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DAPSTOM - An Integrated Database & Portal for Fish Stomach Records

Version 4.7



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DAPSTOM - An Integrated Database & Portal for Fish Stomach Records

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Executive Summary

1.1. The most recent version of the DAPSTOM dataset (Version 4.7, collated in January 2014) includes 226,407 records derived from 449 distinct research cruises, spanning the period 1837- 2012.

1.2. The database contains information from 254,202 individual predator stomachs and 188 species. As such, this represents one of the largest and most diverse compilations of marine food-web data anywhere in the world.

1.3. In this most recent iteration of the DAPSTOM database new datasets (69,056 records) have been added including data on the feeding preferences of pelagic fish species (herring, blue whiting, mackerel) collated as part of the EU Euro-Basin project.

1.4. Historical data from the Cefas archive have also been digitized including information from scientists' log-books in the Arctic during the 1940s, 1950s and 1960s as part of the 'Trawling Through Time' initiative.

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1 Introduction

1.1 Background Information

The DAPSTOM database has now been in existence for 8 years, having been originally created in response to a 'data-rescue' call from the EU 'Network of Excellence' project EUROCEANS. This latest version includes 69,056 additional records bringing the total up to 226,407, spanning the period 1837 to 2012. The work involved in compiling this iteration was funded by the EU project Euro-Basin, with a particular recent emphasis on pelagic fish species (e.g. herring, blue whiting and mackerel) but also the Cefas project 'Trawling Through Time' and Defra project FizzyFish ('Response of ecosystems and fisheries to management in a changing environment' – MF1228). Partners in France, Ireland, Norway and Iceland generously submitted electronic datasets for inclusion, while Cefas staff made efforts to seek out older datasets, both in the Cefas archive and in published reports and papers, especially those focussing on sharks, tunas and unusual species observed around the UK. Large quantities of historical data have been added from the various Annual Reports of the 'Fishery Board for Scotland' (1884-1933). Extensive datasets (33,918 records) have also been digitised from log-books of the research vessel *Ernest* Holt that was operated by the MAFF Directorate of Fisheries (predecessor of Cefas) in the Arctic in the 1940s, 1950s and 1960s. The total number of predator species covered within the DAPSTOM database has now reached 188, with individuals ranging in size from 0.1cm (a herring larva) to 768 cm for a basking shark caught in 1947.

This report provides an account of the newly acquired data that has been included in DAPSTOM version 4.7, it offers an update on the number of records and stomachs examined by year, sea area and species, it includes reflections on how the database might be used, some challenges and remaining aspirations.

1.2 Policy Relevance

Food-webs have become a major focus for EU research and maritime policy. The 2008 European Marine Strategy Framework Directive (2008/56/EC) includes a commitment that Member States should work to achieve 'Good Environmental Status' (GES) by 2015. This is defined by eleven qualitative descriptors, one of which (descriptor 4) explicitly focuses on "Food Webs". In addition documents concerning reform of the EU 'Common

Fisheries Policy' (e.g. COM(2011) 417) have acknowledged that "Fisheries management must ... follow the ecosystem and precautionary approach" and this has been interpreted as requiring information on interactions between species (ICES 2013). Multispecies food-web models are seen as crucial for addressing this new agenda, yet there are surprisingly few long-term datasets available for parameterizing models of predator-prey interactions in the ocean. There is growing demand for data on 'who eats whom' in marine systems, in order to deduce how changes in one part of the ecosystem might have consequences elsewhere.

ICES have stated that "Stomach data are of vital importance" and that it intends to gradually transition to providing multispecies advice on fisheries for some European ecosystems in the near future (ICES 2013). A number of coordinated fish stomach databases do exist in Europe to help facilitate this task, but these typically encompass only a limited selection of species or cover a very discrete period of time. One of the more extensive datasets is the ICES 'Year of the Stomach' database for the North Sea, which provides information on 35 species, although detailed data is only available for 9, primarily based on stomachs collected during sampling campaigns in 1981 and 1991. A similar coordinated ICES dataset exists for cod in the Baltic Sea and has been documented in ICES (1997). In the Barents Sea, a combined database exists for Norway and Russia (Dolgov et al., 2007), but large areas of the north-east Atlantic remain neglected.

2 Datasets

2.1 Datasets provided or collected as part of Euro-Basin

The EU Euro-Basin project aims to understand and predict the dynamics of plankton and pelagic fish species in the North Atlantic, and to assess the impacts of climate variability. This project has a particular focus on herring (*Clupea harengus*), mackerel (*Scomber scombrus*) and blue whiting (*Micromesistius poutassou*), which are the most abundant and widespread planktivorous fish species in the region, but also bluefin tuna (*Thunnus thynnus*) and albacore (*Thunnus alalunga*), top predator species that inhabit the whole North Atlantic basin and carry out trans-oceanic migrations.

The DAPSTOM database is explicitly mentioned in the 'Description of Work' for Euro-Basin, as an open-access repository to accommodate datasets generated during the project. Therefore throughout 2013, Euro-Basin partner institutes submitted datasets and these have been reformatted into the required DAPSTOM formats.

As the DAPSTOM initiative has progressed, a relational-database structure has evolved (in Microsoft Access) that can accommodate all formats of stomach content information (see Hyslop 1980 for a review), including data collected at the level of individual fish, pooled samples of multiple fish stomachs, frequency of occurrence data as well as fully gravimetric information (prey weights or volumes). As a bare minimum, in Version 4.7 of the DAPSTOM database, information on the predator species, geographic area and the number of stomachs examined was required for a dataset to be included. Information on predator length (or size range) was also widely available. Datasets assembled as part of the Euro-Basin initiative can be summarised as follows (Table 1):

Table1. Number of stomach content records for pelagic fish species submitted to the DAPSTOM database as part of Euro-Basin. Number of individual stomachs included in parentheses.

Dataset	**Period**	**Herring**	**Blue whiting**	**Mackerel**
IFREMER (France)	2011	0 (0)	133 (117)	0 (0)
IMR (Norway)	2004, 2006	1291 (538)	354 (139)	1772 (635)
MRI (Iceland)	2010, 2011	1610 (823)	274 (158)	3226 (1486)
GMIT (Ireland)	2011	0 (0)	139 (109)	0 (0)
Cefas (UK)	2010, 2011	1101 (961)	467 (366)	6 (3)
Cefas - Historical	1864-2009	4506 (25424)	216 (237)	5614 (5299)
Total		**8508 (27746)**	**1583 (1126)**	**10618 (7423)**

It is important to note that the pelagic fish data included in Table 1, were also submitted to the PANGAEA open-access data portal (www.pangaea.de) as part of Euro-Basin, to accompany a forthcoming special issue of the journal 'Earth System Science Data'. Within the special issue a peer-reviewed publication (Pinnegar et al. in press) describes the particular dataset as well as an accompanying dataset on tuna, submitted by AZTI-Tecnalia (Spain).

From Table 1 it is clear that the vast majority of the data available for blue whiting was collected explicitly for the purposes of Euro-Basin (1367 records out of 1583), whereas this was not true for either herring or mackerel. It is also apparent that for blue whiting and mackerel the number of database records exceeds the number of stomachs

examined, suggesting that the vast majority of the data available concerns non-pooled information from individual stomachs whereas this was not the case for herring, where 8,508 database records were derived from 27,746 stomachs examined. The reason for this disparity is the digitisation of huge 'pooled' datasets from a MAFF summary report by Hardy (1924), but also summary data from Brook & Calderwood (1886) in the Fourth Annual Report of the Fishery Board for Scotland, and that by Scott (1924) in 'Proceedings and Transactions of the Liverpool Biological Society'.

Additional 'pooled' datasets submitted to the DAPSTOM database as part of Euro-Basin include information on the feeding habits of larval/juvenile herring (0.2 to 13 cm in length) from Plymouth Sound, the Clyde and the North Sea by Lebour (1921, 1924), Marshall et al. (1939) and Last (1980, 1978) respectively. Table 2 shows the number of records and stomachs by geographic area, including all larval and juvenile fish. From this table it is apparent that herring, blue whiting and mackerel have been sampled over a huge geographic range, from the Bay of Biscay (~43°N) to the high Arctic (~73°N) and from Greenland in the West (~29°W) to the Lofoten islands in the East (~9°E). By contrast the sporadic records for Albacore and Bluefin tuna have come from either the English Channel or North Sea.

Table 2. Number of records for pelagic fish species submitted to the DAPSTOM stomach content database as part of Euro-Basin, by geographic region. Number of individual stomachs included in parentheses.

ICES Region (Sea)	Herring	Blue whiting	Mackerel	Albacore	Bluefin tuna
VIIIa,b,c (Bay of Biscay)	0 (0)	157 (139)	896 (598)	0 (0)	0 (0)
VIIf,g,h,j (Celtic Sea)	66 (59)	506 (411)	2804 (2416)	0 (0)	0 (0)
VIIe,d (Channel)	577 (5077)	35 (24)	718 (789)	1 (1)	1 (1)
XIVa,b (E Greenland)	605 (246)	70 (29)	1050 (432)	0 (0)	0 (0)
Va (Iceland)	680 (405)	105 (72)	1356 (672)	0 (0)	0 (0)
VIIa (Irish Sea)	1294 (1285)	183 (166)	29 (19)	0 (0)	0 (0)
XII (North Atlantic)	0 (0)	18 (9)	0 (0)	0 (0)	0 (0)
IVa,b,c (North Sea)	2954 (16480)	19 (49)	1106 (1225)	0 (0)	9 (2)
IIa (Norwegian Sea)	1616 (710)	435 (187)	2447 (987)	0 (0)	0 (0)
VIIb (West Ireland)	0 (0)	55 (40)	129 (116)	0 (0)	0 (0)
Via (West Scotland)	716 (3484)	0 (0)	83 (169)	0 (0)	0 (0)

Figure 1 illustrates the diet composition of herring, blue whiting and mackerel according to predator size (total length in cm). From this figure it is clear that herring and

mackerel feed predominantly on copepods throughout their lives, although herring between 25 and 30cm also fed upon fish eggs and fish larvae (mostly plaice eggs and sandeel larvae). By contrast, blue whiting were observed to feed on hyperiid amphipods and euphausiids over their full size range, with very limited evidence of feeding on copepods or other prey items.

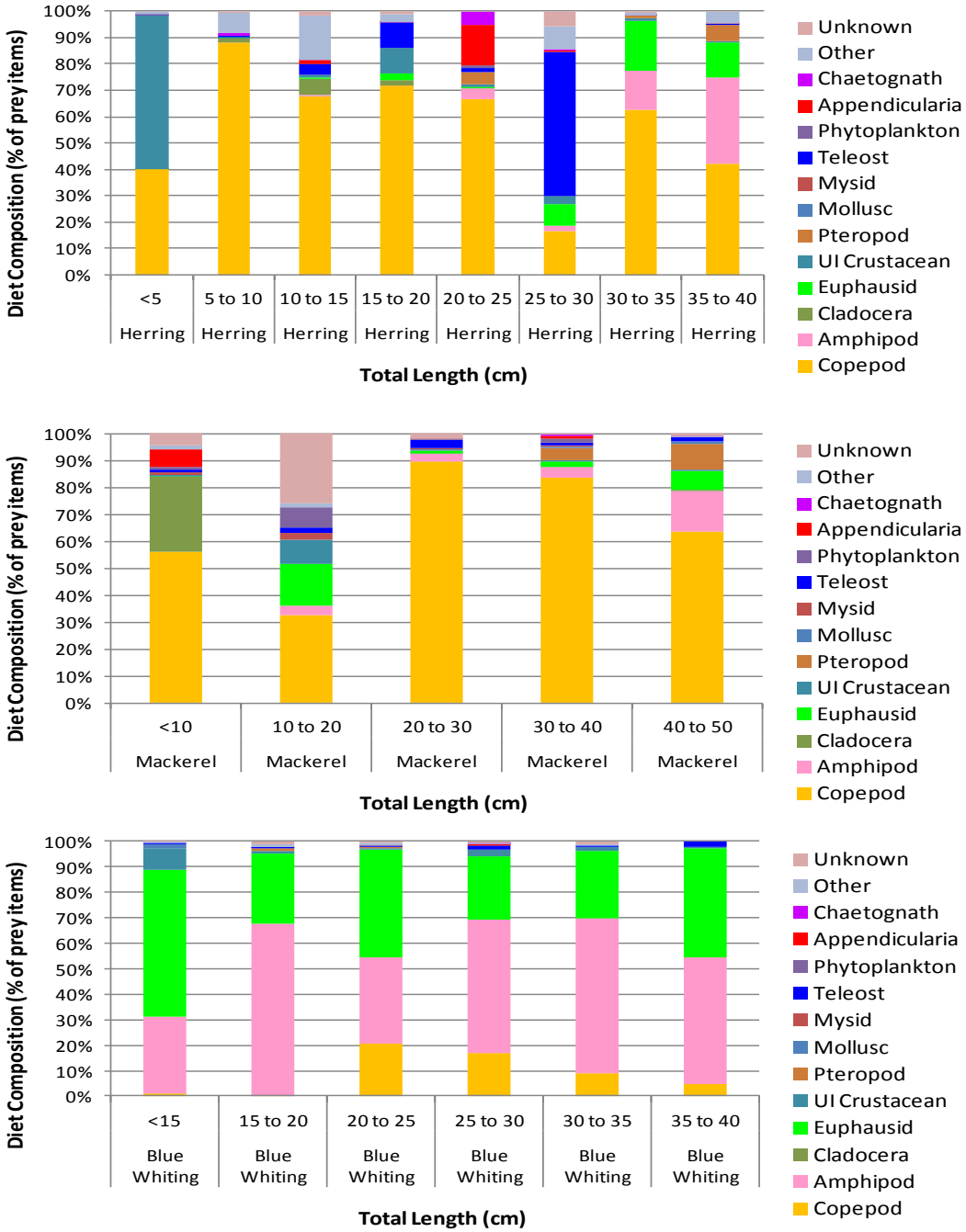

Figure 1. Diet composition (% of prey items) by fish length, for herring, blue whiting and mackerel.

2.2 Other datasets digitised as part of DAPSTOM version 4.7

DAPSTOM is primarily concerned with digitising information contained within the Cefas archive. Cefas (or previously the Ministry of Agriculture, Fisheries & Food – Directorate of Fisheries) was established in 1902 and continues to host a substantial quantity of scientists' logbooks, government reports and obscure fisheries literature that are not available anywhere else. Under the present phase of the DAPSTOM initiative, the following major sources were consulted:

- Multiple datasets from archived editions of the 'Annual Report of the Fishery Board for Scotland' between 1884 and 1933, including information on the diet of sea-trout (*Salmo trutta*) in 1929-1933 (O'Donoghue & Boyd 1931, 1932, 1934). Extensive datasets exist for marine fishes in the Firth of Forth, Aberdeen Bay, Moray Firth, Cromarty Firth, Solway and Clyde.
- Data digitised from Edwards & Steele (1968) on the ecology of 0-group plaice and dab at Loch Ewe (Scotland).
- Papers by Scott (1920, 1924) in the 'Proceedings and Transactions of the Liverpool Biological Society' on the diet of herring and mackerel around the Isle of Man.
- Data from Marshall et al. (1937, 1939) on the feeding of young herring in the Clyde.
- Information collected during MAFF research cruises in the 1970s, especially the diet of fish larvae in the southern North Sea and Channel reported by Last (1980) in a MAFF Fisheries Research Technical Report.
- MAFF data collected on the vessel Sir Lancelot by Shelbourne (1953, 1957) concerning the feeding habits of plaice post-larvae in the Southern Bight of the North Sea.
- Information on the diet of fish in Plymouth Sound, published by Hartley (1940a). Also, the diet of coarse fish in a special Publication of the 'Freshwater Biological Association of the British Empire' (Hartley 1940b).
- Information on the diet of juvenile flounder and plaice in the Kattegat and Baltic Sea by Blegvad (1930, 1932).
- Data from the Northumberland Sea Fisheries Committee, published by Alexander Meek (of the Dove Marine Laboratory) between 1900 and 1906.
- Multiple datasets published in the 'Journal of Animal Ecology' between 1925 and 1946, focussing on the diets of freshwater fish (e.g. trout, pike, perch, grayling,

salmon, eels), especially papers published by Allen (1935, 1939) or Frost (1946, 1950).

- Scattered and sporadic reports in the 'Annals of Natural History' or its successor the 'Annals & Magazine of Natural History' between 1837 and 1902 (mostly unusual fish washing up on UK and Irish coasts).
- Data on the feeding behaviour of cod, haddock, whiting, sprat and herring in the Irish Sea from cruises of the RV Cefas Endeavour in 2009 and 2011 as part of the Defra-funded MEMFISH and PREDATE projects.

A further major addition to this iteration of the DAPSTOM database has been 33,918 records (24,173 stomachs) from scientists' log-books in the Arctic (especially the area around Bear Island and Spitzbergen). In 2013 the DAPSTOM project team obtained funding from the Cefas 'seedcorn panel' to carry out research under the name DINA (Diet and food web dynamics in the Arctic – exploration of old Cefas data with new analytical tools). This project aimed to "begin the process of digitising Cefas' rich holdings of Arctic data. Also to strengthen existing partnerships with the University of Oslo. The project made use of modern statistical techniques (GAMs and GLMs) to explore the basis behind recently observed changes in the Arctic, noting that cod stocks in the Barents Sea (including the area around Spitzbergen) are currently at levels not seen since the 1950s – yet it is unclear how these large numbers of fish are sustained (or were sustained in the 1950s), given the limited prey resources available in the environment. Initial, exploratory analyses of Cefas' data holdings (figure 2) has revealed significant variability in cod diets from year-to-year, with fish prey (herring, capelin) important in some years but not in others. Cannibalism by adult cod on juveniles is also observed more frequently in some years than others, and this project has set out to explain why this might be the case, given a range of explanatory variables (season, year, temperature, location, prey availability etc.).

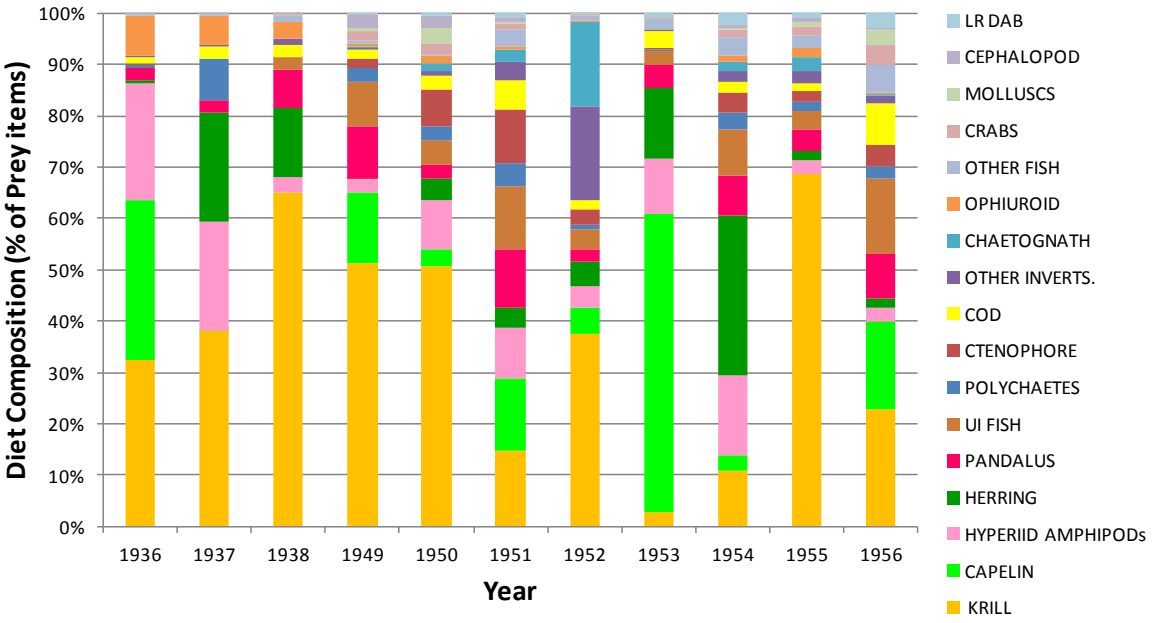

Figure 2. Diet composition of cod *Gadus morhua* in the Arctic (the area around Bear Island and Spitzbergen), based on Cefas survey data between 1936 and 1956. Data have now been digitised up to 1960.

3 The Revised Database

3.1 The 'PROVENANCE' Table

A new innovation within version 4.7 of the DAPSTOM database is the inclusion of a 'PROVENANCE' look-up table. The purpose of this is to record the original source of the data that has been digitised. As can be observed from the list above, much of the information comes from 'grey literature' that is not commonly accessible to researchers or it may be derived from hand-written logbooks that were filled out by individual MAFF scientists (there are many thousands more of these in the Cefas archive and on microfiche). The PROVENANCE table is linked to the 'HAULS' table (see figure 3) and also acknowledges the person (at Cefas or elsewhere) who made the information available, and whether the data was obtained from: a MAFF/CEFAS DATASET, MAFF/CEFAS REPORT, peer-reviewed PAPER, external REPORT, or supplied by a PARTNER.

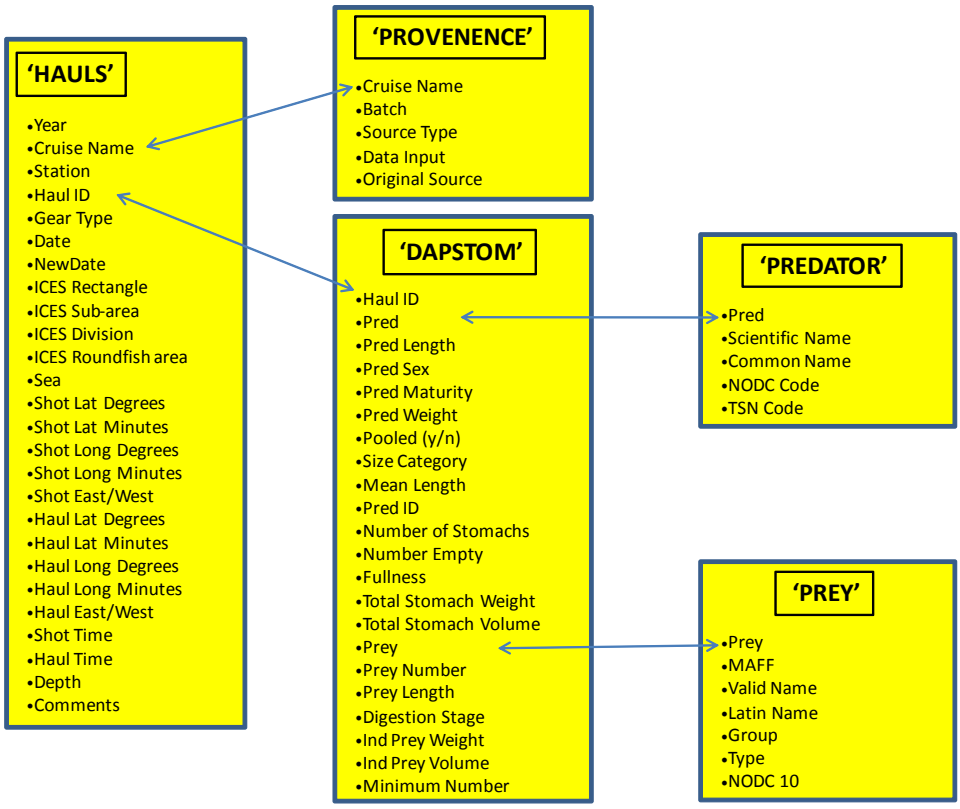

Figure 3. Structure of the DAPSTOM 4.7 relational database, including a list of the fields included (for a full description see Annex 1).

3.2 Taxonomic Coverage

The combined version of the DAPSTOM 4.7 database includes 226,407 records from 254,202 individual stomachs. The most recent iteration has added 37 new species, bringing the total up to 188 (Appendix 3). By far the most common predator species in the database are cod, whiting, haddock, plaice and mackerel(see figure 4). Whereas newly introduced species include: Black Goby, Viviparous Blenny, Greater Silver-Smelt, Hagfish, Golden Grey-Mullet, Norway Haddock (redfish), Snake-Blenny, Spotted Dragonet, Sand-Smelt, Straight-nosed Pipefish, Sea-Snail and Twaite Shad (see Annex 3). 12 species of freshwater fish (Arctic Char, Bullhead, Bleak, Bream, Gudgeon, Grayling, Minnow, Pike, Rudd, Ruffe, Stone-loach, Schelly) have been added to the database for the first time, as has a single record for the harbour porpoise *Phocoena phocoena*, based on information from the 'Annual Report of the Fishery Board for Scotland' in 1902. As part of the Euro-Basin project, the DAPSTOM team tried to seek out additional historical datasets for herring and mackerel, but they also attempted to find information about tunas, sharks and large pelagic fish around the UK. This search yielded particularly valuable data on rarely observed, charismatic (often threatened) fish species including:

- Allis shad (3 records)
- Basking shark (11 records)
- Blue shark (36 records)
- Thresher shark (5 records)
- Albacore tuna (1 records)
- Bluefin tuna (10 records)
- Opah (1 record)
- Porbeagle shark (14 records)
- Spiny Shark (2 records)
- Ribbon-fish (1 record)

An unfortunate consequence of including freshwater fish species in the database was the need to provide taxonomic names for hundreds of terrestrial or freshwater prey items, especially insects. Similarly, the inclusion of data from the 1800s and early 1900s (see below) also necessitated the correction of most taxonomic names, usually using the website www.marinespecies.org.

Figure 4 shows that 30% of all the records (67,884) in the database relate to cod and 21% (47,017) relate to whiting. However, the importance of these species in terms of number of stomachs examined is much reduced (16% and 12% respectively), whereas plaice and herring represent a much greater proportion of the stomachs examined (15% and 11% respectively) than records in the database (6% and 4% respectively). This is largely a consequence of the digitisation of 'pooled' datasets for plaice and herring and data from individual animals of cod and whiting. Similarly, large numbers of 'pooled' stomachs were digitised for dab and hake, but this yielded comparatively few database records.

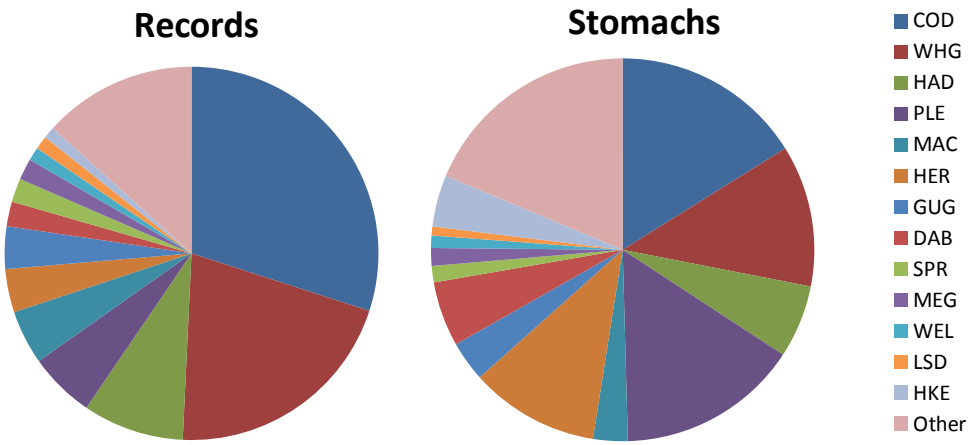

Figure 4. Composition of the DAPSTOM 4.7 database by predator type, according to (a) the number of records, and (b) the number of stomachs examined. Species codes listed in Annex 3.

3.3 Temporal Coverage

The earliest records in the DAPSTOM database are for 1837 and were digitised from Thompson (1838a,b,c) in *Annals of Natural History*. These records comprise 7 stomachs of lemon sole, 1 stomach for starry smoothound and 1 stomach of four-bearded rockling. The most recent record is from 2012 and is associated with a bluefin tuna stranded at Ventnor, Isle of Wight on 1st August, 2012 (that contained 1 mackerel in its stomach). Figure 5 shows that data have been digitised from every decade after 1880. A relatively large number (9,490) of records come from the decade 1900-1909 when the MAFF research vessel 'Huxley' was active around England and Wales (see Todd 1905,1907) and the steam yacht 'Garland' was active around Scotland (see Scott 1902, 1903). During this period, research was also underway by the Northumberland Sea Fisheries Committee, using the steam vessels 'Livingstone' and 'Stanley' (see Carr 1907, 1909; Meek 1906, 1905, 1904, 1902, 1901, 1900).

From the 1940s onwards the number of fish stomachs examined increased steadily, and it should be noted that there remain many hundreds of logbooks in the Cefas archive to digitise from the 1920s and 1930s. 26,375 stomachs have now been digitised for the period 1950-1959, mostly from the *Ernest Holt* cruises around Spitzbergen. Much of the material available after the 1970s has now been located and digitised, and hence this is clearly reflected in figure 5. However it is also worth noting that substantial sampling efforts were conducted in 1981 and 1991 as part of the ICES 'Year of the Stomach' campaigns and that the data derived by MAFF scientists as part of these efforts are not included in the DAPSTOM database in order to avoid duplication with the open-access data available through ICES (see www.ices.dk/marine-data/data-portals/Pages/Fish-stomach.aspx). In the decade spanning 2000-2009 59,748 records were generated, largely through the EU 'Life' project (diets of cod and whiting larvae in the Norwegian Trench), along with repeated surveys of the Dogger Bank between 2004 and 2006 to investigate potential predators of sandeels and a Fishery-Science Partnership (FSP) project in 2006 to examine the diets of whiting off NE England. Several datasets were submitted by partners, notably a dataset of herring and mackerel diets from IMR in Norway, and a dataset of fish stomachs from aggregate extraction sites around England and Wales, submitted by the company MES (Marine Ecological Surveys Limited), under a grant from the UK Aggregate Levy Sustainability Fund (ALSF). Most of the 10,049 records collected after 2010 are detailed in Tables 1 and 2, although additional samples of cod, plaice and haddock were taken in the Irish Sea as part of the UK MEMFISH and PREDATE programmes.

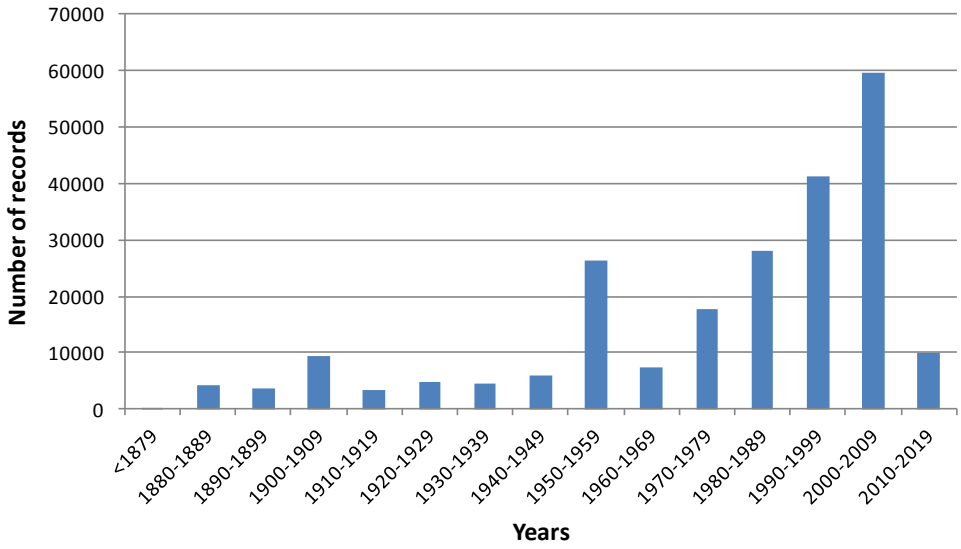

Figure 5. Temporal coverage of records included the DAPSTOM 4.7 database (total records = 226,407).

3.4 Geographic Coverage

As is apparent from Table 3, the DAPSTOM database includes information from sites all over the North East Atlantic. However, when considered in its entirety the vast majority (57%) of the records (53% of stomachs) relate to the North Sea, given that this has continued to be the main focus of work at Cefas/MAFF in Lowestoft for the past 110 years. As part of efforts to create the most recent version of the database, datasets from the Arctic (aboard the research vessel *Ernest Holt*) were particularly targeted for digitisation (15% of records, 10% of stomachs), from the 1940s and 1950s (see above). In addition, partner institutes provided substantial additions for the Norwegian Sea, Iceland, the west of Ireland and Bay of Biscay. Relatively large numbers of records have also been digitised for the Celtic Sea (10%) and Irish Sea (9%) but very few records are available for the west of Scotland (1%).

Table 3. Number of records and stomachs examined, by geographic area.

Sea	ICES Sub-Areas	Records	Stomachs
Baltic	III (24&25)	140	1755
Barents Sea	Ib	2798	2043
Biscay	VIIIa-d	3289	1494
Bristol Channel	VIIf	1200	845
Celtic Sea	VIIf-j	22325	19288
Channel	VIId,e	7929	21485
E Greenland	XIVa,b	3045	1214
Faroes	Vb	657	587
Freshwater	NA	811	4586
Iceland	Va	2241	1397
Irish Sea	VIIa	19842	26485
Kattegat	III (21&23)	534	3969
North Atlantic	XII	18	9
North Sea	IVa,b,c	128805	133957
Norwegian Sea	IIa	5671	3051
Spitzbergen	IIb	25449	19079
W Ireland	VIIb,c	655	5226
W Scotland	VIa	2319	7979

3.5 Structure of the database

Central to the relational-database structure is the "DAPSTOM" data table (see figure 3). This includes much of the 'raw' information about both the predator and prey. The "DAPSTOM" data table includes 22 information fields (see figure 3), and a full definition of each field is provided in Annex 1. The "HAULS" table contains all information about the geographic location from which the sample was derived. In most cases this includes ship name, dates and times, latitudes, longitudes, depth, gear type, ICES area and any additional information. As a bare minimum each 'haul' has been assigned to a predefined "Sea" (e.g. North Sea, Irish Sea, W Ireland, Celtic Sea, Channel, Biscay etc.) and ICES "Division" – a spatial sub-unit used by the International Council for the Exploration of the Seas. The 'provenance look-up' table is linked to the "HAULS" table via the "Cruise Name" (see figure 3).

Two additional look-up tables have been created to help standardise the taxonomic information that is available to users. The "PREDATOR" look-up table expands on the 3 digit predator names in the "DAPSTOM" table and gives the predator's full latin name, common name (in English), 10 digit NODC code and TSN identifier. The "PREY" look-up table aims to reduce the enormous number of potential prey names and descriptions to a manageable number of standardized names that can then be used for analyses and collation. It corrects historic taxonomy to modern counterparts, and allows aggregation by broad prey groups (e.g. euphausids, amphipods, copepods, teleosts etc.).

3.6 The online data-portal

The DAPSTOM dataset has now seen wide usage among ICES Working Groups as well as in a number of theoretical ecology papers (e.g. Rochet et al. 2011; Rossberg et al. 2011; Brose et al. 2006). On the whole, researchers have used the online portal to look at the diet composition of their favoured predator species – however there has also been some interest in making use of historical datasets to determine long-term changes in fish diets at particular localities (Le Quesne & Pinnegar, 2012).

The DAPSTOM data portal has been fully updated to include all datasets that had been amassed by January 2014. This version has been made accessible through the external Cefas internet site www.cefas.defra.gov.uk/our-science/fisheries-information/fish-

stomach-records.aspx. Users are able to download subsets of the available data as .csv files, and the website generates diet composition charts (pie charts) 'on the fly', following selection of predator/prey species, year and geographic area from drop-down menus. An additional feature enables the user to define the size range of predators (minimum length, maximum length) and thus to filter out juvenile/larval animals or adults etc.

At the moment users can gain full access to individual records on screen but they are currently blocked from downloading all fields (figure 3) from the underlying dataset as this would involve very large data files in some instances and potential issues relating to 'Intellectual Property Rights'. Users can obtain broad-scale information about geographic sampling locations (e.g at the ICES rectangle level) but not fine-scale information. For further information or more detailed outputs, users are requested to contact the DAPSTOM project manager (john.pinnegar@cefas.co.uk).

Since the last iteration of the DAPSTOM database the portal has become a key initial component of the UK Fisheries Data Archive Centre (FishDAC, www.cefas.defra.gov.uk/publications-and-data/fishdac.aspx). This initiative is part of the wider Marine Environmental Data and Information Network (MEDIN), which aims to promote sharing of, and improved access to marine data nationally. In addition, DAPSTOM is connected through the data.gov.uk "opening up government" website (http://data.gov.uk/dataset/dapstom) which aims to open up UK government data for other people to re-use. Excluding personal and sensitive information, all information created by public sector bodies is, in principle, available for re-use. In the past, different approaches were adopted by local and regional authorities and individual agencies. The government is now widely encouraging all previously inaccessible public information to be made accessible through this website.

Managing datasets effectively and in the best public interest is hugely important - and Cefas' 2012 independent Science Review suggested that such activities will become ever more so with the implementation of the INSPIRE Directive (http://inspire.ec.europa.eu/), government openness and transparency agendas and Defra's Open Data Strategy.

4 Discussion

A major limitation of the DAPSTOM dataset is that it comprises a mixture of 'pooled' information and data collected from individual fish. Sometimes only information on the number of stomachs containing a particular prey item was available (i.e. 'frequency of occurrence'), rather than the actual number of a particular prey item. Hence in any data extraction, outputs should be viewed as providing information on the 'minimum number' of prey items consumed. This would have little impact in predator species that consume large prey items (e.g. fish feeders), and in most of the newer datasets submitted, but it could mean that in certain older datasets, the total number of prey items in plankton-eating species such as mackerel, herring and blue whiting would be underestimated. An example would be the historical dataset (a component of the 'Cefas Historical' records cited in Table 1) on mackerel stomachs off the Cornish coast from Bullen 1908, as well as the herring datasets digitised from Marshall et al. (1937, 1939).

A further limitation of the DAPSTOM database is paucity of information on prey weights. In many of the constituent datasets no gravimetric information was provided. A result of this is that it can be difficult to judge the importance of a particular prey item to the overall nourishment of the predator, since a mackerel for example, may draw significantly more nourishment from eating a single fish in comparison with 1000+ copepods. To remedy this situation, we plan to develop an updated 'PREY' table that includes average prey weights, and perhaps energy density for each standardised prey type so that numbers consumed can be converted to total weights – however this feature is not yet available. Usually authors provide information about the number of 'empty' or 'everted' stomachs but this is not always the case, and so users of the database need to bear this in mind when carrying out data extractions. For further information, users are encouraged to contact the DAPSTOM project manager (john.pinnegar@cefas.co.uk).

5 The Future...

A number of further developments to the database are already underway (DAPSTOM phase 5), funded by a plethora of new EU, Defra and Cefas contracts. Chief among these is EU Contract MARE/2012/02 (Study on stomach content of fish to support the

assessment of good environmental status of marine food webs and the prediction of MSY after stock restoration). This project aims to: (1) collect new information on the stomach contents of fish in the Baltic Sea; (2) collect new information on the stomach contents of hake, mackerel and grey gurnard in the North Sea; (3) provide a re-worked version of historic stomach datasets that is compatible with, and can be used in conjunction with, those held by ICES. The new data derived from this project will not be inputted directly to DAPSTOM (it will go into the ICES data portal), however the contract will fund a re-engineering of the DAPSTOM database so that csv files can be easily generated with taxonomy and nomenclature that is consistent with the ICES data structures. In practice this means:

1. Adding new fields in both the 'PREY' and 'PREDATOR' tables, enabling taxonomic names to be corrected to NODC, TSN or AphiaID codes.
2. Adding average prey weights to the 'PREY' look-up table, so that numbers of prey items can be converted into a crude estimate of prey weights consumed.
3. Adding new fields to the 'HAULS' table to accommodate: date/time, quarter, month, day, country and ship.
4. Creation of a button on the DAPSTOM data-portal to enable users to automatically generate outputs in standard ICES format, as well as the current output style.

In 2014 the DAPSTOM project team will continue to pursue the further digitization of information contained in scientists' log-books held in the Cefas archive. In particular those from the research vessel *Ernest Holt* in the Arctic from the 1960s and those from the research vessel *George Bligh* in the North Sea in the 1920s and 1930s. Digitisation of information from the latter source will be extremely useful in the context of a new Cefas-seedcorn funded project (SCN394) 'Trawling Through Time 2' that will create a unique 113-year [1902-2014] time-series of plaice length measurements and explore how changes in fish sizes have been related to what fish have been eating during this period (DAPSTOM data) and changes in growth rate (otolith and age readings). We aim to discriminate whether observed changes relate to bottom fauna (e.g. disappearance of bivalve beds with onset of extensive beam trawling), climate change, changes in fishing pressure and/or eutrophication.

A similar approach will be taken under the EU BENTHIS project, the Defra PLACID & NERC/Defra UKOA programmes. Ocean acidification (OA) has been suggested as posing a major threat to commercial fisheries worldwide, both directly through physiological impacts (e.g. on commercial shellfish) but also indirectly through 'bottom-up' influences on higher trophic-level organisms including important fin-fish species. It is possible that

indirect (food-web) effects could be more important for fin-fish, than direct physiological impacts, but few studies have attempted to investigate the "bottom up" impacts of OA on marine food-webs, and hence on fisheries (Le Quesne & Pinnegar 2012). We will make use of the DAPSTOM database to determine the reliance of fish species on vulnerable marine invertebrates (e.g. echinoderms and bivalve molluscs) and then carry out model simulations to explore the 'knock-on' consequences of OA in the future.

Cefas is currently engaged in a 4-year corporate project (DMiC or 'Data Management in Cefas) to increase the effectiveness of data management within the organisation. Cefas is the custodian of significant legacy, recent and current data holdings that need to be managed in accordance with Government/Defra Network requirements and best practice. As part of this programme the DAPSTOM project team will explore long-term storage options for the DAPSTOM database in order to ensure that it will not be lost in the future and remains easily accessible to others throughout the organisation. It is believed that some stomach content data also exists within Cefas as part of the CSEMP (Clean Seas Environment Monitoring Programme) and fish tagging databases. In 2014/15 we will endeavour to combine the relevant information contained in these other datasets and make this available via the DAPSTOM open-access internet portal.

6 Sources of Funding

Phase 4 of the DAPSTOM initiative has been supported by a number different research projects, namely:

- The European Commission FP7 project EURO-BASIN (European Basin-Scale Analysis, Synthesis, and Integration, Grant Agreement 264 933).
- The Cefas 'seedcorn' project 'Trawling Through Time' (DP332), work-package DINA (Diet and food web dynamics in the Arctic – exploration of old Cefas data with new analytical tools).
- The European Commission FP7 project BENTHIS (Benthic Ecosystem Fisheries Impact Study).
- The Defra project 'FizzyFish' (Response of ecosystems and fisheries to management in a changing environment), ME1228.

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8 Annexes

8.1 Annex 1. Database Field Descriptions

'Hauls' Table

1. Year – year in which samples were collected.

2. Cruise Name – usually includes the name of the vessel (or sampling programme) together with an identifying number and a 2 digit year code.

3. Station – the station number or area indicated in the original data. Where multiple station numbers are cited, or ICES rectangles then an over-arching letter and number is used and more details are provided in the 'comments' column.

4. Haul ID – a unique identifier that is also replicated in the main 'DAPSTOM' database table (and forms the linking variable). It comprises the cruise name and station number.

5. Gear Type – the sampling method used to catch the fish, usually some sort of trawl.

6. Date – sampling date when gear was shot, with the format dd/mm/yyyy.

7. NewDate – a numerical representation of the date with the format yyyymmdd. If only the month is known then the 'day' is given as 00.

8. ICES Rectangle – a sea area covering 0.5° Latitude, 1° Longitude used by the International Council for the Exploration of the Sea.

9. ICES Sub-area – a large spatial unit used by the International Council for the Exploration of the Sea.

10. ICES Division – a spatial sub-unit used by the International Council for the Exploration of the Sea. The North Sea is divided into 3 divisions (IVa,b,c), whereas the Channel is divided into 2 (VIId,e), the Celtic Sea into 5 (VIIf,g,h,j) and the Irish Sea is 1 (VIIa).

11. ICES Roundfish area - a defunct spatial sub-unit used by the International Council for the Exploration of the Sea, used in some older stomach sampling campaigns.

12. Sea – a broad geographical area used for DAPSTOM reporting. Includes: North Sea, Irish Sea, W Ireland, Celtic Sea, Channel, Biscay etc.

13. Shot Lat Degrees – Latitude, in full degrees, of position where the net was deployed.

14. Shot Lat Minutes – minutes north or south (to be used with degrees field).

15. Shot Long Degrees – Longitude, in full degrees, of position where the net was deployed.

16. Shot Long Minutes – minutes east or west (to be used with degrees field).

17. Shot East/West – indicates whether the 'shooting' position was east or west of the Greenwich meridian.

18. Haul Lat Degrees – Latitude, in full degrees, of position where the net was hauled.

19. Haul Lat Minutes –minutes north or south (to be used with degrees field).

20. Haul Long Degrees – Longitude, in full degrees, of position where the net was hauled.

21. Haul Long Minutes –minutes east or west (to be used with degrees field).

22. Haul East/West – indicates whether the 'hauling' position was east or west of the Greenwich meridian.

23. Shot Time – time of day (hh:mm) when the net was deployed.

24. Haul Time – time of day (hh:mm) when the net was hauled.

25. Depth – bottom depth of shooting position (in metres).

26. Comments – additional information about the haul or station, sometimes listing the group of stations or ICES rectangles included.

'DAPSTOM' Table

1. Haul ID – a unique identifier which is also replicated in the main 'Hauls' table (and forms the linking variable). It comprises the cruise name and station number.

2. Pred – the predator species, indicated by a 3 digit code (and linked to the 'Predator' look-up table).

3. Pred Length – the length (in cm) of the individual predator.

4. Pred sex – sex of the individual predator, M = male, F = female, U = unknown.

5. Pred Maturity – maturity stage of the individual predator (as listed in the original paper source). Sometimes given a numerical value (spanning 1-7), or simply I = immature, M = mature, S = Spent, R = Running.

6. Pred Weight – weight of the individual predator (in grams).

7. Pooled (y/n) – an indicator of whether or not the record represents a group of individuals or a single animal. y = yes (pooled), n = no (a single animal).

8. Size category – used when the record represents a group of individuals, to indicate the size range included (if known).

9. Mean length - used when the record represents a group of individuals, to indicate the average (or median) size (in cm).

10. PRED ID - a unique identifier for the individual predator animal (or group of animals). This is needed because there is sometimes more than one prey item within a single stomach.

11. Number of Stomachs – indicates how many individuals the PRED ID represents. This has a value of '1' where the data has been collected at the individual animal level, however it may be higher for pooled data.

12. Number Empty – indicates the number of empty stomachs included within the PRED ID.

13. Fullness – an index of stomach fullness (as listed in the original paper source). Sometimes spanning 0-1, 1-10, % or Full, Partially full, Empty.

14. Total Stomach Weight – total weight (in grams) of all contents within the individual predator stomach.

15. Total Stomach Volume – total volume of all contents within the individual predator stomach (as listed in the original paper source).

16. Prey – prey type, as listed in the original paper source. This is used as a linking variable to the 'Prey' look-up table.

17. Prey Number – prey number given in the original paper source (sometimes blank – see MIN NUM).

18. Prey Length – length or size of individual prey item (in cm).

19. Digestion Stage – an index of digestion state (as listed in the original paper source). Usually spanning 0 (pristine) to 4 (unidentifiable).

20. Ind Prey Weight – the weight of the individual prey item (in grams).

21. Ind Prey Volume – the volume of the individual prey item (as listed in the original paper source) in millilitres.

22. Minimum Number – where the prey number is given, this is reproduced in this column. Where no prey number is given, then a minimum of '1' is indicated.

'Predator' look-up table

1. Scientific Name – the latin name of the predator species.

2. Common Name – the common (English) name of the predator species.

3. Pred - the predator species, indicated by a 3 digit code (and linked to the main 'DAPSTOM' table). These codes were derived from those used by the UK Ministry of Agriculture, Fisheries & Food (MAFF).

4. NODC Code – international identifier (now defunct) for the predator species (10 digit).

5. TSN Code – defined by ITIS, the Integrated Taxonomic Information System.

'Prey' look-up table

1. Prey - prey type, as listed in the original paper source. This is used as a linking variable to the main 'DAPSTOM' table.

2. MAFF - a 3 digit code used as an identifier for the species, derived from those used by the UK Ministry of Agriculture, Fisheries & Food (MAFF).

3. Valid Name- the common (English) name of the prey species.

4. Latin Name – the 'correct' latin name of the prey species.

5. GROUP – category of animal, used for broad scale taxonomic analyses (e.g. crab, shrimp, amphipod, copepod, teleost, polychaete, bivalve, gastropod etc.).

6. TYPE – higher-level category, used for broad scale taxonomic analyses (e.g. crustacean, fish, worm, mollusc, echinoderm etc.).

7. NODC-10 - international identifier for the prey species (10 digit).

'Provenance' table

1. Cruise Name – This is used as a linking variable to the main 'HAULS' table.

2. Batch – Indicates the iteration of the DAPSTOM database where the particular dataset was first introduced.

3. Source Type – Derivation of the original source material, i.e. MAFF/CEFAS DATASET, MAFF/CEFAS REPORT, PARTNER, PAPER (non Cefas), REPORT (non Cefas), CHARTER, COMMERCIAL.

4. Data Input – The person who digitised the particular dataset.

5. Original Source – Detailed description of the original source material (e.g. logbooks, folders or full citation for the paper/report).

8.2 Annex 2. Predator stomachs and prey records by research cruise

Cruises added in this latest iteration of the DAPSTOM database shown in red

Cruise Name	Records	Year	Sea	Stomachs
ALBE01-75	70	1975	Irish Sea	251
ALBE01-76	30	1976	Irish Sea	172
ALBE01-77	43	1977	Irish Sea	240
ALBE02-75	30	1975	Irish Sea	254
ALBE02-76	50	1976	Irish Sea	406
ALBE02-77	50	1977	Irish Sea	624
ALBE03-76	39	1976	Irish Sea	321
ALBE03-77	45	1977	Irish Sea	202
ALIDA-1925	10	1925	W Scotland	616
ALSF	1420	2005	North Sea/Channel/Irish Sea	605
BASKING-1947	7	1947	W Scotland	1
BASKING-1952	4	1952	Channel	1
BEAULIEU	54	2001	Channel	40
BEAVER-1962-I	241	1962	North Sea	203
BEAVER-1962-II	126	1962	North Sea	86
BLEGVAD-1911	9	1911	Kattegat	11
BLEGVAD-1912	22	1912	Kattegat	131
BLEGVAD-1913	59	1913	Kattegat	169
BLEGVAD-1921	4	1921	Kattegat	20
BLEGVAD-1922	31	1922	Kattegat	213
BLEGVAD-1923	34	1923	Kattegat	264
BLEGVAD-1924	2	1924	Kattegat	4
BLEGVAD-1925	138	1925	Baltic/Kattegat	1543
BLEGVAD-1926	208	1926	Baltic/Kattegat	1887
BLEGVAD-1927	134	1927	Kattegat	1311
BLEGVAD-1928	2	1928	Baltic/Kattegat	2
BLEGVAD-1929	23	1929	Baltic/Kattegat	113
BLEGVAD-1931	8	1931	Baltic	56
BRUCELLA-1961	51	1961	SE Greenland	40
BULLEN-1906	101	1906	Channel	72
BULLEN-1907	334	1907	Channel	384
CIROL02-90	1258	1990	North Sea	527
CIROL03-78	2256	1978	North Sea	2004
CIROL03-86	1246	1986	Celtic Sea	891
CIROL03-87	759	1987	Celtic Sea	694
CIROL03-91	8113	1991	Celtic Sea	6778
CIROL03-92	12746	1992	North Sea	4229
CIROL03-93	2123	1993	Celtic Sea	1761
CIROL03-94	103	1994	Celtic Sea	87
CIROL04-92	2029	1992	Celtic Sea	1680
CIROL05-79	323	1979	North Sea/Celtic Sea/ W Scotland	799
CIROL05-86	764	1986	Celtic Sea	473
CIROL07-78	1478	1978	North Sea	1754
CIROL07-82	1165	1982	Irish Sea	2953
CIROL07-89	22	1989	North Sea	20
CIROL09-77	4086	1977	North Sea	3374
CIROL09-82	730	1982	Irish Sea	603
CIROL09-84	434	1984	North Sea	251
CIROL10-91	548	1991	Celtic Sea	316
CLARK-1921	44	1921	Channel	209
CLION02-75	62	1975	North Sea	30
CLION03-71	30	1971	Irish Sea	28
CLION05-82	170	1982	Irish Sea	144
CLION06-82	134	1982	Irish Sea	139

CLION07-68	330	1968	North Sea	156
CLION07-82	55	1982	Irish Sea	42
CLION09-86	235	1986	Celtic Sea	131
CLION10-79	40	1979	Irish Sea	321
CLION11-83	3003	1983	Irish Sea	1752
CLION12-81	567	1981	Irish Sea	703
CLION12-82	447	1982	Irish Sea	482
CLION5A-80	261	1980	Irish Sea	262
CLION-68	52	1968	North Sea	21
CLUPEA-1991	2929	1991	North Sea	1773
CLYDE-1934	38	1934	W Scotland	1419
CLYDE-1935	155	1935	W Scotland	290
CLYDE-1936	202	1936	W Scotland	1819
CLYDE-1937	75	1937	W Scotland	120
COMMERCIAL-1903	1	1903	North Sea	6
COMMERCIAL-1904	16	1904	North Sea	10
COMMERCIAL-1905	13	1905	North Sea	48
COREL02-68	287	1968	North Sea	227
COREL04-68	212	1968	North Sea	133
COREL04-73	618	1973	North Sea	244
COREL05-74	711	1974	North Sea	381
COREL06-68	139	1968	North Sea	106
COREL07-68	199	1968	North Sea	124
COREL07-72	4710	1972	North Sea	1206
COREL07-73	81	1973	North Sea	43
COREL07-74	12	1974	North Sea	4
COREL09-68	290	1968	North Sea	149
COREL10-68	723	1968	North Sea	482
COREL12-80	122	1980	Irish Sea	109
COREL13-81	166	1981	Irish Sea	375
CORY04-04	2390	2004	North Sea	2178
CORY07-92	4605	1992	North Sea	1848
CORY08-88	3995	1988	North Sea	1380
CORY09-04	3626	2004	North Sea	2658
CUNNINGHAM-1887	9	1887	Channel	6
CUNNINGHAM-1888	106	1888	Channel/Bristol Channel	90
CUNNINGHAM-1889	5	1889	Channel/Bristol Channel	4
CYPRIS-05-1965	293	1965	Irish Sea	184
DISCARDS-82	12	1982	Irish Sea	43
DORMAN-1983	63	1983	Celtic Sea	611
DOVE-1896	188	1896	North Sea	142
DOVE-1897	30	1897	North Sea	28
DOVE-1898	120	1898	North Sea	111
DOVE-1899	104	1899	North Sea	92
DOVE-1900	87	1900	North Sea	74
DOVE-1901	117	1901	North Sea	103
DOVE-1902	149	1902	North Sea	136
DOVE-1903	127	1903	North Sea	119
DOVE-1904	120	1904	North Sea	110
DOVE-1905	127	1905	North Sea	120
DOVE-1906	134	1906	North Sea	127
DOVE-1907	55	1907	North Sea	50
DOVE-1908	125	1908	North Sea	854
DUBUIT-1977	134	1977	Celtic Sea/Channel	97
DUBUIT-1978	181	1978	Celtic Sea	144
DUBUIT-1979	115	1979	W Scotland	76
DUBUIT-1981	770	1981	Celtic Sea/W Scotland	422
DUBUIT-1982	143	1982	Celtic Sea/W Scotland	86

DUBUIT-1983	600	1983	Celtic Sea/Biscay	523
DUBUIT-1984	6589	1984	Celtic Sea	2416
DUBUIT-1985	1435	1985	Celtic Sea	1008
DUBUIT-1986	247	1986	Celtic Sea/Biscay	234
DUBUIT-1987	143	1987	Celtic Sea/W Scotland	88
DUBUIT-1988	118	1988	Celtic Sea/Biscay	105
EHOLT-1949-01	118	1949	Spitzbergen (Greenland Sea)	21
EHOLT-1949-02	40	1949	Spitzbergen (Greenland Sea)	15
EHOLT-1949-04	1515	1949	Spitzbergen (Greenland Sea)	56
EHOLT-1949-05	623	1949	Spitzbergen (Greenland Sea)	54
EHOLT-1949-06	1359	1949	Spitzbergen (Greenland Sea)	645
EHOLT-1949-07	497	1949	Spitzbergen (Greenland Sea)	231
EHOLT-1949-08	1477	1949	Spitzbergen (Greenland Sea)	763
EHOLT-1949-09	123	1949	Spitzbergen (Greenland Sea)	114
EHOLT-1950-01	314	1950	Spitzbergen (Greenland Sea)	240
EHOLT-1950-02	98	1950	Spitzbergen (Greenland Sea)	39
EHOLT-1950-03	275	1950	Spitzbergen (Greenland Sea)	175
EHOLT-1950-04	237	1950	Spitzbergen (Greenland Sea)	190
EHOLT-1950-05	389	1950	Spitzbergen (Greenland Sea)	311
EHOLT-1950-07	774	1950	Spitzbergen (Greenland Sea)	388
EHOLT-1950-08	756	1950	Spitzbergen (Greenland Sea)	490
EHOLT-1950-09	536	1950	Spitzbergen (Greenland Sea)	412
EHOLT-1951-01	167	1951	Spitzbergen (Greenland Sea)	151
EHOLT-1951-02	469	1951	Spitzbergen (Greenland Sea)	197
EHOLT-1951-03	634	1951	Spitzbergen (Greenland Sea)	372
EHOLT-1951-04	217	1951	Spitzbergen (Greenland Sea)	161
EHOLT-1951-05	173	1951	Spitzbergen (Greenland Sea)	120
EHOLT-1951-06	425	1951	Spitzbergen (Greenland Sea)	270
EHOLT-1951-07	241	1951	Barents Sea	180
EHOLT-1952-01	118	1952	Spitzbergen (Greenland Sea)	62
EHOLT-1952-02	657	1952	Spitzbergen (Greenland Sea)	286
EHOLT-1952-04	134	1952	Spitzbergen (Greenland Sea)	130
EHOLT-1952-05	1251	1952	SE Greenland	460
EHOLT-1952-06	18	1952	SE Greenland	7
EHOLT-1952-07	222	1951	Spitzbergen (Greenland Sea)	191
EHOLT-1953-02	35	1953	Spitzbergen (Greenland Sea)	28
EHOLT-1953-03	82	1953	Spitzbergen (Greenland Sea)	65
EHOLT-1953-04	68	1953	Spitzbergen (Greenland Sea)	64
EHOLT-1953-05	290	1953	Spitzbergen (Greenland Sea)	166
EHOLT-1953-06	349	1953	Spitzbergen (Greenland Sea)	220
EHOLT-1953-07	416	1953	Spitzbergen (Greenland Sea)	231
EHOLT-1953-08	125	1953	Spitzbergen (Greenland Sea)	101
EHOLT-1954-01	77	1954	Spitzbergen (Greenland Sea)	55
EHOLT-1954-02	702	1954	Spitzbergen (Greenland Sea)	419
EHOLT-1954-03	482	1954	Spitzbergen (Greenland Sea)	391
EHOLT-1954-04	311	1954	Spitzbergen (Greenland Sea)	212
EHOLT-1954-05	188	1954	Spitzbergen (Greenland Sea)	177
EHOLT-1954-06	521	1954	Spitzbergen (Greenland Sea)	318
EHOLT-1954-07	954	1954	Spitzbergen (Greenland Sea)	666
EHOLT-1955-01	559	1955	Barents Sea	557
EHOLT-1955-02	805	1955	Spitzbergen (Greenland Sea)	535
EHOLT-1955-03	501	1955	Spitzbergen (Greenland Sea)	470
EHOLT-1955-04	346	1955	Spitzbergen (Greenland Sea)	289
EHOLT-1955-05	415	1955	Spitzbergen (Greenland Sea)	285
EHOLT-1955-06	626	1955	Spitzbergen (Greenland Sea)	489
EHOLT-1955-07	179	1955	Barents Sea	154
EHOLT-1956-01	64	1956	Barents Sea	47
EHOLT-1956-03	65	1956	Spitzbergen (Greenland Sea)	64

EHOLT-1956-04	231	1956	Spitzbergen (Greenland Sea)	210
EHOLT-1956-05	349	1956	Spitzbergen (Greenland Sea)	238
EHOLT-1956-06	340	1956	Barents Sea	195
EHOLT-1956-07	399	1956	Barents Sea	330
EHOLT-1957-01	9	1957	Norwegian Sea	9
EHOLT-1957-02	490	1957	Spitzbergen (Greenland Sea)	467
EHOLT-1957-03	203	1957	Spitzbergen (Greenland Sea)	139
EHOLT-1957-04	102	1957	Spitzbergen (Greenland Sea)	83
EHOLT-1957-05	401	1957	Spitzbergen (Greenland Sea)	272
EHOLT-1957-06	105	1957	Spitzbergen (Greenland Sea)	95
EHOLT-1958-03	250	1958	Spitzbergen (Greenland Sea)	219
EHOLT-1958-04	134	1958	Spitzbergen (Greenland Sea)	125
EHOLT-1958-05	1069	1958	Spitzbergen (Greenland Sea)	911
EHOLT-1958-06	442	1958	Spitzbergen (Greenland Sea)	355
EHOLT-1958-07	312	1958	Spitzbergen (Greenland Sea)	307
EHOLT-1958-2A	382	1958	Norwegian Sea	376
EHOLT-1959-02	415	1959	Faeroes	383
EHOLT-1959-03	672	1959	Spitzbergen (Greenland Sea)	501
EHOLT-1959-04	784	1959	Spitzbergen (Greenland Sea)	721
EHOLT-1959-05	138	1959	Spitzbergen (Greenland Sea)	130
EHOLT-1959-07	307	1959	Spitzbergen (Greenland Sea)	269
EHOLT-1964-06	826	1964	Spitzbergen (Greenland Sea)	470
EHOLT-1964-07	752	1964	Faeroes/W Scotland	669
EHOLT-1970-03	294	1970	North Sea	198
ELLIS-2004	1	2004	North Sea	1
ELMA01-94	6696	1994	North Sea	1722
END02-09	758	2009	Irish Sea	412
END03-08	1075	2008	Irish Sea	1024
END03-09	1169	2009	Irish Sea	318
END04-10	1745	2010	Irish Sea	1289
END04-11	2595	2011	Irish Sea	1776
END07-05	3065	2005	North Sea	2688
END10-09	324	2009	North Sea	199
END11-06	3492	2006	North Sea	2928
END16-05	2963	2005	North Sea	2468
END17-06	2400	2006	North Sea	1703
END19-06	90	2006	Celtic Sea	63
END19-11	326	2011	Celtic Sea	240
EVHOE-2011	133	2011	Biscay	117
FORD-1919	69	1919	Channel	360
FRESHWATER-1925	18	1925	Freshwater	29
FRESHWATER-1931	25	1931	Freshwater	104
FRESHWATER-1933	42	1933	Freshwater	106
FRESHWATER-1933B	9	1933	Freshwater	103
FRESHWATER-1933C	88	1933	Freshwater	643
FRESHWATER-1935B	125	1935	Freshwater	117
FRESHWATER-1938	88	1938	Freshwater	194
FRESHWATER-1938B	54	1938	Freshwater	100
FRESHWATER-1939	107	1939	Freshwater	2716
FRESHWATER-1939B	157	1939	Freshwater	234
FRESHWATER-1946	98	1946	Freshwater	240
FSP13(a)-06	3961	2006	North Sea	3578
FSP13(b)-06	4181	2006	North Sea	2963
GA-REAY-03-82	667	1982	North Sea	2320
GA-REAY-04-81	36	1981	North Sea	350
GA-REAY-09-81	24	1981	North Sea	452
GA-REAY-11-82	964	1982	North Sea	2881
GLAUCUS-2012	1	2012	Channel	1

GRAHAM-1923	1106	1923	North Sea	3705
HARBASINS	604	2007	North Sea	361
HARDY-1922	697	1922	North Sea	4796
HARDY-1923	819	1923	North Sea	8709
HARDY-1924	11	1924	North Sea	330
HARTLEY-1935	2	1935	Channel	2
HARTLEY-1936	733	1936	Channel	2166
HARTLEY-1937	833	1937	Channel	2692
HEINCKE147-01	23849	2001	North Sea	274
HIAWATHA-1914-V	64	1914	North Sea	46
HULL-TRAWLER-1936	191	1936	Iceland/Spitzbergen	500
HULL-TRAWLER-1937	262	1937	Iceland/Spitzbergen	731
HULL-TRAWLER-1938	54	1938	Spitzbergen (Greenland Sea)	203
HUXLEY-1902-III	85	1902	North Sea	117
HUXLEY-1903-IX	36	1903	North Sea	22
HUXLEY-1903-V	32	1903	North Sea	98
HUXLEY-1903-VIII	102	1903	North Sea	803
HUXLEY-1903-X	376	1903	North Sea	1136
HUXLEY-1903-XI	38	1903	North Sea	76
HUXLEY-1903-XII	189	1903	North Sea	353
HUXLEY-1903-XIII	24	1903	North Sea	55
HUXLEY-1903-XIX	53	1903	North Sea	143
HUXLEY-1903-XV	215	1903	North Sea	368
HUXLEY-1903-XVI	32	1903	North Sea	49
HUXLEY-1903-XVII	27	1903	North Sea	61
HUXLEY-1903-XVIII	150	1903	North Sea	286
HUXLEY-1903-XX	19	1903	North Sea	27
HUXLEY-1903-XXI	76	1903	North Sea	178
HUXLEY-1903-XXIII	58	1903	North Sea	164
HUXLEY-1904-XL	77	1904	North Sea	190
HUXLEY-1904-XLI	83	1904	North Sea	120
HUXLEY-1904-XLIII	20	1904	North Sea	73
HUXLEY-1904-XLIV	24	1904	North Sea	119
HUXLEY-1904-XXIX	141	1904	North Sea	226
HUXLEY-1904-XXVIII	196	1904	North Sea	303
HUXLEY-1904-XXX	213	1904	North Sea	360
HUXLEY-1904-XXXI	216	1904	North Sea	446
HUXLEY-1904-XXXII	10	1904	North Sea	11
HUXLEY-1904-XXXIII	16	1904	North Sea	50
HUXLEY-1904-XXXV	21	1904	North Sea	63
HUXLEY-1904-XXXVI	3	1904	North Sea	11
HUXLEY-1904-XXXVII	3	1904	North Sea	2
HUXLEY-1904-XXXVIII	20	1904	North Sea	26
HUXLEY-1905-L	136	1905	North Sea	291
HUXLEY-1905-LII	4	1905	North Sea	5
HUXLEY-1905-LIV	5	1905	North Sea	2
HUXLEY-1905-LIX	332	1905	North Sea	601
HUXLEY-1905-LV	2	1905	North Sea	1
HUXLEY-1905-LVI	356	1905	North Sea	552
HUXLEY-1905-LVII	52	1905	North Sea	118
HUXLEY-1905-LVIII	259	1905	North Sea	508
HUXLEY-1905-LX	12	1905	North Sea	31
HUXLEY-1905-LXI	129	1905	North Sea	472
HUXLEY-1905-LXIII	124	1905	North Sea	359
HUXLEY-1905-LXIV	40	1905	North Sea	84
HUXLEY-1905-LXV	67	1905	North Sea	135
HUXLEY-1905-LXVI	86	1905	North Sea	132
HUXLEY-1905-XLIX	198	1905	North Sea	289

HUXLEY-1905-XLVII	66	1905	North Sea	260
HUXLEY-1905-XLVIII	62	1905	North Sea	259
HUXLEY-1906-LXIX	5	1906	North Sea	2
HUXLEY-1906-LXX	5	1906	North Sea	2
HUXLEY-1906-LXXIII	57	1906	North Sea	37
HUXLEY-1906-LXXIV	7	1906	North Sea	3
HUXLEY-1906-LXXVII	110	1906	North Sea	58
HUXLEY-1907-LXXXIX	170	1907	North Sea	75
HUXLEY-1907-LXXXV	144	1907	North Sea	62
HUXLEY-1907-LXXXVI	97	1907	North Sea	24
HUXLEY-1907-LXXXVII	51	1907	North Sea	28
HUXLEY-1907-LXXXVIII	165	1907	North Sea	62
HUXLEY-1907-XC	61	1907	North Sea	35
HUXLEY-1908-CI	56	1908	North Sea	32
HUXLEY-1908-CIV	2	1908	North Sea	1
HUXLEY-1908-XCIX	55	1908	North Sea	43
HUXLEY-1908-XCVII	42	1908	North Sea	12
HUXLEY-1909-CVI	3	1909	North Sea	2
HUXLEY-1909-CVIII	17	1909	North Sea	4
IGFS-2011	139	2011	Celtic Sea/W Ireland	109
IMR-LLNU-2006	2214	2006	Norwegian Sea	718
IMR-LMQI-2004	1203	2004	Norwegian Sea	594
JACINTH-2002	279	2002	North Sea	238
JONES-1950	146	1950	Irish Sea	1406
JONES-1952	120	1952	Irish Sea	179
KIMMERIDGE	61	2001	Channel	40
KINGS-AMBER-1938	275	1938	Spitzbergen (Greenland Sea)	223
LANCASHIRE-1893	33	1893	Irish Sea	64
LANCASHIRE-1894	600	1894	Irish Sea	1921
LANCASHIRE-1906	451	1906	Irish Sea	337
LANCASHIRE-1913	277	1913	Irish Sea	1610
LANCASHIRE-1921	317	1921	Irish Sea	754
LANCELOT-02-1946	5	1946	North Sea	158
LANCELOT-02-1951	3	1951	North Sea	32
LANCELOT-02-1955	48	1955	North Sea	1149
LANCELOT-03-1947	1	1947	North Sea	1
LANCELOT-03-1951	4	1951	North Sea	34
LANCELOT-04-1947	6	1947	North Sea	35
LANCELOT-04-1951	7	1951	North Sea	129
LANCELOT-04-1955	103	1955	North Sea	5374
LANCELOT-05-1947	5	1947	North Sea	19
LANCELOT-05-1950	9	1950	North Sea	83
LANCELOT-06-1947	3	1947	North Sea	6
LANCELOT-06-1957	333	1957	North Sea	263
LANCELOT-06-1958	154	1958	North Sea	102
LANCELOT-07-1957	160	1957	North Sea	117
LANCELOT-09-1953	43	1953	North Sea	22
LANCELOT-09-1957	198	1957	North Sea	111
LANCELOT-10-1959	11	1959	West Scotland/Celtic Sea	7
LANCELOT-16-1954	8	1954	North Sea	4
LANCELOT-16-1958	133	1958	North Sea/Channel	125
LANCELOT-18-1958	138	1958	North Sea	133
LANCELOT-19-1956	231	1956	North Sea	218
LAST-1971	448	1971	North Sea	6830
LAST-1976	1249	1976	North Sea	8384
LEBOUR-1914	133	1914	Channel	2949
LEBOUR-1917	466	1917	Channel	2302
LEBOUR-1918	593	1918	Channel	1176

LEBOUR-1919	1503	1919	Channel	3244
LEBOUR-1920	40	1920	Channel	164
LEBOUR-1921	16	1921	Channel	34
LEBOUR-1924	203	1924	Channel	1577
LOCH-EWE-1964	92	1964	W Scotland	1364
LOCH-EWE-1965	126	1965	W Scotland	1098
LOCH-EWE-1966	5	1966	W Scotland	25
LOOE-1972	36	1972	Channel	98
LUC-2002	411	2002	North Sea	252
MEDWAY-1973	107	1973	North Sea	1542
MRI-A10-2010	2268	2010	Iceland/E Greenland	1085
MRI-A8-2011	2842	2011	Iceland/E Greenland	1382
NAT-HIST-1837	17	1837	Irish Sea	9
NAT-HIST-1838	16	1838	Irish Sea	3
NAT-HIST-1839	1	1839	Irish Sea	1
NAT-HIST-1840	1	1840	Irish Sea	1
NAT-HIST-1847	2	1847	Irish Sea	1
NAT-HIST-1849	1	1849	North Sea	1
NAT-HIST-1853	2	1853	North Sea	1
NAT-HIST-1864	1	1864	Channel	1
NAT-HIST-1885	6	1885	North Sea	1
NAT-HIST-1902	1	1902	North Sea	1
NEWELL-1935	6	1935	W Ireland	3
NUCEL11-78	4	1978	North Sea	4
OITHONA-1901	113	1901	Channel	294
OITHONA-1904	1	1904	North Sea	22
OITHONA-1906	66	1906	North Sea	46
ONAWAY-07-1959	80	1959	North Sea	46
PASCOE-1982	3	1982	Channel	1
PLATESSA-04-1958	239	1958	North Sea	187
PLATESSA-06-1962	536	1962	Irish Sea	515
PLATESSA-07-1965	52	1965	Irish Sea	38
PLATESSA-08-1962	19	1962	Irish Sea	18
PLATESSA-10-1962	1293	1962	Irish Sea	1100
PLATESSA-11-1959	315	1959	North Sea	240
PLATESSA-12-1951	89	1951	Irish Sea	72
PLATESSA-17-1962	226	1962	Irish Sea	187
PLATESSA-18-1962	28	1962	Celtic Sea	25
PLYMOUTH-1930	25	1930	Channel	23
PLYMOUTH-1931	22	1931	Channel	18
PORT-ERIN-1919	12	1919	Irish Sea	6
PORT-ERIN-1923	44	1923	Irish Sea	45
PRINCE-1925	15	1925	Celtic Sea	1666
RADIANT-2002	158	2002	North Sea	127
SALPA-1928	430	1928	Channel	942
SALPA-1929	475	1928	Channel	943
SCOTIA	129		W. Ireland	116
SCOTLAND-1884	2	1884	North Sea	5
SCOTLAND-1885A	1	1885	North Sea	1
SCOTLAND-1885B	13	1885	North Sea	5
SCOTLAND-1885C	6	1885	North Sea	2
SCOTLAND-1885D	61	1885	North Sea	200
SCOTLAND-1885E	63	1885	North Sea	260
SCOTLAND-1885F	693	1885	North Sea/W Scotland	1775
SCOTLAND-1886	44	1886	W Scotland	117
SCOTLAND-1886B	327	1886	North Sea	381
SCOTLAND-1887	43	1887	North Sea/W Scotland	117
SCOTLAND-1887B	28	1887	North Sea	19

SCOTLAND-1888	775	1888	North Sea/W Scotland	5509
SCOTLAND-1888B	4	1888	W Scotland	1
SCOTLAND-1889	2038	1889	North Sea	4439
SCOTLAND-1890	1614	1890	North Sea	3433
SCOTLAND-1891	1056	1891	North Sea/W Scotland	2443
SCOTLAND-1898	6	1898	North Sea	1
SCOTLAND-1900	78	1900	North Sea	70
SCOTLAND-1901	1606	1901	North Sea/W Scotland	2547
SCOTLAND-1902	128	1902	North Sea/W Scotland	91
SCOTLAND-1910	32	1910	North Sea	30
SCOTLAND-1929	7	1929	W Scotland	2
SCOTLAND-1930	190	1930	North Sea	166
SCOTLAND-1931	289	1931	North Sea/Irish Sea	237
SCOTLAND-1933	325	1933	North Sea	275
SILST01-78	34	1978	Irish Sea	169
SILST01-79	21	1979	Irish Sea	191
SILST01-80	48	1980	Irish Sea	407
SILST01-81	37	1981	Irish Sea	277
SILST01-82	67	1982	Irish Sea	362
SILST01-83	191	1983	Irish Sea	184
SILST02-78	57	1978	Irish Sea	296
SILST02-79	52	1979	Irish Sea	253
SILST02-80	51	1980	Irish Sea	335
SILST02-81	65	1981	Irish Sea	326
SILST02-82	146	1982	Irish Sea	366
SILST02-83	56	1983	Irish Sea	61
SILST03-78	62	1978	Irish Sea	387
SILST03-79	46	1979	Irish Sea	167
SILST03-81	76	1981	Irish Sea	414
SILST03-82	143	1982	Irish Sea	482
SILST08-82	3	1982	Irish Sea	3
SIZEWELL-1981	151	1981	North Sea	2466
SS-ROMAN-1908	8	1908	Barents Sea	4
STEAD-1896	2	1896	Channel	1
STRANDLINE-1987	827	1987	North Sea	708
ST-ROSE-1930	37	1930	Norwegian Sea/Spitzbergen	381
SYKES-1926	8	1926	W Scotland	288
TAMURA-1925	20	1925	W Ireland	878
TAMURA-1926	66	1926	W Ireland/Celtic Sea	5619
TELLINA-04-1963	127	1963	North Sea	90
TELLINA-05A1-1965	10	1965	Irish Sea	9
TELLINA-05A4-1965	41	1965	Irish Sea	35
TELLINA-05B2-1965	26	1965	Irish Sea	20
TELLINA-06-1963	56	1963	Irish Sea	49
TELLINA-06B1-1967	54	1967	Irish Sea	32
TELLINA-11-1961	197	1961	North Sea	124
TELLINA-5A-1964	31	1964	Irish Sea	26

Number of Cruises	449
Number of Records	226407
Number of Stomachs	254202

8.3 Annex 3. Predator stomachs and prey records by species

Latin name	Code	Records	Stomachs
Gadus morhua	COD	67884	40966
Merlangius merlangus	WHG	47017	30392
Melanogrammus aeglefinus	HAD	19823	15645
Pleuronectes platessa	PLE	12916	38992
Scomber scombrus	MAC	10618	7412
Clupea harengus	HER	8508	27746
Eutrigla gurnardus	GUG	8327	8604
Limanda limanda	DAB	4837	13952
Sprattus sprattus	SPR	4651	3517
Lepidorhombus whiffiagonis	MEG	4169	3813
Echiichthys vipera	WEL	2632	2652
Scyliorhinus canicula	LSD	2617	1916
Merluccius merluccius	HKE	2305	11088
Pollachius virens	POK	2146	1033
Micromesistius poutassou	WHB	1583	1126
Ammodytes spp.	SAN	1389	278
Trisopterus minutus	POD	1270	1215
Lophius piscatorius	MON	1202	1358
Platichthys flesus	FLE	1154	5645
Microstomus kitt	LEM	1146	2809
Raja clavata	THR	1085	506
Aspitrigla cuculus	GUR	1055	1008
Salmo trutta	TRS	1050	1171
Solea solea	SOL	898	2041
Squalus acanthias	DGS	878	1071
Trisopterus luscus	BIB	864	1590
Trachurus trachurus	HOM	853	823
Hippoglossoides platessoides	PLA	835	2505
Trisopterus esmarki	NOP	801	2392
Callionymus lyra	CDT	715	1693
Gurnards (unidentified)	GUX	607	320
Zeus faber	JOD	453	465
Raja naevus	CUR	436	318
Pollachius pollachius	POL	400	441
Scopthalmus maximus	TUR	378	387
Engraulis encrasicolus	ANE	363	107
Chelidonichthys lucerna	TUB	361	396
Hyperoplus lanceolatus	GSE	356	736
Argentina sphyraena	LSS	353	359
Raja montagui	SDR	318	236
Raja radiata	SYR	314	269

Capros aper	BOF	304	288
Glyptocephalus cynoglossus	WIT	281	453
Lepidorhombus boscii	LBI	266	250
Scophthalmus rhombus	BLL	247	360
Arnoglossus laterna	SDF	224	897
Gobius spp.	GOB	219	744
Mullus surmuletus	MUR	182	131
Dicentrarchus labrax	ESB	174	249
Anguilla anguilla	ELE	165	313
Ciliata mustela	FVR	162	176
Lophius budegassa	WAF	157	131
Thymallus thymallus	FGR	156	167
Anarhichas lupus	CAA	155	94
Microchirus variegatus	TBS	153	657
Molva molva	LIN	152	161
Perca fluviatilis	FPE	148	849
Agonus cataphractus	POG	141	154
Raja batis	SKT	141	139
Labrus bergylta	BNW	140	155
Raja spp.	SKA	125	236
Sardina pilchardus	PIL	124	448
Enchelyopus cimbrius	FRR	106	74
Pholis gunnellus	BTF	101	113
Galeorhinus galeus	GAG	99	76
Raja brachyura	BLR	94	98
Ammodytes marinus	MSE	93	886
Gaidropsarus vulgaris	TBR	90	356
Ammodytes tobianus	TSE	89	209
Salmo salar	SAL	87	131
Taurulus bubalis	SSN	87	101
Pomatoschistus minutus	SDG	85	215
Belone belone	GAR	82	641
Phrynorhombus norvegius	NKT	82	485
Cyclopterus lumpus	LUM	77	114
Mustellus maculatus	SDS	73	73
Chelon labrosus	MTL	62	52
Lumpenus lampretaeformis	SBY	62	28
Ctenolabrus rupestris	GDY	61	63
Raja fullonica	SHR	60	36
Helicolenus dactylopterus	RBM	58	53
Buglossidium luteum	SOT	56	243
Conger conger	COE	52	40
Myoxocephalus scorpius	BRT	50	56
Sebastes marinus	REG	46	51

Gobiusculus flavescens	TSG	46	68
Liparis liparis	SSL	45	115
Arnoglossus imperialis	ISF	44	43
Argentina spp.	ARG	41	23
Gasterosteus aculeatus	TSS	37	160
Prionace glauca	BSH	36	98
Lepadogaster candollei	CAC	35	35
Gobius paganellus	RKG	35	48
Scyliorhinus stellaris	DGN	32	28
Mallotus villosus	CAP	31	1
Labrus mixtus	CUW	29	17
Pegusa (Solea) lascaris	SOS	29	17
Lophius spp.	ANF	28	26
Trigloporus lastoviza	GUS	28	19
Mustellus mustelus	SMH	28	11
Chimaera monstrosa	RBF	25	28
Esox lucius	FPI	23	159
Callionymus maculatus	SDT	23	28
Pomatoschistus microps	GMG	21	25
Hippoglossus hippoglossus	HAL	21	8
Crenilabrus melops	CWG	20	21
Trachurus mediterraneus	HMM	20	12
Brosme brosme	USK	20	20
Squatina squatina	ALS	18	12
Pomatoschistus pictus	PTG	18	23
Gaidropsarus spp.	ROL	18	26
Alloteuthis subulata	ATS	16	16
Blennius ocellaris	BBY	16	24
Rutilus rutilus	FRO	16	1301
Syngnathus acus	GPF	16	30
Gobius niger	BLG	15	20
Reinhardtius hippoglossoides	GLH	15	13
Spinachia spinachia	SSS	15	12
Gadiculus argenteus	SYP	15	38
Syngnathus rostellatus	NPF	14	8
Lamna nasus	POR	14	4
Blicca bjoerkna	FSB	13	100
Phycis blennoides	GFB	13	15
Somniosus microcephalus	GSK	12	4
Cetorhinus maximus	BSK	11	2
Raja circularis	SAR	11	10
Zeugopterus punctatus	TKT	11	40
Thunnus thynnus	BFT	10	3
Galeus melastomus	DBM	10	9

Abramis brama	FBM	10	514
Maurolicus muelleri	PLS	10	7
Cepola rubescens	RPF	10	3
Diplecogaster bimaculata	TSC	10	10
Salvelinus alpinus	ACH	9	24
Anarhichas minor	CAS	9	2
Liparis montagui	MSS	9	8
Raja microocellata	PTR	9	2
Sebastes mentella	REB	9	9
Coregonus lavaretus	SLY	9	10
Leuciscus leuciscus	FDC	8	55
Scardinius erythrophthalmus	FRD	8	129
Atherina presbyter	SMT	8	15
Spondyliosoma cantharus	BKS	7	7
Gobio gobio	FGN	7	147
Trachinus draco	WEG	7	43
Callionymus spp.	DTX	6	6
Gymnocephalus cernua	FRF	6	77
Loligo vulgaris	LLV	6	6
Mugil spp.	MUL	6	3
Ciliata septentrionalis	NNR	6	5
Osmerus eperlanus	SME	6	6
Malacocephalus laevis	SRT	6	5
Alopias vulpinus	ATH	5	3
Phrynorhombus regius	EKT	5	15
Zoarces viviparus	ELP	5	9
Gadidae	GAD	5	3
Coryphoblennius galerita	MBY	5	3
Lepadogaster lepadogaster	SCF	5	6
Crystallogobius linearis	CLG	4	4
Phoxunus phoxinus	FMW	4	19
Mugil cephalus	MTG	4	3
Macrorhamphosus scolopax	SNI	4	2
Parablennius gattorugine	TBY	4	3
Nerophos lumbriciformis	WPF	4	3
Alosa alosa	AAS	3	3
Sebastes norvegicus	GRF	3	3
Syngnathidae	PFX	3	1
Phocoena phocoena	PRP	3	1
Sebastes spp.	RED	3	3
Aphia minuta	TPG	3	5
Cottus gobio	BUL	2	12
Cottunculus microps	CTM	2	1
Alburnus alburnus	FBK	2	8

Barbatula barbatula	FTL	2	11
Argentina silus	GSS	2	2
Echinorhinus brucus	SYS	2	1
Alosa fallax	TAS	2	1
Thunnus alalunga	ALB	1	1
Anarhichas denticulatus	CAJ	1	1
Flatfish (unidentified)	FLX	1	1
Myxine glutinosa	HGF	1	15
Amphioxus lanceolatus	LCT	1	1
Raniceps raninus	LFB	1	1
Liza aurata	MGN	1	1
Lampris guttatus	OPA	1	1
Boreogadus saida	POK	1	1
Regalecus glesne	RNF	1	1
Nerophis ophidion	SNP	1	1

Number of species	188
Number of records	226407
Number of stomachs	254202

About us

Cefas is a multi-disciplinary scientific research and consultancy centre providing a comprehensive range of services in fisheries management, environmental monitoring and assessment, and aquaculture to a large number of clients worldwide.

We have more than 500 staff based in 2 laboratories, our own ocean-going research vessel, and over 100 years of fisheries experience.

We have a long and successful track record in delivering high-quality services to clients in a confidential and impartial manner.
(www.cefas.defra.gov.uk)

Cefas Technology Limited (CTL) is a wholly owned subsidiary of Cefas specialising in the application of Cefas technology to specific customer needs in a cost-effective and focussed manner.

CTL systems and services are developed by teams that are experienced in fisheries, environmental management and aquaculture, and in working closely with clients to ensure that their needs are fully met.
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Customer focus

With our unique facilities and our breadth of expertise in environmental and fisheries management, we can rapidly put together a multi-disciplinary team of experienced specialists, fully supported by our comprehensive in-house resources.

Our existing customers are drawn from a broad spectrum with wide ranging interests. Clients include:

- international and UK government departments
- the European Commission
- the World Bank
- Food and Agriculture Organisation of the United Nations (FAO)
- oil, water, chemical, pharmaceutical, agro-chemical, aggregate and marine industries
- non-governmental and environmental organisations
- regulators and enforcement agencies
- local authorities and other public bodies

We also work successfully in partnership with other organisations, operate in international consortia and have several joint ventures commercialising our intellectual property.

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