Text S1. Additions to MATERIALS & METHODS

1.1 Data

1.1.1 Fish stomach content data

Exact geographical information on haul positions was missing in several datasets, providing only the ICES rectangle of hauling. Because the affected datasets were all compiled in the context of the ICES North Sea International Bottom Trawl Survey (NS-IBTS) (ICES 2020a), they could be reconstructed, using the haul data publicly accessible via the Database of Trawl Surveys (DATRAS, see ICES 2022). Haul position and stomach data were matched using a combination of haul information recorded in both datasets (Haul ID, ICES Statistical Rectangle, Country, Ship, Day, Date (D-M-Y)) as unique identifier. Predator and prey names in the data were updated to the latest accepted status using the World Register of Marine Species (WoRMS Editorial Board 2022).

1.1.2 Survey data on prey availability in the field

For both IBTS and GSBTS hauls, species abundances were standardized to unit (number of individuals caught) per km^2 swept area, to allow for comparability with benthos abundance data. The catch data from the fisheries surveys were transformed to swept-area based densities using recorded data on distance, speed over ground, and haul duration, as well as measurements describing the net opening during hauling. Since the latter were not systematically recorded for many of the hauls in question, opening parameters (door spread and wing spread) were estimated in such cases, using vessel-specific regression functions (ICES 2015, 2020b). When calculating swept-area-based abundance, a differentiation was made between species that are typically herded together by the sweeps of the net), and species which are only caught when positioned in the pathway of the opened net itself (for more information on swept-area estimation, see ICES 2021).

Text S2. Additions to RESULTS

The most common and dominant prey types across all predator species were decapods (Decapoda) and sandeels (Ammodytidae), which were found in all Pred/LS and constituted the highest relative biomass in four and six Pred/LS, respectively. For turbot, gadoids (Gadidae, specifically whiting) were a primary food source (56.1%). Both life stages of haddock had large proportions of ophiuroids (Ophiuroidea) in their stomachs (juvenile = 43.2% and adult = 64.6%). Prey items to be excluded prior to trait-based analyses (grey-shaded items in Figure 2), including zooplanktonic organisms, unidentified or imprecisely identified prey, and non-prey items such as rocks, contributed little (< 10%) to the diet composition of eight Pred/LS. Greater sandeel (23.9%) and juvenile haddock (22.8%) had the highest proportions of prey excluded for later analyses, 19.5% and 14.9% of which consisted of planktonic prey, respectively.

Ontogenetic variation between diets occurred in all species for which data on both juvenile and adult life stages were available (whiting, cod, grey gurnard, haddock, plaice), and in all cases, the diets shifted towards higher proportions of fish prey from juveniles to adults. The diet shifts were strongest for cod and grey gurnard, with the proportions of the initially dominating prey decapods decreasing markedly from juvenile (69.2% and 62.2%) to adult stages (38.1% and 20.9%). They were replaced by flatfishes (Pleuronectidae, 12.3%), other gadoids (12%), and clupeids (Clupeidae, 13%) in adult cod, while grey gurnard diets shifted towards sandeels (35.2%). In the cases of whiting, haddock, and plaice, shifts were less pronounced. Clupeids became a relevant food source of whiting only at the adult stage (20.6%). While adult whiting showed relatively few cases of cannibalism (28 prey items over 1242 stomachs), juvenile whiting fed, to a considerable extent, on its conspecifics (constituting 14.8% of average relative prey biomass and 49 prey items across 283 stomachs). For plaice, the proportion of decapods decreased from juveniles to adults (11.7% to 5%) and that of bivalves (Bivalvia) increased (7.8% to 14.4%), as did that of sandeels (43.9% to 63.4%). Juvenile haddock consumed polychaetes (Polychaeta, 8.6%), which decreased below 5% in adult individuals. Instead, adult haddock consumed more ophiuroids (43.2% to 64.6%).

TABLES, FIGURES

Table S1. Summaries of the datasets included in the present study prior to data filtering

Dataset	Provider/ Source	Reference	Temporal extent	Spatial extent	No. species	No. entries
DAPSTOM	Dr. Murray Thompson (Cefas)	*Pinnegar 2014*	1837 - 2016	North-East Atlantic, partly North-West Atlantic, Arctic Ocean	76	223395
ICES Year of the Stomach	Margarethe Nowicki (Lower Saxony Chamber of Agriculture)	*ICES 1997, Daan 1989*	All quarters 1980 - 1991	Whole North Sea	33	201514
LIFECO Project	Dr. Jens Floeter (UHH)	*Huwer et al. 2014*	Spring 2001	Southern North Sea and Skagerrak	11	6090
Tender *C. lucerna* 2005	Dr. Jens Floeter (UHH)	*Huwer et al. 2014*	Summer 2005	Southern North Sea, Box A	1	58
Tender Boxes 1992-1997	Dr. Jens Floeter (UHH)	*Huwer et al. 2014*	Spring, summer, autumn 1992, 1996, 1997	North Sea (boxes A, B, D)	3	38471
Tender *E. gurnardus* 2001-2004	Dr. Jens Floeter (UHH)	*Huwer et al. 2014*	Spring/summer 2001, 2003, 2004	Southern North Sea	1	320
Tender *E. gurnardus* 2005-2006	Dr. Jens Floeter (UHH)	*Huwer et al. 2014*	Spring, summer 2005, 2006	North Sea (incl. boxes A, B, C, D, H, K, L, N)	1	6700
Tender *M. merlangus* 2005	Dr. Jens Floeter (UHH)	*Huwer et al. 2014*	Summer 2005	North Sea (boxes D, F, H, K)	1	758
Tender *E. gurnardus* 2013 DE	Dr. Stefan Neuenfeldt (DTU-Aqua)	*Huwer et al. 2014*	Winter 2013	Central and northern North Sea	1	662
Tender *E. gurnardus* 2013 NOR	Dr. Stefan Neuenfeldt (DTU-Aqua)	*Huwer et al. 2014*	Winter 2013	Central/ Northern North Sea	1	579
Hinz et al. 2005	Prof. Dr. Ingrid Kröncke (SaM)	*Hinz et al. 2005*	Winter, summer 1999, 2000, 2001	Box A	2	919
Schückel et al. 2011/2012/2013	Prof. Dr. Ingrid Kröncke (SaM)	*Schückel et al. 2011, 2012, 2013*	All quarters 2009, 2010	Box A	4	5563
S. maximus 2019-2020	Dr. Matthias Bernreuther	*Bernreuther et al. in prep.*	Summer 2019, 2020	Southern North Sea	1	129

Table S2. Overview of lengths at maturity applied to separate predators by life stage

Predator	Length at Maturity	Reference
Grey gurnard (*Eutrigla gurnardus*)	18 cm	(Muus & Nielsen 1999)
Cod (*Gadus morhua*)	38 cm	(Froese & Sampang 2013)
Greater sandeel (*Hyperoplus lanceolatus*)	15 cm	(Vaz et al. 2007)
Common dab (*Limanda limanda*)	11 cm	(Rijnsdorp et al. 1992)
Haddock (*Melanogrammus aeglefinus*)	34 cm	(Jennings et al. 1998)
Whiting (*Merlangius merlangus*)	20 cm	(Jennings et al. 1998)
Plaice (*Pleuronectes platessa*)	27 cm	(Jennings et al. 1998)
Turbot (*Scophthalmus maximus*)	28 cm	(Froese & Sampang 2013)

Table S3. Summary of prey trait distributions in the analysis dataset and the complete dataset (in brackets). Continuous traits were log10-transformed for analysis, thus both untransformed and transformed ranges are provided for reference. Distributions of categorical traits are given in percentages of the total (88 species in the analysis dataset, 244 species in the complete data set)

Continuous	***untransformed***	***log10 (analysis)***
Maximum length	1.5 – 140 cm (0.6 – 140 cm)	0.18 – 2.15
Energy density	0.71 – 11.45 kJ g_{WM}^{-1} (0.13 – 11.45 kJ g_{WM}^{-1})	-0.15 – 1.06

Categorical					
Body shape	*compressiform*	*elongated*	*flat*	*round*	
	3% (12%)	67% (61%)	26% (21%)	3% (3%)	
Texture	*soft*	*medium*	*hard*	*very hard*	
	10% (16%)	42% (30%)	38% (37%)	10% (14%)	
Protection	*chemical defence*	*physical defence*	*counter attack*	*escape*	*hiding*
	2% (2%)	11% (7%)	13% (7%)	22% (24%)	52% (55%)
Mobility	*immobile*	*low*	*medium*	*high*	*very high*
	1% (3%)	31% (44%)	15% (12%)	39% (28%)	15% (10%)
Habitat	*in seafloor*	*on seafloor*	*benthopelagic*	*pelagic*	
	19% (29%)	69% (62%)	8% (5%)	2% (2%)	

Table S4. Summary table of the RLQ-ordination. Total inertia is the maximum explainable co-variance between tables **Q** and **R**. For more information on interpretation, please see Dolédec et al. (1996), Dray (2013)

Total inertia = 2.676				
Eigenvalues				
Axis 1	**Axis 2**	**Axis 3**	**Axis 4**	**Axis 5**
1.62452281	0.61368	0.32641	0.18769	0.03639
Projected inertia (%)				
Axis 1	**Axis 2**	**Axis 3**	**Axis 4**	**Axis 5**
57.908	21.875	11.635	6.691	1.297
Cumulative projected inertia (%)				
Axis 1	**Axis 2**	**Axis 3**	**Axis 4**	**Axis 5**
57.91	79.78	91.42	98.11	99.41

Eigenvalue decomposition					
RLQ axis	**Eigenvalue**	**Covariation**	**Standard dev. R**	**Standard dev. Q**	**Correlation**
1	1.6245153	1.2745647	1.236803	1.903913	0.5412706
2	0.6136773	0.7833756	1.317832	1.393339	0.4266319

Inertia & coinertia R			
RLQ axis	**Inertia**	**Max**	**Ratio**
1	1.529681	2.603646	0.5875149
1 & 2	3.266361	4.336182	0.7532805
Inertia & coinertia Q			
RLQ axis	**Inertia**	**Max**	**Ratio**
1	3.624885	3.963710	0.9145181
1 & 2	5.566278	6.753483	0.8242085
Correlation L			
RLQ axis	**Correlation**	**Max**	**Ratio**
1	0.5412706	1	0.5412706
1 & 2	0.4266319	1	0.4266319

Table S5. Summary table of the k-mean clustering outcomes. RLQ1 and RLQ2 give the coordinates of the respective trait along the first and second axis of the RLQ-outcomes, respectively. Pred_Prey indicates whether the trait in column "Trait" refers to predator or prey species

RLQ1	RLQ2	Trait	Pred_Prey	Cluster
-0.554808545	0.211438749	rel.maxillary.jaw.length	Predator	2
-0.090296788	0.173645586	Bertalanffy.growth.coefficient	Predator	2
0.009186275	-0.126799949	energy.density	Predator	2
-0.068389094	0.3572705	protein	Predator	2
-0.782954967	-0.41691153	omega3	Predator	2
0.099744478	-0.646426613	length.max	Predator	3
-0.237286898	0.435589072	AR	Predator	2
-0.278977628	-0.219933527	length.max	Prey	2
-0.426643426	-0.232900179	energy.density	Prey	2
1.149928912	0.08748106	body.compressiform	Prey	1
-0.2375289	0.082441031	body.elongated	Prey	2
0.548589123	-0.272411847	body.flat	Prey	1
0.985961611	0.493964217	body.round	Prey	1
0.087902572	-0.356926553	textu.soft	Prey	2
-0.11337725	0.236083839	textu.medium	Prey	2
0.029282667	-0.557472327	textu.hard	Prey	3
1.053933951	-0.090982556	textu.very.hard	Prey	1
0.143620807	0.437014609	prote.chemical.defence	Prey	2
0.445541876	-0.484694055	prote.physical.defence	Prey	1
0.268089574	-1.364977186	prote.counter.attack	Prey	3
-0.558399808	-0.532190133	prote.escape	Prey	2
0.081776374	0.305073717	prote.hiding	Prey	2
0.626750004	0.932368328	mobil.immobile	Prey	1
0.777318045	0.033195864	mobil.low	Prey	1
-0.643606689	0.414191296	mobil.medium	Prey	3
-0.035095952	-0.921476244	mobil.high	Prey	3
-0.40396104	0.367292087	mobil.very.high	Prey	2
0.862044628	-0.277180115	habit.in.seafloor	Prey	1
0.128211259	-0.138616353	habit.on.seafloor	Prey	2
-0.366189827	0.499291275	habit.benthopelagic	Prey	2
-0.498403894	-1.835829125	habit.pelagic	Prey	3

Table S6. Comparisons of diet compositions identified in this study with diet reports by other authors. Where divergences were identified, explanations are provided. Where preferences were identified based on Chesson's α, supporting studies are listed

Predator	**Life stage**	**Observed prey**	**Corresponding to observations in other studies**	**If applicable: explanation for divergence**	**References diet observations**	**Observed preference (significant *Chesson's α*)**	**References supporting preference**
Greater sandeel (*Hyperoplus lanceolatus*)	adult	lesser sandeel, copepods	Yes	n.a.	Engelhard et al. 2008, 2013	n.a.	n.a.
Common dab (*Limanda limanda*)	adult	decapods, bivalves, ophiuroids, polychaetes, fishes	Yes	n.a.	Braber & de Groot 1973, Hinz et al. 2005, Schückel et al. 2012	n.a.	n.a.
Grey gurnard (*Eutrigla gurnardus*)	adult	sandeels	Yes	n.a.	de Gee & Kikkert 1993, Engelhard et al. 2008, 2013, Weinert et al. 2010	sandeels	de Gee & Kikkert 1993, Engelhard et al. 2008, 2013
	juvenile	decapods, euphausiids	Yes	n.a.	de Gee & Kikkert 1993	n.a.	n.a.
Turbot (*Scophthalmus maximus*)	adult	gadoids, clupeids, sandeels	No: sandeels expected to constitute large- and clupeids small proportion.	Sandeels only found in one of analysed turbots. Turbot was caught at sites with unsuitable habitat for sandeels but high abundance of clupeids (= opportunistic feeding).	de Groot 1971, Braber & de Groot 1973, Wetsteijn 1981	n.a.	

Predator	**Life stage**	**Observed prey**	**Corresponding to observations in other studies**	**If applicable: explanation for divergence**	**References diet observations**	**Observed preference (significant *Chesson's α*)**	**References supporting preference**
Whiting (*Merlangius merlangus*)	adult	sandeels, clupeids, decapods (*Crangon spp.*)	Yes	n.a.	Hislop et al. 1991, Pedersen 1999, Temming et al. 2004, Engelhard et al. 2008, Lauerburg et al. 2018, Temming & Hufnagl 2015	sandeels clupeids	Temming et al. 2004, Engelhard et al. 2008 Pinnegar et al. 2003
	juvenile	gadoids (other whiting)	Partly: some studies report primarily crustaceans, others fish as food source for juveniles	Juveniles fed mostly on other whiting. Cannibalism among young life stages of whiting is common and possibly related to energetic advantages.	Bromley et al. 1997	n.a.	n.a.
Haddock (Melanogrammus aeglefinus)	adult	echinoderms (ophiuroids), sandeels	Partly: more sandeel than expected	Haddock mainly caught at the Dogger Bank, which is known sandeel habitat. Aggregations of sandeel are preyed upon by haddock.	ICES 1997, Schückel et al. 2010, Temming et al. 2004	n.a.	n.a.
	juvenile	benthic invertebrates, mainly ophiuroids	Partly: can vary between mixed fish-invertebrate and exclusively invertebrate-based diet	n.a.	Bromley et al. 1997, Schückel et al. 2010	n.a.	n.a.

Predator	Life stage	Observed prey	Corresponding to observations in other studies	If applicable: explanation for divergence	References diet observations	Observed preference (significant *Chesson's α*)	References supporting preference
Cod (Gadus morhua)	adult	mixed diet of invertebrates (decapods) and fish (flatfish, gadoids, clupeids)	Partly: cod typically show dominance of one prey type	Adult cod show intraspecific variation = feeding groups with one prey type dominating: "clupeids", "flatfishes", "other gadoids". Fish prey preferences account for half of diet, crustaceans (decapods) for the other half.	Hüssy et al. 2016	common dab, whiting	Hüssy et al. 2016, Daan 1989
	juvenile	benthic invertebrates (decapods)	Yes	n.a.	Daan 1989, Bromley 1997, ICES 1997	n.a.	n.a.
Plaice (Pleuronectes platessa)	adult	sandeels	No: expected diet to be composed of mostly benthic invertebrates (polychaetes, bivalves)	Consumption of sandeels by plaice varies in extend with the availability of sandeels. Previous accounts of contributions to diets varied between < 1% and 15%. Data analysed here originated from the Dogger Bank where sandeels are abundant.	Braber & de Groot 1973, Bromley et al. 1997, Piet et al. 1998, Schückel et al. 2012, Kaiser et al. 2004, Engelhard et al. 2008, 2013	n.a.	n.a.
	juvenile	sandeels	Same as for adults	Same as for adults	Same as for adults	n.a.	n.a.

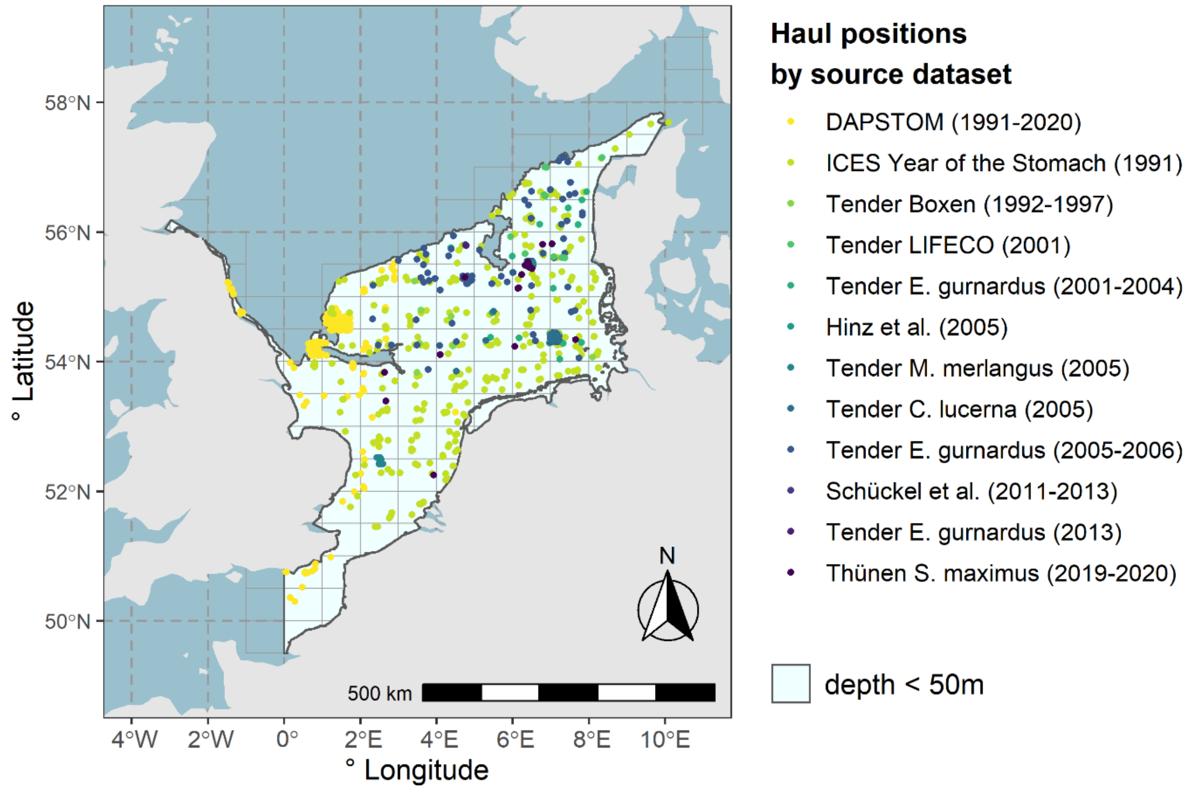

Fig. S1. Map showing the spatial distribution of all stomach datasets compiled, filtered spatially for the southern North Sea. A few of the datasets depicted here were not included in the analyses, due to lacking important data. This overview, however, may provide any potential future user with the information of which stomach data are theoretically available. "Thünen S. maximus" refers to unpublished data by M. Bernreuther

Fig. S2. Workflow and steps of data cleaning, starting from the individual datasets. Yellow boxes indicate the size of the dataset (schematic and number of rows), the brown arrows indicate exclusion of data, with description of what was removed written inside. Blue arrows give the direction of the cleaning process

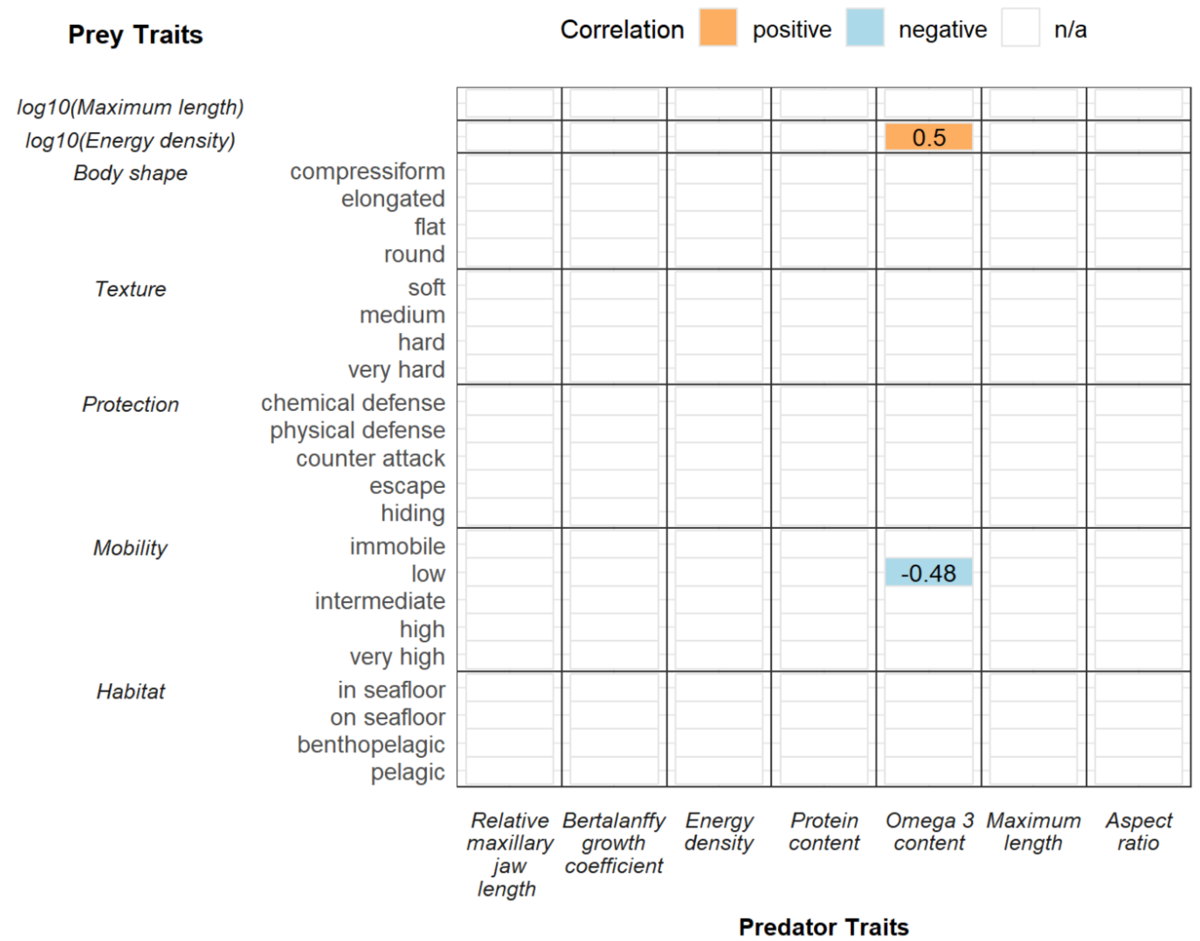

Fig. S3. Output of the fourth-corner analysis, testing pairwise Pearson correlations between predator (abscissa) and prey traits (and categories thereof, ordinate). Significant correlations are illustrated by coloured boxes (orange = positive, blue = negative) and the correlation coefficients being printed inside the boxes. White boxes symbolize absence of a correlation between the respective traits

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