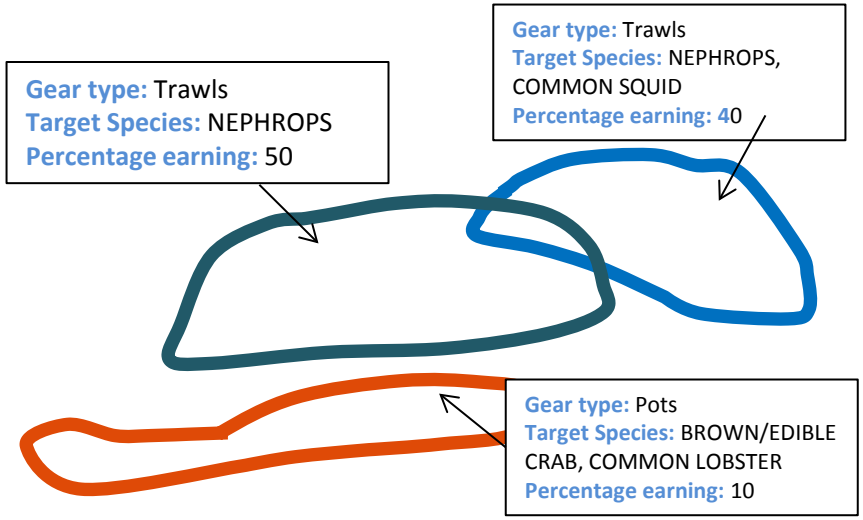
1. FACE-TO-FACE INTERVIEWS

Requested Information on:

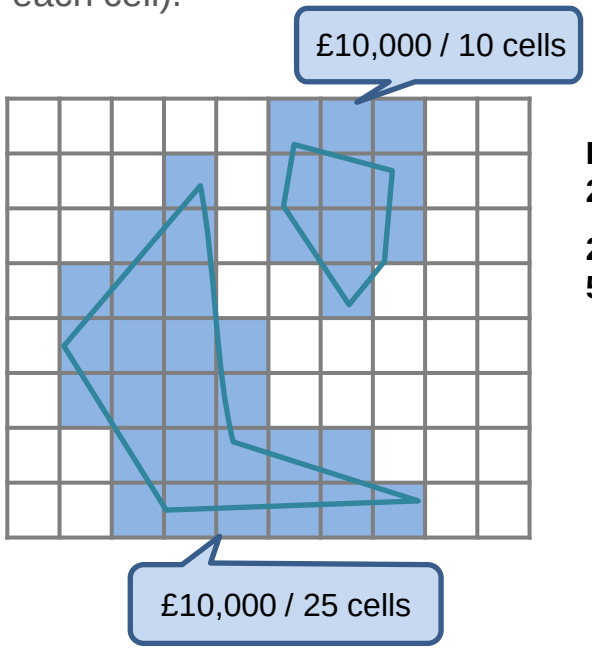
Fishing pattern	Fishermen's information	Vessel's information	Personal data



In total: 1090/ 1510 mapped interviews **(72%)**
2,634 fishing areas (polygons)

2. RASTERISING & AGGREGATING

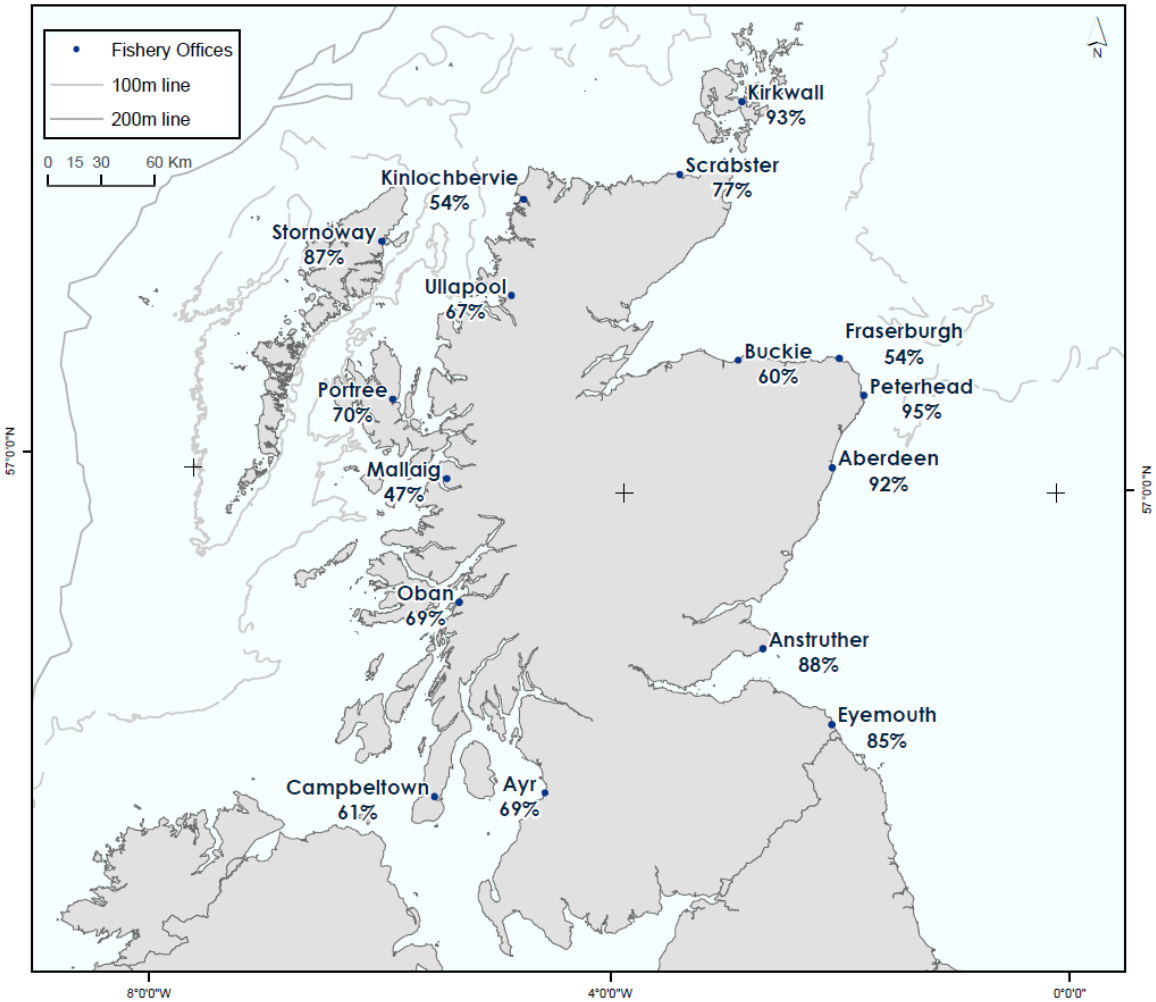
- Monetary value (£s per cell),
- Relative value (sum of percentage splits per cell), and
- Number of vessels and Crew (total number of vessels or Crew associated with each cell).



Earnings: £ 20,000 p.a.

2 polygons: 50% each

Landings Coverage



District Name	Landings Coverage
Aberdeen	£ 4.02M /£ 4.39M (92%)
Anstruther	£ 7.06M /£ 8.04M (88%)
Ayr	£ 4.53M /£ 6.54M (69%)
Buckie	£ 2M /£ 3.31M (60%)
Campbeltown	£ 7.22M /£ 11.88M (61%)
Eyemouth	£ 7.37M /£ 8.69M (85%)
Fraserburgh	£ 2.33M /£ 4.35M (54%)
Kirkwall	£ 9.66M /£ 10.34M (93%)
Kinlochbervie	£ 0.56M /£ 1.05M (54%)
Lochinver	£ 0.69M /£ 1.22M (57%)
Mallaig	£ 1.11M /£ 2.38M (47%)
Oban	£ 5.9M /£ 8.53M (69%)
Peterhead	£ 1.42M /£ 1.51M (95%)
Portree	£ 7.96M /£ 11.36M (70%)
Scrabster	£ 2.53M /£ 3.28M (77%)
Stornoway	£ 10.67M /£ 12.22M (87%)
Ullapool	£ 3.67M /£ 5.48M (67%)
Total:	**£ 78.71M /£ 104.56M (75%)**

Average FIN Landings 2010-2011

Inshore commercial fishing fleet ScotMap (< 15 m)

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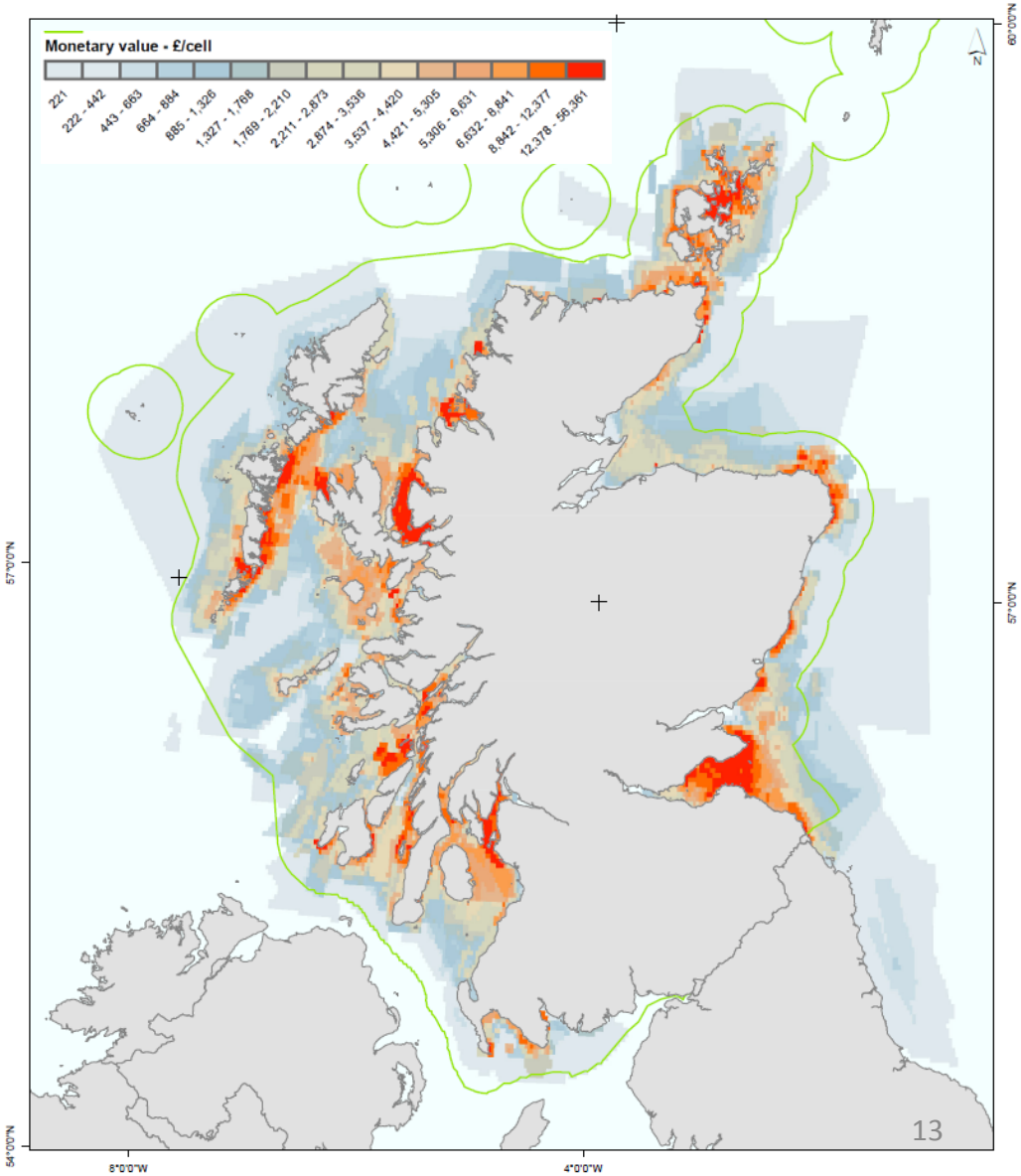
Pros:

- ✓ Interview based approach
- ✓ Provided a long needed layer
- ✓ Data accounts for 75% of Scottish inshore landings
- ✓ Layers consulted with the public

Cons

- X Resolution
- X Regional coverage variations
- X Snap shot of the activity
- X Information recorded with variable precision
- X Unable to verify individual data



Kafas, A., McLay, A., Chimienti, M., Gubbins, M. 2013. Mapping fishing activity in Scotland's inshore waters – analytical approaches applied to data from fishery stakeholders. ICES CM I:28.

Combining spatial information from the two fleet sections

Fishing boats tied up at Fraserburgh

Marine Scotland Image Bank © Crown copyright

Combining spatial information from the two fleets sections

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1. VMS QUADRANT COUNT ANALYSIS

Using the same VMS data, a Quadrant Count analysis using a fine grid produced landings distribution maps of the offshore fleet.

2. RASTERISE SCOTMAP

Same analysis as described before, but using FIN values and same resolution with VMS layer.

3. SCALING UP SCOTMAP

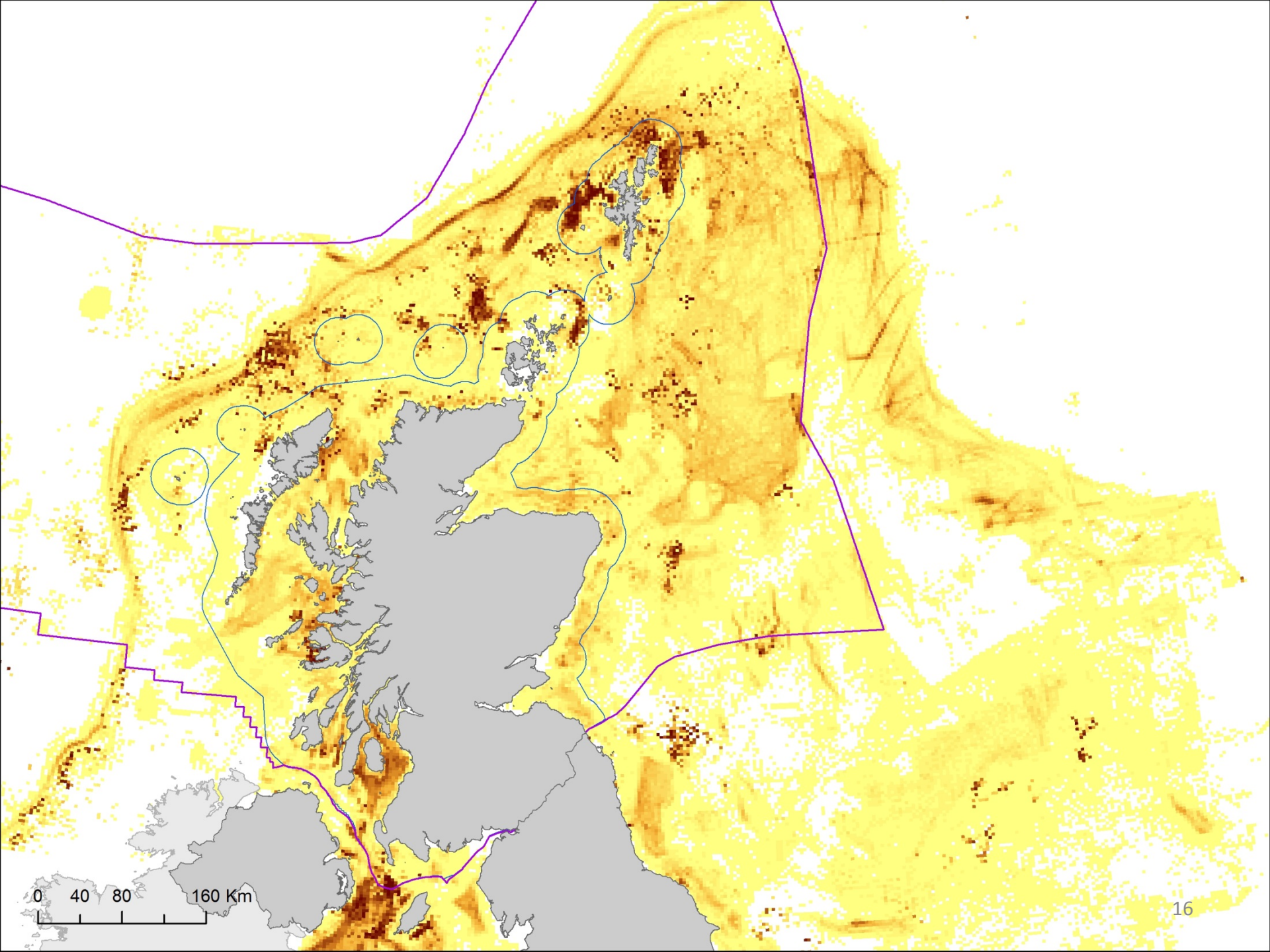
This was done in two different ways:

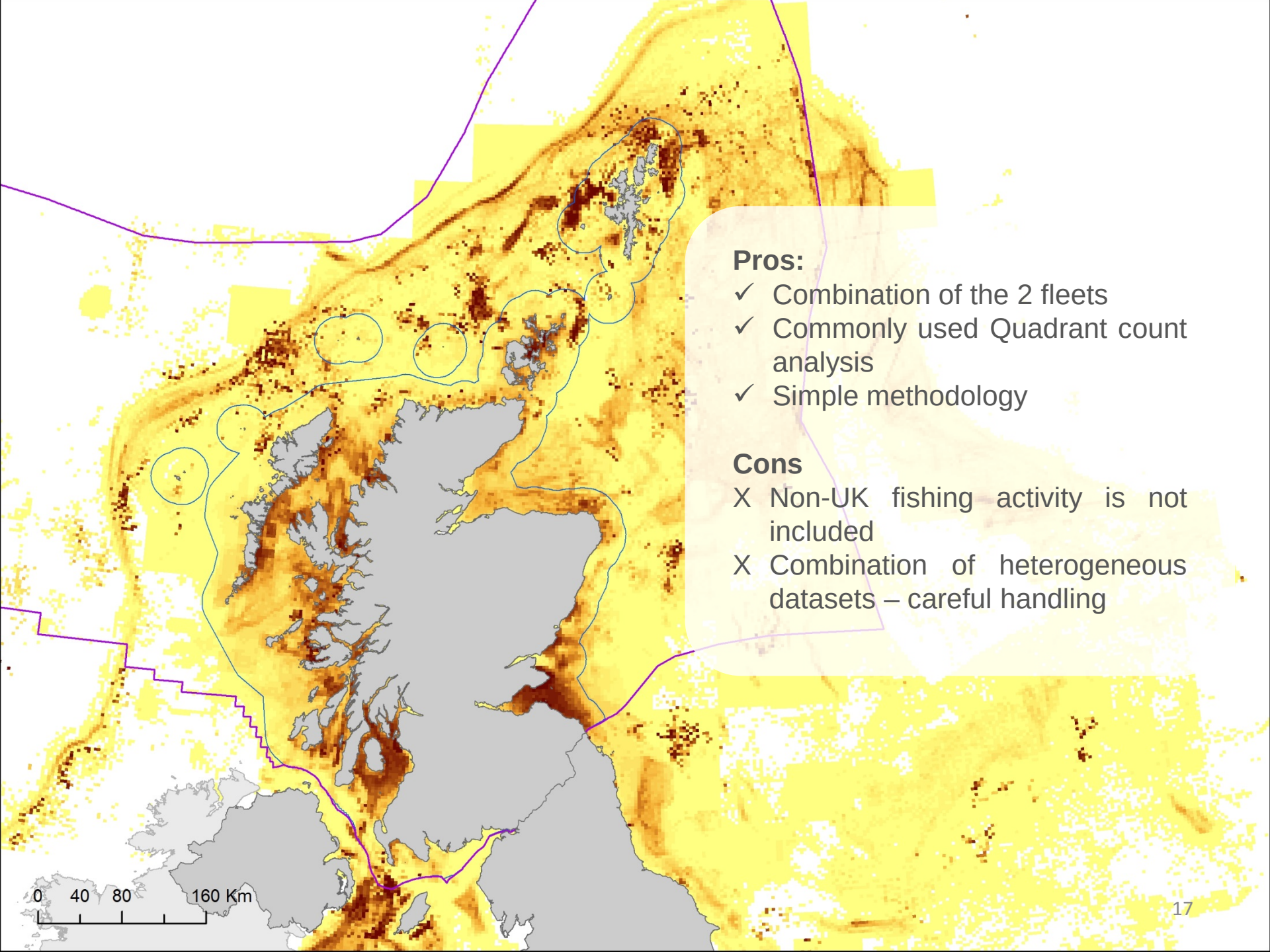
A) For fleet sectors closely associated with specific habitats – ScotMap spatial extent was used.

B) Remaining non-interviewed vessels – landing values in ICES statistical rectangles was used.

4. COMBINING

The scaled up value data from ScotMap and VMS layers were added together to produce a combined data set.


0 40 80 160 Km



Pros:

- ✓ Combination of the 2 fleets
- ✓ Commonly used Quadrant count analysis
- ✓ Simple methodology

Cons

- X Non-UK fishing activity is not included
- X Combination of heterogeneous datasets – careful handling

Conclusions

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- The combination of the spatial information from the two fleets (offshore and inshore), provides a comprehensive representation of fishing activities in Scotland
- Can inform decision making in various policy areas
  - marine spatial planning,
  - sustainable development of offshore renewable energy,
  - nature conservation, and
  - fisheries management.
- The data set will inform future studies of fisheries displacement

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Thank you!