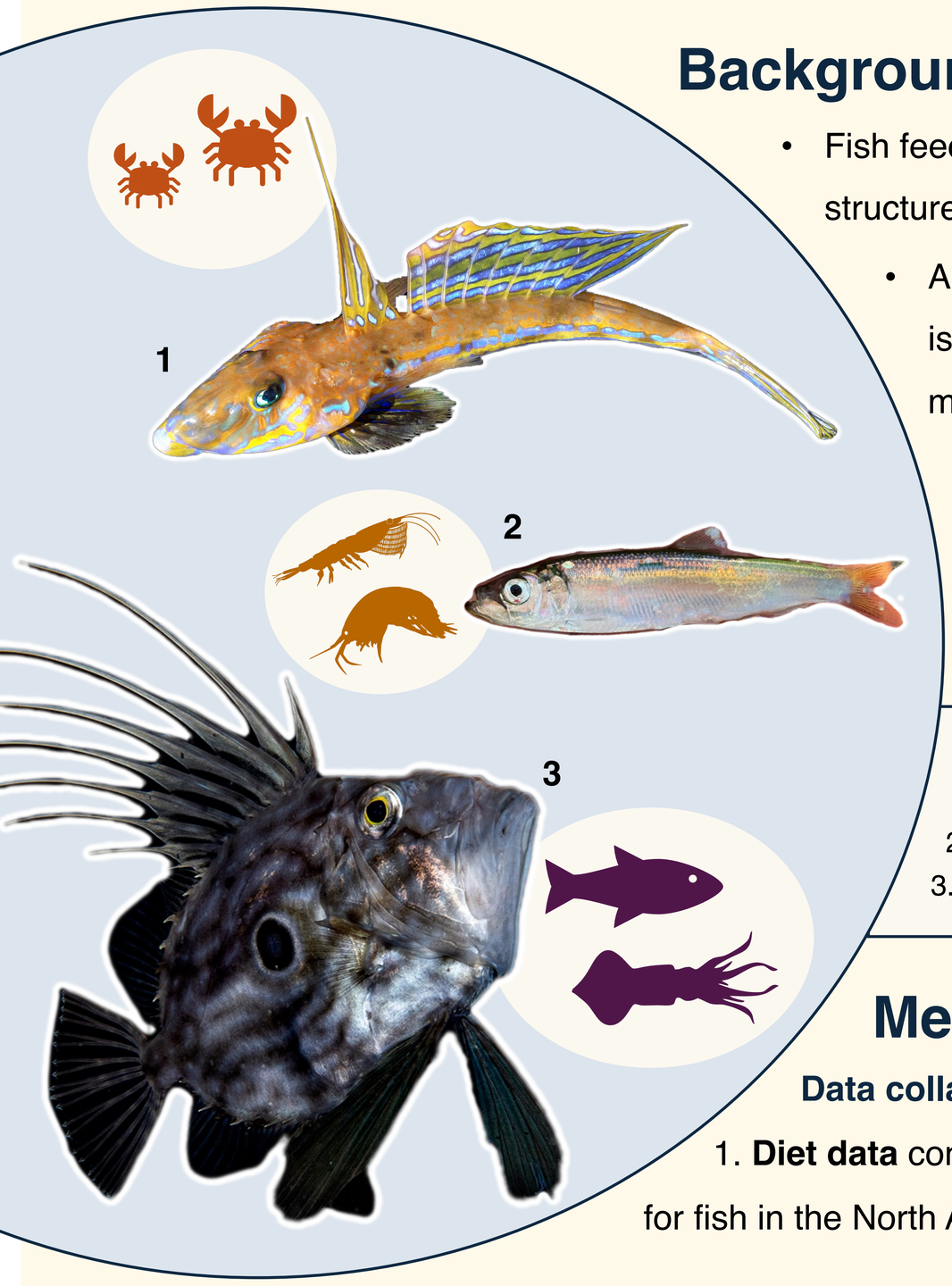
# Can you judge a fish by its looks? Using fish traits to predict what they eat

Ziyi Harriet Low [1] (zlow2@sheffield.ac.uk)
Tom Webb [1], Murray Thompson [2], Andrew Beckerman [1], Beth Gillie [2]
[1] Ecology & Evolutionary Biology, School of Biosciences, University of Sheffield [2] Cefas




## Background

- Fish feeding behaviours link trophic networks across habitats[1], maintain habitat structure[2], and contribute to biogeochemical cycling[3]
- As feeding behaviour is difficult to observe in situ and collect routine data on, there is a lack of diet data in many taxa and regions, hindering our understanding of marine ecosystems[4]
  - Fish morphology can be linked to their feeding behaviour, but existing studies tend to be geographically or taxonomically restricted[5]
  - **Aim**: Predict marine fish diets across broad geographic and taxonomic scales using spatial distributions, taxonomy, and traits.

**Examples of fish species in the North Atlantic and their diets:**

1. Common dragonet (*Callionymus lyra)*, mainly feeds on crabs and other benthic crustaceans
2. Atlantic herring (*Clupea harengus)*, mainly feeds on zooplankton, such as krill
3. John dory (*Zeus faber)*, adults feed on other fish, squids, and some benthic crustaceans

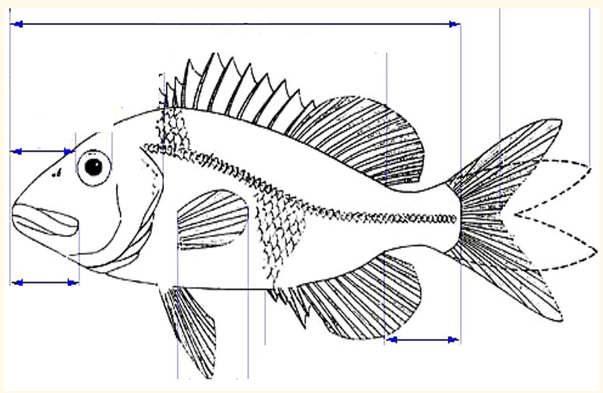
## Methods

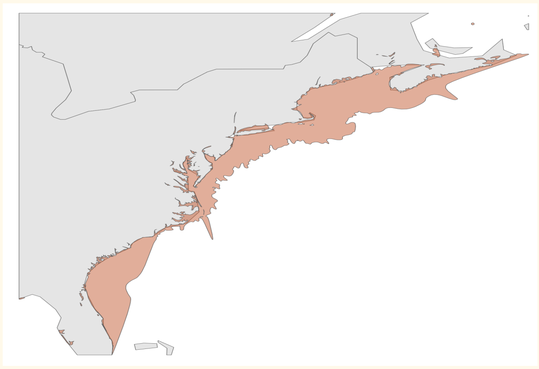
### Data collation

1. **Diet data** containing prey weights, predator and prey taxonomy, size, and locations were obtained for fish in the North Atlantic[6]. Additional data from the Southern and Pacific Oceans were also collated[5,7]

2. **Trait data** was collected from the FishShapes[8] and FishLife[9] databases, and missing data was phylogenetically imputed

Traits include head depth, mouth width, caudal peduncle width and depth, jaw length, body shape, habitat



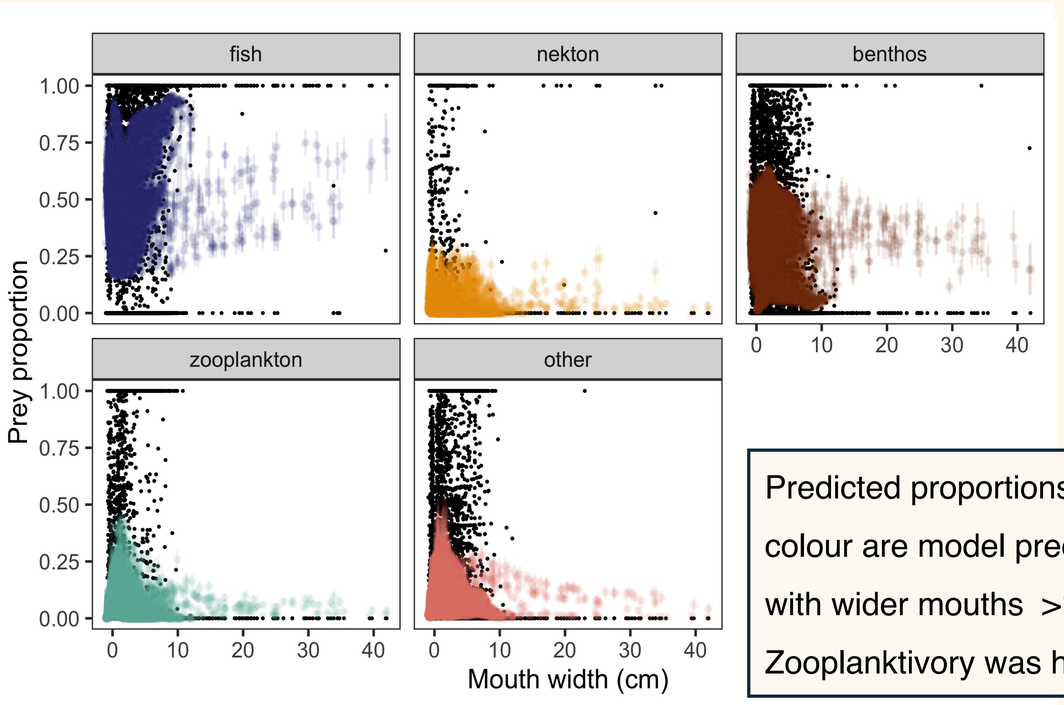


3. **Range areas** were calculated from IUCN Red List range maps and maps derived from OBIS occurrence records

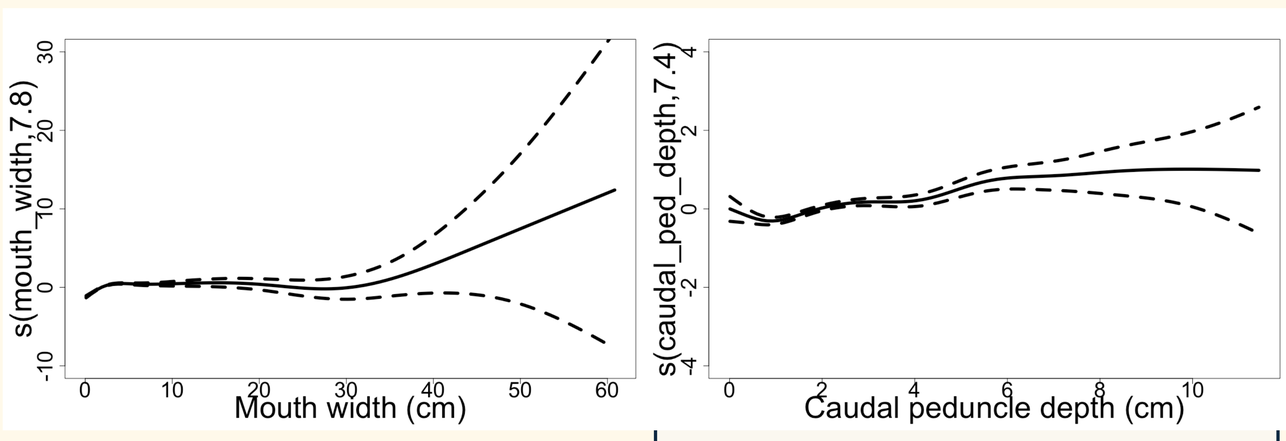
**Modelling:** A Tweedie Generalised Additive Model with smooths for each continuous trait and spatial coordinates, and parametric terms for range area, habitat, body shape, and prey type was used to explore the relationships between predator traits and their stomach contents (prey weights).

## Initial Results

The model captured 51% of deviance in the data, and all the smooth terms were significant.




Predicted proportions of prey type against mouth width. Points in colour are model predictions, while observations are in black. Fish with wider mouths >10cm were more likely to be piscivorous. Zooplanktivory was highest around 2.5cm.




Partial effects of the smooths for mouth width and minimum caudal peduncle depth, on the log(prey weight) scale

**References** **[1]** Albouy et al, Nat. Ecol. Evol. 3(8) (2019) **[2]** Fischer et al, Mar. Env. Res 209 (2025) **[3]** Bianchi et al, Sci. Adv. 7(41) (2021) **[4]** Braga et al, Rev. Fish Biol. Fish. 22(4) (2012) **[5]** Parravicini et al, PLOS Biol. 18(12) (2020) **[6]** Thompson et al, Cefas (2024) **[7]** Collins et al, UK Polar Data Centre (2020) **[8]** Price et al, Ecology 103(12) (2022) **[9]** Thorson et al, Methods Ecol. Evol. 14(5) (2023) **Images (backgrounds removed for 1-3)** **[1]** Common dragonet - Hans Hillewaert, 2007 **[2]** Atlantic herring - Zakqary Roy / iNaturalist, 2024 **[3]** John dory - Xavier Mas / iNaturalist, 2023 **[4]** Prey silhouettes via PhyloPic **[5]** Morphometric measurements image adapted from FMNH