The following supplement accompanies the article

Diet is correlated with otolith shape in marine fish

T. Mille*, K. Mahé, M. Cachera, M.C. Villanueva, H. de Pontual, B. Ernande

*Corresponding author: tiphaine.mille@ifremer.fr

Marine Ecology Progress Series 555: 167–184 (2016)

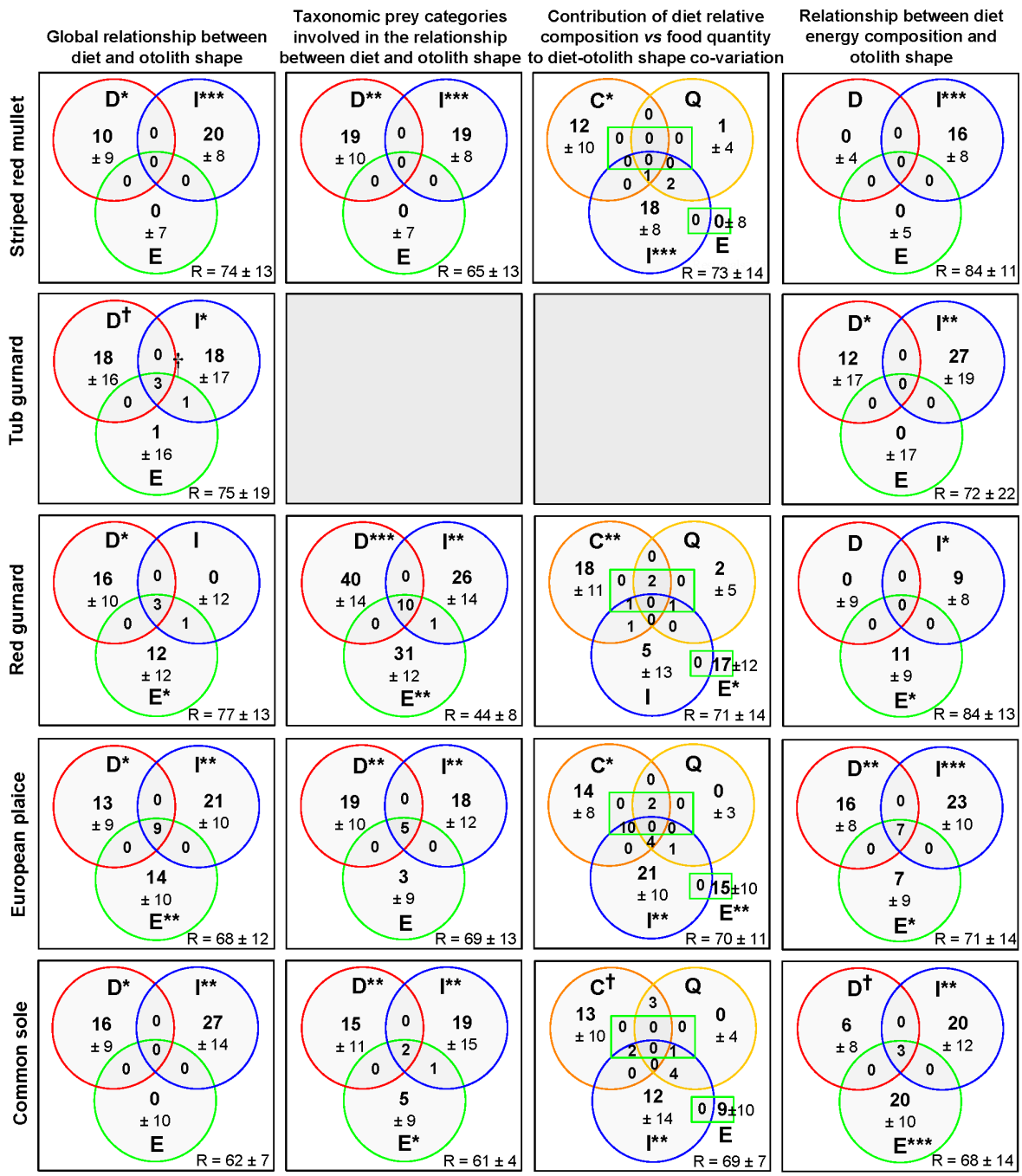

Fig. S1: Variation partitioning between diet and individual-state for the four questions investigated for each species. Questions investigated are organized into columns whereas species are organized into lines. Each circle corresponds to one matrix: diet matrix **D**, environmental matrix **E**, individual-state variable matrix **I**, diet relative composition matrix **C**, and food quantity **Q**. The number in the non-overlapping part of each circle represents the unique contribution in percentage of variation of the corresponding matrix. The number in the overlapping parts of the circles represent the joint contribution in percentage of variation of the corresponding matrices. Standard deviations obtained by bootstrapping are given for unique contributions only for ease of reading. All contributions and their standard deviations are given in Table S5 for more details. P-values of contribution fractions are indicated by the following symbols: <10%†,<5%* ,<1%** ,<0.1 %***.

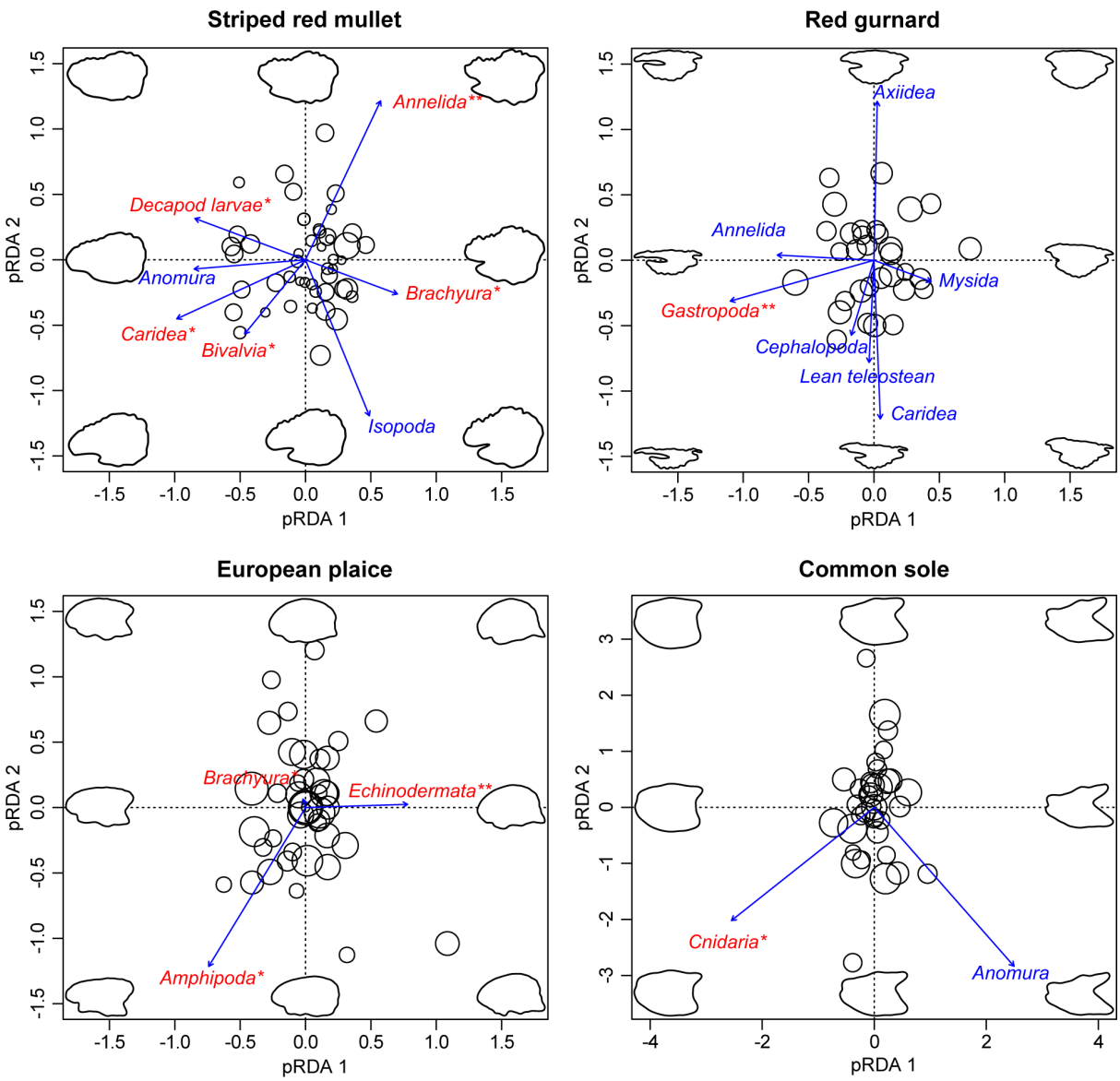

Fig. S2: pRDA biplot of otolith shape constrained by selected taxonomic prey categories and conditioned by selected individual variables and environmental variables (model 3) according to species. Explanatory variables with a significant effect (permutation test) on otolith shape are in red, the corresponding P-value being indicated by the following symbols: <5%*, <1%**, <0.1 %***. Each circle represents an individual and its size represents the individual total length. For each species, eight otolith shapes have been reconstructed from model predictions illustrating the relationship between diet and otolith shape.

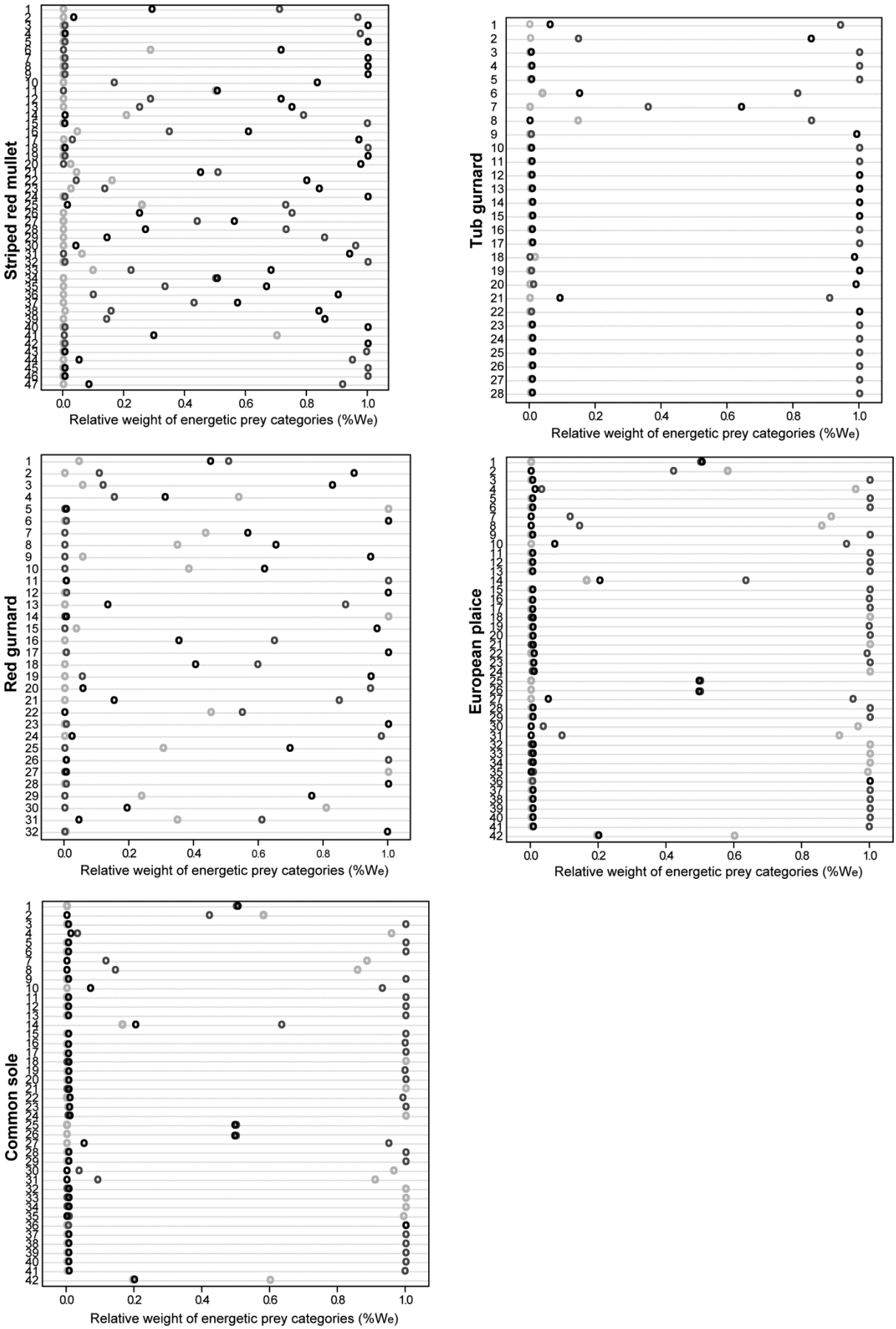

Fig. S3: Contribution of enegetic prey categories (**o** high, o medium, o low) to species specific diet, measured in terms of relative weight (%W_e).

Table S1: Prey items found in the stomach contents of the studied species and the corresponding prey categories based on taxonomy (Taxonomic prey category) and on their energy content (Energetic prey category). References used to categorize preys in terms of energetic content are also given. When the energetic value of the prey item was not found, the energetic value of a closer taxon was used.

Prey item	Taxonomic prey category	Energetic prey category	Reference
Algae	**Algae**	Low	
Amphipoda	**Amphipoda**	High	Dauvin & Joncourt 1989 Steimle & Terranova 1985
Aphroditidae	**Annelida**	High	Dauvin & Joncourt 1989
Opheliidae	**Annelida**	High	Dauvin & Joncourt 1989
Nereidae	**Annelida**	High	Dauvin & Joncourt 1989
Glyceridae	**Annelida**	High	Dauvin & Joncourt 1989
Glycera sp	**Annelida**	High	Dauvin & Joncourt 1989
Phyllodocida	**Annelida**	High	Dauvin & Joncourt 1989
Eunicidae	**Annelida**	High	Dauvin & Joncourt 1989
Nephtyidae	**Annelida**	High	Dauvin & Joncourt 1989 Steimle & Terranova 1985
Spionidae	**Annelida**	Medium	Dauvin & Joncourt 1989
Chloraemidae	**Annelida**	Medium	Dauvin & Joncourt 1989
Pectinariidae	**Annelida**	Medium	Dauvin & Joncourt 1989
Pectinaria koreni	**Annelida**	Medium	Dauvin & Joncourt 1989
Terebellidae	**Annelida**	Medium	Dauvin & Joncourt 1989 Steimle & Terranova 1985
Lanice conchilega	**Annelida**	Medium	Dauvin & Joncourt 1989
Arenicolidae	**Annelida**	Medium	Dauvin & Joncourt 1989
Galatheoidea	**Anomura**	Low	Norrbin & Båmstedt 1984
Galathea intermedia	**Anomura**	Low	Norrbin & Båmstedt 1984
Pisidia longicornis	**Anomura**	Low	Norrbin & Båmstedt 1984
Porcellana platycheles	**Anomura**	Low	Norrbin & Båmstedt 1984
Porcellana sp	**Anomura**	Low	Norrbin & Båmstedt 1984
Paguroidea	**Anomura**	High	Dauvin & Joncourt 1989 Steimle & Terranova 1985
Pagurus bernhardus	**Anomura**	High	Dauvin & Joncourt 1989 Steimle & Terranova 1985
Diogenes pugilator	**Anomura**	High	Dauvin & Joncourt 1989 Steimle & Terranova 1985
Axiidea	**Axiidea**	Low	Norrbin & Båmstedt 1984
Mytilidae	**Bivalvia**	Medium	Dauvin & Joncourt 1989 Steimle & Terranova 1985
Mytilus edulis	**Bivalvia**	Medium	Dauvin & Joncourt 1989 Steimle & Terranova 1985
Mactridae	**Bivalvia**	Medium	Dauvin & Joncourt 1989 Steimle & Terranova 1985
Arcidae	**Bivalvia**	Medium	Dauvin & Joncourt 1989 Steimle & Terranova 1985
Arca tetragona	**Bivalvia**	Medium	Dauvin & Joncourt 1989 Steimle & Terranova 1985
Nuculidae	**Bivalvia**	Medium	Steimle & Terranova 1985
Nucula sp	**Bivalvia**	Medium	Steimle & Terranova 1985
Solenidae	**Bivalvia**	Medium	Dauvin & Joncourt 1989 Steimle & Terranova 1985
Phaxas pellucidus	**Bivalvia**	Medium	Dauvin & Joncourt 1989 Steimle & Terranova 1985
Ensis sp	**Bivalvia**	Medium	Steimle & Terranova 1985
Semelidae	**Bivalvia**	Medium	Dauvin & Joncourt 1989

			Steimle & Terranova 1985
Abra alba	**Bivalvia**	Medium	Dauvin & Joncourt 1989
Cardiidae	**Bivalvia**	Medium	Dauvin & Joncourt 1989 Steimle & Terranova 1985
Parvicardium sp	**Bivalvia**	Medium	Dauvin & Joncourt 1989 Steimle & Terranova 1985
Solecurtidae	**Bivalvia**	Medium	Dauvin & Joncourt 1989 Steimle & Terranova 1985
Azorinus chamasolen	**Bivalvia**	Medium	Dauvin & Joncourt 1989 Steimle & Terranova 1985
Donacidae	**Bivalvia**	Medium	Dauvin & Joncourt 1989 Steimle & Terranova 1985
Donax vittatus	**Bivalvia**	Medium	Dauvin & Joncourt 1989 Steimle & Terranova 1985
Pectinidae	**Bivalvia**	Medium	Dauvin & Joncourt 1989 Steimle & Terranova 1985
Mimachlamys varia	**Bivalvia**	Medium	Dauvin & Joncourt 1989 Steimle & Terranova 1985
Portunidae	**Brachyura**	High	Spitz et al. 2010
Liocarcinus sp	**Brachyura**	High	Dauvin & Joncourt 1989
Liocarcinus depurator	**Brachyura**	High	Dauvin & Joncourt 1989
Liocarcinus pusillus	**Brachyura**	High	Dauvin & Joncourt 1989
Leucosiidae	**Brachyura**	Low	Dauvin & Joncourt 1989 Steimle & Terranova 1985
Ebalia cranchii	**Brachyura**	Low	Dauvin & Joncourt 1989 Steimle & Terranova 1985
Pinnotheridae	**Brachyura**	Low	Dauvin & Joncourt 1989 Steimle & Terranova 1985
Pinnotheres pisum	**Brachyura**	Low	Dauvin & Joncourt 1989
Thiinae	**Brachyura**	Low	Dauvin & Joncourt 1989 Steimle & Terranova 1985
Thia scutellata	**Brachyura**	Low	Dauvin & Joncourt 1989 Steimle & Terranova 1985
Atelecyclidae	**Brachyura**	Low	Dauvin & Joncourt 1989 Steimle & Terranova 1985
Inachidea	**Brachyura**	Low	Dauvin & Joncourt 1989 Steimle & Terranova 1985
Macropodia rostrata	**Brachyura**	Low	Dauvin & Joncourt 1989 Steimle & Terranova 1985
Inachus dorsettentis	**Brachyura**	Low	Dauvin & Joncourt 1989 Steimle & Terranova 1985
Crangonidae	**Caridea**	High	Dauvin & Joncourt 1989 Spitz et al. 2010
Crangon crangon	**Caridea**	High	Dauvin & Joncourt 1989 Spitz et al. 2010
Philocheras sp	**Caridea**	High	Dauvin & Joncourt 1989 Spitz et al. 2010
Philocheras fasciatus	**Caridea**	High	Dauvin & Joncourt 1989
Philocheras sculptus	**Caridea**	High	Dauvin & Joncourt 1989
Philocheras trispinosus	**Caridea**	High	Dauvin & Joncourt 1989
Hippolytidae	**Caridea**	High	Dauvin & Joncourt 1989 Spitz et al. 2010
Hippolyte sp	**Caridea**	High	Dauvin & Joncourt 1989 Spitz et al. 2010
Eualus gaimardii	**Caridea**	High	Dauvin & Joncourt 1989 Spitz et al. 2010
Eualus occultus	**Caridea**	High	Dauvin & Joncourt 1989 Spitz et al. 2010
Processidae	**Caridea**	High	Dauvin & Joncourt 1989 Spitz et al. 2010

Processa sp	**Caridea**	High	Dauvin & Joncourt 1989 Spitz et al. 2010
Processa canaliculata	**Caridea**	High	Dauvin & Joncourt 1989 Spitz et al. 2010
Processa edulis	**Caridea**	High	Dauvin & Joncourt 1989 Spitz et al. 2010
pandalidae	**Caridea**	High	Dauvin & Joncourt 1989 Spitz et al. 2010
Pandalina brevirostris	**Caridea**	High	Dauvin & Joncourt 1989 Spitz et al. 2010
Palaemonidae	**Caridea**	High	Spitz et al. 2010
Palaemon sp	**Caridea**	High	Spitz et al. 2010
Sepiolidae	**Cephalopoda**	Medium	Spitz et al. 2010
Ommastrephidae	**Cephalopoda**	Medium	Spitz et al. 2010
Hydrozoa	**Cnidaria**	Low	Steimle & Terranova 1985
Anthozoa	**Cnidaria**	Low	Steimle & Terranova 1985
Copepoda	**Copepoda**	High	Norrbin & Båmstedt 1984
Bodotriidae	**Cumacean**	High	Norrbin & Båmstedt 1984
Bodotria sp	**Cumacean**	High	Norrbin & Båmstedt 1984
Bodotria arenosa	**Cumacean**	High	Norrbin & Båmstedt 1984
Bodotria scorpioides	**Cumacean**	High	Norrbin & Båmstedt 1984
Vaunthompsonia sp	**Cumacean**	High	Norrbin & Båmstedt 1984
Pseudocumatidae	**Cumacean**	High	Norrbin & Båmstedt 1984
Pseudocuma sp	**Cumacean**	High	Norrbin & Båmstedt 1984
Decapod larvae	**Decapod larvae**	High	Norrbin & Båmstedt 1984
Echinozoa	**Echinodermata**	Low	Dauvin & Joncourt 1989 Steimle & Terranova 1985
Echinocyamus pusillus	**Echinodermata**	Low	Dauvin & Joncourt 1989 Steimle & Terranova 1985
Asterozoa	**Echinodermata**	Low	Dauvin & Joncourt 1989 Steimle & Terranova 1985
Ophiutrix fragilis	**Echinodermata**	Low	Dauvin & Joncourt 1989 Steimle & Terranova 1985
Ophiuridae	**Echinodermata**	Low	Dauvin & Joncourt 1989
Mullus surmuletus	**Fatty teleostean**	High	Spitz et al. 2010
Trachurus Trachurus	**Fatty teleostean**	High	Spitz et al. 2010
Naticidae	**Gastropoda**	Medium	Dauvin & Joncourt 1989
Euspira sp	**Gastropoda**	Medium	Dauvin & Joncourt 1989
Lacunidae	**Gastropoda**	Medium	Dauvin & Joncourt 1989
Littorinidae	**Gastropoda**	Medium	Dauvin & Joncourt 1989
Calyptraeidae	**Gastropoda**	Medium	Dauvin & Joncourt 1989
Crepidula fornicata	**Gastropoda**	Medium	Dauvin & Joncourt 1989
Buccinidae	**Gastropoda**	Medium	Dauvin & Joncourt 1989
Gebiidea	**Gebiidea**	High	Norrbin & Båmstedt 1984
Isopoda	**Isopoda**	High	Dauvin & Joncourt 1989
Mysida	**Mysida**	High	Norrbin & Båmstedt 1984
Scaphopoda	**Scaphopoda**	High	Dauvin & Joncourt 1989
Upogebia deltaura	**Tanaidacea**	High	Dauvin & Joncourt 1989
Perciformes	**Lean teleostean**	Medium	Spitz et al. 2010
Callionymus lyra	**Lean teleostean**	Medium	Spitz et al. 2010
Gobiidae	**Lean teleostean**	Medium	Spitz et al. 2010
Pleuronectiformes	**Lean teleostean**	Medium	Spitz et al. 2010
Solea Solea	**Lean teleostean**	Medium	Spitz et al. 2010

LITERATURE CITED

Dauvin JC, Joncourt M (1989) Energy values of marine benthic invertebrates from the western English Channel. J Mar Biol Assoc UK 69:589–595

Norrbin F, Båmstedt U (1984) Energy contents in benthic and planktonic invertebrates of Kosterfjorden, Sweden. A comparison of energetic strategies in marine organism groups. Ophelia 23:47–64

Spitz J, Mourocq E, Schoen V, Ridoux V (2010) Proximate composition and energy content of forage species from the Bay of Biscay: high- or low-quality food? ICES J Mar Sci 67:909–915

Steimle Jr FW, Terranova RJ (1985) Energy equivalents of marine organisms from the continental shelf of the temperate northwest Atlantic. J Northwest Atl Fish Sci 6:117–124

Table S2. Results of the four RDA models (as detailed in figure 3) for the five studied fish species. "Otolith shape" gives the number of principal components (N PCs) in the response matrix **S** used to describe otolith shape and the percentage of variance in Elliptical Fourier Descriptors they explain (%). "Environment", "Individual" and "Diet" correspond to explanatory matrices **E**, **I**, and **D** in reduced models. More precisely, "Environment" and "Individual" give the selected environmental and individual-state variables, respectively. "Diet" indicates the variables in the matrix **D**, i.e. the number of correspondence axes (N CAs) and the percentage of variance they explain (%) in diet composition $\mathbf{W}_t$ and relative diet composition $\%W_{t,j}$ in models 1 and 3, respectively, and the selected prey categories in models 2 and 4. "Model selected" gives the degrees of freedom (df), the F statistic, the corresponding P-value and the percentage of variation explained (%) by the reduced model.

Species	**Otolith shape S**		**Environment E**	**Individual I**	**Diet D**		**Model selected**			
	N PCs	%					df	F	P-value	%
Global relationship between diet and otolith shape (model 1)					**N CAs**	**%**				
Striped red mullet	4	77	-	Size Sex	10	99.85	13	2.22	**0.001**	25.61
Tub gurnard	2	70.18	Longitude×Latitude	Age Sex	4	90.59	11	1.83	0.041	25.31
Red gurnard	3	77.84	Longitude×Latitude Temperature		4	94.01	8	2.15	**0.007**	22.89
European plaice	3	74.02	Temperature Salinity	Age Sex Maturity	4	93.53	15	2.28	**0.001**	31.94
Common sole	3	78.23	-	Age Size Sex	8	95.32	16	2.31	**0.003**	37.50
Taxonomic prey categories involved in the relationship between diet and otolith shape (model 2)					**Taxonomic prey category**					
Striped red mullet	4	77	-	Size Sex	Annelida, Anomura, Bivalvia, Brachyura, Caridea, Decapod larvae, Isopoda		10	3.49	**0.001**	35.11
Tub gurnard	2	70.18	-	-	-	-	-	-	-	00.00
Red gurnard	3	77.84	Longitude×Latitude Temperature Depth	Size Age Maturity	Annelida, Axiidea, Caridea, Cephalopoda, Gastropoda, Mysida, Teleostean		17	3.28	**0.001**	55.56
European plaice	3	74.02	Depth	Age	Amphipoda, Brachyura, Echinodermata		10	2.85	**0.001**	31.10
Common sole	3	78.23	Temperature	Age Size Sex	Anomura, Caridea, Cnidaria		12	2.85	**0.001**	38.85
Contribution of diet relative composition *vs* food quantity to diet-otolith shape co-variation (model 3)					**N CAs**	**%**				
Striped red mullet	4	77	-	Size Sex	10	99.87	14	2.19	**0.001**	26.66
Tub gurnard	2	70.18	-	-	-	-	-	-	-	00.00
Red gurnard	3	77.84	Longitude×Latitude Temperature	Maturity	4	94.23	10	2.24	**0.004**	28.63
European plaice	3	74.02	Temperature Salinity	Age Sex Maturity	4	92.64	16	2.12	**0.005**	30.44
Common sole	3	78.23	Temperature Longitude×Latitude	Size	9	96.78	15	2.04	**0.002**	30.77
Relationship between diet energy composition and otolith shape (model 4)					**Energetic prey category**					
Striped red mullet	4	77	-	Size Sex			3	3.94	**0.001**	16.09
Tub gurnard	2	70.18	-	Age Size	low/medium/high		7	2.53	**0.003**	28.45
Red gurnard	3	77.84	Longitude×Latitude	Size			4	2.41	**0.006**	15.43
European plaice	3	74.02	Salinity Depth	Age	low/medium/high		11	2.51	**0.004**	28.80
Common sole	3	78.23	Temperature Longitude×Latitude Depth	Size Sex	low/medium/high		11	2.51	**0.001**	32.20

Table S3. Individual-state (***A***: age, L_T: total length, ***Se***: sex, ***M***: maturity) variables acting on otolith shape according to the model and the species considered. For each effect kept in the model reduced by stepwise selection, the *F* statistic (while respecting marginality of the effects, type 2 tests) is given together with the numerator degrees of freedom as exponent and the denominator degrees of freedom as index. The corresponding *P*-value is indicated by the following symbols: <5%*, <1%**, <0.1 %***.

Species	***A***	L_T	***Se***	***M***
Global relationship between diet and otolith shape (model 1)				
Striped red mullet		2.98^{1}_{33} *	4.46^{2}_{33} ***	
Tub gurnard	2.64^{3}_{18} *		5.67^{1}_{18}	
Red gurnard				
European plaice	2.11^{6}_{26} *		3.00^{2}_{26} *	2.40^{1}_{26}
Common sole	2.30^{5}_{19} *	2.87^{1}_{19} *	2.45^{2}_{19} *	
Prey categories involved in the relationship (model 2)				
Striped red mullet		4.41^{1}_{36} *	4.41^{2}_{36} ***	
Tub gurnard				
Red gurnard	1.30^{3}_{16}	0.17^{1}_{16}		2.54^{1}_{16}
European plaice	2.65^{6}_{31} **			
Common sole	1.62^{5}_{26}	3.13^{1}_{26} *		
Contribution of diet relative composition VS food quantity (model 3)				
Striped red mullet		3.80^{1}_{32} **	4.38^{2}_{32} ***	
Tub gurnard				
Red gurnard				1.98^{1}_{23}
European plaice	2.02^{6}_{25} *		3.01^{2}_{25} *	2.58^{1}_{25}
Common sole		3.87^{1}_{22} *		
Relationship between diet energy composition and otolith shape (model 4)				
Striped red mullet		3.47^{1}_{43} *	2.68^{2}_{43} **	
Tub gurnard	3.40^{3}_{20} **	4.03^{1}_{20} *		
Red gurnard		2.53^{1}_{30} *		
European plaice	2.42^{6}_{32} *			
Common sole	2.38^{5}_{30} **			

Table S4. Individual-state (***A***: age, L_T: total length, ***Se***: sex, ***M***: maturity) and environmental (***T***: temperature, ***Sa***: salinity, ***D***: depth, $L_o \times L_a$: interaction between longitude and latitude) variables acting on otolith shape according to the model and the species considered. For each effect kept in the model reduced by stepwise selection, the *F* statistic (while respecting marginality of the effects, type 2 tests) is given together with the numerator degrees of freedom as exponent and the denominator degrees of freedom as index. The corresponding *P*-value is indicated by the following symbols: <5%*, <1%**, <0.1 %***.

Species	***A***	L_T	***Se***	***M***	***T***	***Sa***	***D***	$L_o \times L_a$
Global relationship between diet and otolith shape (model 1)								
Striped red mullet		$2.98\,{}^{1}_{33}$ *	$4.46\,{}^{2}_{33}$ ***					
Tub gurnard	$2.64\,{}^{3}_{18}$ *		$5.67\,{}^{1}_{18}$					$0.16\,{}^{1}_{18}$
Red gurnard					$3.02\,{}^{1}_{25}$ *			$3.10\,{}^{1}_{25}$ *
European plaice	$2.11\,{}^{6}_{26}$ *		$3.00\,{}^{2}_{26}$ *	$2.40\,{}^{1}_{26}$	$3.56\,{}^{1}_{26}$ *	$4.29\,{}^{1}_{26}$ **		
Common sole	$2.30\,{}^{5}_{19}$ *	$2.87\,{}^{1}_{19}$ *	$2.45\,{}^{2}_{19}$ *					
Taxonomic prey categories involved in the relationship between diet and otolith shape (model 2)								
Striped red mullet		$4.41\,{}^{1}_{36}$ *	$4.41\,{}^{2}_{36}$ ***					
Tub gurnard								
Red gurnard	$1.30\,{}^{3}_{16}$	$0.17\,{}^{1}_{16}$		$2.54\,{}^{1}_{16}$	$0.73\,{}^{1}_{16}$			$0.53\,{}^{1}_{16}$
European plaice	$2.65\,{}^{6}_{31}$ **						$2.44\,{}^{1}_{31}$	
Common sole	$1.62\,{}^{5}_{26}$	$3.13\,{}^{1}_{26}$ *			$3.15\,{}^{1}_{26}$ *			
Contribution of diet relative composition *vs* food quantity to diet-otolith shape co-variation (model 3)								
Striped red mullet		$3.80\,{}^{1}_{32}$ **	$4.38\,{}^{2}_{32}$ ***					
Tub gurnard								
Red gurnard				$1.98\,{}^{1}_{23}$	$3.73\,{}^{1}_{23}$ *			$3.64\,{}^{1}_{23}$ *

Species	***A***	$L_{\mathbf{T}}$	***Se***	***M***	***T***	***Sa***	***D***	$L_{\mathbf{o}} \times L_{\mathbf{a}}$
European plaice	$2.02\ {}^{6}_{25}\ *$		$3.01\ {}^{2}_{25}\ *$	$2.58\ {}^{1}_{25}$	$3.34\ {}^{1}_{25}\ *$	$4.25\ {}^{1}_{25}\ **$		
Common sole		$3.87\ {}^{1}_{22}\ *$			$2.13\ {}^{1}_{22}$			$0.64\ {}^{1}_{22}$
Relationship between diet energy composition and otolith shape (model 4)								
Striped red mullet		$3.47\ {}^{1}_{43}\ *$	$2.68\ {}^{2}_{43}\ **$					
Tub gurnard	$3.40\ {}^{3}_{20}\ **$	$4.03\ {}^{1}_{20}\ *$						
Red gurnard		$4.02\ {}^{1}_{27}\ **$						$4.63\ {}^{1}_{27}\ **$
European plaice	$2.94\ {}^{6}_{30}\ **$					$3.91\ {}^{1}_{30}\ *$	$3.00\ {}^{6}_{30}\ *$	
Common sole		$6.86\ {}^{1}_{24}\ **$	$2.82\ {}^{2}_{24}\ *$		$7.29\ {}^{1}_{24}\ **$		$6.15\ {}^{1}_{24}\ **$	$5.53\ {}^{1}_{24}\ **$

Table S5. Percent contribution with bootstrapped standard deviation of the diet matrix (**D**), the individual matrix (**I**), the environmental matrix (**E** and residuals (**R**), obtained from variation partitioning performed on the reduced model for the four questions investigated and each studied species. model and studied species.

Global relationship between diet and otolith shape (model 1)								
	D	**I**	**E**	**D&I**	**I&E**	**E&D**	**D&I&E**	**R**
Striped red mullet	10 ± 9.48	20 ± 8.10	0 ± 7.28	0 ± 7.94	0 ± 5.73	0 ± 5.66	0 ± 6.46	74 ± 13.21
Tub gurnard	18 ± 16.46	18 ± 16.80	1 ± 15.67	0 ± 16.19	1 ± 16.28	0 ± 15.76	3 ± 16.86	74 ± 18.68
Red gurnard	16 ± 10.31	0 ± 12.08	12 ± 12.02	0 ± 12.74	1 ± 13.10	0 ± 11.65	3 ± 12.95	77 ± 13.13
European plaice	13 ± 8.99	21 ± 9.94	14 ± 10.49	0 ± 10.92	0 ± 8.26	0 ± 8.79	9 ± 10.07	68 ± 12.49
Common sole	16 ± 8.91	27 ± 13.76	0 ± 9.63	0 ± 13.68	0 ± 13.67	0 ± 9.78	0 ± 12.37	62 ± 7.23
Taxonomic prey categories involved in the relationship between diet and otolith shape (model 2)								
	D	**I**	**E**	**D&I**	**I&E**	**E&D**	**D&I&E**	**R**
Striped red mullet	19 ± 10.43	19 ± 7.97	0 ± 7.48	0 ± 8.12	0 ± 6.15	0 ± 6.30	0 ± 6.80	65 ± 13.43
Tub gurnard								
Red gurnard	40 ± 14.09	26 ± 13.56	31 ± 11.70	0 ± 18.09	1 ± 15.77	0 ± 14.63	10 ± 16.06	44 ± 8.31
European plaice	19 ± 10.10	18 ± 11.72	3 ± 9.31	0 ± 11.42	0 ± 9.22	0 ± 11.45	5 ± 11.06	69 ± 12.87
Common sole	15 ± 11.08	19 ± 14.89	5 ± 8.74	0 ± 16.57	1 ± 13.73	0 ± 12.14	2 ± 16.03	61 ± 4.25

Contribution of diet relative composition *vs* food quantity to diet-otolith shape co-variation (model 3)																
	C	**Q**	**I**	**E**	**C&Q**	**Q&I**	**C&I**	**E&C**	**E&Q**	**E&I**	**C&Q&E**	**C&Q&I**	**I&E&Q**	**C&I&E**	**C&Q&I&E**	**R**
Striped red mullet	12 ± 9.69	1 ± 3.69	18 ± 7.69	0 ± 7.85	0 ± 3.86	2 ± 4.69	0 ± 8.39	0 ± 5.71	0 ± 2.40	0 ± 6.34	0 ± 2.50	1 ± 5.13	0 ± 3.58	0 ± 6.46	0 ± 3.81	73 ± 13.51
Tub gurnard																
Red gurnard	18 ± 10.72	2 ± 4.60	5 ± 12.56	17 ± 11.82	0 ± 5.64	0 ± 6.12	1 ± 12.63	0 ± 11.59	0 ± 4.97	0 ± 13.13	2 ± 6.22	0 ± 8.09	1 ± 6.42	1 ± 13.13	0 ± 7.06	71 ± 13.68
European plaice	14 ± 7.83	0 ± 3.06	21 ± 10.32	15 ± 10.45	0 ± 4.14	1 ± 3.77	0 ± 10.07	0 ± 8.73	0 ± 4.05	0 ± 9.05	2 ± 5.10	4 ± 4.76	10 ± 4.55	0 ± 10.05	0 ± 5.58	70 ± 11.06
Common sole	13 ± 9.59	0 ± 4.04	12 ± 14.19	9 ± 9.94	3 ± 5.49	4 ± 6.62	0 ± 13.20	0 ± 11.46	0 ± 5.26	0 ± 13.39	0 ± 6.02	0 ± 7.53	1 ± 7.16	2 ± 12.94	0 ± 7.87	69 ± 6.84

Relationship between diet energy composition and otolith shape (model 4)								
	D	**I**	**E**	**D&I**	**I&E**	**E&D**	**D&I&E**	**R**
Striped red mullet	0 ± 4.31	16 ± 8.27	0 ± 5.46	0 ± 3.20	0 ± 4.69	0 ± 2.42	0 ± 3.65	84 ± 10.87
Tub gurnard	12 ± 17.03	27 ± 18.66	0 ± 17.33	0 ± 17.03	0 ± 18.98	0 ± 16.81	0 ± 18.05	72 ± 21.78
Red gurnard	0 ± 10.61	9 ± 14.68	11 ± 13.74	0 ± 11.09	0 ± 13.27	0 ± 9.43	0 ± 10.11	84 ± 19.88
European plaice	16 ± 7.89	23 ± 10.31	7 ± 8.91	0 ± 8.36	0 ± 9.73	0 ± 7.59	7 ± 8.80	72 ± 14.12
Common sole	6 ± 7.56	20 ± 11.77	20 ± 10.35	0 ± 7.15	0 ± 11.06	0 ± 6.50	3 ± 7.59	68 ± 13.92