Deep-sea fish

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Key message

There are no trends in three measures of the diversity of deep-sea fish in the Bailey or Rockall offshore marine regions between 1998 and 2018. There were insufficient data available to derive a trend for the Hatton and Faroe-Shetland Channel OMRs.

Orange roughy on coral reef © NOC

Background

Species diversity, or biodiversity, is a measure of the variety of species present and is an important property of natural systems. The simplest measure of diversity is richness, or the number of species present. The proportion of these species, or evenness is, however, also important for diversity and proportional abundance can be incorporated into measures of diversity that are also known as diversity indices.

Species diversity is often measured because diverse communities are thought to be more resilient, stable and productive than less diverse ones. As no single index adequately summarises the concept of diversity (Morris, 2014), here a range of indices is used to represent diversity within deep-sea fish (or demersal fish assemblages) through time in the Offshore Marine Regions (OMRs) (Figure 1). These are; species richness, the Simpson index and the Shannon index.

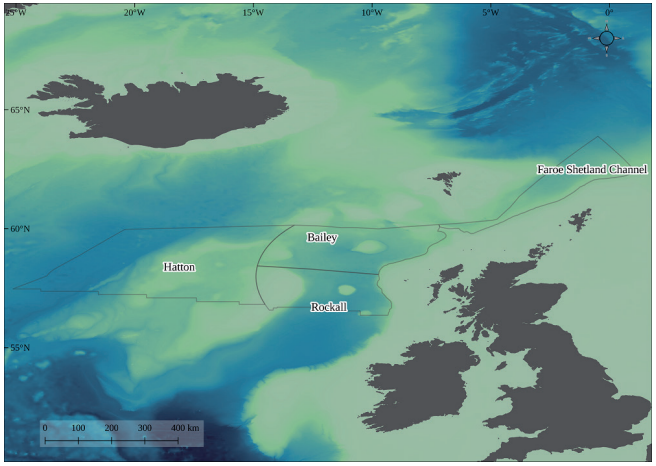


Figure 1:
The Offshore Marine Regions considered in this assessment.

Species diversity within a system may be affected by pressures, such as climate change (both through changes in temperature and ocean acidification); invasive non-native species; pollution and habitat change. Quantifying diversity and assessing changes in it over time is one way that general ecosystem health can be monitored.

This assessment focuses on the diversity of the demersal fish assemblages in the deep-water and offshore areas to the west and north of Scotland. The data used to inform this assessment arose from scientific trawl surveys, the majority of which were conducted from the MRV Scotia. These surveys catch a wide range of fish and all are included in the analysis to measure species richness and the two indices.

For further information on this topic go to: https://marine.gov.scot/sma/assessment/deep-sea-fish

Results

For the FSC OMR, no data prior to this assessment period (2014–2018) were available. As such, it was not possible to determine any temporal trends. Similarly, the Hatton OMR only had data for the 2005–2011 and current assessment periods and this is restricted to the south-east of the area.

There are no clear trends in species richness across the OMRs (Figure 2). In the Bailey OMR, the 2005–2011 richness value is higher, but also has wide error bars. The elevated values for 2005–2011 at Bailey is likely more an artefact of the patchy sampling than a reflection of any real change in diversity. The FSC OMR has data for the current assessment only. It has notably lower species richness than the other OMRs, but this is expected given the influence of Arctic water in the FSC OMR. For the Hatton OMR, there is a slight increase in species richness for the current assessment period against the 2005–2011 one. However, given there are data for only two time periods and the Hatton OMR has not been sampled extensively, it is not possible to say with any confidence whether this is reflective of a trend. There is no apparent trend for the Rockall OMR and the values across the three time periods are quite stable.

For each OMR a similar pattern to that of species richness is observed for the Simpson (Figure 3) and Shannon (Figure 4) indices, where there are no clear trends across the three time periods. The

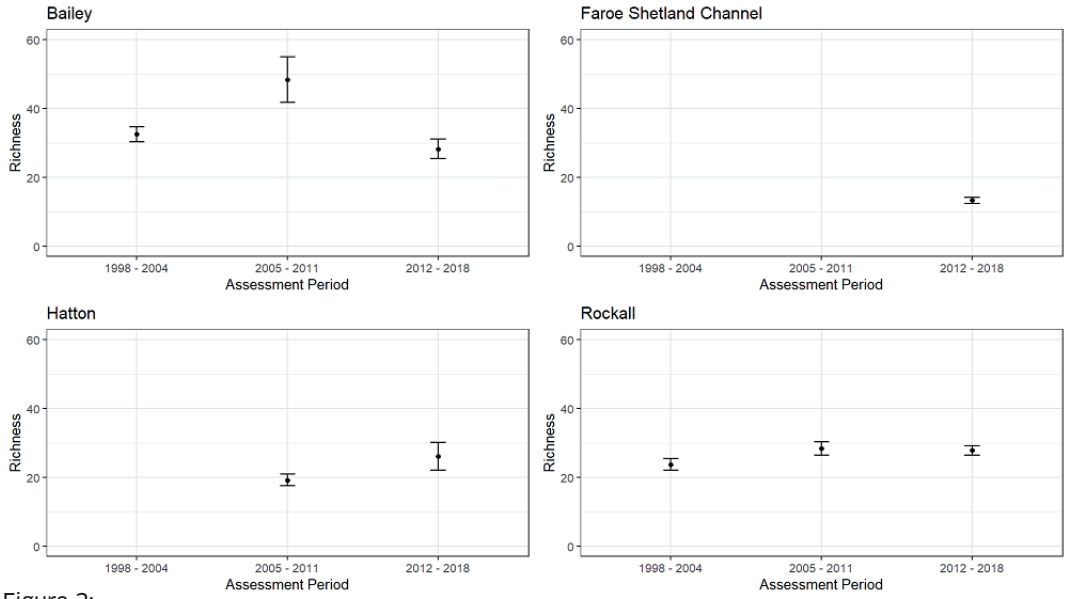


Figure 2:
Species richness (mean / OMR ± standard error) across the three assessment periods.

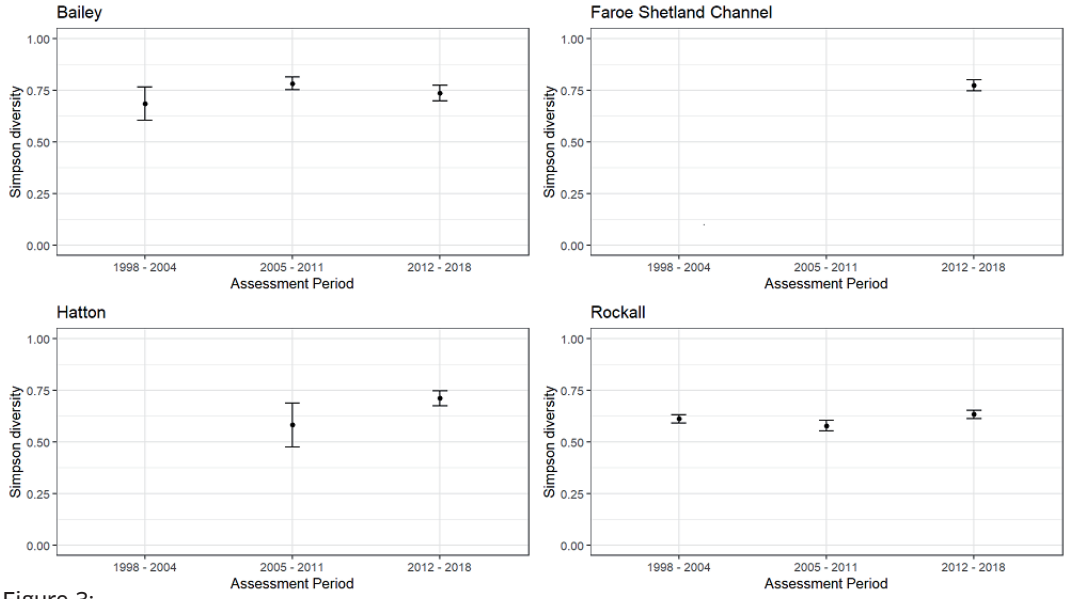


Figure 3:
Simpson index (mean / OMR ± standard error) across the three assessment periods.

values for the Simpson and Shannon indices in the FSC OMR are more similar to the other OMRs than for the species richness. This is because evenness (abundance across species) is also factored into these diversity indices. The Rockall OMR has little variation between values through time and appears quite stable, potentially due to the higher levels of survey effort in this OMR. For the Shannon index in particular, however, the Rockall OMR appears to have lower values than the other three OMRs. This is likely a consequence of the relatively shallow nature of the most numerous data on top of Rockall Bank, where the lower diversity at these depths (Figures I, j and k in Read More) has a greater influence on the mean value across the OMR than that of Bailey, for example.

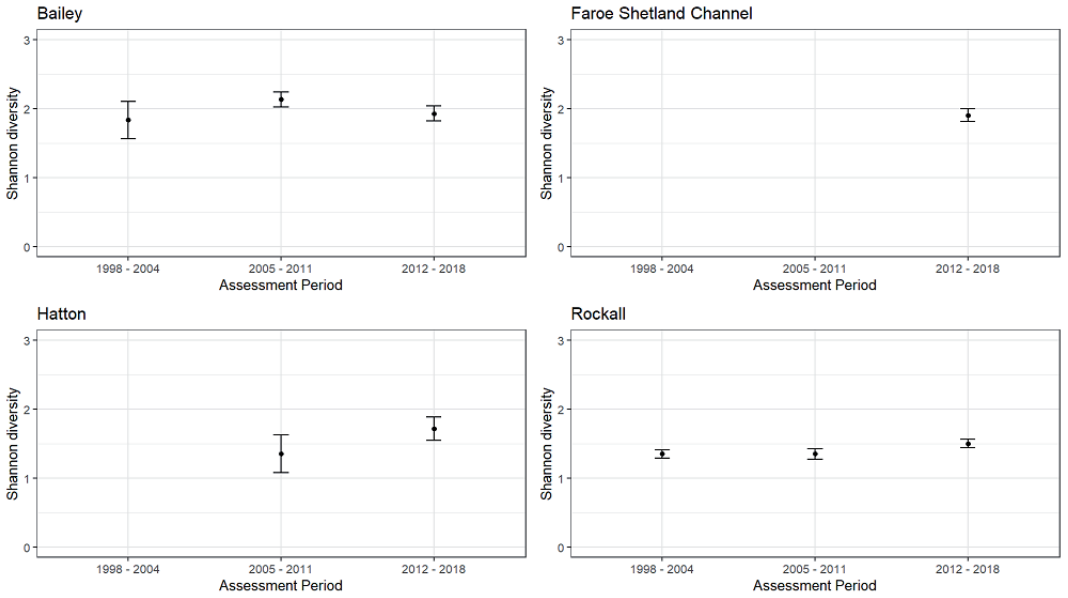


Figure 4:
Shannon index (mean / OMR ± standard error) across the three assessment periods.

Conclusion

There are no clear trends evident in the diversity of the deep-sea fish community across the Bailey and Rockall OMRs as measured by the diversity indices across the time periods assessed here. Our findings are consistent with Campbell *et al.*, 2011, where no temporal trends in community composition were found on the continental slope to the west of Scotland (Bailey and Rockall OMRs).

Knowledge gaps

The offshore marine regions are large areas that have been patchily sampled in space and time, which is a common issue in the deep-sea due to the challenges involved in accessing these areas. In the current assessment, this patchy sampling has necessarily been extrapolated across the entire area of each OMR. The notable gaps in sampling coverage are; the deep regions of the Rockall Trough, the western reaches of the Bailey OMR and the entire Hatton OMR, save the furthest south-east corner. Future sampling in these areas will allow for a more holistic assessment of these OMRs in the future.

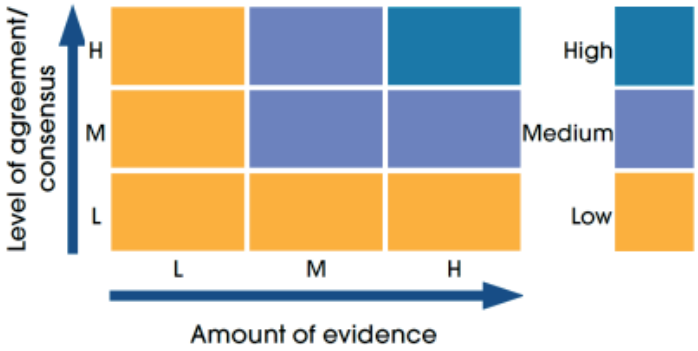
Status and trend assessment

Region assessed	Status with confidence	Trend with confidence
All regions	☆☆	☆☆
Bailey	☆☆	☆☆
Faroe-Shetland Channel	☆☆	☆☆
Hatton	☆☆	☆☆
Rockall	☆☆	☆☆

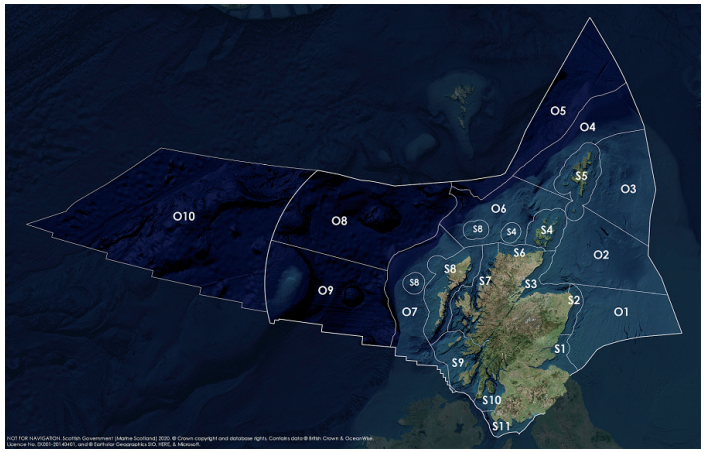
Status and trend assessment legend

Status assessment (for Clean and safe, Healthy and biologically diverse assessments)		Trend assessment (for Clean and safe, Healthy and biologically diverse and Productive assessments)	
	Many concerns		No / little change
	Some concerns		Increasing
	Few or no concerns		Decreasing
	Few or no concerns, but some local concerns		No trend discernible
	Few or no concerns, but many local concerns		All trends
	Some concerns, but many local concerns	**Confidence assessment**	
	Lack of evidence / robust assessment criteria	**Symbol**	**Confidence rating**
	Lack of regional evidence / robust assessment criteria, but no or few concerns for some local areas		Low
	Lack of regional evidence / robust assessment criteria, but some concerns for some local areas		Medium
	Lack of regional evidence / robust assessment criteria, but many concerns for some local areas		High

Overal confidence

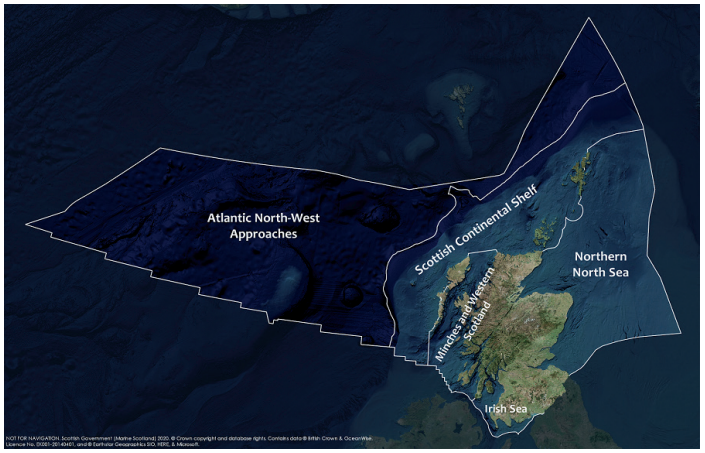


Assessment regions

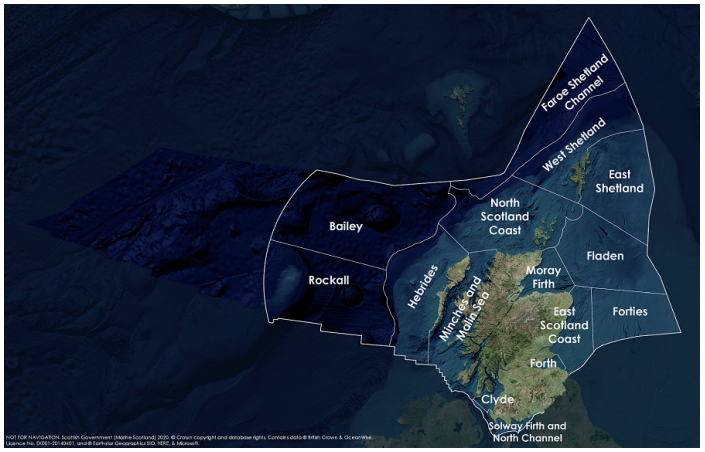


The Scottish Marine Regions (SMRs; S1 – S11) and the Scottish Offshore Marine Regions (OMRs, O1 – O10)

Key: S1, Forth and Tay; S2, North East; S3, Moray Firth; S4 Orkney Islands, S5, Shetland Isles; S6, North Coast; S7, West Highlands; S8, Outer Hebrides; S9, Argyll; S10, Clyde; S11, Solway; O1, Long Forties, O2, Fladen and Moray Firth Offshore; O3, East Shetland Shelf; O4, North and West Shetland Shelf; O5, Faroe-Shetland Channel; O6, North Scotland Shelf; O7, Hebrides Shelf; O8, Bailey; O9, Rockall; O10, Hatton.



Biogeographic, Charting Progress 2 (CP2) Regions. These have been used as the assessment areas for hazardous substances.



Scottish Sea Areas as used in Scotland's Marine Atlas 2011. These are sub divisions of the biogeographic, or Charting Progress 2 (CP2), Regions.

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NatureScot
Scotland's Nature Agency
Buidheann Nàdair na h-Alba

JNCC
Joint Nature Conservation Committee

SEPA
Scottish Environment Protection Agency

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