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Report
Cruise SO 723 of FRV „SOLEA“
22.07. – 08.08.2016

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Objectives

1. Participation in the German Small-Scale Bottom Trawl Survey (GSBTS) to monitor the fish fauna in 6 out of 12 small areas (boxes),

2. Investigation of the hydrographical conditions within the boxes (vertical distribution of temperature, salinity and turbidity).

Narrative

FRV "Solea" left Cuxhaven on the 22nd of July 2016 and started its scientific program the following day in Box P (see Figure 1 and 2). In general, the scientific program consisted of three days with 7 hauls per day within each box. Each day at least two CTD casts were deployed. The scheduled personnel exchange was carried out around noon of the 30th of July in Esbjerg. The scientific program continued from the 31st of July until the 7th of August. The vessel returned to Cuxhaven on the 8th of August 2016.

During this year's survey a total of 93 hauls with the cod hopper trawl net and an additional 33 accompanying CTD casts were conducted in the six boxes of the GSBTS assigned to FRV "Solea". The actual sequence of sampling in the boxes was: Box P (German EEZ; 1 day), Box H (British EEZ; 3 days), Box P (German EEZ; 2 days), Box N (German Bight; 2 days), Box K (Danish EEZ; 2 days), Box E (Dutch EEZ; 1 day), Box F (British EEZ; 3 days) and Box E (Dutch EEZ; 1 day) (Figure 1). Due to net damages in Box F, two hauls were invalid. A summary of the activities during SB723 within each box is given in Table 1 and a summary of the total sampling effort within the GSBTS survey program by box and year for the cod hopper is presented in Table 2.

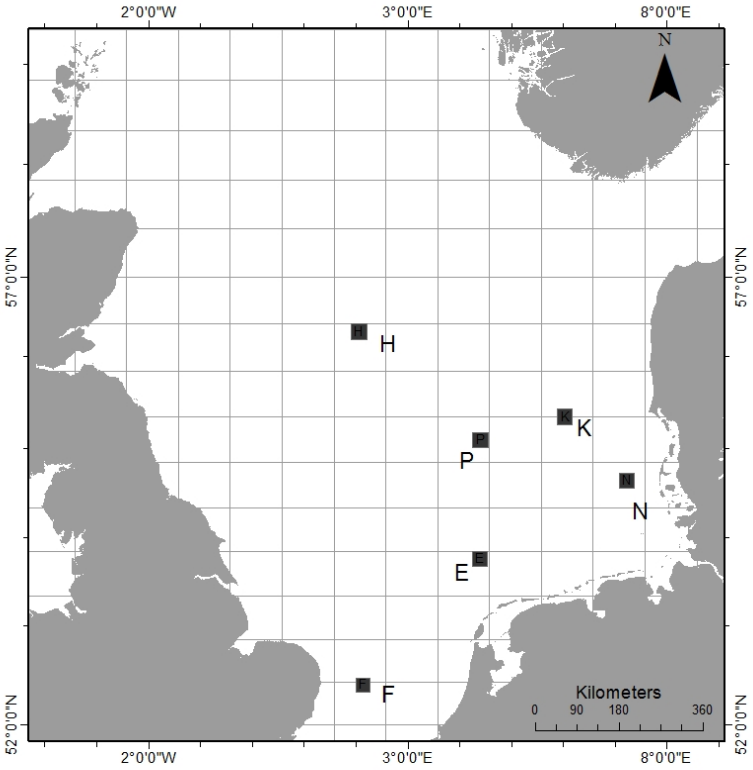

Figure 1: Positions of German small scale bottom trawl survey "boxes" (10 x 10 nm) monitored by the research vessel „Solea" during cruise no. 723. With ICES rectangles (30 x 30 nm)

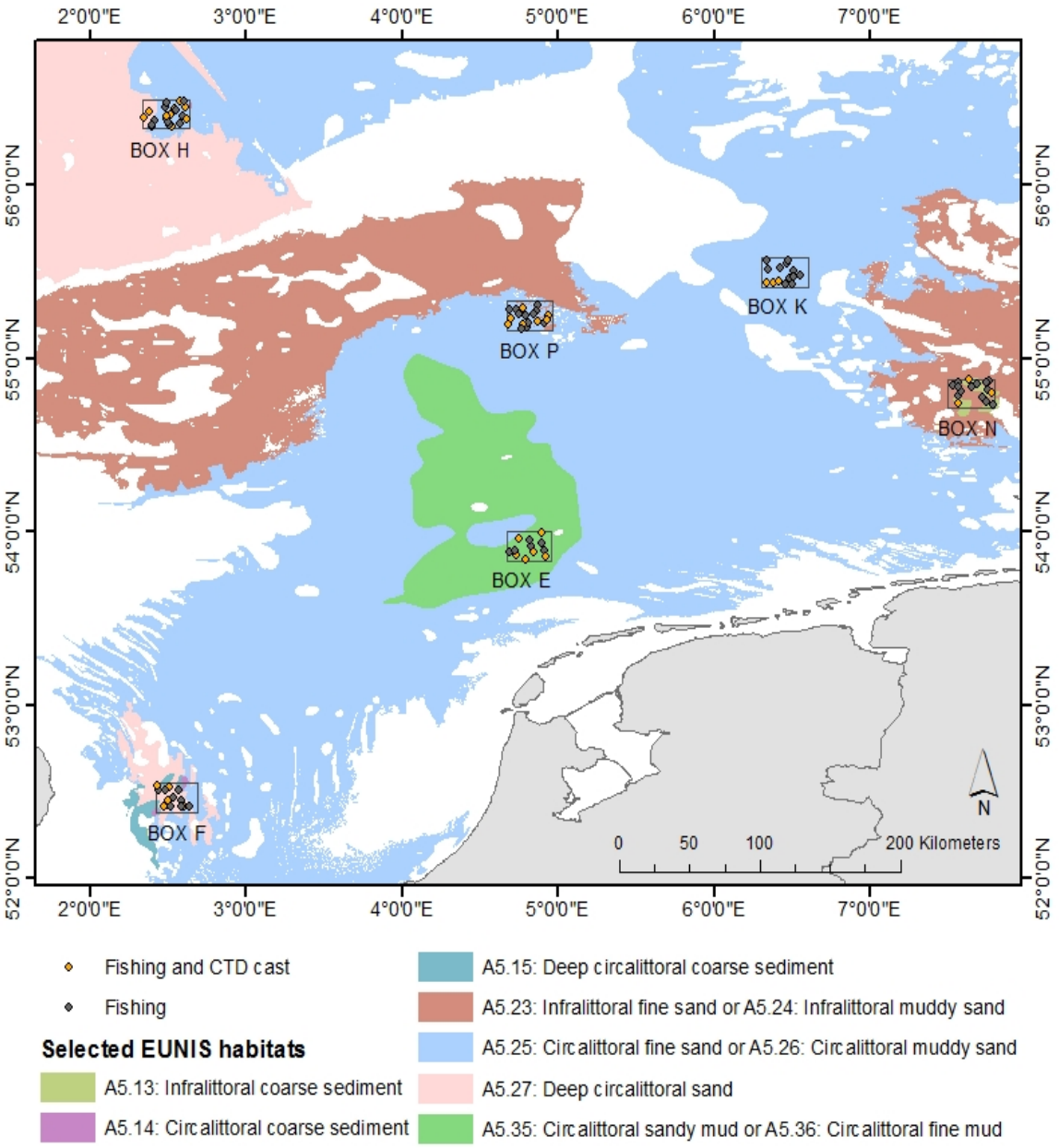

Figure 2: Sampling stations as mid positions indicating fishing activity (grey dot) or fishing in combination with a CTD cast (orange dot) per GSBTS box with intersecting EUNIS habitats categories.

Table 1. Total number of valid cod hopper (KJN) hauls and CTD casts during SO 723.

Box	KJH hauls	CTD
Box E	12	6
Box F	12	5
Box H	21	9
Box K	14	3
Box N	16	3
Box P	18	7
Total	**93**	**33**

Table 2. Total sampling effort (cod hopper hauls) in the GSBTS for each box and survey year.

Year	BOX P	BOX H	BOX N	BOX K	BOX E	BOX F	Total
1990	-	-	-	-	8	28	36
1991	-	27	-	24	28	28	107
1992	-	23	-	19	28	21	91
1993	-	25	-	27	27	23	102
1995	-	26	-	24	21	25	96
1996	-	17	-	28	28	26	99
1997	-	25	-	26	6	18	75
1998	-	25	-	23	17	20	85
1999	-	17	-	30	10	27	84
2000	-	-	8	-	-	-	8
2002	-	17	-	9	15	17	58
2003	24	23	-	24	15	24	110
2004	16	23	15	17	19	17	107
2005	14	20	20	14	14	16	98
2006	-	16	19	24	-	-	59
2007	16	24	21	12	23	22	118
2008	18	21	21	18	21	22	121
2009	16	21	22	15	24	22	120
2010	14	21	21	16	21	21	114
2011	21	21	21	7	10	-	80
2012	18	21	21	7	21	-	88
2013	18	21	23	21	21	21	125
2014	24	23	17	18	21	21	124
2015	18	21	17	21	22	23	122
2016	18	21	16	14	12	12	93
Total	235	499	262	438	432	454	2320

Results

Trawl durations were constantly close to 30 min and the trawl speed ranged around 3.5 kn across all valid hauls (Table 3). Box F forms an exception since the fishing gear deployed differed due to different habitat conditions.

Table 3. Summary of mean catch depth (m), mean distance between trawl doors (m), mean vertical net opening (m), mean length of trawl warp (m), mean trawl duration (min) and mean trawl speed (kn) of all valid hauls per box.

Box	mean depth (m)	mean distance trawl doors (m)	mean vertical net opening (m)	mean length trawl warp (m)	mean trawl duration (min)	mean trawling speed (kn)
BOX E	41.23	55.41	3.64	210.42	28.67	3.45
BOX F	48.43	57.19	NA	296.50	29.75	4.42
BOX H	73.77	60.07	3.84	350.62	29.05	3.60
BOX K	42.21	56.08	3.94	225.50	29.50	3.52
BOX N	21.38	52.30	4.29	118.88	29.75	3.46
BOX P	47.33	58.47	4.03	252.50	29.06	3.24

In Figures 3 to 9 for each GSBTS box the annual catches (kg $30min^{-1}$) of the species contributing at least 0.5% to the cumulative total catch across all sampling years are displayed. Between a number of nine and 13 species contributed most to the overall biomass caught in the respective GSBTS boxes.

Consistent patterns emerging across all boxes were:

- The total catches were in the average range for all boxes, except for Box P (lowest ever observed in 2016) and Box N (higher than average in 2016).
- Cod (*Gadus morhua*) was either absent or its abundance remained at very low levels.
- Dab (*Limanda limanda*) showed a strong upward trend in abundance, except in Boxes F and P.

Compared to the long-term trend some differences in 2016 are noticeable:

- Catches in Box P (Fig. 3 top and bottom) had low herring (*Clupea harengus*) abundance and lower CPUE of grey gurnard (*Eutrigla gurnadus*) and European sprat (*Sprattus sprattus*) than in all years before.
- In Box H (Fig. 4 top and bottom) highest CPUE values were detected for dab and the upward trend of whiting (*Merlangius merlangus*) CPUE seemed to continue.
- Box N (Fig.5 top and bottom) had highest CPUE of dab and tub gurnad (*Trigla lucerna*) ever observed.
- In Box K (Fig. 6 top and bottom) the catches of dab, sprat and mackerel (*Scomber scombrus*) were higher, whereas the catches of herring were lower than the long-term average.
- In Box E (Fig. 7 top and bottom) CPUE of plaice (*Pleuronectes platessa*) dropped after four years below the median long-term CPUE and CPUE of whiting continued to be lower than the median long-term CPUE.
- In Box F (Fig. 8 top and bottom) we found the lowest CPUE of mackerel over the past nine years and whiting dominated the catch composition more than in all years before.

Catches of rare or endangered species are displayed in Figures 9 and 10. Spiny spurdog (*Squalus acanthias*), which was found in box H, in the 2014 survey, in exceptionally high numbers was not caught in this year (Fig. 10, Table 4). Thornback ray (*Raja clavata*) has been caught in box E every year since 2010, however here the CPUE suggested a downward trend, while CPUEs in box F indicated a slight upward trend.

Table 4. Overview on caught elasmobranchs in the 2016 GSBTS.

Box	Species	No. Hauls per box	Total catch		Mean CPUE	
			No.	Weight (Kg)	No.	Weight (Kg)
E	*Raja clavata*	12	1	1.3	0.08	0.11
E	*Scyliorhinus canicula*	12	6	1.5	0.50	0.13
F	*Galeorhinus galeus*	12	1	24.2	0.08	2.02
F	*Mustelus asterias*	12	9	22.5	0.75	1.88
F	*Raja clavata*	12	2	6.2	0.17	0.52
F	*Scyliorhinus canicula*	12	21	9.3	1.75	0.78
H	*Raja radiata*	21	4	1.4	0.19	0.07
K	*Raja clavata*	14	3	6.8	0.21	0.49
K	*Scyliorhinus canicula*	14	3	1.6	0.21	0.11
P	*Raja radiata*	18	5	2.5	0.28	0.14
P	*Scyliorhinus canicula*	18	1	0.4	0.06	0.02

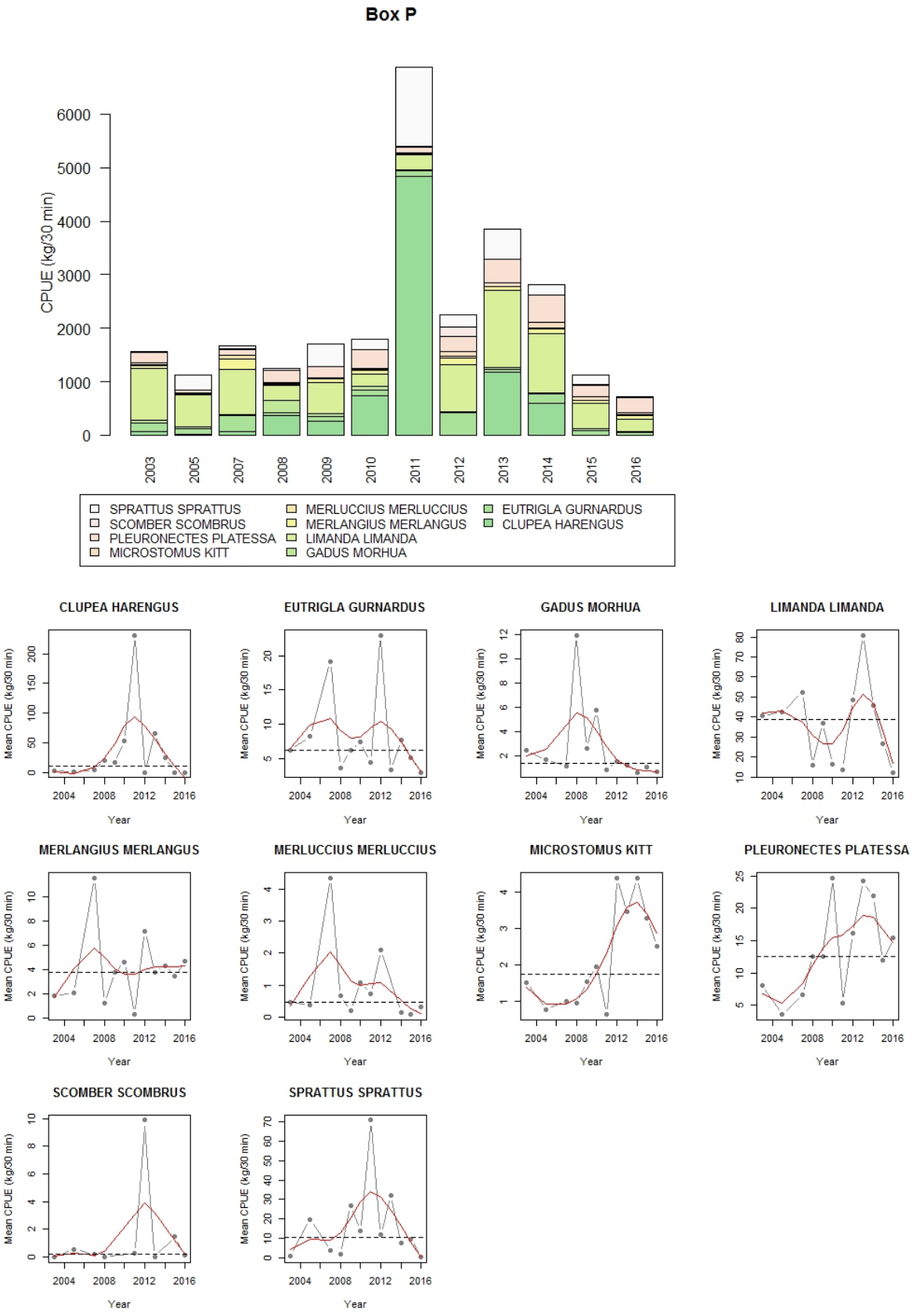

Figure 3: Top: Summed CPUE (kg 30 min^{-1}) of the most abundant species in Box P. Bottom: Long-term trends in mean CPUE per haul (kg 30 min^{-1}) of the most abundant species in Box P, with indicated median CPUE value per haul over all sampling years (dashed line).

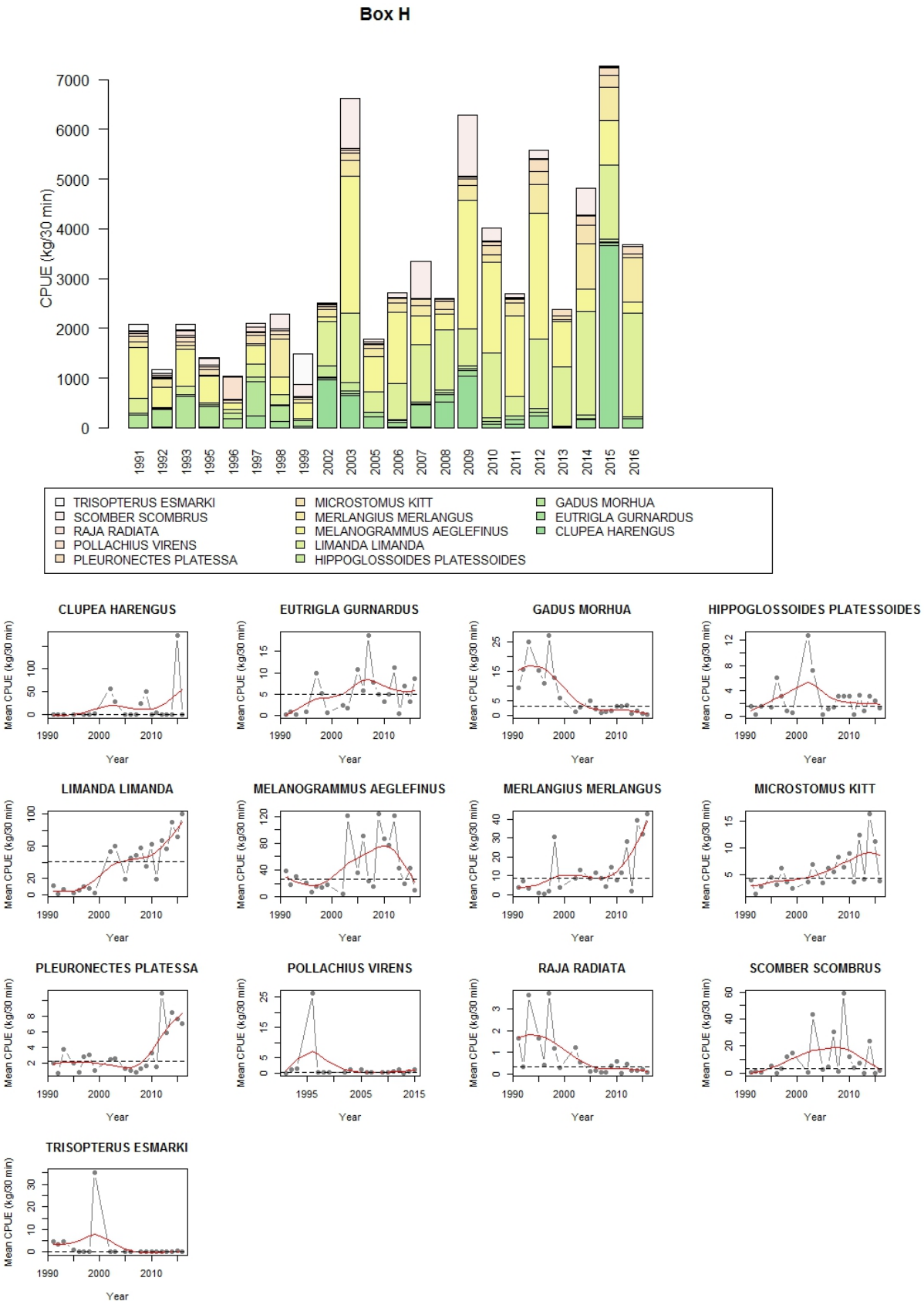

Figure 4: Top: Summed CPUE (kg30 min^{-1}) of the most abundant species in Box H. Bottom: Long-term trends in mean CPUE per haul (kg 30 min^{-1}) of the most abundant species in Box H, with indicated median CPUE per haul value over all sampling years (dashed line).

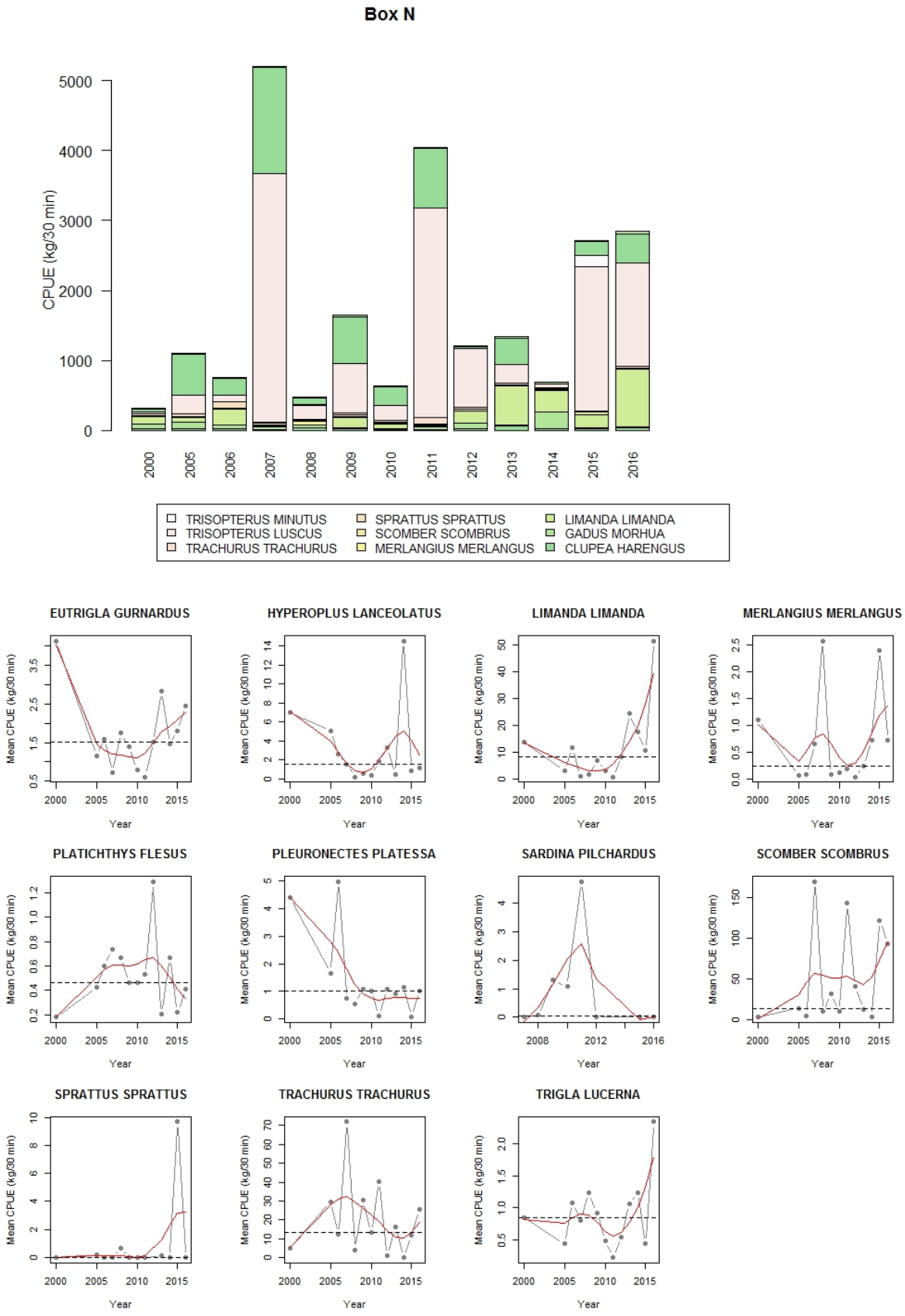

Figure 5: Top: Summed CPUE (kg 30 min^{-1}) of the most abundant species in Box N. Bottom: Long-term trends in mean CPUE per haul (kg 30 min^{-1}) of the most abundant species in Box N, with indicated median CPUE per haul value over all sampling years (dashed line).

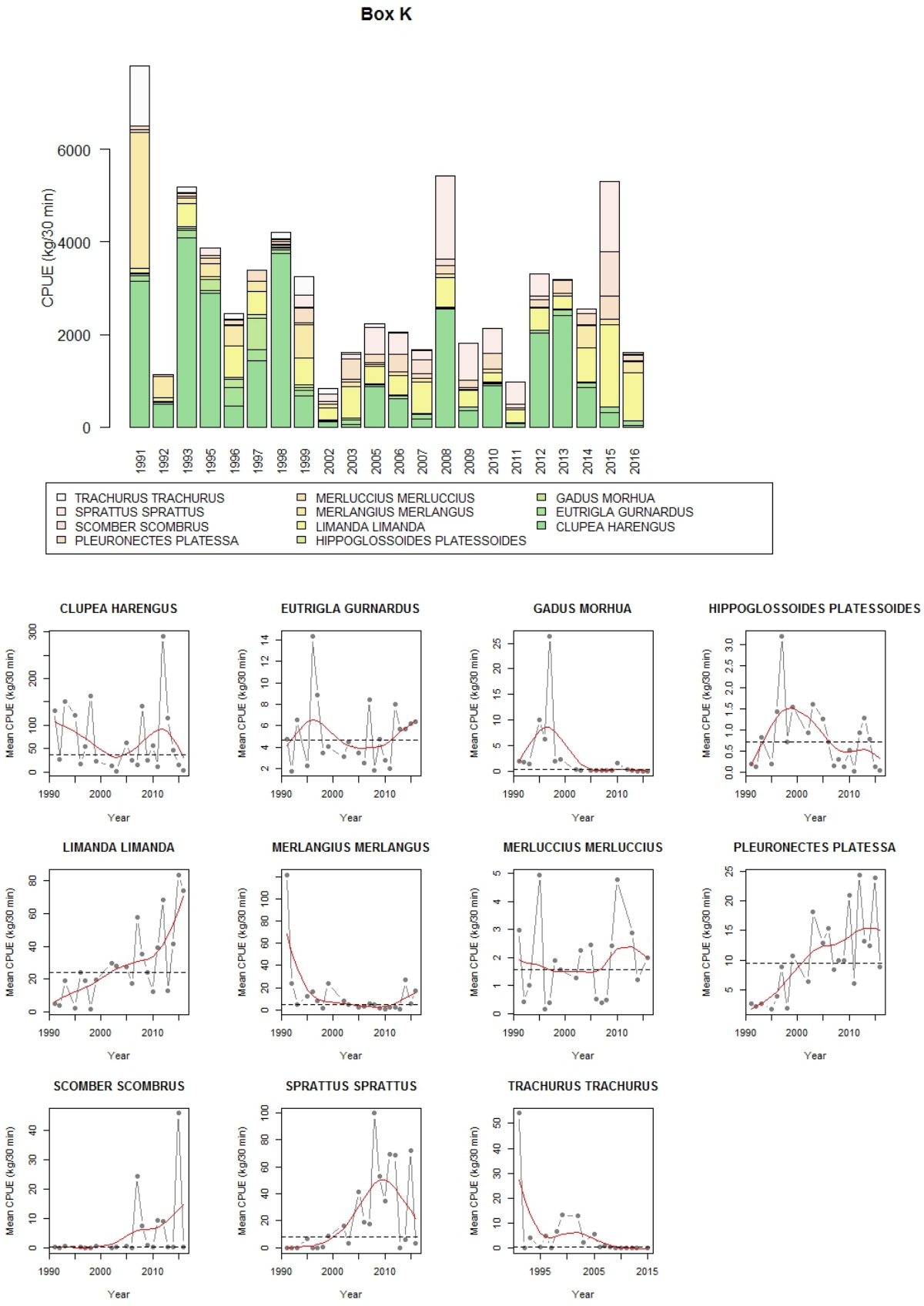

Figure 6: Top: Summed CPUE (kg 30 min^{-1}) of the most abundant species in Box K. Bottom: Long-term trends in mean CPUE per haul (kg 30 min^{-1}) of the most abundant species in Box K, with indicated median CPUE value over all sampling years (dashed line).

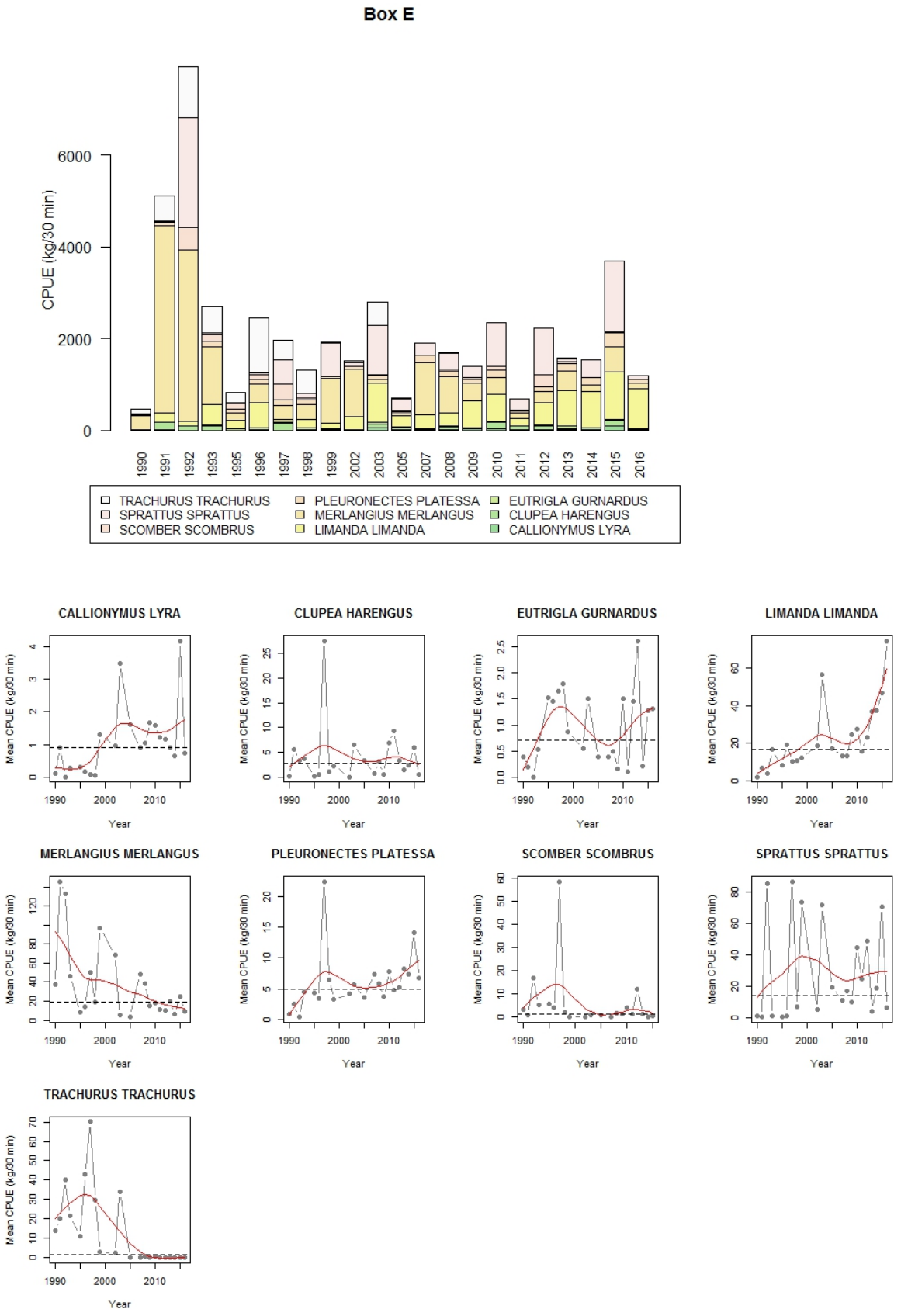

Figure 7: Top: Summed CPUE (kg 30 min^{-1}) of the most abundant species in Box E. Bottom: Long-term trends in mean CPUE per haul (kg 30 min^{-1}) of the most abundant species in Box E, with indicated median CPUE per haul value over all sampling years (dashed line).

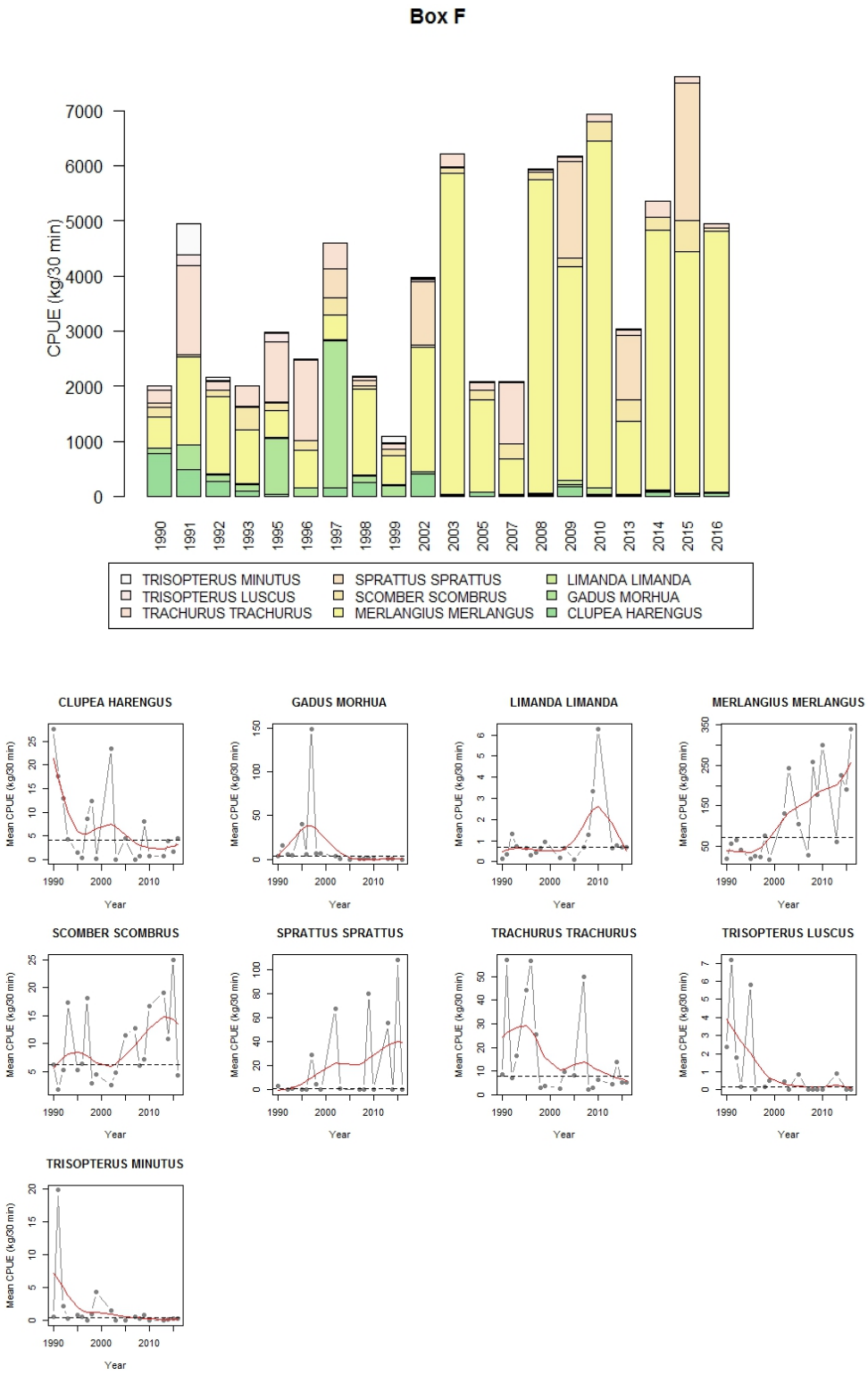

Figure 8: Top: Summed CPUE (kg 30 min^{-1}) of the most abundant species in Box F. Bottom: Long-term trends in mean CPUE per haul (kg 30 min^{-1}) of the most abundant species in Box F, with indicated median CPUE per haul value over all sampling years (dashed line).

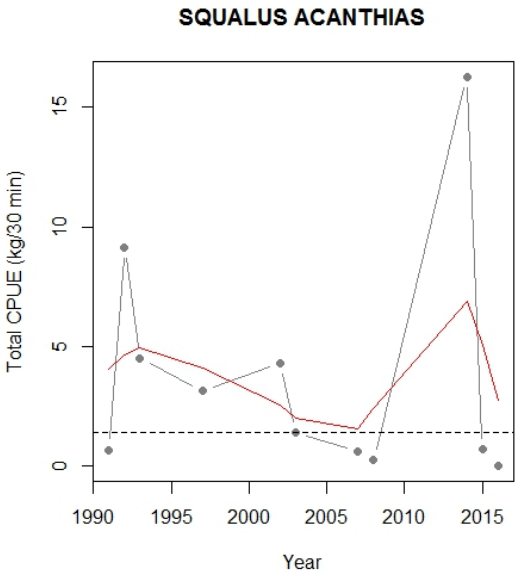

Figure 9: Long-term trend of annual total CPUE (kg 30 min^{-1}) of spiny spurdog (*Squalus acanthias*) in GSBTS box H.

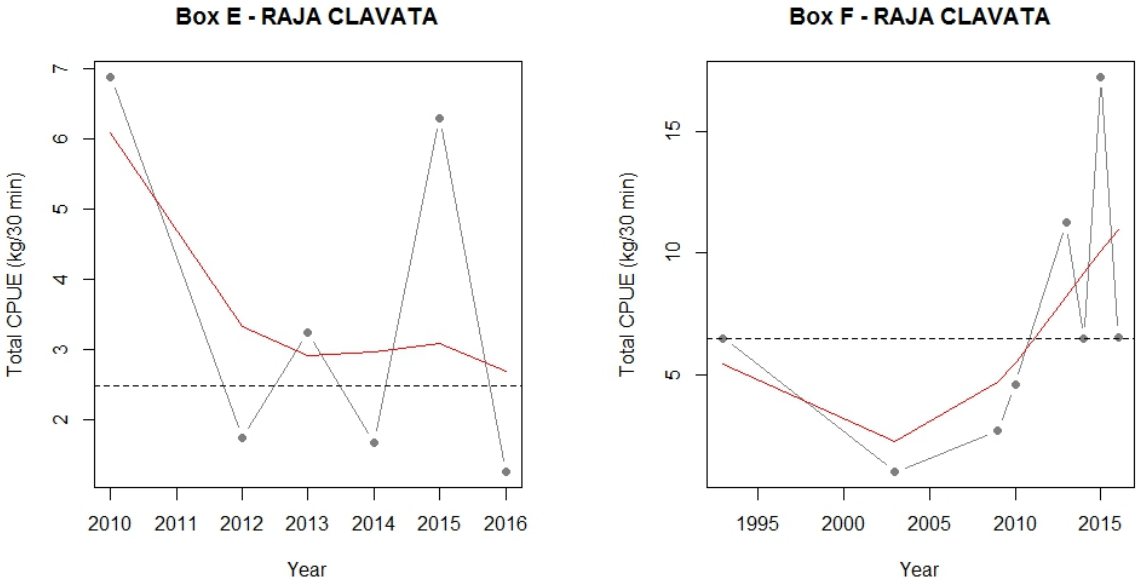

Figure 10:Long term trends of annual total CPUE (kg 30min^{-1}) of thornback ray (*Raja clavata*) in boxes E (left) and F (right).

Personnel

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