

Body size-trophic position relationship in marine fish depends on biological and spatial scales

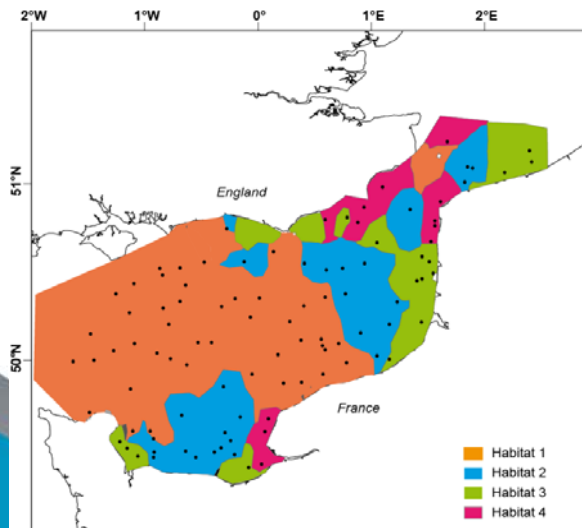
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Context

- Food web structure can be partly characterized by species' trophic level
- In marine fish, trophic level appears positively correlated to individual body size at the community scale (Jennings et al 2001)
- Trophic level may change across sizes but also taxa, seasons, and habitats
- Very few studies have addressed how size-dependence of trophic position varies in space, i.e. according to habitat, and whether observed community-scale patterns hold at the level of species or guilds.

Hypothesis: A fundamental relationship exists between trophic level and body size but some sources of variations may affect the realized pattern, among which the biological organisation level and the geographical scale.

Methods



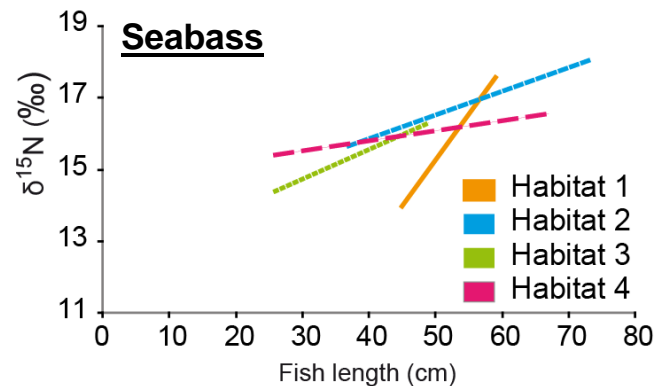
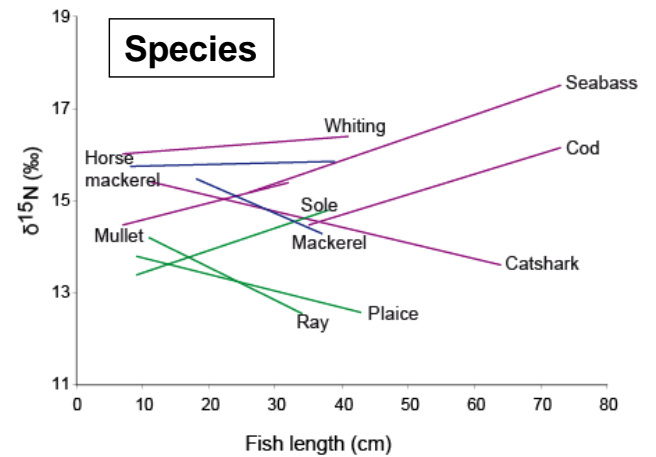
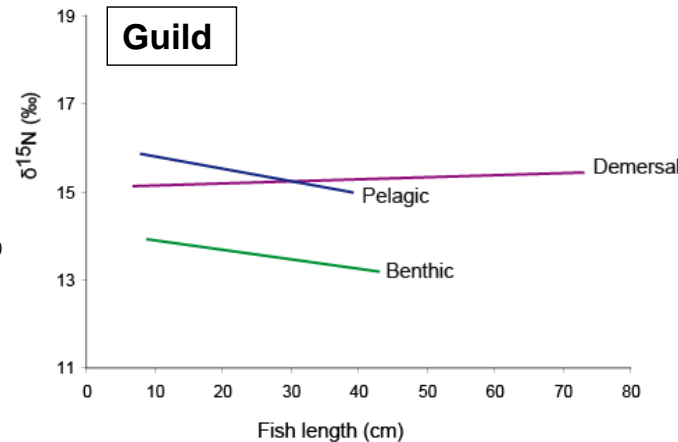
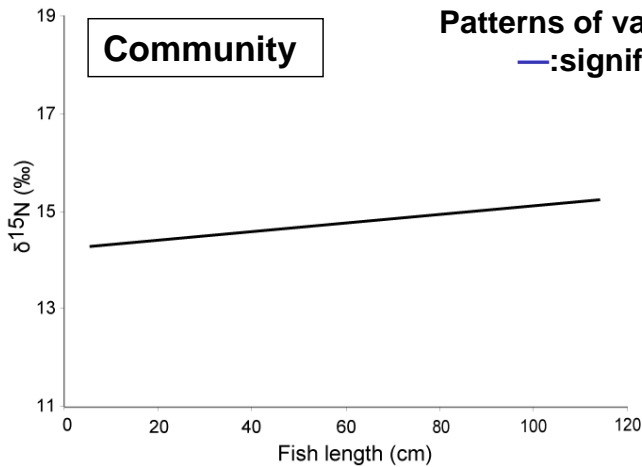
- Channel Ground Fish Survey
- GOV demersal trawl
- Stable isotope analysis: $\delta^{15}\text{N}$ ratios
- Generalized Linear Mixed Modelling: fish body size, habitats, interaction
- 3 biological organisation levels: community (50 species), guilds (benthic, pelagic and demersal) and species (10)
- 2 geographical scales: Eastern English Channel or habitats (4) (Vaz et al. 2007)



Results

Community									
+									
Benthic			Demersal					Pelagic	
0			+					-	
Plaice	Ray	Sole	Sea Bass	Cat-shark	Red Mullet	Cod	Whiting	Macke-rel	Horse Mack.
0	-	+	+*	0	+	0	0	0	0

Patterns of variation in $\delta^{15}\text{N}$ with body size. 0: no significant pattern, +: significant positive pattern, -: significant negative pattern, *: pattern slope varies with zone but sign doesn't change



Main findings:

- No clear pattern between body size and trophic level at the community level
→ bottom-up control of the trophic level due to the shallowness of the Eastern English Channel and to the abundance of food resources
- Guild level not relevant for the Eastern English Channel: guild-level patterns simply result from adding patterns of the populations they include
- The sign and strength of the relationship depend on the species considered (feeding mode, ontogenetic changes) and on the geographical scale.

Conclusions:

- Relationship between size and trophic level is highly variable and depends on the considered scale, be it spatial or biological
- Using a generic positive relationship might be an oversimplification of trophic relationships and may hide some specific properties of marine food webs
- Implications for models of size spectra or trophic models that rely on the assumption of a positive relationship between body size and trophic level or for indicators of fishing pressure based on trophic level calculation.

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