Contact Information
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Willing to Attend Workshop?
Yes

Target Name(s)
Porcupine Seabight / Porcupine Abyssal Plain. Biomass estimation concepts also apply generally.

Main Feature(s)/Area(s) of Interest
Porcupine Seabight

Geographic Area(s) of Interest within the North Atlantic Ocean
North East

Relevant Subject Area(s)
Biology, Geology, Chemistry and Physical Oceanography

Description of Topic or Region Recommended for Exploration
Brief Overview of Area or Feature.
The Porcupine Seabight is a broad, canyon-like oceanic basin in the NE Atlantic, extending from approximately 400 – 3000 m depth on the continental margin off SW Ireland. Within this region, a number of distinct seafloor habitats have been identified, including: three major carbonate mound provinces (Belgica, Hovland and Magellan Mounds) in the north that support cold-water coral frameworks (e.g. Huvenne *et al.* 2005); canyons to the east; and hexactinellid sponge beds between 1000 and 1300 m depth (Rice *et al.* 1990), with new data showing evidence of trawling damage. The Gollum Canyon System extends from the Irish continental shelf, along the axis of the Porcupine Seabight, and ultimately connects the Porcupine Seabight to the Porcupine Abyssal Plain to the west. The Porcupine Abyssal Plain – Sustained Observatory provides a long-term ecological research dataset from 1989-present for understanding change and pelagic benthic coupling processes that help shape seafloor communities (Hartman et al. 2012; Durden et al. 2017).

Brief Summary of Current State of Knowledge
The Porcupine Seabight has been subject to extensive seafloor mapping efforts (e.g. Dorschel et al, 2010). and the demersal and benthic megafauna were well surveyed, primarily by trawling, during the 1970s – early 2000s (e.g. Rice et al, 1991; Priede et al, 2010). The majority of these studies focused on the bathymetric and regional-scale distributions (i.e. 10s – 100s km) of deep-living fauna. As a result, we have a good taxonomic knowledge of the benthic and demersal fauna occurring within the Porcupine Seabight (and wider NE Atlantic), as well as on the regional oceanographic and biogeochemical setting (e.g. Carney, 2005). More recently, ROV video surveys of the biota have been conducted, but these have been focused mainly on the coral mound provinces. However, the region is subject to anthropogenic influences, the most notable of which is commercial fishing, which has extensive impacts on both target and non-target fishes and habitat-forming species such as cold-water corals and sponges. More generally, global to regional scale seafloor biomass can be estimated with valuable skill (see Wei et al. 2010), but there is an important challenge left revise such model estimates to better account for attributes like seafloor shape and composition in driving seafloor ecology. Models with such regional to local focus will be valuable in managing natural resources across a range of uses including fishing, energy extraction and

mining. This program provides an opportunity to collect data to help drive data collection suitable to address this challenge.

Rationale for Future Exploration.
The Porcupine Seabight make it a highly desirable location in which to conduct high-resolution photographic, video and acoustic surveys that build upon the existing knowledge base. As interest in spatial approaches to seafloor management increases within Europe and beyond (e.g. by designating Marine Protected Areas and identifying Vulnerable Marine Ecosystems), there is a clear need to better understand how the spatial distributions of deep-sea fauna relate to seafloor heterogeneity, and how they are affected by overlying oceanographic and biogeochemical processes in the water column. This includes the need to collect data suitable for estimating size specific biomass to help form and revise theories of how regional scale surface ocean and local scale seafloor features interact to influence the distribution and abundance of deep sea life. These management requirements feed into a growing interest in understanding the landscape ecology of marine organisms in general, and the role of the deep sea as a comparative environment in which to examine general ecological principles relating to space and habitat use.

In the present study, we propose a series of visual (video / photographic) ROV surveys conducted across different substrate / habitat types, conducted at different depths along the axis of the Porcupine Seabight, with the aim of examining the fine-scale spatial distributions of mobile invertebrate megafauna and demersal fishes at the seafloor. Acoustic and CTD surveys of the overlying water column (if feasible) would also allow connections between the benthic and pelagic realm to be examined and provide far more comprehensive, and high-resolution exploration of the Porcupine Seabight region than has been achieved to date.

Relevant Partnerships
The following colleagues have expressed interest in participating:
David M. Bailey, University of Glasgow, UK
Henry A. Ruhl, National Oceanography Centre, UK; Monterey Bay Aquarium Research Institute, CA, USA

The data collected from these surveys could be used to revise the estimates of Priede et al., 2010, Wei et al. 2010 and augment the NOC National Capability Project Climate Linked Atlantic Sector Science (CLASS) efforts.

Key References

1. Carney, R. S. (2005). Zonation of deep biota on continental margins. In Oceanography and Marine Biology - an Annual Review, Vol. 43, pp. 211-+. Ed. by R. N. Gibson, R. J. A. Atkinson, and J. D. M. Gordon.
2. Dorschel B. et al. (2010) Porcupine Seabight. In: Atlas of the Deep-Water Seabed. Springer, Dordrecht
3. Durden, JM, HA Ruhl, C Pebody, SJ Blackbird, D van Oevelen, 2017. Differences in the carbon flows in the benthic food webs of abyssal hill and plain habitats. Limnology and Oceanography: doi: 10.1002/lno.10532.
4. Hartman, SE et al. (2012). The Porcupine Abyssal Plain fixed-point sustained observatory (PAP-SO): variations and trends from the Northeast Atlantic fixed-point time-series. ICES Journal of Marine Science 69: 776-783.
5. Huvenne V.A.I. et al. (2005). The seabed appearance of different coral bank provinces in the Porcupine Seabight, NE Atlantic: results from sidescan sonar and ROV seabed mapping. In: Freiwald A., Roberts J.M. (eds) Cold-Water Corals and Ecosystems. Erlangen Earth Conference Series. Springer, Berlin, Heidelberg

6. Priede, I. G., et al. (2010). Deep-sea demersal fish species richness in the Porcupine Seabight, NE Atlantic Ocean: global and regional patterns. Marine Ecology-an Evolutionary Perspective, 31: 247-260.
7. Rice, A.L. et al. (1991). The Institute of Oceanographic Sciences Biology Programme In The Porcupine Seabight: Background And General Introduction. *Journal of the Marine Biological Association of the UK* 71(02):281 – 310
8. Wei C-L, et al. (2010) Global Patterns and Predictions of Seafloor Biomass Using Random Forests. PLoS ONE 5(12): e15323. doi:10.1371/journal.pone.0015323