



**Regional Coordination Group**  
North Atlantic  
North Sea & Eastern Arctic



**Regional Coordination Group**  
Baltic

## **DCF Regional Coordination Group North Atlantic, North Sea, and Eastern Arctic (RCG NANSEA) + Baltic (RCG Baltic)**

### **- At sea Stomach sampling manual -**

#### **General**

- Stomachs should be selected randomly within 5-cm groups, but can be taken from fish sampled for maturity and age determination. The stomachs are frozen individually in plastic bags together with a label describing the sampled fish. Only predators larger than or equal to 15 cm should be sampled as fish below this size are generally not piscivorous. Deviations from this rule could apply to e.g. Atlantic mackerel and Horse mackerel which may feed on fish larvae and post-larvae at sizes smaller than 15 cm total length (Table 1). Fish smaller than 15 cm total length may be frozen as a whole fish. Note: This 15 cm threshold may vary in other regions of the North Atlantic and Mediterranean, sampling other fish species.
- Data are recorded in the ICES exchange format on the labels used for year, quarter, ship and haul consistent with those used for haul information uploaded to ICES Stomach data base (Table 3). This assures accessibility of further haul details if necessary.
- Note: All photographs were taken by Karolina Wikström (SLU) who owns the copyright.

#### **Selection of stomachs at sea**

The selection of stomachs should be based on the following stomach classification:

1. *Everted stomach*. Some fish have everted stomachs due to the pressure difference between trawling depth and the surface of the sea. Since it is not known whether these stomachs contained food or not, such ones should not be sampled.
2. *Stomach showing evidence of regurgitation*. Some fish have regurgitated all or part of their stomach contents and these stomachs should not be sampled. The number of such stomachs encountered during the examination must however be recorded to ensure that the proportion of feeding fish in the sample is accurately defined. In practice, it is often difficult to tell whether regurgitation has taken place, except in situations of prey remains in mouth or pharynx.
3. *Non-everted stomach showing no evidence of regurgitation* – with or without contents – should be sampled. It should be noted that not all feeding fish have significantly distended stomachs, i.e. feeding does not necessarily mean full.
4. *Empty stomach* is included in the category *Non-everted Stomach of a fish showing no evidence of regurgitation*.

The stomachs sampled at sea should thus originate from feeding fish showing no evidence of regurgitation (category 3) and from non-feeding fish (empty stomachs; category 4). The sampling

should continue until at least two stomachs classified in one of these two categories per length class are obtained.

### Step-by-step picture sampling guide

#### *Protocol for stomach sampling at sea*

Step 1. Collect predators according to the sampling scheme elaborated for each sea area and predator species (in this case North Sea, Skagerrak and Kattegat; Table 1).

Step 2. Do not sample everted stomachs -> Look into the mouth, if you see the stomach or parts of it, do not sample!

Step 3. Check the individual predators for evidence of regurgitation -> Look into the mouth. If you see prey or prey remains in mouth or pharynx, do not sample, but remember to record them. However, if you see perfectly fresh prey in mouth or esophagus, this could indicate net feeding, and this "prey" should be removed and the stomach can be sampled.

Step 4. Measure total length below (cm), weigh the fish (in g) and register the information (and the relevant subsequent information) either on paper protocol or in national on-board data system.

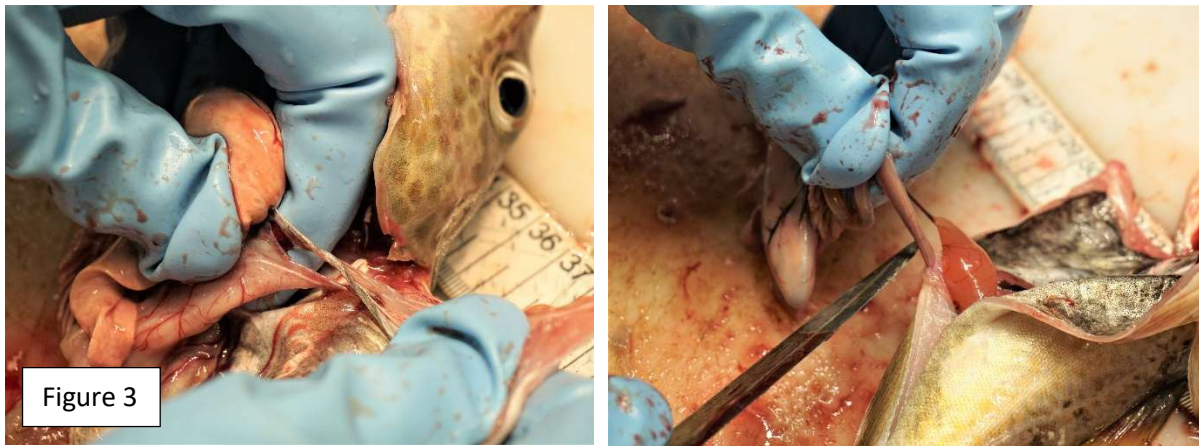


Step 5. Stun the fish by a blow to the head and kill it with a cut through the throat. Continue to cut until the esophagus is severed (Fig. 1).



Step 6. Cut the ventral side from throat to anus, but not through it, using knife or scissors (Fig. 2). By keeping the fish on its right side (looking into the abdominal cavity from the left side) the gall bladder is exposed to the viewer which facilitates the stomach removal process.

Step 7. Open the fish and determine the sex and (optionally) the maturity stage.



Step 8. The esophagus should already be cut through (or almost), but the liver is still attached to the dorsal side of the fish. Cut or tare the connective tissue to remove it (Fig. 3). Remove intestinal package from the body cavity and cut the colon close to the anus. If the colon is full of runny substance the anus can be left attached to the colon as a natural clamp to keep the contents contained. Gonads should not stay attached to the intestinal package but should be removed from the fish (if they are large and will significantly impact the gutted weight).



Step 9. Carefully cut the liver off the intestinal package, and make sure to leave the gallbladder intact and still attached to the intestinal package (Fig. 4). Note the gallbladder stage (1-4, Table 4, Figure 1). However, reporting the gallbladder status is not mandatory, but may be useful for gadoids. Place the intestinal package in a labeled plastic bag. Collect all stomachs from the same species and haul in a larger bag and freeze it quickly.



Step 10. Remove heart and gonads from the fish (if not done previously) and note the gutted fish weight (Fig. 5). The kidney should not be removed. Collect otoliths and store in a labeled paper bag.

***For flatfishes (steps 1 to 4 identical to roundfishes):***



Step 5. Kill the fish before starting the dissection by using a blow to the head. Make a small incision between the ventral fin and the anus to allow for easier access, using knife/scalpel or scissors. Be careful not to cut through the anus. Cut along the abdominal cavity to access the stomach (Fig. 6).



Figure 7



Step 6. Sever esophagus and the connective tissue to the liver (Fig. 7).

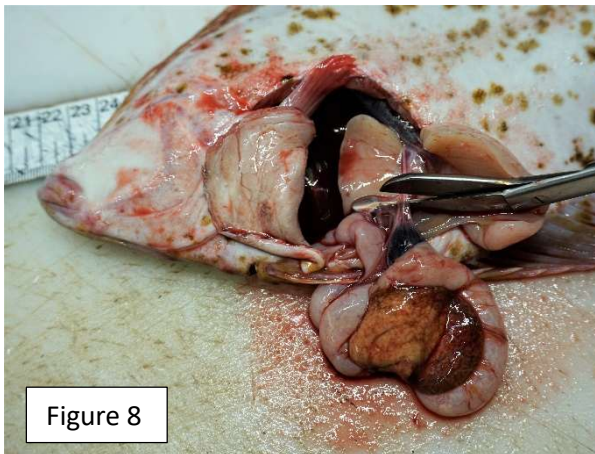


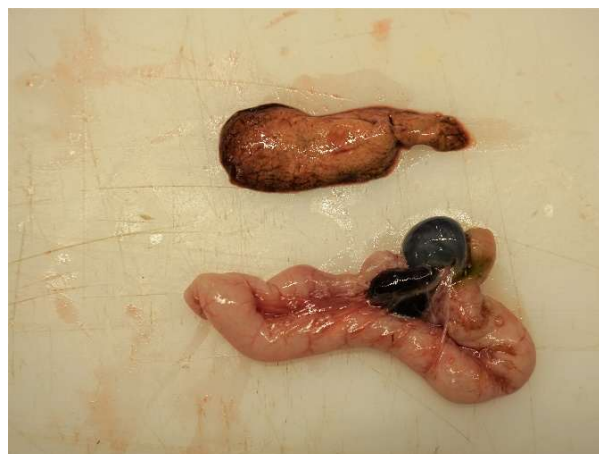
Figure 8



Step 7. Flip the intestinal package out and cut the connective tissue to the gall bladder and the colon close to the anus (Fig. 8). If the colon is full of runny substance the anus can be left attached to the colon as a natural clamp to keep the contents contained.



Figure 9



Step 8. Cut the connective tissue to the liver to remove it, careful not to damage the gallbladder (Fig. 9) Note the gallbladder stage (1-4, Table 4, Fig. 1). However, reporting the gallbladder stage is not mandatory. Place the intestinal package in a labeled plastic bag. Collect all stomachs from the same species and haul in a larger bag and freeze it quickly.



Step 9. Be aware: For flatfishes, the gonads are left in the body when noting the gutted weight (Fig. 10).

---

**Additional information:**

- For minor species, opportunistic species and all main species not included in the IBTS sampling program for age (Table 1) it is mandatory to measure length, weight and determine sex (determining maturity, measuring liver weights and taking otoliths for age reading is optional).
- Either analyze the stomach contents at the laboratory or send the frozen stomachs to the stomach analysis center (SAC) upon arrival (have to be established!).
- It is recommended that the predator (and prey) species are recorded using WORMS' AphiaID codes (<http://www.marinespecies.org/aphia.php>).
- Fallback option: In case of time constraints, entire fish can be frozen and the sample bags should be labelled accordingly (Table 2).

**Tables**

**Table 1.** Updated 5-year rolling sampling plan (November 2024)

Year	Quarter	Species	"Minor" species sampled each year	Species to be sampled opportunistically each year (dead specimens; live specimens are generally released)										
1	1	Whiting												
	3													
	1	Anglerfish												
	3													
	1	Megrim												
	3													
2	1	Cod			Turbot	Starry ray								
	3													
	1	Horse Mackerel					Brill	Cuckoo ray						
	3													
3	1	Hake							Pollack	Thornback ray				
	3													
	1	Plaice	Tusk	Spotted ray										
	3													
4	1	Haddock									Ling	Spurdog		
	3													
	1	Mackerel											Tub gurnard	Tope
	3													
5	1	Saithe				Halibut								
	3													
	1	Red gurnard												
	3													
	1	Grey gurnard												
	3													

**Table 2.** Label to be included in each stomach bag

Ship + Cruise/survey-No.
Station/haul number
Date
Species
Total body length (cm)
Wet weight (g)
Fish ID

**Table 3.** ICES data exchange format for stomach data (<https://www.ices.dk/data/data-portals/Pages/Stomach-content.aspx>). Note: The code lists in column 4 are available on the ICES-webpage.

FI – File\_information

Start	FieldCode	Datatype	Code List	Mandatory	Header	Description
1	RecordType	char(2)		yes	Record type	
2	Country	char(2)	ISO_3166	yes	Country code based on the ISO 3166 standard -	Country of the organisation responsible for data collection and storage
3	Reporting_organisation	char(6)	EDMO	yes	EDMO code of the reporting organisation	
4	CruiseID	char(20)		yes	CruiseID	- Unique cruise ID in the format: Country + EDMO code + Ship code+ year (DA219526D42021)

HH – Haul Information

Start	FieldCode	Datatype	Code List	Mandatory	Header	Description / Additional Information
1	RecordType	char(2)		yes	Record type	
2	Ship	char(4)	SHIPC	yes	SeaDataNet ship code	
3	Gear	char(15)	SMTYP	yes	Sampling gear used	
4	HaulNo	int(6)		yes	Haul number	- sequential numbering by cruise
5	StationNumber	char(10)		yes	Station number by national coding system	
6	Year	char(4)		yes	Year of the cruise	
7	Month	int(2)		yes	Month of the cruise	
8	Day	int(2)		yes	Day of the haul	
9	Time	char(4)		yes	Shooting time (UTC)	(HHMM), 4 digits. E.g. 10:15=1015
10	ShootLat	decimal4(8)		yes	Shoot of gear latitude	
11	ShootLong	decimal4(9)		yes	Shoot of gear longitude	

12	HaulLat	decimal4(8)		no	Haul latitude	
13	HaulLong	decimal4(9)		no	Haul longitude	
14	ICESrectangle	char(4)	StatRec	no	ICES statistical rectangle of the sampling location	
15	Depth	int(4)		no	Average depth during trawling	
16	Survey	char(20)		no	Survey code (ICES survey codes) or project name	
17	ICESDatabase	char(1)	YesNoFields	no	Catch and biological data available in other ICES databases, e.g DATRAS or Acoustic -	Yes or No field
18	Notes	char(100)		no	Any additional information	

#### PI – Predator Information

Start	FieldCode	Datatype	Code List	Mandatory	Header	Description / Additional Information
1	RecordType	char(2)		yes	Record type	
2	Ship	char(4)	SHIPC	yes	SeaDataNet ship code	
3	Gear	char(15)	SMTYP	yes	Sampling gear used	
4	HaulNo	int(6)		yes	Haul number	- sequential numbering by cruise
5	StationNumber	char(10)		yes	Station number by national coding system	
6	Year	char(4)		yes	Year of the cruise	
7	Month	int(2)		yes	Month of the cruise	
8	Day	int(2)		yes	Day of the haul	
9	Time	char(4)		yes	Shooting time (UTC)	(HHMM), 4 digits. E.g. 10:15=1015
10	FishID	char(20)		yes	Unique fish identification number for predator	
11	AphiaIDPredator	int(10)		yes	WoRMS AphiaID Species reference code of predator	
12	IndWgt	float(5)		no	Weight of predator in grams	
13	Number	int(2)		no	Number of species taken for stomach analyses (pooled samples)	
14	MeasurementIncrement	float(2)		no	Measurement increment in cm	
15	Length	float(10)		no	Length of species	

16	AgeSource	char(10)	AGDET	yes	Age reading source material	
17	Age	int(2)		no	Age of predator	
18	Sex	char(1)	SEXCO	no	Sex of predator	
19	MaturityScale	char(6)	AC_MaturityScale	no	Maturity scale	
20	MaturityStage	char(4)	AC_MaturityCode	no	Maturity stage within chosen maturity scale	
21	PreservationMethod	char(8)		no	Storage/preservation method at the time of sampling -	Insert the storage/preservation method used according to ICES vocabulary METST/METFP.
22	Regurgitated	int(4)		no	Number of stomachs regurgitated	
23	StomachFullness	char(1)	StomachFullness	no	Stomach fullness scale	
24	FullStomWgt	float(6)		no	Weight of stomach with prey	
25	EmptyStomWgt	float(6)		no	Weight of stomach without prey	
26	StomachEmpty	int(6)		no	Number of empty stomachs in the sample	
27	GenSamp	char(1)	YesNoFields	no	Stomach content analysed using genetics - Yes or No	
28	Notes	char(100)		no	Any additional information	

#### PP – Prey Information

Start	FieldCode	Datatype	Code List	Mandatory	Header	Description / Additional Information
1	RecordType	char(2)		yes	Record type	
2	Ship	char(4)	SHIPC	yes	SeaDataNet ship code	
3	Gear	char(15)	SMTYP	yes	Sampling gear used	
4	HaulNo	int(6)		yes	Haul number	- sequential numbering by cruise
5	StationNumber	char(10)		yes	Station number by national coding system	
6	Year	char(4)		yes	Year of the cruise	
7	Month	int(2)		yes	Month of the cruise	
8	Day	int(2)		yes	Day of the haul	

9	Time	char(4)		yes	Shooting time (UTC)	(HHMM), 4 digits. E.g. 10:15=1015
10	FishID	char(20)		yes	Unique fish identification number for predator	
11	AphiaIDPredator	int(10)		yes	WoRMS AphiaID Species reference code of predator	
12	AphiaIDPrey	int(10)		no	WoRMS AphiaID Species reference code of prey	
13	IdentMet	char(10)		no	Prey species identification method -	Insert the identification method used according to ICES vocabulary METOA/SampleType.
14	DigestionStage	int(1)	DigestionStage	no	Stage of digestion of prey items	
15	GravMethod	char(5)	PARAM	no	Gravemetric method used	
16	SubFactor	decimal4(9)		no	Subsampling factor	- report 1 if the whole catch was analysed, or report a raising factor if only a part of the catch was analysed.
17	PreySequence	char(10)		yes	Unique prey sequence ID number	
18	Count	int(8)		no	Number of prey	
19	UnitWgt	char(6)	MUNIT	no	Unit of weight measurement	
20	Weight	float(8)		no	Weight, individual or grouped	
21	UnitLngr	char(6)	MUNIT	no	Unit of length measurement	
22	Length	float(10)		no	Length of species	
23	OtherItems	char(100)		no	Other items descriptor	
24	OtherCount	int(10)		no	Number of other items	
25	OtherWgt	float(6)		no	Weight of other items in grams	
26	AnalysingOrg	varchar(6)	EDMO	yes	EDMO code of the organisation in charge of analysing stomach samples	
27	Notes	char(100)		no	Any additional information	

**Table 4.** Condition of gall bladder, bile and hindgut, which can be used to differentiate between empty and regurgitated stomachs (from Robb 1992).

Stage	Gall bladder	Bile colour	Hind gut	State
1	Shrunken, empty or with small amount of bile	Pale	Contains large amounts of bile and digested food material	Feeding*
2	Elongate	Pale green to light emerald green	Contains some bile and digested food particles	Feeding*
3	Elongate	Dark green	Empty or contains some food particles	Empty
4	Round	Dark blue	Empty	Empty

\*NB: If fish satisfying these criteria are found without food in their stomach, they should be classified as regurgitated

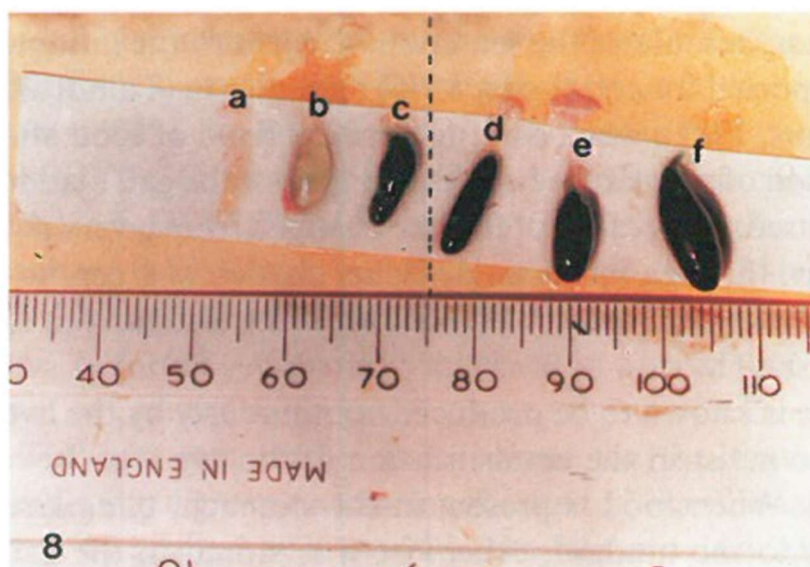


Figure 1. Different gallbladder stages of whiting, indicating: a-c feeding fish and d-f non-feeding fish (from: Robb, A.P. (1992). Changes in the gall bladder of whiting (*Merlangius merlangus*) in relation to recent feeding history. ICES J. Mar. Sci. 49, 431-436)