EU stomach tender

Datasets from the Baltic Sea

1 Background and summary

The current reform of the Common Fisheries Policy anticipates more extensive use of long-term management plans which are consistent with the ecosystem approach to fishery management. Both long term management plans and estimates of the fishing mortality providing MSY are particularly sensitive to changes in natural mortality, and a prerequisite for estimating natural mortality correctly is the accurate knowledge of species interactions for application in multispecies models. The use of historic data in the multispecies models has so far been limited by the need for data to represent a full spatial coverage. However, the recent model developments have made it possible to integrate regional samples of stomach content data into the multispecies and ecosystem models. It is hence no longer necessary to have complete spatial coverage in a given year, before new stomach data can be included into the models. This provided a unique opportunity to utilize the vast amount of historic data available at individual fisheries research institutes.

Under EU Tender No MARE/2012/02 6 partner institutes in the Baltic Sea basin (enlisted in the Data Acknowledgement section below) have conducted a stomach collection and analysis project in order to (i) include all appropriate historical stomach content information into the Baltic stomach content databases, (ii) conduct stomach content analyses of new cod stomachs collected in the Baltic Sea, to support our knowledge of the spatial and temporal stability of cod preferences, and (iii) conduct stomach content analyses of whiting stomachs collected in the Baltic Sea to support knowledge of potentially important predators for which the diet is presently poorly known or is expected to have changed significantly since the last sampling efforts in this area.

All historical and new sample data are included in the final product of the EU stomach tender, and are hosted in ICES Stomach database. The data are available to the scientific community via Fish Stomach data portal (http://www.ices.dk/marine-data/data-portals/Pages/Fish-stomach.aspx). This database can then be used to re-estimate multispecies reference points such as F_{MSY} of the different fish species.

2 Scope of the data

Within the **Baltic Sea**, efforts were focused on stomach content analyses of **Baltic cod** as the most abundant piscivorous fish in this ecosystem. In addition to cod, a limited number of **whiting** stomach samples from the westernmost areas of the Baltic were collected and analyzed, as this species is potentially another important piscivorous predator in these regions.

The Baltic data collection contains more than 100 000 individual cod stomachs collected between 1963 and 2014.

3 Quality of data

All participating institutes that conducted stomach analyses have extensive experience in this type of work. Due to the large number of Baltic cod stomachs, none of the institutes in the Baltic area had the necessary capacities to analyze all stomach samples alone. Therefore, the stomach samples of Baltic cod have been processed at three locations, i.e. at NMFRI (Poland), DTU Aqua (Denmark) and BIOR (Latvia). This work has been conducted by very experienced personnel, so additional quality control of the prey species identification was considered unnecessary.

However, in order to analyze potential differences in the interpretation of the digestive status of individual prey items beyond the usual application in multispecies models, the digestive stage of a sub-sample of individual prey items has been evaluated by all 3 institutes. For this purpose, photographs of a total of 76 individual prey items (25 sprat, 19 herring, 26 clupeid fish and 6 cod) have been taken and their digestive status has been judged by all three institutes. Out of the 76 prey items, DTU Aqua and BIOR interpreted the digestive stage of 64 and 65 items identical to NMFRI, corresponding to a match in interpretation of 84% and 86%, respectively.

The original data have been submitted to ICES with variety of names for the same prey species. Species naming was standardized by ICES as in Appendix B, Table 2.

In the Latvian data from before 2000, prey weight is not given per prey item, but PER PREY SPECIES AND DIGESTIONS STAGE in one single stomach. The example in Table 3 (Appendix B) shows data for 13 sprat ingested by 1 cod. 5 of the sprat were not length measurable, while 8 were measured. The prey weight of 307.6 grams is for all og the 13 sprat together. Individual weights have not been available for this period of the data. From 2000 onwards Latvian data, as well as in the data from other countries, prey weight is given per prey specimen.

The stomach data were recorded manually, naturally resulting in punching errors. A quality check to this end has shown, that some prey weights are too high, however, there is no consistent pattern in these errors. These data have not been deleted form the material submitted to the database. A 893g-sprat is highly unreliable, however, there might be border cases where judgment is difficult. Hence, caution should be taken, and using the prey weight data, users should have a look at outliers.

More information about specific quality issues can be found in the Appendix B

4 End product

ICES Data Centre received several datasets from DTU Aqua in variety of data formats. The datasets were manually exported to the Stomach database, where the input was adjusted to the standard ICES stomach data format.

As a final product, two distinct datasets with Baltic data are available for download:

1. Stomach tender data collection in the Baltic sea (2007-2014)
2. Latvian historical stamach data (1963-2009)

The finalized data can be downloaded from the Stomach data portal (http://www.ices.dk/marine-data/data-portals/Pages/Fish-stomach.aspx) or the ICES Data Portal (http://ecosystemdata.ices.dk).

5 Stomach database

ICES stomach data, including this dataset, are stored in a relational database. Access to the data is regulated by ICES Data Policy (see more in Appendix A). Download format is described below in Table 1.

Table 1. Stomach data download format.

Field	Description
Dataset	Dataset name
RecordType	SS for single stomach
Country	Country that collected the data
Ship	Vessel that collected the data
Latitude	Data sampling position – latitude
Longitude	Data sampling position – longitude
Estimated_Lat_Long	Flag whether the sampling position based on the reported area
ICES_StatRec	ICES statistical rectangle
ICES_AreaCode	ICES area code
Year	YYYY
Month	MM
Day	DD
Time	Sampling time like HHMM
Station	Station reference
Haul	Haul number
Sampling_Method	Predator sampling method
Depth	Sampling depth
Temperature	°C
SampleNo(FishID)	Predator reference code Fish ID unique for Country, year, quarter and ship
ICES_SampleID	ICES predator reference
Predator_AphiaID	Predator WoRMS AphiaID
Predator_LatinName	Predator taxon Latin Name
Predator_Weight(mean)	(Mean) predator weight
Predator_Age(mean)	(Mean) predator age
Predator_Lengh(mean)	(Mean) predator length
Predator_LowerLengthBound	Predator's length lower bound
Predator_UpperLengthBound	Predator's length upper bound
Predator_CPUE	Predator catch per hour
GallBladder_stage(class)	Gall bladder stage
Stomach_METFP	Method of stomach preservation

Stomach_TotalNo	Total number of stomachs in the pool – for single stomachs always 1.
Stomach_WithFood	Number of stomachs with food
Stomach_Regurgitated	Number of stomachs regurgitated
Stomach_WithSkeletalRemains	Number of stomachs with skeletal remains
Stomach_Empty	Number of empty stomachs
Stomach_ContentWgt	Stomach content weight
Stomach_EmptyWgt	Stomach empty weight
Stomach fullness	Stomach fullness
Stomach_Item	Stomach item name (see Appendix B)
ICES_ItemID	ICES stomach item ID
Prey_AphiaID	Prey WoRMS AphiaID
Prey_LatinName	Prey taxon Latin Name
Prey_IdentMet	Prey identification method
Prey_DigestionStage	Prey digestion stage 0= Intact prey (skin, fins, legs and flesh is complete), 1= partially digested prey (prey in more advanced stages of digestion), 2= partially digested prey (prey in more advanced stages of digestion), 3= skeletal material (no flesh, only bones, shells, otoliths)
Prey_TotalNo	Total number of preys
Prey_Weight	Prey weight in grams
Prey_LengthIdentifier	Prey length identifier
Prey_Length	Prey length in cm
Prey_LowerLengthBound	Prey length lower bound
Prey_UpperLengthBound	Prey length upper bound
Prey_MinNo	Minmum number of preys
Remarks	Any relevant comments

6 Acknowledgements

We highly acknowledge the great efforts of all people involved in the collection of stomach samples at sea, mainly on the BITS (Baltic International Trawl Survey), but also on variety of other research cruises.

Contributing institutes and specialists to the Baltic stomach dataset:

DTU Aqua – Technical University of Denmark, National Institute of Aquatic Resources, Denmark (Project Coordinator). (Bastian Huwer, Stefan Neuenfeldt, Anna Rindorf, Heidi Andreasen, Svend-Erik Levinsky, Marie Storr-Paulsen, Stine Dalmann Ross, Ole Henrik Haslund)

NMFRI - National Marine Fisheries Research Institute, Poland. (Jan Horbowy, Marzenna Pachur, Joanna Pawlak)

BIOR - Institute of Food Safety, Animal Health and Environment, Fish Resources Research Department, Latvia. (Didzis Ustups, Eriks Kruze, Ivo Sics, Danute Uzars)

SLU - Swedish University of Agricultural Sciences, Department of Aquatic Resources, Sweden. (Michele Casini, Andrea Belgrano)

TI-OF - Institute of Baltic Sea Fisheries, Johann Heinrich von Thünen Institute, Federal Research Institute for Rural Areas, Forestry and Fisheries, Rostock, Germany. (Andres Velasco)

Data are processed and collated into the ICES Stomach Database by ICES Data Centre (Carlos Pinto, Anna Osypchuk)

7 Data Acknowledgement

When referring to the data downloaded from ICES Stomach Database, please acknowledge the data as follows:

ICES Baltic Stomach Dataset 2015, ICES, Copenhagen

Contact:

Web : http://ecosystemdata.ices.dk/stomachdata

http://www.ices.dk/marine-data/Pages/default.aspx

E-mail : accessions@ices.dk

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Appendix A. Data Policy

By maximizing the availability of data to the community at large, ICES promotes the use of these data, thereby ensuring that their maximum value can be realized and thus contribute to an increased understanding of the marine environment.

Use of data distributed via ICES is regulated by ICES Data Policy.

The latest version of the Data Policy can be found here:

http://ices.dk/marine-data/guidelines-and-policy/Pages/ICES-data-policy.aspx

Appendix B. Data quality issues

Prey names in the database

The data have been submitted with variable names in prey species. In order to accommodate these names and specifics, field Stomach_Item shows information on stomach content subjects, while Prey_AphiaID and Prey_LatinName provide species reference, if relevant. Table 2 gives an overview over the prey names from the original datasets mapped to the Stomach_Item names

Table 2. Original prey names mapped to the Stomach_Item.

Name (in the original datasets)	Stomach_Item
Q	Lost
Algae	Algae
Algea	Algae
Unidentified algae covered with eggs	Algae covered with eggs
Ammodytes tobianus	Ammodytes tobianus
Ammodytidae	Ammodytidae
Amphibalanus improvisus	Amphibalanus improvisus
Amphipoda	Amphipoda
Eel	Anguilla anguilla
Unidentified worm	Annelida
Wood	Annelida
Annelida	Annelida
Annelidae	Annelida
Worm	Annelida
A. islandica	Arctica islandica
Aurelia aurita	Aurelia aurita
Bathyporeia pilosa	Bathyporeia pilosa
Belone belone	Belone belone
Bivalvia	Bivalvia
Bylgides sarsi	Bylgides sarsi
Bylgides	Bylgides sp.
Caprellidae	Caprellidae
Carbon	Carbon
carbon	Carbon
Cardium edule	Cardium edule
Cerastoderma glaucum	Cerastoderma glaucum
Chicken bone	Chicken bone
Clay	Clay
Clupea	Clupea harengus
C. harengus	Clupea harengus
Clupea harengus	Clupea harengus
Herring	Clupea harengus
Clupeidae	Clupeidae
Clupeidiae ssp	Clupeidae
Clupeidae scales	Clupeidae Scales
Copepoda	Copepoda
Corophium volutator	Corophium volutator
Cottidae	Cottidae

Cottus gobio	Cottus gobio
C. crangon	Crangon crangon
Crangon crangon	Crangon crangon
Crustacea	Crustacea
Crustacea ssp	Crustacea
cumacea	Cumacea
Cumacea	Cumacea
cummaceer sp.	Cumacea
Diastylis rathkei	Diastylis rathkei
e	Empty
Emty	Empty
R. cimbrius	Enchelyopus cimbrius
Enchelyopus cimbrius	Enchelyopus cimbrius
Four-bearded rockling	Enchelyopus cimbrius
Enchelyopus eggs	Enchelyopus cimbrius Eggs
Fucus	Fucus sp.
Gadidae	Gadidae
Gadidae ssp	Gadidae
Filet of Cod	Gadus morhua
Cod	Gadus morhua
G. morhua	Gadus morhua
Gadus morhua	Gadus morhua
Cod Eggs	Gadus morhua Eggs
Cod stomach	Gadus morhua Stomach
Gammarus	Gammarus sp.
Gammarus sp.	Gammarus sp.
Gasterosteus aculeatus	Gasterosteus aculeatus
Gastropoda	Gastropoda
Gastrosaccus spinifer	Gastrosaccus spinifer
Gobiidae	Gobiidae
Goby	Gobiidae
H. spinulosus	Halicryptus spinulosus
Halicryptus spimulosus	Halicryptus spinulosus
Halicryptus spinulosus	Halicryptus spinulosus
Hediste divericolor	Hediste diversicolor
Hediste diversicolor	Hediste diversicolor
Hediste diversicolos	Hediste diversicolor
Hydrobia	Hydrobia sp.
Hydrobia sp.	Hydrobia sp.
H. galba	Hyperia galba
Hyperia galba	Hyperia galba
Hyperoplus lanceolatus	Hyperoplus lanceolatus
Idotea balthica	Idotea balthica
Idotea Balthica	Idotea balthica
Insect	Insecta
Insecta	Insecta
Unidentified invertebrata	Invertebrata
Isopoda	Isopoda
Lampetra fluviatilis	Lampetra fluviatilis
Limanda limanda	Limanda limanda
Lumpenus lampretaeformis	Lumpenus lampretaeformis

M. baltica	Macoma balthica
Macoma balthica	Macoma balthica
Whiting	Merlangius merlangus
Mollusca	Mollusca
Monoporeia affinis	Monoporeia affinis
Pontoporeia affinis	Monoporeia affinis
Mya arenaria	Mya arenaria
Myoxocephalus quadricornis	Myoxocephalus quadricornis
Myoxocephalus quadricornis eggs	Myoxocephalus quadricornis Eggs
Myoxocephalus scorpius	Myoxocephalus scorpius
Mycidea ssp.	Mysidae
mysidae	Mysidae
Mysidae	Mysidae
Mysis mixta	Mysis mixta
Mysis oculata	Mysis oculata
Mysis relicta	Mysis relicta
Mytilidae sp.	Mytilidae
Mytilus edulis	Mytilus edulis
Neogobius melanostomus	Neogobius melanostomus
Round goby	Neogobius melanostomus
Neomysis integer	Neomysis integer
Nylon tred	Nylon thread
O. eperlanus	Osmerus eperlanus
Osmerus eperlanus	Osmerus eperlanus
Ostracoda	Ostracoda
Palaemon elegans	Palaemon elegans
Palaemon sp.	Palaemon sp.
Perca fluviatilis	Perca fluviatilis
Pholis gunnellus	Pholis gunnellus
Entrails	Pisces
Unidentified fish	Pisces
Fish	Pisces
Pisces	Pisces
pisces	Pisces
Fish remains	Pisces
Fish eggs	Pisces Eggs
plastic	Plastic
Plastic	Plastic
Plastik	Plastic
Flounder	Platichthys flesus
Platichthys flesus	Platichthys flesus
Place	Pleuronectes platessa
Polychaeta	Polychaeta
polychaeta sp.	Polychaeta
Pomatoschistus microps	Pomatoschistus microps
Pomatoschistus minutus	Pomatoschistus minutus
Pomatoschistus	Pomatoschistus sp.
Pomatoschistus otholyth	Pomatoschistus sp. Otholyth
Pontoporeia femorata	Pontoporeia femorata
Pontoporeia	Pontoporeia sp.
Praunus flexuosus	Praunus flexuosus

Praunus inermis	Praunus inermis
Priapulida	Priapulidae
Priapulidae	Priapulidae
Priapulus caudatus	Priapulus caudatus
Nine-spined stickleback	Pungitius pungitius
r	Regurgitated
Rutilus rutilus	Rutilus rutilus
Saduria entemone	Saduria entomon
Saduria entomon	Saduria entomon
Saduria entomon eggs	Saduria entomon Eggs
Salmon stomach	Salmon Stomach
Sand	Sand
Sander lucioperca	Sander lucioperca
Scales	Scales
scales	Scales
Scoloplos armiger	Scoloplos armiger
Scyphozoa	Scyphozoa
Fifteen-spined stickleback	Spinachia spinachia
Spinachia spinachia	Spinachia spinachia
Spine	Spine
S. sprattus	Sprattus sprattus
sprat	Sprattus sprattus
Sprat	Sprattus sprattus
Sprattus sprattus	Sprattus sprattus
Sprat eggs	Sprattus sprattus Eggs
Stickelbacks	Stickleback
Stickleback	Stickleback
ston	Stone
Stone	Stone
stone	Stone
Synchaeta	Synchaeta sp.
Broad-nosed pipefish	Syngnathus typhle
Taurulus bubalis	Taurulus bubalis
Taurulus bubalis eggs	Taurulus bubalis Eggs
Terebellides stoemi	Terebellides stroemii
Terebellides stroemi	Terebellides stroemii
Horse mackerel	Trachurus trachurus
Siphon	Unidentified mass
Spawn	Unidentified mass
Usp	Unidentified mass
USP	Unidentified mass
Other	Unidentified mass
Unidentified remains	Unidentified mass
Undefined mass	Unidentified mass
Unidentified mass	Unidentified mass
Waste	Waste
Vimba vimba	Vimba vimba
V. viviparus	Zoarces viviparus
Zoarces viviparus	Zoarces viviparus
Zoarces viviparus eggs	Zoarces viviparus Eggs
Zooplancton	Zooplankton

Prey weight in the historical Latvian data

In the Latvian data before 2000, prey weight is NOT given per prey item, but PER PREY SPECIES AND DIGESTIONS STAGE in one single stomach. The example below shows data for 13 sprat ingested by 1 cod. 5 of the sprat were not length measurable, while 8 were measured. The prey weight of 307.6 grams is for all og the 13 sprat together. Individual weights have not been available for this period of the data. From 2000 onwards, as well as in the data from other countries, prey weight is given per prey specimen.

Table 3: Prey weight in the historical Latvian data

Country	Fish_ID	Year	Month	Day	Latin name	Prey_size	prey_weight	Prey_number
LAT	15	1975	04	12	Sprattus sprattus		307.6	5
LAT	15	1975	04	12	Sprattus sprattus	14.60	307.6	1
LAT	15	1975	04	12	Sprattus sprattus	14.50	307.6	1
LAT	15	1975	04	12	Sprattus sprattus	14.00	307.6	1
LAT	15	1975	04	12	Sprattus sprattus	13.50	307.6	1
LAT	15	1975	04	12	Sprattus sprattus	13.20	307.6	1
LAT	15	1975	04	12	Sprattus sprattus	13.10	307.6	1
LAT	15	1975	04	12	Sprattus sprattus	13.00	307.6	1
LAT	15	1975	04	12	Sprattus sprattus	12.90	307.6	1

Punching errors

The data have been checked for punching errors, and some prey weight figures appear to be too high. Two examples are given in the summary table:

Country	Fish_ID	Year	Month	Day	Latin name	Prey_size	prey_weight
LAT	157	2004	03	14	Sprattus sprattus		324
LAT	35	2008	03	11	Sprattus sprattus	10.50	893

These data have not been deleted form the material submitted to the database, however, a 893 g sprat is highly unreliable. For this case it might not be a problem, but there are border cases where judgment is difficult. Hence, caution should be taken, and using the prey weight data, users should have a look at outliers.