

## Number of stations sampled during WH 376

	Hauls GOV	CTD casts (total)	CTD casts with O <sub>2</sub> - /Sal- samples	Hauls 2-m beam trawl	Van Veen sediment grab**
IBTS*	29	29	29	29	81
Box A	21	15	9	9	18
Box B	14	10	6	6	12
Box C	14	11	7	7	14
Box D	1	1	1	1	2
Box L	14	10	6	6	12
Box M	10	7	5	5	10
<b>total</b>	<b>97</b>	<b>77</b>	<b>57</b>	<b>57</b>	<b>137</b>

\*) IBTS: Includes 24 stations in the wider German Bight, and 1 each in "Boxes" B, C, D, L, and M; see map.  
\*\*) Sediment samples from all stations, infauna for selected areas.

## Methods

### 1. Groundfish (Thünen Institute of Sea Fisheries, TI-SF)

The qualitative and quantitative composition of the bottom fish fauna was analysed from a total of 97 GOV hauls for the IBTS and the GSBTS, respectively. Larger invertebrates of commercial interest were quantified as specified in the IBTS manual. In addition, other benthic macro-invertebrates from the by-catch of the GOV otter board trawl were analysed for IBTS stations, and for selected additional GSBTS stations. During all hauls, the GOV was equipped with Scanmar sensors for net geometry as required for the IBTS and GSBTS surveys. Data from the IBTS hauls taken in the wider German Bight are to be combined with international data covering the entire North Sea for the assessment of groundfish stocks and for analyses on the non-commercial species. IBTS data have been uploaded to the ICES DATRAS system.

Before the cruise, the numbers of hauls to be conducted within each of the boxes were planned, using a similar procedure as in 2013 (compare 2013 report). However, storms with strengths of up to 12 Beaufort kept interrupting the programme and required many days of weathering, leading to a substantial loss of usable ship time. In one of the GSBTS Boxes (Box D), only one single haul could be performed.

Additional sampling: Extra fish samples (whiting) were provided to the project "AutoMAT (UFO)" at the Thünen Institute of Sea Fisheries. Juvenile cod were sampled and frozen for a research project DTU Aqua.

### 2. Hydrography (TI-SF)

A total of 77 hydrographic casts were performed with a Seabird CTD to record vertical profiles of temperature, salinity and oxygen concentration at the fishing stations. Samples for calibration of the oxygen probe were taken and processed through Winkler titration for a subset of 57 stations. Measurements of the salinity probe were calibrated on shore with water samples taken at the same 57 stations.

### 3. Epibenthos (Senckenberg Research Institute)

Epibenthos was sampled within ICES rectangles of the wider German Bight (IBTS stations), as well as in the Boxes B, C, L and M, applying a 2m-beam trawl. Samples were sieved over 5-mm and 2-mm mesh. The 5-mm fraction was analysed aboard, the 2-mm fraction was preserved in 4-% formaldehyde for

analysis in the laboratory ashore. Selected species were taken from the beam-trawl hauls for further genetic analysis (barcoding).

#### **4. Sediments, benthic infauna (Senckenberg Research Institute)**

Investigations of epibenthos were accompanied by sampling of sediments using a 0.1 m<sup>2</sup> van Veen grab. The same grab was used to sample benthic infauna from stations in the Boxes B, C, L and M (6 to 9 replicates per Box) as well as in the ICES Rectangles (1 replicate per rectangle). Specific invertebrate specimens were collected in order to contribute to a genetic bar-coding project at Senckenberg Research Institute.

#### **5. Stable isotopes (University of Nordland, Bodø, Norway)**

Specimens of individual invertebrate and fish species were collected in the GSBTS Boxes A (German bight) and L (southern Norway) and prepared for a project on feeding interactions in the respective ecosystems. The data will be used to analyze the food web structure in the two North Sea habitats and to compare them to a fjord system and an offshore area in Vesterålen, Norway. This work will be part of Marc Silberberger's PhD project: "Structure, transport, and production of benthic organisms in the Lofoten-Vesterålen region". The sampling aimed at including the most common organisms in the two regions with representatives from all trophic levels and feeding modes. Therefore, zooplankton, various macrobenthic species (infauna and epifauna) and various fish species were collected. The organisms were frozen until further analysis. Particulate organic matter and sediment (detritus) samples were taken to characterize their possible energy sources. The samples will be analyzed for stable isotope ratios of carbon and nitrogen isotope later in 2015.

#### **6. Marine litter (TI-SF)**

Occurrence of marine litter as by-catch in the fishing hauls was documented at all stations, following the IBTS manual.

### **Cruise schedule**

On July 28, 2014, the *FRV Walther Herwig* departed for cruise WH 376 from Bremerhaven, Germany. On the 29<sup>th</sup>, the scientific program started with the first haul in ICES rectangle 36F6 and continued sampling for the IBTS until August 2, with 4 hauls per day. During the next two days, with limited time due to the unexpected exchange a crew member, three more IBTS hauls were performed. From August 5-7 under perfect weather conditions, the GSBTS sampling programme in Box A could be fully conducted as planned. The work in Box C started similarly, but had to be interrupted after the first haul of August 9 in order to weather the exceptionally strong approaching storm, of which the *Walther Herwig* still experienced winds of 11-12 Bft in the evening. Returning to Box C, further hauls were conducted on August 10, but had to be terminated again in the afternoon, in order to timely pass the transit area, for which later wind gusts of "12+" (over a basic force 9-10 wind) were announced. During August 11 and 12, the ship again weathered the storm, after relocating towards the margin of the low pressure system. On August 13, fishing activities were started again in Box L, where several of the planned haul positions needed to be shifted outside of the north eastern area of the Box, where the access was denied due to ongoing seismic operations. After two days of work in Box L, one crew member was delivered to the pilot station in Marstein, and work in Box M was started on August 16, but had yet again to be terminated due to the prevailing weather conditions before noon on August 17. August 18 was spent riding out the next storm in the Murray Firth, fishing activities were impossible. On August 19<sup>th</sup>, a single IBTS / GSBTS haul could be performed in Box D, using the only available window of reduced wind speeds. Finally, on August 20-21, two days of the regular fishing

programme could be conducted as planned, before the Walther Herwig steamed back to Bremerhaven, where the ship docked at 13:00 MESZ on August 23<sup>rd</sup>.

## Preliminary Results

### Groundfish (TI-SF)

#### IBTS samples (ICES rectangles in the wider German Bight)

Preliminary data from the IBTS stations have been transmitted to the Q3 survey coordinator directly after termination of the cruise. The full IBTS data set, including age readings, has in the meantime been submitted to ICES and is available via the ICES database DATRAS.

#### GSBTS samples

Data from the German Small-scale bottom Trawl Survey GSBTS extend the existing time series of annual data. Due to the exceptionally stormy weather conditions, many GSBTS hauls had to be sacrificed in 2014, and in Box D, only a single haul could be performed.

#### **Box A (German Bight)**

Total catches in Box A were slightly higher than average (ca. 790 versus 670 kg/30 min-haul; Fig. 2 a). The dominating species was sprat (*Sprattus sprattus*) with 383 kg/haul, which was similarly high as in preceding years, and considerably higher than before 2002. Other abundant species were whiting (*Merlangius merlangus*), with on average 160 kg/haul as high in biomass as last observed in 1992. Dab (*Limanda limanda*) and herring (*Clupea harengus*) appeared with on average 112 and 126 kg, respectively in the catches. Mackerel (*Scomber scombrus*) occurred at the lowest abundances observed since 1987, and horse mackerel (*Trachurus trachurus*) was completely absent for the first time.

#### **Box C (Central North Sea)**

Mean total catches in Box C amounted to about half of the average calculated over the entire time series since 1987 (Fig. 2b). Herring biomass has traditionally been very variable between years, ranging from 0.5 to ca. 350 kg/haul, and amounted to 22 kg/30-min haul in 2014. Dab biomass had generally remained rather constant over the time series, and was with 35 kg/haul in 2014 close to the long term average of 39 kg/haul.

#### **Box M (Northern North Sea)**

Total biomass in Box M was about average for the time series sampled (mean of 285 kg/ haul; Fig. 2 c). High abundances of mackerel, and for the first time since 1999, noticeable biomass of horse mackerel (13 kg/haul), appeared. Norway pout appeared at the highest biomass observed in Box M throughout the time series (63 kg/haul; compare also Box D). Hake (*Merluccius merluccius*) had continued to increase in abundance since its first appearance in Box M in 2005.

#### **Box L (Northern North Sea)**

Total biomass in Box L was with similar as in 2013, remaining below average (Fig. 2 d). Cod biomass (27 kg/haul) had slightly increased over values reported in the preceding years. Low biomass of herring was observed (23 kg/haul), specifically in comparison to the years from 2002-2006, when values

between ca. 100 and 1000 kg/haul occurred. Hake was present, similar to the years before, continuing the noticeable increase in biomass after 2005. Plaice, initially not typically appearing in this area except for single individuals, had been increasing over the last three years, and now occurred with an average of ca. 4 kg / haul.

#### **Box D (Western North Sea)**

Due to the prevailing storm, only one haul could be performed in Box D. This haul has been reported as IBTS haul and was a valid haul, although it was terminated after 16 minutes due to high echo recordings, apparently related mainly to exceptionally high abundances of Norway pout (*Trisopterus esmarkii*), accompanied by herring (Fig. 2 e). Raised to the standard haul duration, Norway pout would have been caught with 515 kg/ 30 min-haul, whereas the long-term average in Box D is around 61 kg. Mackerel also occurred in relatively high numbers (equivalent to 146 kg/30 min), compared to the average of 67 kg, but similar catches had been recorded in a few other years within the time series.

#### **Box B (Western North Sea)**

Total catches in Box B were with on average 317 kg/haul about 50% of the long-term average since 1987, but in the same range as during the preceding years (Fig. 2 f). Herring abundances have been highly variable between years, but were close to the average value in 2014. Sprat was almost absent. Haddock (*Melanogrammus aeglefinus*) appeared with the almost lowest biomass recorded (11 kg/haul), similar to records in the first two years of the time series, whereas the 1990's and the following years until 2007 were characterized by values beyond 100 and up to > 600 kg/30 min haul. Whiting remained similarly low in abundance as in 2012 and 2013 (ca. 50 kg/haul), whereas in the 1990's values > 600 kg/haul had also occurred in this species.

### Epibenthos (Senckenberg Research Institute)

#### **IBTS rectangles**

Samples were taken in all 24 ICES rectangles. Generally, abundance and biomass of species was high at the coast and decreased towards offshore areas. Six invertebrate species were found in all rectangles: The starfishes *Asterias rubens* and *Astropecten irregularis*, the brittle star *Ophiura ophiura* as well as the crustaceans *Liocarcinus holsatus*, *Crangon allmanni* and *Pagurus bernhardus*. Common fishes were the goby *Pomatoschistus minutus*, the dab *Limanda limanda* and the solenette *Buglossidium luteum*. Abundance of the solenette was remarkably lower than in previous years. Many sponges together with high abundances of the associated brittle star *Ophiothrix fragilis* were found along the slope of the Dogger Bank. The area of the Frisian front (rectangle 36F4) is characterized by special hydrographic and sedimentological condition resulting in high numbers of the snail *Turritella communis*, the bivalve *Corbula gibba* and the brittle stars *Ophiura spp.* and *Amphiura filiformis*.

#### **GSBTS samples**

##### **Box A**

Epifauna in Box A was dominated by the starfish *Asterias rubens*, the solenette *Buglossidium luteum* and the goby *Pomatoschistus minutus*. High abundances of the brittle stars *Ophiura ophiura* and *O. albida* were found this year in Box A. In contrast, abundance of the shrimp *Crangon allmanni* had decreased remarkably in comparison to previous years.

### Box B

Box B near the British coast revealed very low abundance and biomass of benthic species. The hermit crab *Pagurus bernhardus* and the shrimp *Crangon allmanni* were the most frequently found species in Box B. Sessile species such as Hydrozoa, Bryozoa and Anthozoa were also very common resulting in high epibenthic diversity in this Box, despite the low overall biomass.

### Box D

No sampling possible in 2014, due to weather conditions.

### Box C

The assemblages in Box C were dominated by the starfish *Astropecten irregularis* and the hermit crab *Pagurus bernhardus*. Abundance of the gastropod *Turritella communis* and the sea urchin *Brissopsis lyrifera* were exceptionally low this year. In contrast, abundance of the starfish *Luidia sarsi* had increased compared to previous years.

### Box L

In Box L, very high abundance of the sea urchin *Gracilechinus acutus* was found, accompanied by larger numbers of the shrimp *Crangon allmanni*. The starfish *Astropecten irregularis* the hermit crab *Anapagurus laevis* were less frequently found compared to previous years. However, species composition, abundance and biomass were very similar to the preceding years in Box L.

### Box M

Box M is the most diverse area of all Boxes, with respect to benthic epifauna. Common species were the hermit crabs *Anapagurus laevis*, *Pagurus pubescens* and *P. prideaux* as well as the sea urchin *Spartangus purpureus* and the polychaete *Thelepus cincinnatus*. *P. prideaux* was always found together with the symbiotic sea anemone *Adamsia carcinopados*. A rich sessile fauna was also characteristic. In contrast to previous years, high abundances of the shrimp *Crangon allmanni* and the brittle star *Ophiecten affinis* were found.

## Cruise participants

Name	Institution	Tasks
Dr. Anne Sell	Thünen Institute, TI-SF	Cruise leader; fisheries biology, hydrography
Dr. Hermann Neumann	Senckenberg	Benthos
Sascha Bednarz	Senckenberg	Benthos
Christina Fromm	TI-SF	Fisheries biology <sup>(1)</sup>
Gertrud Dehlfs	TI-SF	Fisheries biology
Jens Edinger	TI-SF, student	Fisheries biology
Inken Rottgardt	TI-SF, student	Fisheries biology
Lars Christiansen	TI-SF, student	Fisheries biology
Marcel Bächtiger	TI-SF, student	Fisheries biology
Sandra Rybicki	TI-SF, student	Fisheries biology
Hendrik Jarosch	TI-SF, student	Fisheries biology <sup>(2)</sup>
Marc Silberberger	University of Nordland, Bodø, Norway	Fisheries biology <sup>(3)</sup>

<sup>(1)</sup> Until August 3

<sup>(2)</sup> From August 4

<sup>(3)</sup> First cruise leg, until August 15

## Acknowledgements

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*A. Sell*

(Dr. Anne Sell, Cruise leader)

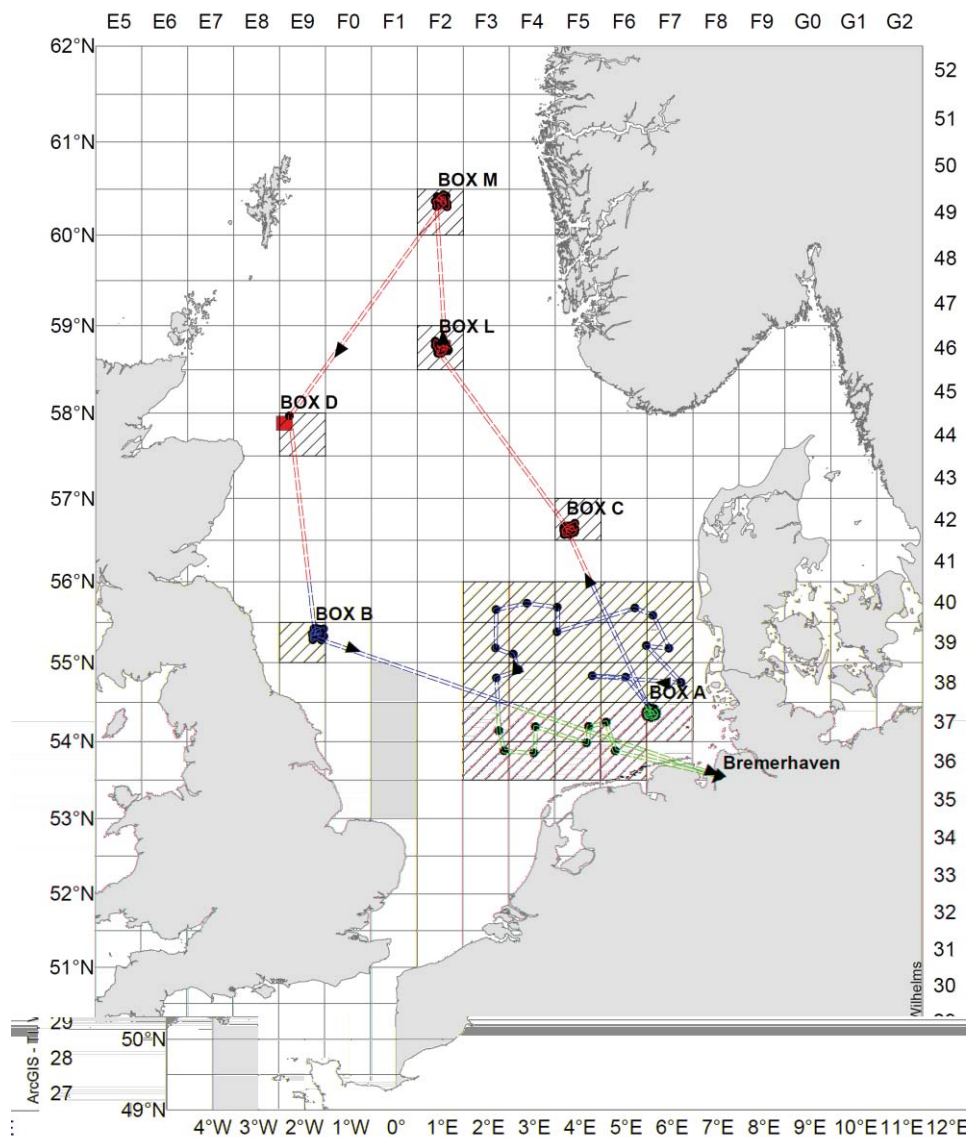


Fig. 1: Cruise track of WH 376, GSBTS and IBTS, 07/28-08/23/2014. Hatched area: ICES rectangles sampled within the IBTS, letters: areas of investigation (Boxes) within the GSBTS.

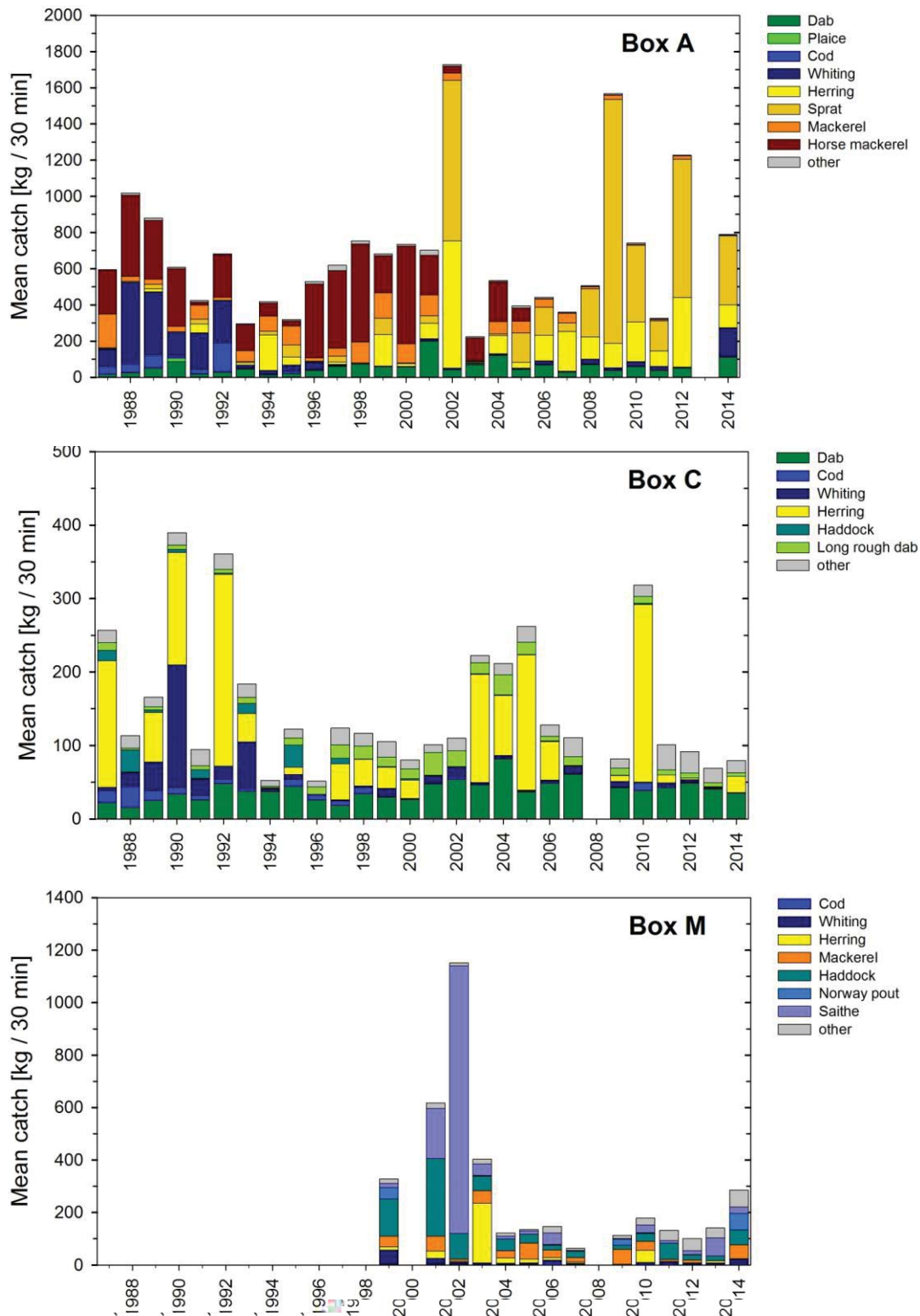


Fig. 2 (a-c), Boxes A, C and M: mean catch in GOV hauls during cruise WH 376 (2014) and preceding years since the beginning of the GSBTS.

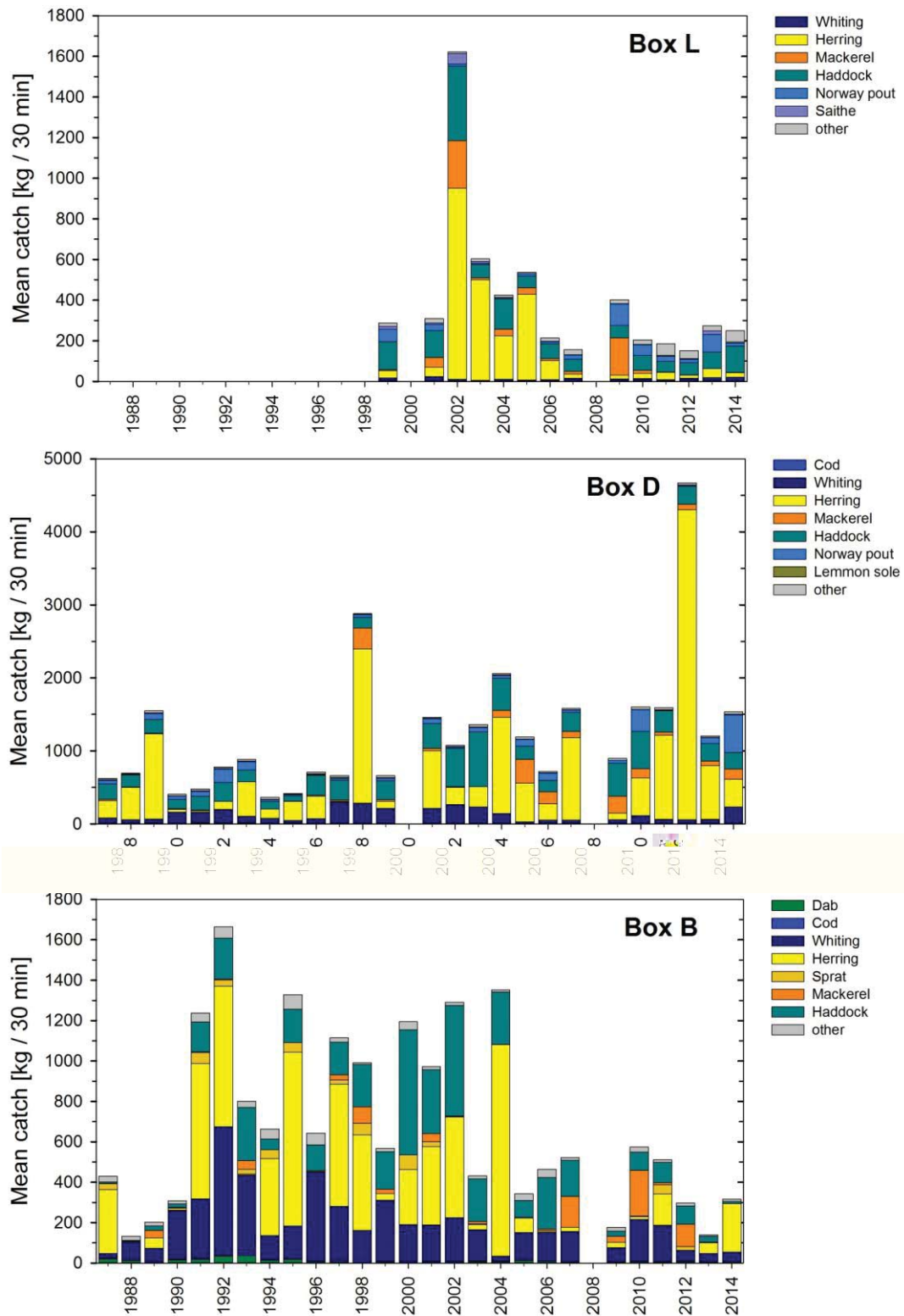


Fig. 2 (d-f), Boxes L, D and B: mean catch in GOV hauls during cruise WH 376 (2014) and preceding years since the beginning of the GSBTS. (Box D: only 1 haul in 2014).