BENTHIC-PELAGIC COUPLINGS AS KEY DETERMINANTS OF FOOD WEB STRUCTURE ALONG ENVIRONMENTAL GRADIENTS

Lefebvre S.[1,2], Giraldo C. [2], Kopp D. [3], Cresson P. [2], Travers-Trolet M. [2], Ernande B. [2]

[1] Université de Lille 1, CNRS, ULCO UMR8187 LOG (Laboratoire d'Océanologie et Géosciences), Wimereux, France, [2] Ifremer, Laboratoire Ressources Halieutiques, Boulogne sur mer, France, [3] Ifremer, Unité de Sciences et Technologies halieutiques, Laboratoire de Technologie et Biologie Halieutique, Lorient Cedex, France

Introduction

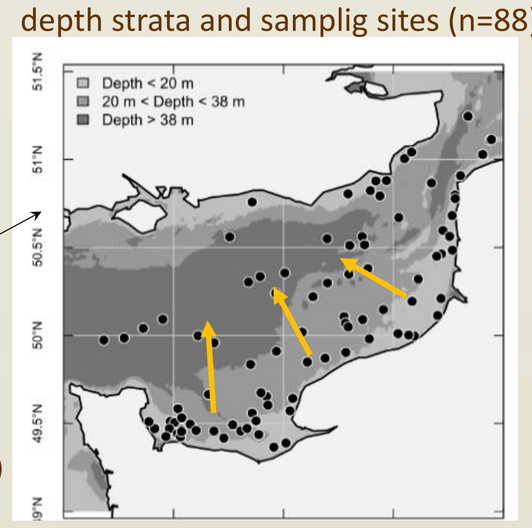
- ✓ Trophic relationships play a crucial role in shaping community structure and ecological functions in marine ecosystems.
- ✓ Studying the trophic networks' variation along environmental gradients is still in its infancy and provides new insights in understanding how abiotic variables shape species interactions.
- ✓ In epicontinental seas, benthic-pelagic couplings modify predator-prey relationships and lead to complex entangled trophic networks.
- ✓ Here, we assumed depth as a forcing variable of benthic-pelagic couplings and we then investigated depth-related changes in feeding patterns of fish assemblages in the whole English Channel (EC) as a case study.

Natural Gradients + Benthic-pelagic couplings + Fish Omnivory → Expected changes in fish feeding and in trophic network

Europe

33 fish species collected
+ additional compartments (n=900)
between 0-80 m

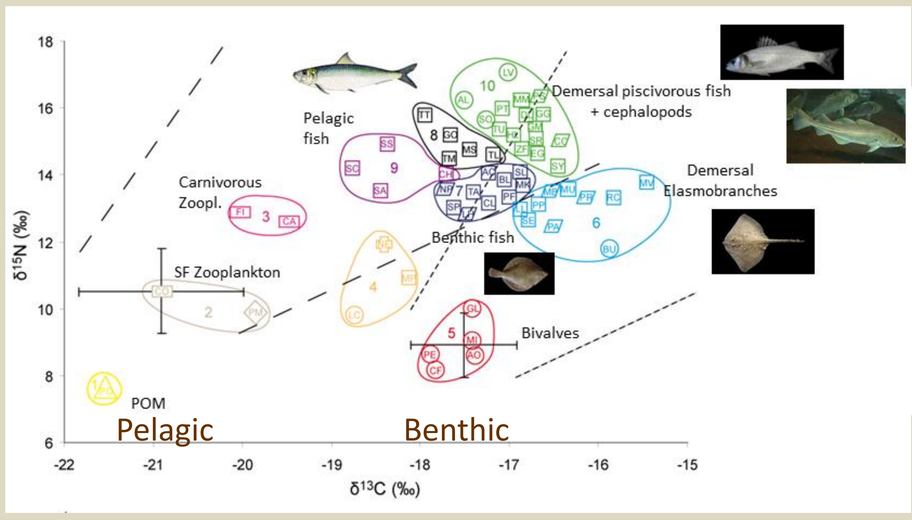
Eastern English Channel
depth strata and samplig sites (n=88)



Community level

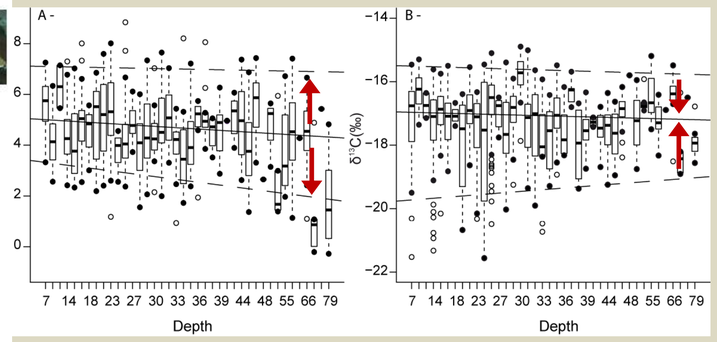
Methods: $\delta^{13}C$ + $\delta^{15}N$ + stats (Clustering, Generalized least squares model…)

Four trophic levels and two trophic pathways



Variance of isotopic ratios of the fish community significantly changed with depth

→ Network reorganization along the gradient

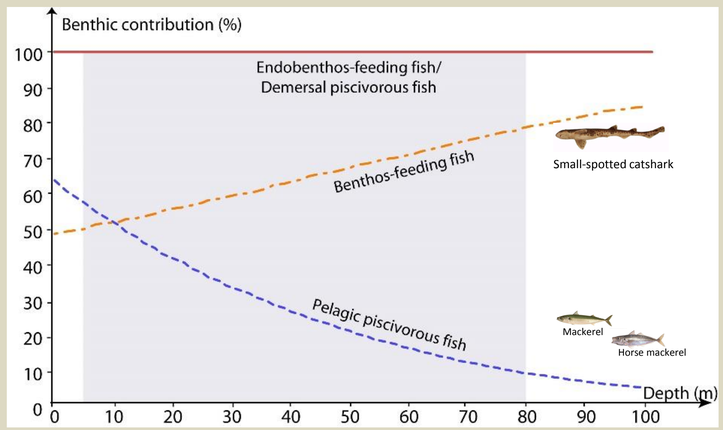


Kopp et al., 2015

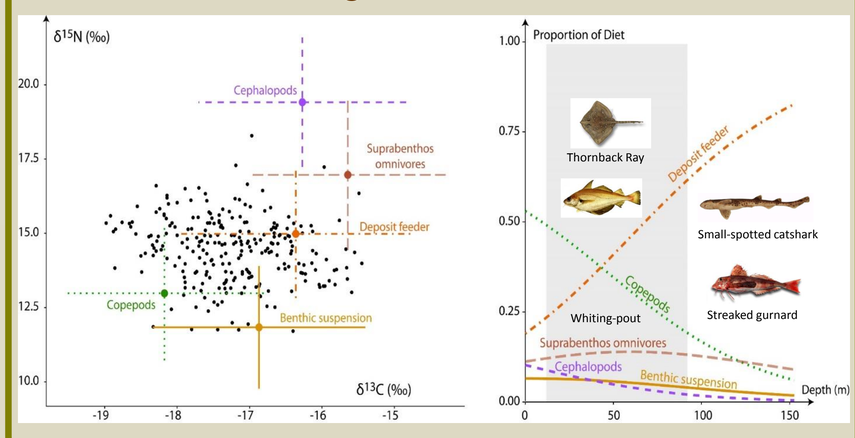
Functional groups level

Methods: $\delta^{13}C$ + $\delta^{15}N$ + stomach contents + Bayesian models (IsoWeb, MixSIAR)

Contribution of benthic subsidies changed with depth in two groups



Ex: Benthos feeding fish



Giraldo et al., 2017

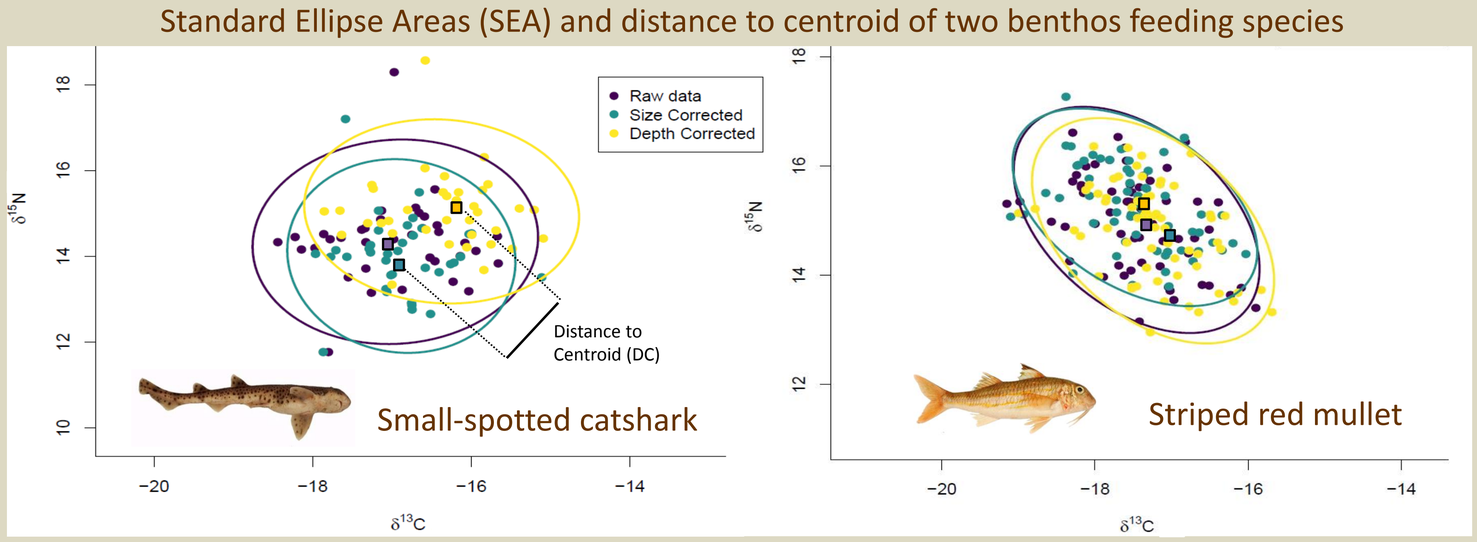
Species niche level

Methods: $\delta^{13}C$ + $\delta^{15}N$ + SIBER + stats (Linear model…)

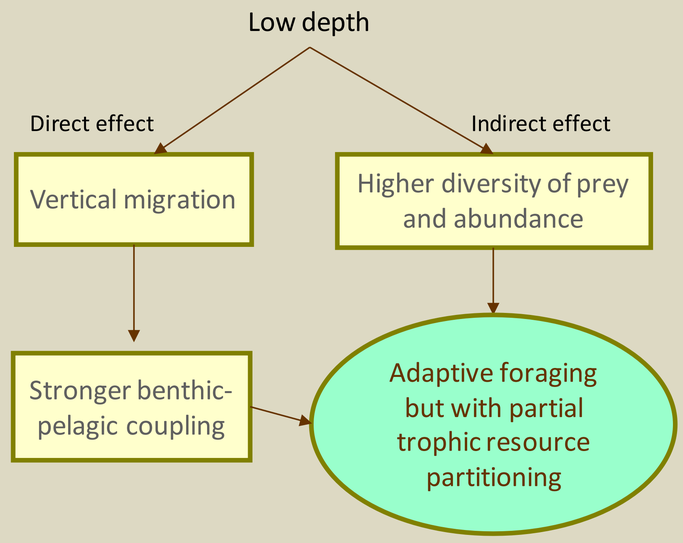
Most species changed their trophic niche position with depth but not their niche breadth

	Sea bass	Atlantic Cod	Whiting	Striped red mullet	European plaice	Thornback ray	Atlantic mackerel	Small-spotted catshark	Common sole	Atlantic horse mackerel
Displacement (DC)										
Depth	*	**	-	-	***	***	***	***	-	***
Size	-	-	-	-	-	-	*	-	-	-
Niche breath (SEA)										
Depth	*	-	-	-	-	-	*	-	-	-
Size	-	-	-	-	-	-	-	-	-	-

Standard Ellipse Areas (SEA) and distance to centroid of two benthos feeding species



Conclusions



- ✓ Reorganization of the network is due to the change in trophic niche position of fish species along depth
- ✓ Fish trophic niche breadths did not change suggesting resource partitioning possibly due to competition
- ✓ Environmental gradients such as depth gradient should be used as proxies of benthic-pelagic couplings' strength to understand spatial variation in consumers' resource use and highlight varying energy pathways structuring marine food webs.

References

Progress in Oceanography 130 (2015) 157–171

Contents lists available at ScienceDirect

Progress in Oceanography

journal homepage: www.elsevier.com/locate/pocean

Reorganization of a marine trophic network along an inshore–offshore gradient due to stronger pelagic–benthic coupling in coastal areas

Dorothée Kopp [a,b,c,*], Sébastien Lefebvre [b], Marie Cachera [b,c], Maria Ching Villanueva [c], Bruno Ernande [c]

LIMNOLOGY and OCEANOGRAPHY

ASLO

Limnol. Oceanogr. 62, 2017, 2213–2226
© 2017 Association for the Sciences of Limnology and Oceanography
doi: 10.1002/lno.10561

Depth gradient in the resource use of a fish community from a semi-enclosed sea

Carolina Giraldo [1,2*] Bruno Ernande,[2] Pierre Cresson,[2] Dorothée Kopp,[3] Marie Cachera,[4] Morgane Travers-Trolet,[2] Sébastien Lefebvre[1,2]

Acknowledgements

We thank Manuel Rouquette and Mickael Baheux (RHBL Ifremer Boulogne-sur-Mer) for their valuable help in the laboratory. This work was part-funded by the INTERREG IV A France (Channel) as part of the CHARM3 project and Regional Council "Hauts de France" and Prefecture du Nord Pas de Calais as part of the CPER project MARCO